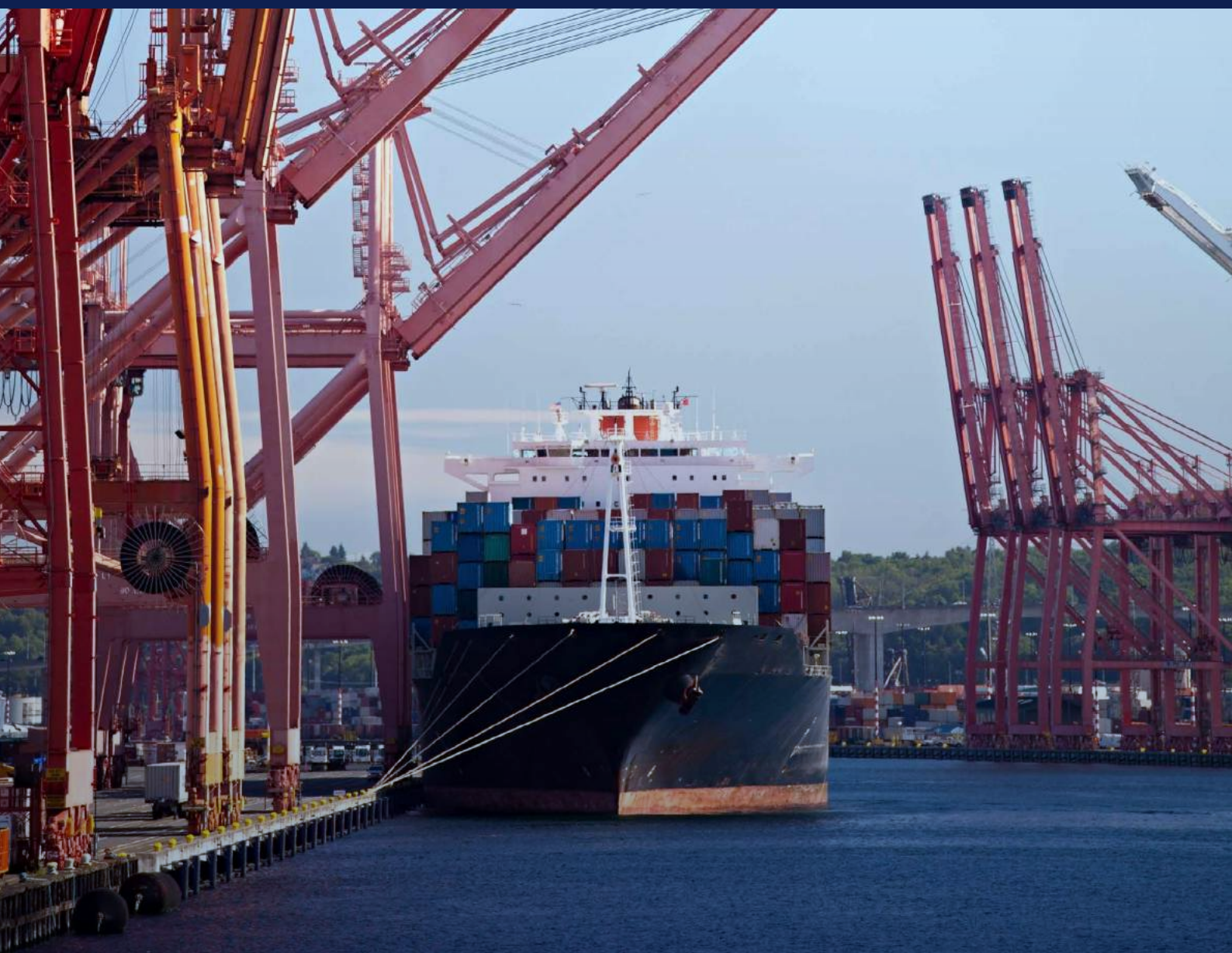




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FOREWORD

Margherita Bruno,
Editor



Welcome to PTI's inaugural journal of 2024, dedicated to the realm of port development and investment. We are thrilled to go back to our tradition of delivering one journal per month, promising a year filled with insightful content and special editions to commemorate our events in 2024.

After a bustling 2023, the onset of this year brings formidable challenges as geopolitical shifts disrupt global supply chains. This compilation of articles

captures the dynamic landscape of port development, providing a thorough exploration of topics pivotal to the industry's evolution. As the maritime sector grapples with environmental imperatives, geopolitical changes, and technological advancements, this journal serves as a guiding light for informed discourse.

Highlighted in our first journal of the year is the critical importance of investment in transitioning to greenfield environments in ports and terminals, along

with investments in smart technology and automation solutions driving the industry's evolution. Yvo Saanen, Managing Director at Portwise, invites you on the next page to uncover groundbreaking developments from the past year, which not only showcase the investment trajectory in the industry, but also guide stakeholders in making informed and careful decisions.

We hope you find this journal insightful and look forward to engaging with you in the next issue!



FOREWORD

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Yvo Saanen,
Managing Director,
Portwise



ZEPA - COP28

The United Nations Climate Change Conference, COP28, has concluded with a historic agreement to transition away from fossil fuels, triple renewable energy and increase climate finance for the most vulnerable. It aims to keep alive the goal of the Paris Agreement to try to limit long-term global average near-surface temperature to 1.5°C above the pre-industrial era.

During COP28, [APM Terminals and DP World launched a joint initiative – Zero Emission Port Alliance \(ZEPA\)](#) - a sector-wide coalition open to all industry participants, intending to accelerate the adoption of zero-emission container handling equipment in ports.

This initiative follows the white paper published by the two GTO's in October, where they sketch a path towards zero-emission terminals, whilst listing the hurdles towards increased sustainability. The objectives of ZEPA are as follows:

- Encourage scaled-up production capacity of battery-electric container handling equipment by manufacturers and reduce product costs
- Bring down the cost of batteries and charging systems, simplify implementation and increase equipment interoperability
- Ensure terminal operators and the grid infrastructure are ready for the new equipment and shore power roll-out
- Create better implementation conditions for zero-emission fleets and help accelerate the adoption of zero-emission container handling equipment

In the current jungle of battery types, charging technologies, and equipment types, the aim to streamline and foremost standardise is key. However, standardisation takes time and typically delays progress. It takes bold approaches like Tesla did with rolling out their charging infrastructure and making other manufacturers adopt their de-facto standards along the way.

Moving towards prudent investments into zero-emission fleets requires careful analysis to align the demands of dynamic terminal operations and the characteristics of battery-electric fleets of equipment. Given the limitations of feed from the grid, simplistic approaches (e.g. charging all vehicles at the same time – during the break) will lead to unfulfillable demands on the grid.

IMPACT ON GLOBAL SUPPLY CHAINS FROM THE RED SEA DISRUPTIONS

Not too far away from the COP28 (geographically), the global supply chain is once more confronted with its vulnerability to disturbances, now caused by Houthi rebels [making the entrance to the Red Sea too dangerous to pass](#). Consequently European factories are experiencing some hurdles resulting in closure due to a lack of supplies. At the same time, freight rates are going through the roof, as the demand for ships – to compensate for the longer journey times – spikes. It's almost like post-Covid times are returning. The earnings made by the shipping lines in the two years after COVID-19 have led to major investments

into different assets across the supply chain, whether its terminals (for instance [MSC acquiring a stake in HHLA](#), or [CMA CGM purchasing GCT North America](#)), intermodal facilities or other players (3PL's, warehouses, distribution centres, trucking companies or rail operators). Of course, with the rates coming back to 'normal', this enormous influx of capital has stopped.

LESSONS LEARNED FROM AUTOMATION; HANDS-ON EXPERIENCE

Finally, it becomes evident worldwide that terminal automation is here to stay. The societal wish for increased safety and better working conditions, fostered by the increasing availability and maturity of technology, makes automation (almost) mainstream for the terminal sector. However, the road to a successful implementation is paved with hurdles, which require clever circumventing. Learning from past experiences and avoiding mistakes is essential to ensure a smooth ramp-up of a new automated facility. In an in-depth paper, Kaj de Groot, Director of Automation Projects at Portwise, and Pim van Leeuwen, Simulation Consultant at Portwise, discuss several typical pitfalls they have come across in their daily work while assisting terminals in their automation journey. Again, standardisation and integration are hot topics, which are not easily achieved in a competitive industry where technology is rapidly advancing. Keeping it simple remains a basic rule, which should be applied wherever possible.



Port Development and Investment

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BROWNFIELD TERMINAL AUTOMATION FIVE MAJOR PITFALLS

**"LABOUR SHORTAGES AND ENVIRONMENTAL CONSIDERATIONS
HAVE MADE AUTOMATION INCREASINGLY ATTRACTIVE."**





portwise

Kaj de Groot, Director of Automation Projects, Portwise, and **Pim van Leeuwen**, Simulation Consultant, Portwise

MORE TYPES OF AUTOMATED EQUIPMENT ARE AVAILABLE ON THE MARKET

Today, most container terminals worldwide still have a fully manual operation for the yard, quay and transport. However, labour shortages and environmental considerations have made automation increasingly attractive. Container terminals would also like to increase their capacity and efficiency on the existing footprint. This means operators are looking into automation to increase their throughput capacity and to be less affected by labour shortages.

The industry is aware of the move towards automation, with more companies looking into ways to automate existing terminal concepts. Automated Rubber-Tyred Gantry Cranes (A-RTGs) are an example of such equipment, as shown in Figure 1. With these new types of automated equipment, the road towards automation becomes more straightforward, with less infrastructural impact on the operation.

Yet, the road to automation is full of risks and challenges. If such challenges are not tackled adequately, the objectives may not be achieved. In this paper, we will discuss some pitfalls to be avoided during the implementation of (automation) technology:

1. Overestimating automation potential
2. Underestimating the changes required for automation
3. Misjudging integration timelines
4. No thorough automation roll-out strategy



FIGURE 1.
3D image of an Automated Rubber Tyre Gantry crane, interchanging with a terminal truck.

5. Trouble operating a hybrid terminal with two different modes

When these pitfalls are not remediated, the chance of additional costs, project delays and unsatisfactory automation implementation will increase.

1. OVERESTIMATING AUTOMATION POTENTIAL

Container terminal automation offers increased safety, higher storage density and the possibility to work 24 hours, 7 days per week, without much loss due to shift changes and meal breaks. However, at Portwise, we have seen terminals that overestimate the benefits of these points for their future automated operation. Consequently, business cases may be too optimistic, causing distress when the target productivity cannot be reached.

Consider a remotely operated quay crane, involving a handover between automated and manual control. This handover is not always seamless, causing longer crane cycles, due to additional braking of the hoist or trolley and could therefore result in lower productivity. Similarly, automated interchange is typically slower than manual interchange, due to positioning times of automated equipment. This must be taken into account when aiming to set realistic automation targets.

Careful estimations and assumptions are essential to setting realistic targets and creating accurate business cases. Equipment specifications and productivities should be discussed in detail with suppliers. Furthermore, by properly assessing the impact of a system change towards an automated terminal concept, for example using

“THE IMPACT OF REQUIRED CHANGES FOR AUTOMATION IS OFTEN OVERLOOKED OR UNDERESTIMATED. WORKING WITH AUTOMATED EQUIPMENT HAS A HUGE IMPACT ON THE WAY OF WORKING.”

detailed simulation models, realistic expectations of the operational gains or losses can be quantified. This helps in managing expectations for the project team and overall terminal organisation.

2. UNDERESTIMATING THE CHANGE REQUIRED FOR AUTOMATION

The impact of required changes for automation is often overlooked or underestimated. Working with automated equipment has a huge impact on the way of working. If the complete terminal, including hardware, software and staff, is not fully prepared and on board with the transition, there will be costly interruptions and delays and less efficiency.

At Portwise, we have seen numerous requests for proposals with detailed equipment specifications, and little to no specifications of how the automation should interact with the operation, including workflows, but also the interaction between man and machine. Workflows and processes are often assumed to be similar between a manual and automated terminal, but more often than not, automation is different, and cannot work the same as a manual operation. Moreover, results from virtual testing are often assumed to be easily replicated after the go-live. This way, the go-live could result in disappointment due to the set expectations.

Existing operational procedures should be mapped and reevaluated against the situation with the new automated system. Automation systems can only perform up to their potential if the operational processes can be adequately adjusted to the provided automated solution. Next, personnel must

be fully on board and trained to work in a new environment. Also, to manage an automated system, the (IT-)organisation needs to be prepared, trained and likely expanded. They should be familiar with the new technology, the ways to maintain it, install upgrades, but also firefight exception cases.

3. MISJUDGING INTEGRATION TIMELINES

With the change towards automation, integration of software systems of different suppliers is key to success. These systems need to work together seamlessly; equipment, control software, scheduling, TOS, etc. The time and effort needed to complete this component is often underestimated because it does not only depend on the supplier delivering automation, but also on the other systems that need to interact with an automated system.

When a container is discharged from a vessel in an automated container terminal, it often involves OCR cameras on the quay crane to validate and confirm container information. The OCR might detect a different container than expected by the automated system. When the new container information is not fully updated in all systems (e.g., equipment control system, terminal operating system), it could lead to a mismatch in validation between the different systems, resulting in delays and manual intervention. This is one of the many integration items that could be encountered during go-live of an automated system.

Project planning is key to the success of any project. Projects should start with a proper and realistic schedule of the

key deliverables. Civil project timelines and equipment delivery times are often predictable and well known in the industry. Integration of software comes with much more uncertainty, but by predefining integration needs and constructively planning with suppliers, delays can be minimised. Planning sufficient time for testing, and solving integration issues is key to success. Proven and existing solutions often help here, since general issues have already been tackled, resulting in an easier implementation.

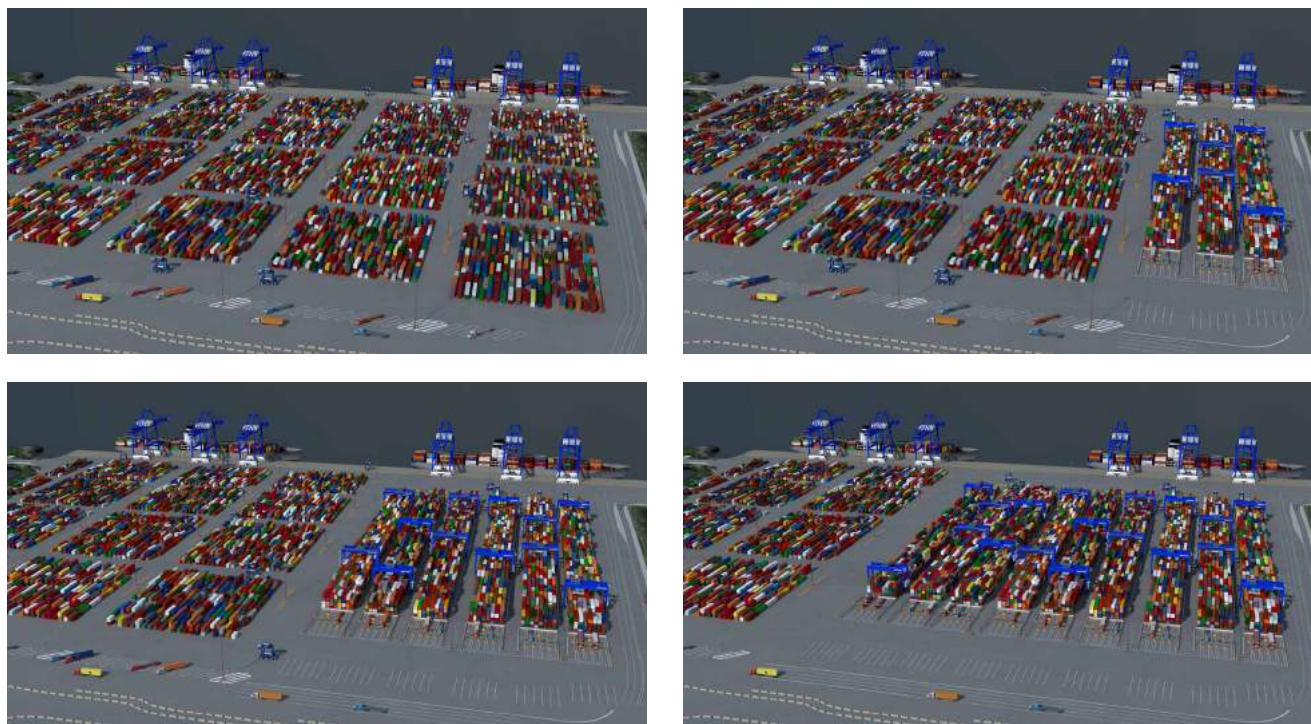
4. NO THOROUGH AUTOMATION ROLLOUT STRATEGY

When civil works are completed, the equipment has been facilitated, planning control software is installed and the terminal can start transitioning operations from manual to automated. This rollout requires a clearly defined strategy, which could be a gradual transition or a so-called big bang. Every strategy has advantages and disadvantages, but not having one in place will inevitably lead to problems when going live.

There are three different ways of implementing a new automated container terminal concept;

1. Big-bang transition; switching from the old mode of operation to the new mode of operation in a couple of days.
2. Greenfield expansion, with the new mode of operation.
3. Gradual transition to the new mode of operation.

Planning a big bang could be a way to mitigate the impact of transitioning, but it includes many risks such as:



- Edge cases (non-happy flow) not properly defined and tested
- Integration between different system components is not adequately tested.
- Personnel has not been given enough time and training to work in the newly automated system

A greenfield expansion, where an additional piece of land is used for testing and commissioning an automated operation, has a lower risk, but cannot be performed everywhere due to lack of space. It ensures that sufficient testing and familiarising with the system can take place, before further roll-out to the brownfield piece of the terminal.

Gradual transition is a way to provide sufficient time for testing and commissioning, but results in a reduction in capacity, or a change

of operation throughout the testing period. A phased transition is shown in Figure 2.

Having a well-defined rollout strategy that is clear to every member of staff involved in the step towards automation is essential for a successful go-live. When going through an extensive go-live with an existing running operation, always ensure that a fallback strategy is defined. This way, the automated system can be bypassed to continue operation in case of failures.

5. TROUBLE OPERATING A HYBRID TERMINAL WITH 2 DIFFERENT MODES

Automating the terminal is not done within a day. Instead, there typically is a phasing period during which an increasing share of the

terminal becomes automated. During this period, a hybrid operation could exist, utilising both manned and automated equipment. This is difficult to manage from both a planning and operating perspective. However, shutting down a large part of the terminal is very costly and interruptions must be avoided.

When operating with multiple modes of horizontal transport or stacking concepts, one should consider that there are two separate terminals. For example, consider the terminal shown in Figure 3. This terminal has two different types of stacking concepts, Automated Stacking Cranes (ASC) and Rubber Tired Gantry Cranes (RTGs). Also, two types of horizontal transport are used by this terminal: Shuttle carriers and Terminal trucks. When loading from the ASC modules,

FIGURE 2.

A phased transition path from straddle carriers to automated stacking cranes

“PROJECT PLANNING IS KEY TO THE SUCCESS OF ANY PROJECT. INTEGRATION OF SOFTWARE COMES WITH MUCH MORE UNCERTAINTY, BUT BY PREDEFINING INTEGRATION NEEDS AND CONSTRUCTIVELY PLANNING WITH SUPPLIERS, DELAYS CAN BE MINIMISED.”

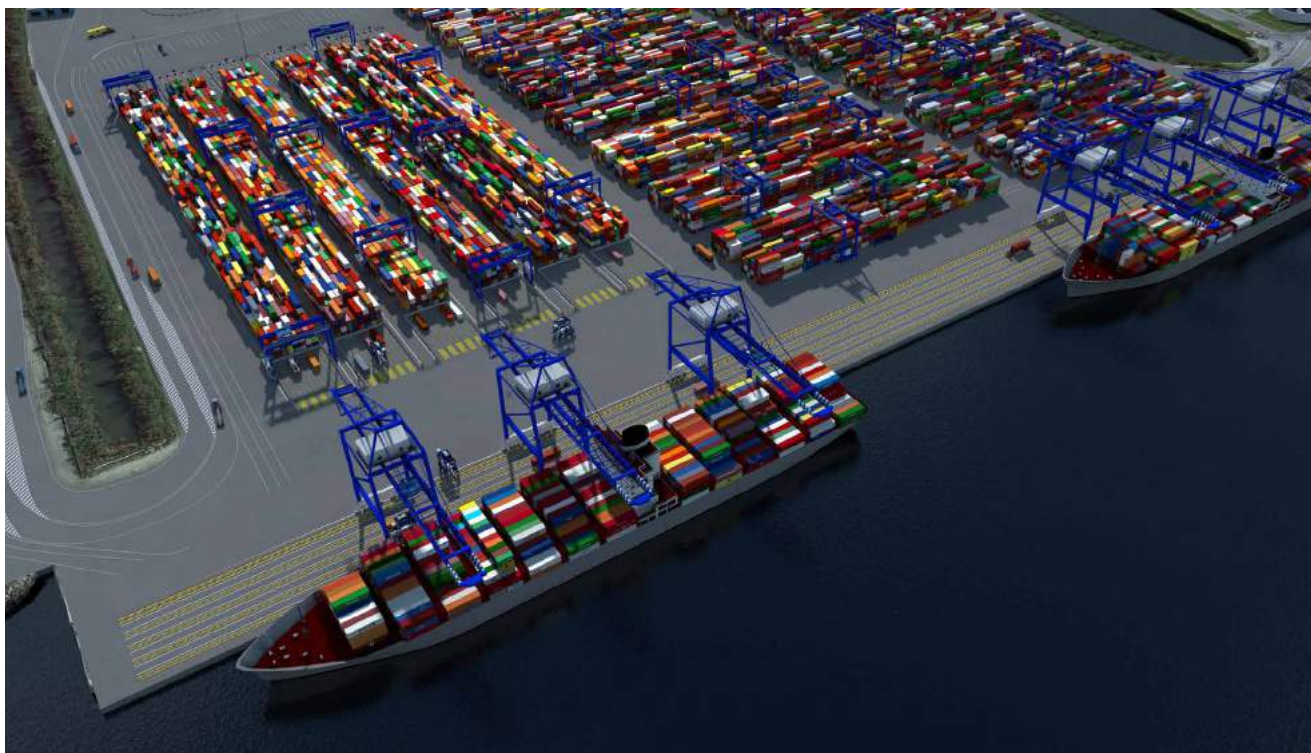


FIGURE 3.
Visualisation of a
container terminal
converting van RTG +
TT to ASC + ShC in a
hybrid operation

the terminal uses Shuttle carriers, which place containers underneath the quay crane. This is a different type of operation and does not mix. Hence, when containers are placed in the RTG stacks, but must be loaded to the quay cranes served by ASCs / Shuttle carriers, a handover must take place.

Using detailed operational planning and analysing the impact on all systems that are influenced by such a hybrid operation, the risk of overspending can be reduced or avoided.

CONCLUSION

Manually operated container terminals are currently researching how to either partly or fully automate their operation. Automated existing equipment, such as Automated Rubber-Tyred Gantry cranes or Straddle carriers, could make the automation process more straightforward and less risky. However, at Portwise, we have seen that the discussed

points in this paper are often not considered in a sufficient level of detail, resulting in severe project delays and additional costs.

Before starting your automation project, or even signing with suppliers, these 5 major pitfalls should be extensively noticed, discussed and evaluated. By taking the aforementioned points into account in the planning phase of automation projects, a stronger start to the process can be guaranteed. In addition, expectations within the organisation of what automation may bring can be managed well, which is key to the success of an automation project.

Portwise has years of experience with automation projects, both in the preplanning phase, project initiation phase and the implementation and go-live phase. We provide valuable automation consulting to mitigate risks and delays and to ensure project success. In this way, we guide terminal operators along the journey towards automation.

ABOUT THE AUTHORS:

Kaj de Groot works as Director of Automation Projects at Portwise. He has worked in the ports and terminals field for about 9 years and has been involved in many different brownfield terminal design and automation transition projects.

Pim van Leeuwen works as a Simulation Consultant at Portwise and has extensive experience with capacity analyses in ports and other logistics facilities. Next to this, he is a PhD candidate at Erasmus University Rotterdam, studying the effects of communication between terminals and shipping lines.

ABOUT THE COMPANY:

Portwise, formerly part of TBA Group, is a world-leading consultancy and simulation firm that combines extensive automation and operational knowledge with proven simulation tools to create a future-proof plan for your port, terminal or warehouse operation.

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

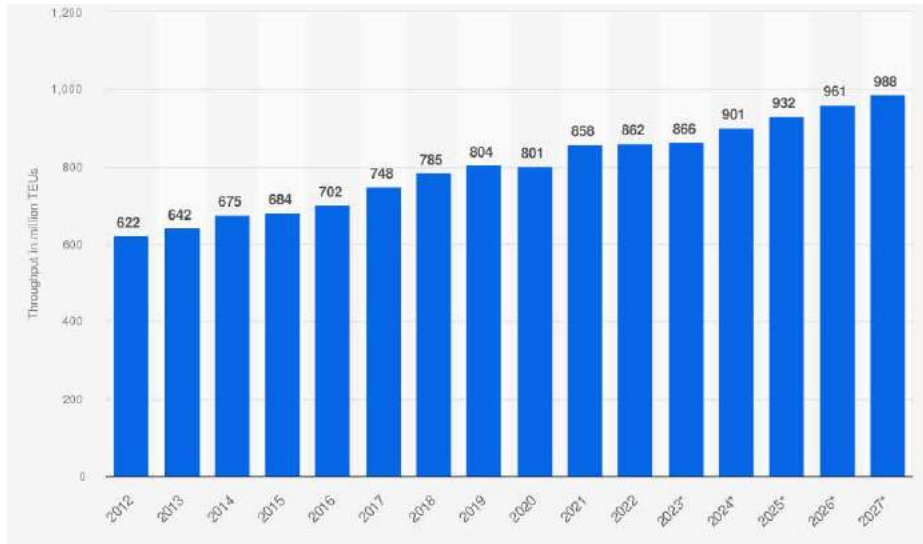
Given the complexity of both quayside and landside operations, the level of automation in horizontal transportation has stagnated when compared to other industries. With increases in container throughput expected to continue, success rests on a port's ability to continually optimise efficiency in container 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-

"GIVEN THE COMPLEXITY OF BOTH QUAYSIDE AND LANDSIDE OPERATIONS, THE LEVEL OF AUTOMATION IN HORIZONTAL TRANSPORTATION HAS STAGNATED WHEN COMPARED TO OTHER INDUSTRIES."

CONTAINER THROUGHPUT AT PORTS WORLDWIDE



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

ABOVE

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

Statista

automated and teleoperated cranes, where automation handles most of the action and human operators can oversee safely from a control room.

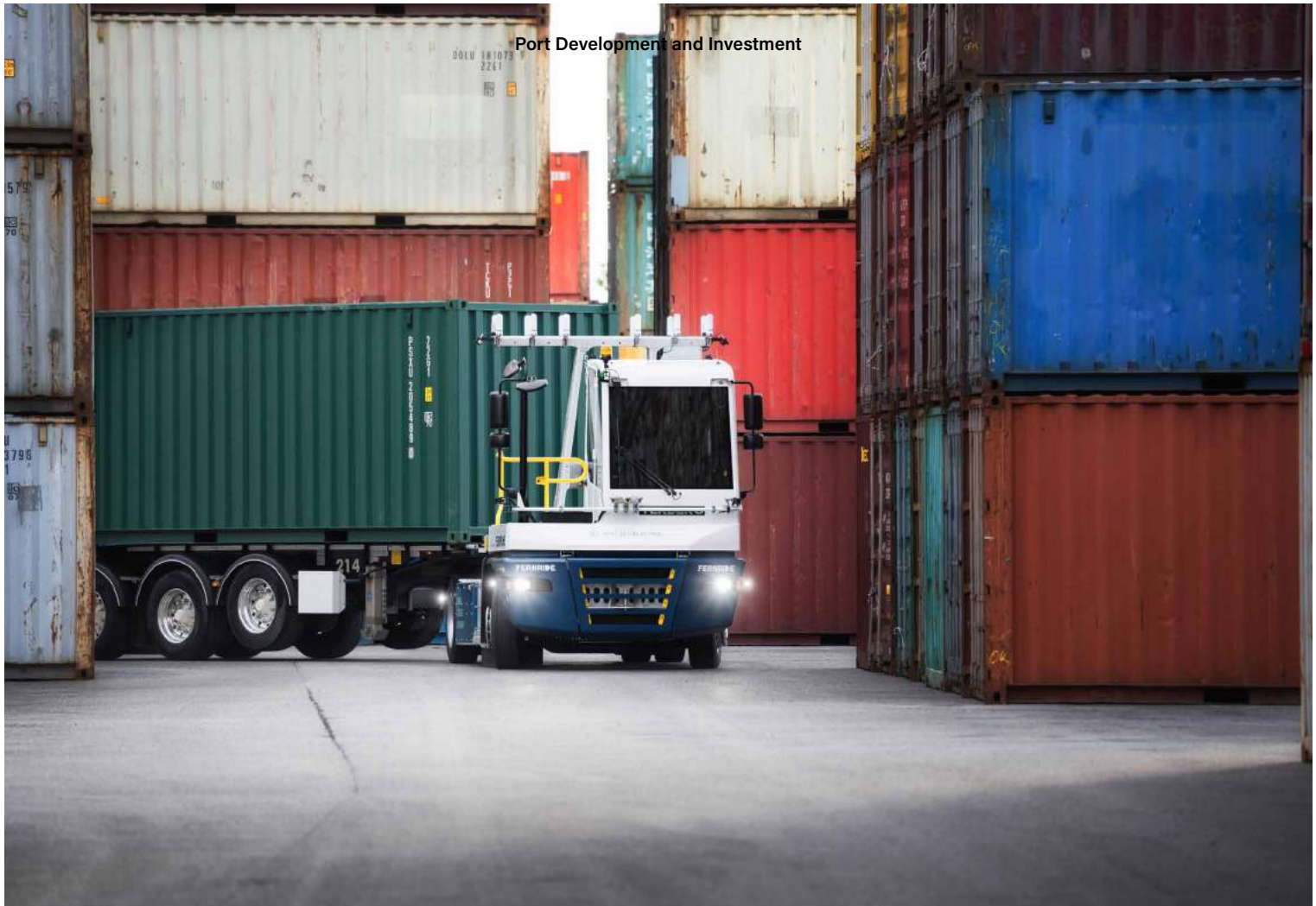
This approach has been particularly effective in the case of STS container cranes where autonomy can gather visual information using cameras and sensors over long distances, much more accurately than the naked eye, and without risk to the human operator. We have also seen ports successfully introduce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

"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."

“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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CTAC NORTH AMERICA 2023: TRANSFORMING PORT OPERATIONS AT THE PORT OF VIRGINIA

"ONE OF THE POSITIVE SIDE EFFECTS OF THE NEW TECHNOLOGY IS THAT VIRTUALLY EVERYTHING IS ELECTRIC. REPLACING FOSSIL FUEL VEHICLES WITH ELECTRIC ONES IS A MAJOR CONTRIBUTOR TO A MORE ENVIRONMENTALLY FRIENDLY OPERATION."





Margherita Bruno, Editor, Port Technology International, interviewing

Rich Ceci, Senior Vice President Technology and Projects, Virginia International Terminals

Following the success of Port Technology International's last year's Container Terminal Automation Conference (CTAC) North America 2023, we had the opportunity to engage in a conversation with Rich Ceci, Senior Vice President of Technology and Projects at Virginia International Terminals. In this interview, we explore how the port is actively adopting technology to elevate efficiency, sustainability, and safety.

Can you start by telling me about the specific areas or processes within The Port of Virginia where automation has been implemented recently?

Automation started in The Port of Virginia in 2007 when our Virginia International Gateway (VIG) terminal, located in Portsmouth, came online. Since then, our approach to using technology and understanding its overall value to our operation has not changed very much.

In 2019, we doubled VIG's capacity and implemented the same technology used in 2007 to drive operational efficiency and consistency across the operation; a year later we converted our Norfolk International Terminal's (NIT) straddle carrier operation to the

same technology. This conversion ended up increasing the container storage capacity on the same land footprint by 60 per cent. From our standpoint, we are a high-technology port first and foremost, though not all of our technology is associated with automation.

For example, we are using a grant from the US Department of Transportation to evaluate the technology required to service autonomous over-the-road trucks. That project resulted in our latest technology innovation: the installation of a private 5G network at VIG. Though the technology is still being evaluated, it has the potential to make a major impact on push-to-talk human-to-human communications as well as improve our on-terminal manned vehicles' ability to communicate with our terminal control systems. In addition, it may enhance our DGPS location tracking system.

Two years ago, we brought a brand-new intermodal yard concept online that has proven to be amazing. The new approach allows remotely operated intermodal cranes to service an on-dock rail operation much faster and safer than our previous systems. Once again, the win here was speed and safety that was attained by deploying technology assists.

How has technology improved efficiency and productivity in the port's day-to-day operations?

Technology is improving safety and operating speeds. In some cases, by taking humans out of fast-moving equipment and putting them in an office building we have been able to operate the equipment at higher speeds with increased acceleration and deceleration parameters that humans could not tolerate if they were onboard the equipment.

We have taken inspectors out of busy truck gate lanes and moved them into an office setting where they can do their jobs better. They are examining high-resolution pictures rather than walking around and dodging trucks in the rain and snow doing a manual, visual inspection. The result is faster, safer, and more reliable and that directly impacts productivity.

How has technology influenced the overall safety and security measures at The Port of Virginia?

VIG has always had excellent safety ratings. Recently, when we switched our other deep-water container terminal from a conventional to a high-technology operation we saw a significant reduction in lost time incidents – injuries. There is no doubt that

“FROM OUR STANDPOINT, WE ARE A HIGH-TECHNOLOGY PORT FIRST AND FOREMOST, THOUGH NOT ALL OF OUR TECHNOLOGY IS ASSOCIATED WITH AUTOMATION.”



“THE DEMANDS ON THE WORKFORCE RELATED TO TECHNOLOGY ARE GREATER THAN AT A CONVENTIONAL TERMINAL. MORE OF OUR WORKFORCE IS USING COMPUTERS AND TABLETS RATHER THAN PENCILS AND PAPER.”

these reductions are directly linked to the safety elements that are intrinsic to the technology.

In what ways have new technologies contributed to environmental sustainability and reduced the port's ecological footprint?

One of the positive side effects of the new technology is that virtually everything is electric. Replacing fossil fuel vehicles with electric ones is a major contributor to a more environmentally friendly operation. In 2020, we made a commitment to get all of our operational electricity needs from clean energy sources like solar, wind, etc. Our goal for achieving this milestone was 2032, but we completed that migration on 1 January 2024 well ahead of our deadline.

We have also reduced our carbon footprint by replacing our diesel shuttle trucks with hybrid alternatives that use 30 per cent to 40 per cent less fuel. And, we recently started a pilot program to evaluate the use of electric vehicles for on-terminal container movement between the yard and rail operation. The results are very interesting, but the early data shows this will need more time to evolve to become viable.

With the introduction of automation, have there been any changes in the workforce or the skill sets required for your employees?

This is a very good question and in short, yes. The demands on the workforce related to technology are greater than at a conventional

terminal. More of our workforce is using computers and tablets rather than pencils and paper.

The demands have been very high and our labour partner, to its credit, is responding well to this challenge and is making strides to master the required skills. And this evolution comes in other areas that have nothing to do with automation.

Take the skills required by a mechanic to service an engine. It is much different from maintaining a hybrid vehicle versus a simple diesel. The advancement of technology impacts more than the obvious computer-assisted jobs that come to mind. Rather these advances affect many aspects of life. This helps because now people are seeing technology all around them – from their phones to their TVs, to their cars. In some ways, our use of these advanced concepts has helped people cope with the other changes happening in other parts of their lives.

In light of last year's labour issues on the US West Coast, how does the port intend to strike a balance between harnessing the benefits of automation and safeguarding the well-being and job security of its employees in port operations?

Our labour union is our partner, and it is a partnership that we value. The VIG terminal was built on a greenfield site to replace a smaller, conventional container terminal. The new terminal became the Western Hemisphere's first high-technology container terminal and when it came online in 2007, not a single job was lost.

From the outset, we decided against the fully automated approach that was used in the Hamburg, and Rotterdam terminals (the only other automated terminals in existence at the time). We did this because we felt that the vessel productivity of the fully automated facilities was not adequate to meet our needs.

Our vision was vessel productivity that was 60 per cent higher than those happening at the

European sites. We felt our labour partner could do a superior job performing the horizontal transport (vessel to/from yard) portion of the operation than those that were automatic and this proved to be the case. We knew from the outset that once we locked in that operating model, there would be no going back.

If we were faced with that same decision today, we would make the exact same one. Our semi-automated approach keeps people in key spots and will outperform any fully automated system. Being part of the Commonwealth of Virginia, our performance is heavily focused on leveraging jobs and commerce.

Has automation had any unexpected challenges or lessons learned during its implementation at The Port of Virginia?

The software demands associated with these systems are significant. The vessel operations on a marine terminal are much less routine than you might imagine. Things

are happening all the time, and the uncertainty causes enormous stress on the software.

There are cases where gaps in the software cause people to engage in areas that, while necessary, are impactful for both productivity and accuracy. We strive to plug the gaps and improve the software to reduce the cases where people must work around software problems. The less variability we experience the greater the productivity.

The biggest lessons we learned are that the software makes a huge difference and that the job of that software is much more complicated than anyone would imagine at the start of a project.

What feedback have you received from your clients and stakeholders regarding the impact of new technologies on their experience at the port?

Generally, the feedback is exceptional. Several of the nation's largest retailers called beneficial

cargo operators (BCOs), have named us the best logistics hub in their network.

Take, for example, our use of truck reservations. Back in 2019, one BCO was so against the concept it was threatening to pull its business out of the port. We asked it to stick with us so we could prove the value of our concept.

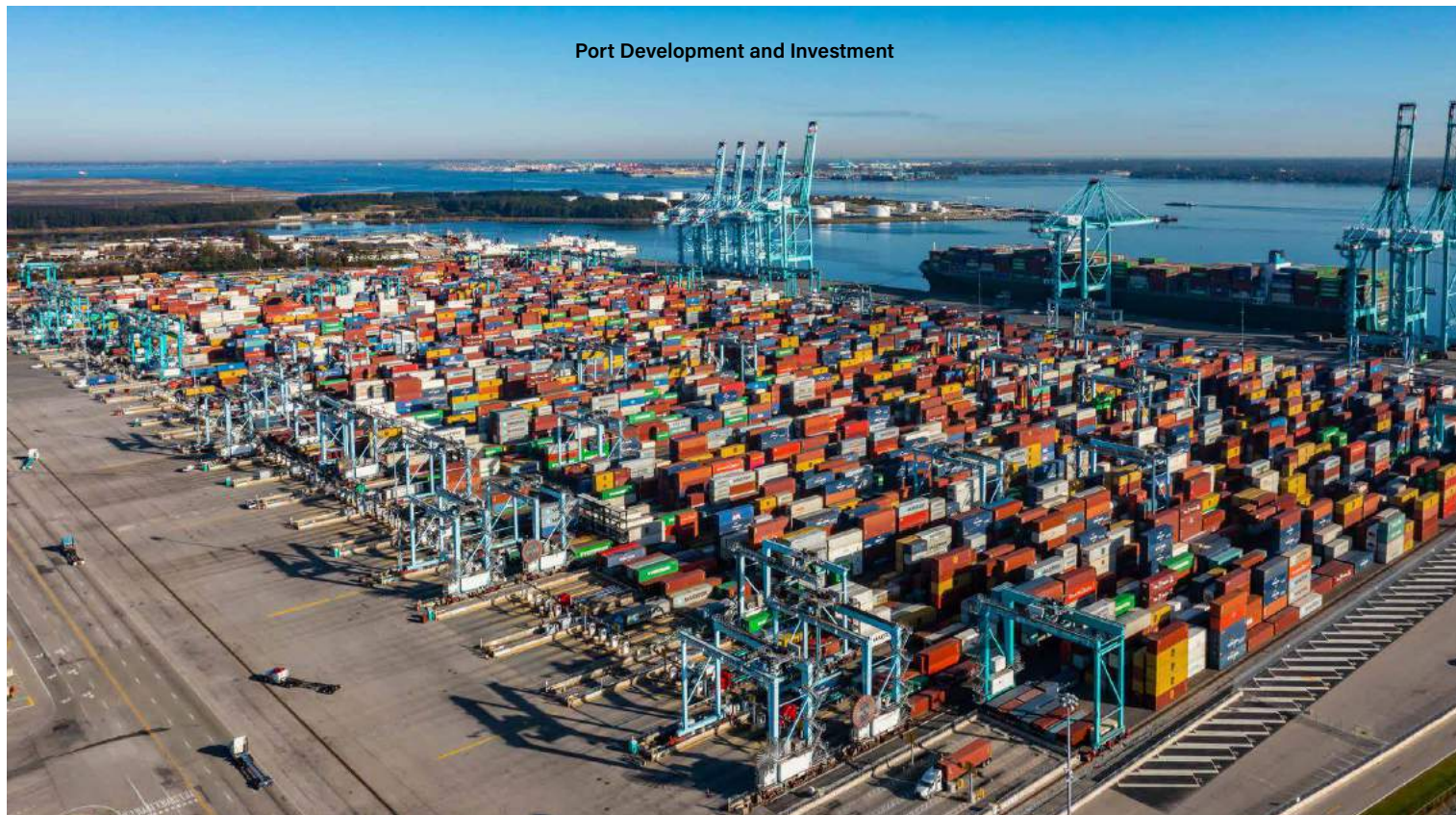
Over the course of an operating year, this company saw the dual move gate turn times of its trucks drop to under 40 minutes; it became an instant convert.

This year another major customer has latched on to our free API-based information subscription platform. That platform is handling 3.1 million messages per month and growing.

Our focus on the environment has also caught the attention of eco-friendly BCOs. The advancements we're making in overall sustainability are helping some of our BCOs hit their Scope 3 reductions goals. Our goal is to be America's Most Modern Gateway and a growing number of our port users understand why.

"THE BIGGEST LESSONS WE LEARNED ARE THAT THE SOFTWARE MAKES A HUGE DIFFERENCE AND THAT THE JOB OF THAT SOFTWARE IS MUCH MORE COMPLICATED THAN ANYONE WOULD IMAGINE AT THE START OF A PROJECT."





“OUR EARLY-ADOPTER APPROACH TO TECHNOLOGY BACK IN 2007 HAS ALLOWED SOME MAJOR EQUIPMENT PROVIDERS TO EVOLVE INTO TECHNOLOGY COMPANIES. THE RESULT IS THAT WE HAVE A VERY LOYAL SET OF SUPPLIERS WHO ARE HIGHLY COMPETENT TECHNOLOGY COMPANIES.”

Can you elaborate on any partnerships or collaborations with technology companies or research institutions that have facilitated the integration of automation at The Port of Virginia?

Our early-adopter approach to technology back in 2007 has allowed some major equipment providers to evolve into technology companies. The result is that we have a very loyal set of suppliers who are highly competent technology companies.

Domestically-based companies like Nascent (a gate system supplier based in North Carolina) Now-Trac (a California-based DGPS provider), Versiant/General Informatics (network consulting supplier in North Carolina), and Navis/Kaleris (TOS

provider based in Oakland) have been with us from the start. So have a number of European companies like CAMCO (OCR provider based in Antwerp), and TBA (simulation/simulation emulation provider based in the Netherlands). These companies grew their technology in concert with the development of our first terminal, and have gone on to enhance and grow them further over the past 16 years.

We have recently expanded some of our partnerships to a group of Virginia universities that are contributing to our autonomous vehicle project and also providing great help in our evolving cybersecurity strategy.

You can't have the success we have had by working alone. We have been fortunate to have as many great companies helping out

along the way. One other area that made a major contribution is the equipment suppliers and control system companies. The list in that area includes some very large, well-known names like Konecranes for Automated Stacking Cranes, and Kalmar for shuttle trucks, TMEIC for advanced equipment control systems, and ZPMC for ship-to-shore cranes.

What advice do you have for other ports or businesses looking to incorporate new technologies into their operations based on your experiences at The Port of Virginia?

First, you must manage the expectations of all your project stakeholders: all of them. If you get

any one of them out of sync you will likely have problems.

Be 100 per cent transparent. Do not trivialise any problems and, by all means, do not make problems sound hopeless. Accurate, factual transparent updates are mandatory.

Second, this is a lot harder than anyone imagines at the outset. The project team will work harder on one of these projects than on any other in their career: take whatever you think is a lot of work and then double it. And before you think this can be solved by adding people – just be careful. As the team gets larger the communications demands increase non-linearly.

Our project teams have been fairly small, usually less than 10 people. Those teams have typically done the entire job and by that I mean, business case development, engineering design, construction, procurement, equipment selection, and commissioning as well as all IT-related stuff.

Every seam between two suppliers adds an element of risk. So be careful how much you allow to be farmed out.

As automation becomes more prevalent in the shipping and logistics industry, what strategies does the port have in place to remain at the forefront of these technological advancements?

This is an interesting question. We deploy technology when it makes sense and has a benefit to safety, efficiency, or capacity. We also look for cases to improve the experience of the port stakeholders (i.e. API interfaces etc). So, we do not benchmark ourselves to ensure we are in the “forefront”. That question might be better if we consider how a new project team can digest the various emerging and existing technologies to create a project that is at the forefront of advancement.

People today have a major advantage versus what we were looking at back when our APM

project started in 2004. There are 20-plus successful cases today that can serve as a benchmark for the design of new projects. Technology has advanced over that period.

Undoubtedly new project teams are going to want to pick and choose elements from successful terminals. They will think they know better or have different needs (even if they don't).

A recommendation would be to look at a successful terminal as though it is a cake. The procedure for achieving a great cake involves following a recipe. The recipe used to produce a successful terminal can be adapted to different tastes or needs.

Be careful and make sure you know what you are doing. You might for instance decide to add almonds instead of chocolate to the batter and still get a great result. On the other hand, eliminating eggs, or replacing wheat flour with rice flour might end up making a mess and the follow-on result will be very costly. So, innovate, but be mindful of the risks.

Could you discuss any ongoing or upcoming automation projects or initiatives that are part of The Port of Virginia's future plans?

We currently have \$1.4 billion of projects underway and several very large projects in the engineering phase. The running projects are well-known:

- Renovating, modernising and adding capacity to the North Berth at Norfolk International Terminals (NIT)
- Deepening our harbour to 55 feet and widening it to allow for two-way traffic by the largest ships in the world
- Expanding capacity at NIT's Central Rail Yard and
- Creating the Mid-Atlantic's staging hub for the development of offshore wind infrastructure

All of these projects will be completed by the end of 2027.

ABOUT THE AUTHOR:

Rich Ceci joined VIT in May 2016 as Senior Vice President of Technology and Projects. He is responsible for the major expansion projects in The Port of Virginia. Rich and his team have completed expansions to two of the port's largest terminals that have increased capacity by 40 per cent.

Previously, Rich was VP of Information Technology for GCT USA in Bayonne NJ where he managed the Global Expansion Project, winner of several industry awards. In addition, he was the IT lead on the APM Terminals Virginia project.

ABOUT THE PORT:

The Port of Virginia is proudly recognised as CPP's top-performing port (with more than 1,000 vessel calls) and is located in Site Selection's 2022 Top State for Business Climate. The port exclusively owns and operates its terminals and the nation's leading chassis pool. At The Port of Virginia, customers and partners experience the efficiency and service excellence only offered through the most modern and technologically advanced container terminal operations on the US East Coast.

CTAC NORTH AMERICA 2023: IN CONVERSATION WITH NOKIA



NOKIA

Margherita Bruno, Editor, Port Technology International, interviewing

Peter Miller, Technical Specialist Director, Private Wireless, Nokia

In the wake of Port Technology International's Container Terminal Automation Conference (CTAC) North America 2023, this Q&A delves into the forefront of port development, specifically focusing on connectivity. Here, we illuminate the seamless integration of Nokia's digitalisation solutions into the evolution of conventional port operations. Within the connectivity domain, Nokia's technology serves as a catalyst, reshaping the port landscape to enhance efficiency, streamline processes, and champion environmental responsibility. Success stories, exemplified by the experiences of the Port of Seattle and Husky Terminal at the Port of Tacoma, underscore Nokia's

pivotal role in fortifying the core structures of port infrastructure.

How is Nokia's digitalisation technology transforming the traditional port operations into more efficient and streamlined processes?

Nokia's digitalisation technology, applied to traditional port operations, aims to transform the operations to be more efficient and streamlined in several ways:

1. Enhanced Connectivity:

By utilising Nokia's One Platform, ports can leverage the advanced connectivity provided by private wireless solutions, including 4.9G/LTE and 5G networks.

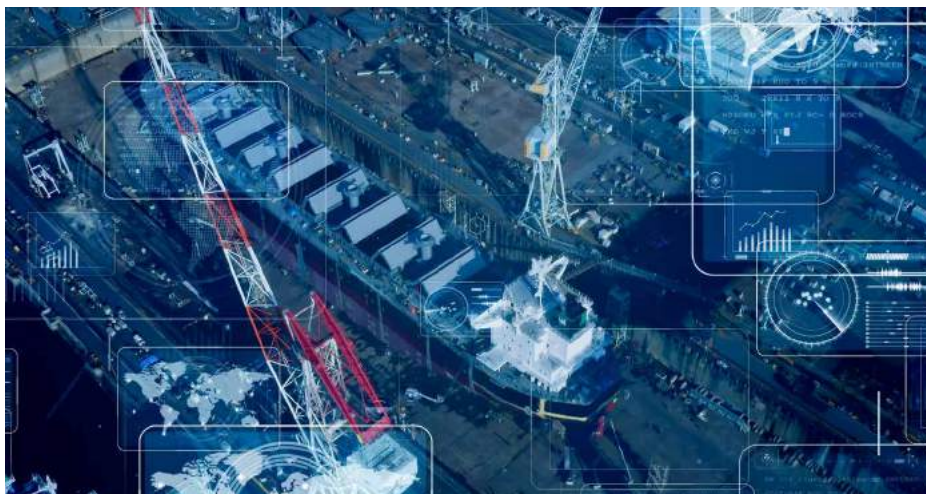
These networks offer reliable, high-capacity communication that is critical for port operations, allowing for seamless transfer of large amounts of data in real-time, which is vital for logistics management, remote operations, and various automation processes. Combining with existing Wi-Fi infrastructure which supports non-mission-critical IT systems, the connectivity can be streamlined to enable and focus on advanced operational (OT) use cases.

2. Operational Efficiency:

Digitalisation with Nokia's technology facilitates more efficient operation management. High-bandwidth and low-latency

"THE DEPLOYMENT OF NOKIA PRIVATE LTE WAS A SIGNIFICANT MILESTONE FOR US AT THE PORT OF TACOMA AND HAS EXCEEDED OUR EXPECTATIONS. THE REGULAR DISCONNECTIONS AND PACKET LOSS THAT WE EXPERIENCED OVER WI-FI, THAT CREATED DOWNTIME AND IMPACTED PRODUCTIVITY, ARE NOW A THING OF THE PAST. WITH RELIABILITY NO LONGER A CONCERN, WE'VE MOVED FROM FIREFIGHTING MODE TO FOCUSING ON THE STRATEGIC USE CASES THAT WILL FURTHER ENHANCE OPERATIONS FOR OUR CUSTOMERS AS WELL AS OUR TEAMS WORKING AT THE PORT."

Philip Styf, Director of IT, Husky Terminal



communication enable better coordination of operations, reduce waiting times, and optimise the flow of goods and vehicles through the port, leading to increased throughput.

3. **Automation and IoT:**

The use of the Internet of Things (IoT) allows for various components of the port to be interconnected. Equipment such as cranes, trucks, and containers can be equipped with sensors and become part of an integrated ecosystem that communicates continuously. This data can be used to automate processes,

schedule maintenance, and reduce downtime, thereby enhancing productivity.

4. **Safety and security:**

Nokia's platform can support applications that improve safety and security in port environments. Surveillance systems, drones, and other security measures can be integrated into the network, providing real-time monitoring to prevent accidents, unauthorised access, and other security threats.

5. **Data analytics:**

With the deployment of Nokia's

digitalisation solutions, ports can gather vast amounts of data from various sources. This data can be analysed to gain insights into operational efficiencies, traffic patterns, and predictive maintenance. Such analytics support decision-making and future-proofing of port operations.

6. **Sustainability:**

By optimising routing and scheduling, reducing congestion, and supporting autonomous vehicles and cranes, Nokia's solutions help reduce the environmental impact of port operations. Less idling time for ships and on-ground vehicles reduces fuel consumption and emissions.

7. **Remote and real-time insights:**

Centralised management software can provide a real-time view of all operations across the port. This ensures that port management can react promptly to any situation and adjust operations accordingly, even remotely.

8. **Scalability and flexibility:**

As ports grow and evolve, the digital infrastructure provided by Nokia's technology can scale to meet changing demands without the need for extensive physical reconfiguration, making it a future-proof investment.

"WE ARE WORKING WITH AT&T MEXICO AND NOKIA BECAUSE OF THEIR EXPERTISE AND UNIQUE KNOWLEDGE IN THE MEXICAN TELECOM MARKET. THE SIGNAL STRENGTH HAS REALLY EXCEEDED OUR EXPECTATIONS SO FAR. WE CAN COVER THE ENTIRE PORT WITH THE SOLUTION, REACHING A RADIUS OF ABOUT 6 KILOMETRES. THIS PLATFORM IS ALREADY CONSIDERED A REFERENCE FOR THE REST OF THE TERMINALS IN THE GROUP."

Nathalie Rush, Managing Director, APM Terminals Yucatan

Can you share some success stories or case studies of ports that have implemented Nokia's digitalisation solutions and witnessed significant improvements?

SSA Marine at Port of Seattle

In January 2021, Nokia announced a new LTE/5G private wireless network deal with the Port of Seattle. The deployment of this network aimed to modernise operations to deliver better performance, reliability, and security. Nokia provided high-performance private wireless/LTE, which was an upgrade from the previously used Wi-Fi networks, lacking in capacity, coverage, and performance. This improvement allowed the Port of Seattle to

leverage IoT and machine-to-machine communication, which is essential for modern port operations. As a result, the port anticipated improved operational efficiency and safety, paving the way for further IoT adoption, operational flexibility, and a platform for innovative applications.

Husky Terminal at Port of Tacoma

In September 2023, Nokia announced its deployment of private wireless at Husky Terminal. The deployment included a Nokia Digital Automation Cloud (DAC) end-to-end private wireless network, which provided reliable, secure, and high-speed connectivity to support all terminal operations. With the Nokia DAC, the Husky Terminal

aimed to optimise its container handling using advanced applications such as real-time yard inventory management, which would help track and move freight efficiently through the terminal. The improvement enabled Husky to manage its operations more effectively, ensuring precise scheduling and reducing container idle times, leading to increased throughput and reduced operational costs. The terminal experienced benefits in terms of asset tracking, video surveillance, and voice services through the enhanced connectivity. This supported Husky Terminal's move towards full optimisation and digitalisation in alignment with broader trends in the maritime industry.



What role does 5G technology play in enabling digitalisation at ports, and how does Nokia contribute to this advancement?

5G technology plays a crucial role in the digitalisation of ports, enabling a transformation in operational efficiency, safety and sustainability. It provides the high-speed, low-latency and massively connective network infrastructure required to handle the vast amounts of data generated by port operations and supports the use of advanced applications that require real-time data processing. 5G enables a number of key use cases echoing my keynote presentation at CTAC North America 2023. Nokia contributes to port digitalisation through its integrated 5G digitalisation solutions, which are tailored for mission-critical industrial applications requiring high reliability and security.

Nokia provides private wireless networks leveraging 4.9G/LTE and 5G, which deliver the needed control, reliability, and cybersecurity for port operations. These networks are designed to

support both outdoor and indoor coverage, ensuring comprehensive connectivity across port facilities. Nokia Digital Automation Cloud (DAC) and MX Industrial Edge (MXIE) offer a scalable, high-performance end-to-end private wireless network combined with edge computing capabilities crucial for port operations, enabling innovation and technology evolution.

With over 675 private wireless customers around the world, Nokia is the most preferred partner for port operators. Nokia has recently been recognised by Kaleido Intelligence as the number one champion in private network software, hardware and management.

Can you explain how Nokia's solutions help ports reduce their environmental footprint through digitalisation?

Nokia helps port operators reduce their environmental footprint achieving more efficient and sustainable operations.

1. Automated and optimised operations

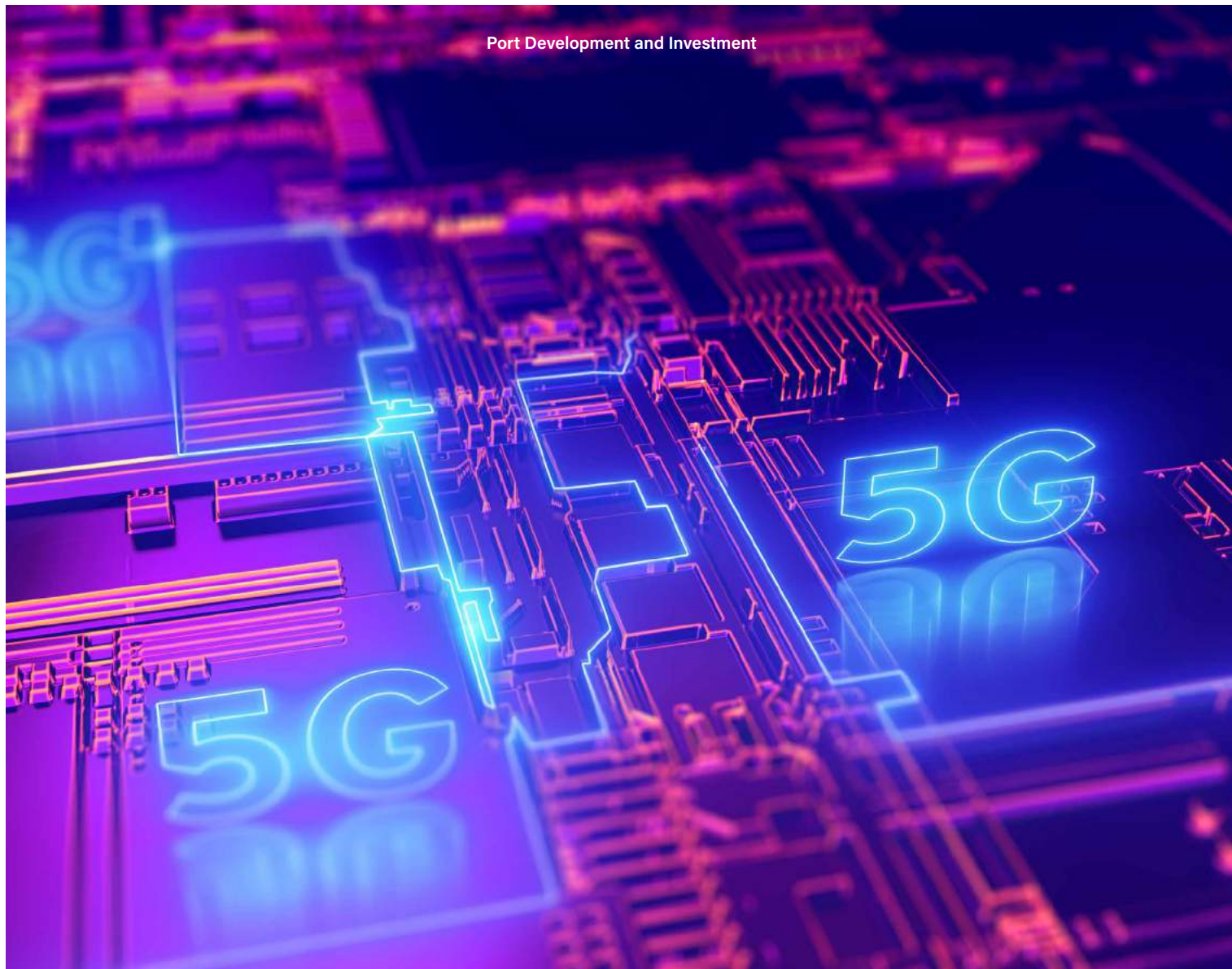
Automated equipment such as cranes, carriers and trucks can operate more efficiently, reduce idle time and optimise fuel consumption connecting through a robust network without any signal loss. The productivity gain and consumption reduction by reducing human errors cuts down costs and accidents.

2. Predictive analytics and energy management

The reduction in hardware required by private wireless networks means that the energy consumption is also reduced. Our Bell Labs study shows that replacing Wi-Fi infrastructure with private wireless can reduce up to 90 per cent of electricity required to cover the same area, while reducing blind spots and improving signal handoffs. Advanced predictive analytics can forecast when machinery or vehicles require maintenance, which ensures they operate at peak efficiency, using less energy and reducing the likelihood of energy-intensive breakdowns. The on-premises

"BUILDING FLEXIBLE AND RESILIENT TECHNOLOGY PLATFORMS TO MEET OUR CUSTOMERS' NEEDS IS A KEY ELEMENT OF OUR STRATEGY, AND BECOMING THE FIRST MAINLAND PORT OPERATOR IN THE UK TO OFFER A PRIVATE 5G NETWORK TO OUR CUSTOMERS IS A FANTASTIC MILESTONE FOR ABP. WE WOULD LIKE TO THANK OUR PARTNERS FOR ENABLING THIS PROJECT, WHICH WILL EQUIP OUR PORT IN SOUTHAMPTON WITH THE STATE-OF-THE-ART INFRASTRUCTURE NEEDED TO BE AT THE FOREFRONT OF THE DIGITAL REVOLUTION IN THE MARITIME INDUSTRY."

Henrik L. Pedersen, Chief Executive Officer, Associated British Ports



edge computing can facilitate a low-latency, fast responding process across the entire yard.

3. **Asset tracking and enhanced monitoring**

Using IoT connected to the private wireless network can help port operators monitor the condition and performance of equipment, ensuring that assets are used efficiently and environmental resources are managed responsibly. Besides, reducing the equipment loss and/or theft also reduces waste and costs.

4. **Nokia innovations**

Nokia actively invests in research and development to continuously improve its technology and services, supporting innovative applications that can further reduce the environmental impact of port operations.

Nokia committed to becoming carbon neutral by 2030, through our technology, advocating for policies that promote connectivity and reducing environmental impact through our products and services. (Nokia press release about ESG strategies)

How does Nokia collaborate with other industry partners to enhance optimisation at ports and drive digital transformation in the sector?

Nokia deploys digitalisation solutions to meet the unique needs of different ports by fostering strong ecosystem partnerships and deploying advanced, flexible technologies that can be tailored to various operational environments.

In April 2021, Nokia collaborated with Edzcom, a leader in edge connectivity for industrial settings, to deploy a 5G SA private wireless network for Konecranes, a company specialising in equipment and services for container handling. This partnership underscores the importance of creating an ecosystem that includes connectivity experts and industrial equipment manufacturers to deliver quality, integrated, reliable private wireless solutions. The private wireless network supports Konecranes' research and development work and expands the sophisticated R&D capabilities within the port industry.

In January 2021, Nokia also announced our extended partnership with Kalmar, a company that provides cargo solutions and focuses on

“BY IMPLEMENTING THE NOKIA INDUSTRIAL FIELDROUTERS AND DONGLES WITHIN STRADDLE CARRIERS, CRANES AND MOBILE MACHINES WE CAN RELY ON THEM STAYING CONNECTED TO THE CONTROL CENTRE. IT HAS ALLOWED US TO INCREASE AUTOMATION AS WE CONTINUE TO DELIVER INNOVATIVE SOLUTIONS THAT WILL BENEFIT OUR CUSTOMERS”

Toni Söderlund, Vice President, Products & Solutions, Kalmar

developing automated transport and logistics systems. Nokia demonstrated the ability to scale and enhance its digitalisation offerings to match the changing demands of port operations by co-developing new features with Kalmar. This partnership helps drive efficiency, safety and sustainability in port operators, which are common concerns for adaptation and scalability for port operators.

These partnerships reflect Nokia's strategic approach to adapt its digitalisation offerings to the distinctive requirements of each port, ensuring that the solutions are not only scalable and adaptable but also future-ready and aligned with the industry's move towards increasing automation and intelligence in operations.

What benefits can ports expect in terms of cost savings and increased operational efficiency by implementing Nokia's digitalisation technologies?

Cost savings

Nokia One Platform consists of industrial-grade 4G/5G private wireless, on-premises edge computing, ruggedised devices and one-click-to-deploy industrial applications, offered on subscription/as-a-Service. It means

port operators enjoy low CAPEX deployments and have full flexibility to scale up when they see fit. While increasing productivity and reducing idle time, the cost savings are substantial, in comparison to traditional Wi-Fi deployment. Our business case page summarises the key data points including return-on-investment (ROI), equipment cost reduction and productivity improvement: <https://www.nokia.com/industries/ports/private-wireless-business-case/>

Operational efficiency

The Nokia One Platform helps streamline operations through facilitating real-time coordination of activities, leading to more efficient cargo handling and less vessel turnaround times. The reliable and fast connectivity for data transfer on the Nokia One Platform allows for better communication between various stakeholders and systems within the port, improving response times and decision-making processes. With better tracking and monitoring of equipment, ports can optimise the use of their assets, ensuring that they are used efficiently and reducing idle times. Enhanced data analytics capabilities also enable ports to optimise logistics and supply chain management, reducing bottlenecks and improving the overall flow of goods.

How does Nokia ensure the reliability and uptime of critical systems when deploying digitalisation in a port environment?

Quoting Husky Terminal as an example, Nokia ensures the reliability and uptime of critical systems in a port environment by deploying the Nokia Digital Automation Cloud (DAC) platform, which provides a secure and resilient private wireless network. Nokia DAC delivers a private LTE network that is tailored for Husky Terminal's specific operational needs. LTE is known for its reliability and strong coverage, which is essential in a dynamic port environment where uninterrupted connectivity is critical. In addition, Nokia's industrial equipment such as fieldrouter, handheld, workpad and dongle is built to withstand the harsh and hazardous conditions often present in port environments, further ensuring the continuity of operations.

How does Nokia plan to support smaller or less technologically advanced ports in their journey towards automation and digitalisation?

Nokia recently announced the [Nokia DAC PW Compact](#),

designed to support smaller or less technologically advanced ports in their journey towards automation and digitalisation by offering a solution that is both easy to deploy and manage, with a small footprint and reduced deployment complexity.

The compact nature of the solution means it requires less physical space for installation, making it ideal for smaller ports that may not have the extensive infrastructure or space to accommodate large or complex systems. DAC Compact comes with pre-integrated hardware and software which reduces the time and expertise required to get the network up and running. With plug-and-play components, ports can set up their private wireless network with minimal disruption to existing operations.

Despite its compact size, the solution does not compromise on coverage or capacity, ensuring that

even smaller ports can enjoy the benefits of a high-performance private wireless network capable of supporting current and future digitalisation initiatives. The network is designed to be scalable, allowing ports to start with a small deployment and expand as their operations grow and as they adopt more advanced technologies. This scalability ensures that the investment is future-proofed, giving ports the confidence that the network can grow in line with their digitalisation journey.

By reducing the complexity and size of the required equipment, the DAC PW Compact offers a more cost-effective solution for smaller ports, which may have tighter budgets for technology upgrades. Nokia DAC PW Compact is well-suited to support smaller ports as they modernise their infrastructure, enhancing efficiency and competitive advantage through digitalisation.



ABOUT THE AUTHOR:

Peter has been working in the networking industry for over 35 years, as both an RF Technician/Engineer (US Army 33S) and Systems Engineer at sizeable global companies. Throughout his career he has been involved in networking technologies and products including high security wired and wireless networks, video surveillance cameras, autonomous hauling, PC networking technology, and Wi-Fi networking products. He submitted several patents which ultimately drove the requirements for Wi-Fi connectivity initiatives.

Peter is experienced with commercial and federal marketplace, sales channels, and project management. He earned his bachelor's in business at Strayer University with a major in business administration and minor in computer information systems and possesses an EET equivalent U.S. Army Education.

ABOUT THE COMPANY:

At Nokia, we create technology that helps the world act together.

As a B2B technology innovation leader, we are pioneering networks that sense, think, and act by leveraging our work across mobile, fixed, and cloud networks. In addition, we create value with intellectual property and long-term research, led by the award-winning Nokia Bell Labs.

Service providers, enterprises and partners worldwide trust Nokia to deliver secure, reliable, and sustainable networks today – and work with us to create the digital services and applications of the future.

IN CONVERSATION WITH OUR HOST PARTNER FOR SDP NORTH AMERICA 2023: THE PORT OF HALIFAX





Margherita Bruno, Editor, Port Technology International, interviewing **Mike Davie**, VP Operations & Technology, Halifax Port Authority

In the dynamic realm of port development, the Port of Halifax emerges as a beacon of innovation and efficiency. Following the success of Port Technology International's Smart Digital Ports of the Future (SDP) Conference in North America last year, this Q&A with Mike Davie, Vice President of Operations & Technology at the Halifax Port Authority, unveils the port's transformative initiatives. From pioneering Canada's first sector-focused living lab, The PIER, to leveraging smart technologies for safety and sustainability, the Port of Halifax navigates the digital landscape adeptly.

Can you share some of the recent innovative initiatives that the Port of Halifax has undertaken to enhance its operations and efficiency?

At the Port of Halifax, we're really focused on taking advantage of the tremendous opportunities for transformation that come with increased digitalisation, availability of data and connectivity. Any new initiatives we take on need to be done responsibly, enhancing security, efficiency and sustainability components, and so those are always at the foundation as we look

to innovate. There are a few exciting projects that come to mind.

In 2021, we established Canada's first sector-focused living lab for the transportation and supply chain industry called The PIER, which stands for Port Innovation, Engagement and Research. The PIER is a physical space that brings together an ecosystem of organisations looking to solve complex problems related to port logistics, supply chain and transportation. As well, we aim to focus on regulatory change requirements to enable innovation while always looking for ways to begin to decarbonise port-related activities through innovative solutions.

We've also set up several programmes over the past few years that are focused on operations and efficiency. PortControl is one example, a digital operating system we launched in 2021 for our partners, where they can both receive and submit information to help manage operations, including live access to harbour schedules and vessel information. We've also established a Port Operations Centre, where our Operations Coordinators work 24/7 to oversee all operations taking place within the harbour and at the facilities

we manage. On top of that, we set up a Joint Operations Centre with our supply chain partners PSA Halifax, our container terminals operator and CN, our railway provider, where we coordinate, deconflict and plan those critical links between vessels, terminals and rail through a collaborative data sharing system to streamline decision making. Finally, we have adopted an international system to promote ships to use cleaner engines, fuels and technology with preferential treatment offered either through discounts on port dues, tariff incentives or other benefits commensurate with the level of sustainability.

How is the Port of Halifax integrating smart technologies to improve the overall functionality and intelligence of the port?

As I mentioned, there are many opportunities as we become an increasingly digital industry and society. At the Port of Halifax, we value working with partners to do things differently. We don't need to always do things the same way they've been done. In fact, we need to change and evolve. Leveraging the Internet of Things and smart technologies is part of that shift.

"THE PORT OF HALIFAX IS THE ONLY EASTERN CANADIAN PORT THAT CAN HANDLE THE GIANT ULTRA-CLASS CARGO VESSELS INCREASINGLY BEING DEPLOYED BY THE SHIPPING LINES TO HALIFAX AND OTHER DEEPWATER PORTS IN NORTH AMERICA."

“SUSTAINABILITY IS A TOP PRIORITY FOR OUR WHOLE TEAM AT THE PORT. IT IS A CORE VALUE IN OUR 50-YEAR PLAN AND A FACTOR IN EVERY DECISION WE MAKE.”

We've been working with Protex AI and Telus, and even participated in a panel with them at the PTI conference in December, about technology we are using to help monitor activity in industrial zones to enhance safety. We have invested in this technology that augments our existing CCTV system and is trained through object recognition to identify when something could be amiss. It uses AI to augment the human and equipment activities around monitoring for safety, by constantly scanning and alerting management or operations if there is activity that might overlap where it shouldn't and needs attention.

Similarly, we have Environsuite, a noise monitoring system set up to monitor and record noise levels and send alerts if readings are over acceptable levels. The Port of Halifax mainly operates in and around the centre of the city, so we always want to make sure we are striving to be good neighbours. This system allows us to monitor and investigate if we get concerns from the community. It's important that we use technology where and when we can to increase transparency and visibility to operations.

While it may seem simple, a lot of this technology would not have been in place even five years ago. We believe it's important to work with partners to find solutions for the challenges of today and tomorrow, and the best way to do that is to collaborate. That's where The PIER has been key, helping to facilitate partnerships and find opportunities. We can write a challenge statement and through The PIER, share it with industry and innovation players, like small businesses, start-ups, and universities, that may be able to help us solve the problem. PIER members

can then take that solution to market in Halifax and internationally, which strengthens the industry.

Could you provide insights into any development projects at the Port of Halifax that are aimed at enhancing infrastructure or capacity?

The Port of Halifax is the only eastern Canadian port that can handle the giant ultra-class cargo vessels increasingly being deployed by the shipping lines to Halifax and other deepwater ports in North America. In November, our container terminal operator PSA Halifax unloaded two new mega Ship-to-Shore (STS) cranes at the Atlantic Hub terminal located at the south end of the port. These ultra-large cranes add more capacity, along with our existing five super-post-Panamax cranes at the terminal which allow PSA Halifax to handle the largest container vessels on the water today. The new cranes will also support our plan to expand PSA Halifax's capacity from 1.1 to 1.4 million TEU through optimising existing infrastructure.

PSA Halifax is also purchasing eight new electric Rubber-Tired Gantry cranes (E-RTGs) for its Atlantic Hub terminal, which will not only increase the terminal's handling capacity by 25 per cent but are part of PSA's plan to electrify their terminal equipment, which will help the Port meet sustainability and decarbonisation goals.

One goal we have at the Port of Halifax is to grow the Atlantic Gateway through new and improved rail infrastructure, which will enable the Port to handle the projected increases in container volumes in the next 10 or more

years. We are currently delivering a Rail Solution project under the National Trade Corridor Fund, which will make use of existing infrastructure to create a more efficient and sustainable way of moving and handling cargo, aiming to reduce container traffic through the downtown core.

Those are just a few developments from recent months at the Port of Halifax. We also have a 50-year plan for growth that brings us out to 2070.

Reflecting on last month's "Smart Digital Ports of the Future 2023" conference, how is the Port of Halifax collaborating with other global ports to share best practices and foster innovation?

That is a great question. In October of last year, The PIER at the Port of Halifax along with homePORT at the Port of Hamburg and Opentop at the Port of Valencia announced they are working together to design and establish the first-ever network of global port innovation hubs.

The goal of this collaboration, the Port Innovators Network (PIN), is to enable a global alliance of port innovators, which will provide members access to a broader pool of companies to work with. The connection of the three living labs will bring additional international perspective, and help create a greater understanding of cultures, ideas and solutions to complex problems. It will also expand existing capabilities for testing and demonstrating new technologies. We're enthusiastic about this partnership and the upcoming new additions to the network, and should be sharing more in the coming months.

How is the Port of Halifax incorporating environmentally sustainable practices and technologies into its operations, and what are the key focus areas in this regard?

Sustainability is a top priority for our whole team at the port. It is a core value in our 50-year plan and a factor in every decision we make. I've mentioned a few projects that support our sustainability efforts and goals already, but another initiative worth mentioning is our work with carriers. We have seen continuous positive trends in vessel emission reduction at the port since implementing our Harbour Dues Incentive programme in April 2022. The initiative offers annual rebates to vessels that voluntarily register and meet the Environmental Ship Index (ESI) requirements for reducing greenhouse gas emissions.

ESI-qualifying vessel calls were up from 83 in Q2 2022 to 128 in Q2 2023 – an increase of more than 50 per cent. We're just compiling

our numbers for the first full year of measurement and have seen excellent participation including multiple carriers with 100 per cent of vessels registered, and many vessels reaching the 2050 IMO CO2e targets already.

ESI incentivises responsible shipping and gives us an idea of where the vessels coming into the Port are with respect to emissions, so we can benchmark and measure progress moving forward.

In the context of digitalisation, what steps has the port taken to streamline processes and improve communication within the port community?

In 2023, the Port of Halifax and project partners were recognised at the International Association of Ports and Harbours (IAPH) Sustainability Awards in the "Digitalization" category. By integrating data from cargo handling and transport, operations, and other factors in an accurate and interoperable system, the Data Enhancement Framework 2

(DEF2) project builds an assessment of CO2e intensity associated with operations, showing per container and per metric ton amounts of carbon.

I mentioned our Port Operations Centre already, which is a significant project for us, as well as the Joint Operations Centre (JOC), which will be grounded around data collaboration with our core supply chain partners. The JOC has allowed us to transition our legacy data platform into the cloud using the most modern data tools available. We're essentially setting up seamless data sharing so we all have one central database and one source of truth about core operational activities that will allow for better planning and visibility for decision making. Halifax is unique because we have the key components of larger ports, but the nimbleness to move quickly and innovate. Over the next few years, building out the data platform for systems and data innovation for collaboration across the port will be a major focus.

"OUR GOAL IS TO BUILD SMART, IN A WAY THAT IS FINANCIALLY AND ENVIRONMENTALLY SUSTAINABLE, AND THAT COMPLEMENTS OUR SURROUNDING COMMUNITY."





With the increasing reliance on digital technologies, what measures has the Port of Halifax implemented to ensure the security and integrity of its digital infrastructure?

All of these projects I've mentioned, have cybersecurity wrapped around their plans. You can put the best new innovations in place, but without ensuring the physical and cyber security aspects, it doesn't work. We're putting in a cyber resilience programme with a number of components, awareness at all levels, and IT security tools, leveraging advanced capabilities with partners like Microsoft. We've also put in place a strong incident response programme, so we are ready to respond. These are important foundational components of all modern programmes. You have to have them in place to sustain your business these days.

Looking ahead, can you provide a glimpse into the Port of Halifax's vision for the future and any upcoming projects or technological advancements that stakeholders and the industry can anticipate?

The Port of Halifax is future-focused and guided by our 50-Year Plan, which looks at port planning to 2070. Our Plan is a roadmap for sustainable development and identifies measurable benchmarks that need to be met before infrastructure expansion is necessary.

As we move forward with our

50-year plan, our goal is to build smart, in a way that is financially and environmentally sustainable, and that complements our surrounding community. We are working to become One Port City and want to see more people sharing in the benefits that come from cargo and cruise operations at the Port of Halifax. Sustainability, environment, and inclusion are all factors included in our ongoing planning decisions. Since the plan was released, we have signed an MOU with the Port of Hamburg to explore decarbonising the shipping corridor between our two ports. The MOU has the potential to introduce new technology to our port that could result in hydrogen-powered yard equipment or hydrogen, or its derivatives, refuelling for ocean vessels when the technology advances.

We've talked a lot about technology, but I wanted to highlight the importance of our people and our culture as well. There's no doubt that technology has and will continue to change the world, but without a dedicated and motivated workforce to guide and enable these advancements, no port will advance. A big part of our story and our future focuses on staff development. We have worked to implement learning paths and growth opportunities for our team. We're becoming more data literate and providing opportunities to change the digital culture, and it's necessary to leverage technology, but I do believe the differentiator for Halifax is our culture, the ability to embrace change and the flexibility to learn and grow.

ABOUT THE AUTHOR:

Capt(N) (Ret'd) Mike Davie joined the Halifax Port Authority (HPA) in 2018 initially in the role of Vice President Operations & Planning. Mike led efforts to modernise operations management and built a Planning team to complete a comprehensive Port 50-Year Plan and manage HPA's larger infrastructure projects in the future. As VP Operations & Technology, Mike continues to ensure secure, safe, efficient, and environmentally sustainable conduct of marine and landside operational activities. He also oversees the port's ability to respond to emergencies through a comprehensive Emergency Management System and provides oversight for Information and Technology Services transformation and innovation through the Port's living lab, The PIER (Port Innovation, Engagement and Research).

ABOUT THE PORT:

As Canada's Ultra Atlantic Gateway, the Port of Halifax is essential for Canada's global trade security. Offering a natural, deep harbour and big ship infrastructure, Halifax can accommodate large volumes of containerised cargo, breakbulk cargo, and project cargo. By collaborating with strong operating partners, labour and other interested parties, fluid, reliable, and efficient cargo capabilities at the Port of Halifax help deliver excellence to containerised cargo trading partners around the world.

The Port of Halifax is a full service, diversified port and is receiving the largest containerised cargo ships of any Canadian port. Ultra large 16,000+ TEU vessels approaching 400 metres arrive regularly and contribute to steady and sustainable growth.

COLLECTIVE ACTION AS A PATHWAY TO NET ZERO





Keith Svendsen, CEO, APM Terminals, and
Tiemen Meester, COO Ports & Terminals, DP World

APM Terminals and DP World are steering port development towards Net Zero by addressing the fragmentation of solutions hindering zero emissions in container terminals. Their white paper outlines a pathway for decarbonising ports, culminating in the formation of the Zero Emission Port Alliance (ZEPA) at COP28.

To reach Net Zero, we have to think big, think outside our own 20 or 40 ft boxes and we have to think ahead to overcome the roadblocks in our way. We believe that the roadblock to zero emissions in container terminals right now is a fragmentation of solutions. In a maze of battery sizes, life spans, charging infrastructure and software, we must make choices to reach a point where we have solutions that are efficient, can be rolled out fast and will not add unnecessary cost to our customers. We believe that electrification of terminal equipment is the right choice and the way ahead to reach Net Zero for our part – and even better: this solution is within reach!

The first step we did to reach this, was to analyse what needed to be done and how. These findings were presented in our recent white paper [“Reaching a tipping point in battery-electric container handling equipment”](#). In that paper, we laid out

a pathway for port decarbonisation by overcoming the challenges in the uptake of battery electric container handling equipment (BE-CHE).

The next step on this pathway was announced at COP28 in Dubai in the form of the [Zero Emission Port Alliance \(ZEPA\)](#). APM Terminals and DP World launched this industry-wide coalition to accelerate the electrification of container handling equipment, both in our own terminals – as well as in many more terminals around the world. Because this is not something for us to do alone. Everyone in our industry needs to be on board in picking the low hanging fruit of terminal transformation – the electrification of terminal equipment – both to be able to lower our greenhouse gas (GHG) emissions, but also to make a good business case. Therefore, we are delighted to have started the discussion with other organisations in the container handling value chain, who are exploring collective action. Across various industries, there is a precedence for industry alliances like this one. It is all about de-risking the supply chain.

NO SMALL TASK

At APM Terminals and DP World alone, we have about 10,000 units of container handling equipment each. On a global level the number

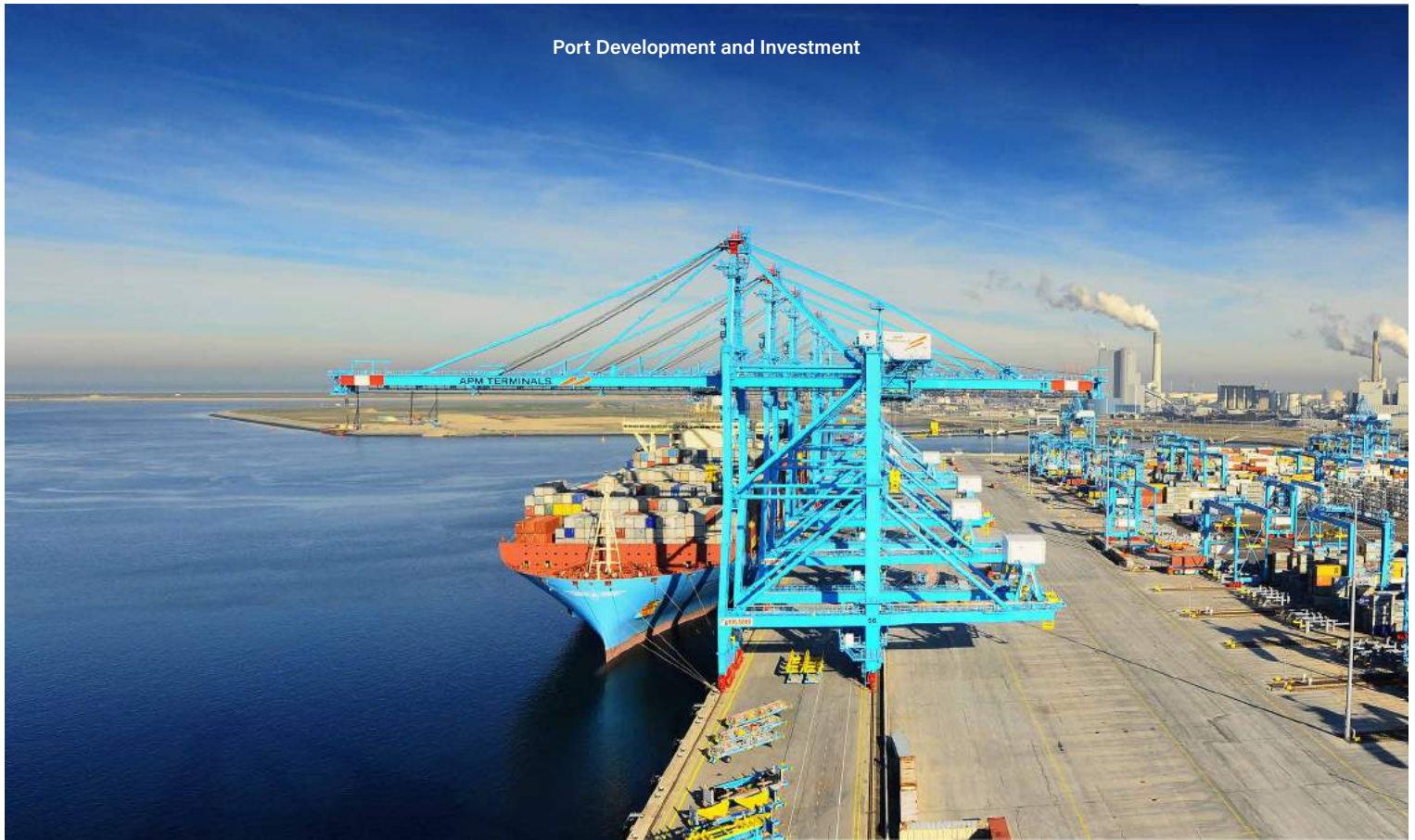
is about 100-150,000 units. Globally those units are responsible for 10 to 20 million tonnes of carbon dioxide emissions every year. We want to electrify all these units. We believe the point at which electric container handling equipment becomes more attractive, accessible, and affordable than the incumbent diesel technology will be reached within two to eight years, as the research in our white paper sets out.

Switching out more than 100,000 units of container handling equipment is no small task – it might even sound like an impossible task – but we already have good examples to lead the way and to inspire.

A HEAD START

Already this year, massive changes are happening in our own fleets. At APM Terminals in Jordan, employees are currently being trained in operating electric reach stackers, empty handlers and terminal tractors that arrived this fall. At Maasvlakte II in Rotterdam, the terminal is now fully decarbonised after having put six additional electric terminal tractors into operation. Electrical terminal tractors are also heading to Egypt to run in full operations in April 2024. Also in 2024, we will

“TO REACH NET ZERO, WE HAVE TO THINK BIG, THINK OUTSIDE OUR OWN 20 OR 40 FT BOXES AND WE HAVE TO THINK AHEAD TO OVERCOME THE ROADBLOCKS IN OUR WAY .”



“IN A MAZE OF BATTERY SIZES, LIFE SPANS, CHARGING INFRASTRUCTURE AND SOFTWARE, WE MUST MAKE CHOICES TO REACH A POINT WHERE WE HAVE SOLUTIONS THAT ARE EFFICIENT, CAN BE ROLLED OUT FAST AND WILL NOT ADD UNNECESSARY COST TO OUR CUSTOMERS.”

deploy electric straddle carriers in Barcelona, and in Los Angeles, we will deploy electric automated straddle carriers. To finalise the five pilots, we are working with an US-based supplier to deploy electric terminal tractors in Mobile, Alabama in Q4 2024. For all five pilots that we are currently running, we have invested \$60 million in electrification. Also this year, APM Terminals Bahrain, the operator at Khalifa Bin Salman Port, announced the launch of a solar power project to generate 18.5 Gigawatts of electricity per year to secure a renewable energy source to various port operations. As of this fall, about 40 per cent of all APM Terminals' electric consumption is from renewable energy.

At DP World, we have established an equipment electrification capital plan focused on our fleet of Rubber-tyred gantry (RTG) cranes and electric terminal tractors. In so doing, we have identified up to \$350 million investment for this programme through to 2027. 20 electric terminal tractors have been ordered for our Callao operations, and 12 electric straddle carriers for London Gateway. At our terminal in Jebel Ali Port, we have 121 electric terminal tractors in process, half of which are conversions, with the plan to electrify the whole fleet within the decade. And of course, that means ensuring adequate clean electricity supply. We have achieved 100 per cent renewable electricity supply at

operations in Netherlands, Belgium, Germany, Serbia, Brazil, Ecuador, Chile and DryDocks World in the UAE. Our terminal in Antwerp now runs on 100 per cent green energy, while Rotterdam World Gateway is our first net zero carbon terminal, achieved through equipment electrification, using biofuels and compensating for residual emissions.

Forging the way ahead together

We are pushing our future forward strategy hard, but we need all industry stakeholders to take the same path to get all the way to zero. Join us on the path to Net Zero. As an industry, let's all think big. The goal is just on the horizon. We can reach it by pulling together.

“SWITCHING OUT MORE THAN 100,000 UNITS OF CONTAINER HANDLING EQUIPMENT IS NO SMALL TASK - IT MIGHT EVEN SOUND LIKE AN IMPOSSIBLE TASK - BUT WE ALREADY HAVE GOOD EXAMPLES TO LEAD THE WAY AND TO INSPIRE.”

ABOUT THE AUTHORS:

Prior to his role as CEO of APM Terminal, Keith Svendsen has held several leadership positions across several businesses in Denmark, Italy, the United Kingdom, Turkey, China, and The Netherlands. Most recently, as Chief Operating Officer in APM Terminals (2017 – 2022) leading the transformation to become the best terminal operator, and Head of Operational Execution for Maersk Line (2012 – 2017). Keith joined A.P. Moller-Maersk as sea-going cadet to become a master mariner

Tiemen is the Group Chief Operating Officer, Ports & Terminals at DP World.

Prior to joining DP World, Tiemen held several business positions at Sea-Land, Maersk, and APM Terminals, including Senior Vice President for New Business at Maersk, VP of Human Resources at APM Terminals, and Regional Manager at Sea-Land.

Tiemen has over 16 years' worth of experience covering the globe, large scale multi-port acquisitions, greenfield and brownfield port projects, and ports and logistics responsibility over a large portfolio of ports and terminals. Tiemen has educational qualifications from Columbia, Cornell, IMD and Harvard and was a naval officer for five years at Merchant Maritime.

ABOUT THE COMPANIES:

APM Terminals develops and operates advanced container terminals around the world and has been doing so for more than a half century. The company has facilities in 64 key locations in 38 countries around the globe – with several in development. As an independent division in A.P. Moller-Maersk, APM Terminals employ approximately 22,000 people, and in 2022, there were 30,000 vessel calls in the terminals.

APM Terminals has made an industry-leading commitment to be fully net-zero in 2040 and to reduce total emissions by 70 per cent by 2030 compared to 2020. Find more on the APM Terminals decarbonisation efforts here.

Trade is the lifeblood of the global economy, creating opportunities and improving the quality of life for millions of people around the world. DP World is here to make trade flow better, changing what's possible for the customers and communities we serve globally. With more than 106,500 employees across 73 countries, we are pushing trade further and faster towards a seamless supply chain that's fit for the future. By integrating our physical infrastructure with cutting-edge technology, we create efficient end-to-end solutions, pushing the sector towards better ways to trade, minimising disruptions from the factory floor to the customer's door. Find out more about DP World's decarbonisation strategy here.



DIGITAL TRANSFORMATION AND SUSTAINABLE DEVELOPMENT AT THE PORT OF TYNE



Rakin Rahman, Staff Reporter, Port Technology International, in conversation with **Ian Blake**, Head of Innovation and Technology, Port of Tyne

Exploring the transformative potential of digitalisation, PTI delved into the prospects of enhancing efficiency, safety, and sustainability at the Port of Tyne during the Maritime Innovation Week in November 2023, hosted at the 2050 Maritime Innovation Hub in the North East and at the BT Tower in central London. As we navigate the evolving landscape of port development, the question arises: How can the integration of digital technologies revolutionise operations and propel the Port of Tyne towards a more streamlined and resilient future? In this exploration, Ian Blake, Head of Innovation and Technology at the Port of Tyne, dissects the manifold ways in which digitalisation stands poised to redefine the maritime domain, shaping a narrative of progress and innovation within the port's infrastructure.

IB: We are at the beginning of our digitalisation and smart port journey, which has accelerated since 2019 when the UK government launched Maritime 2050. Here at the port, we



launched Tyne 2050, which is our own 30-year transformational strategic plan, which is in line with Maritime 2050. Intentionally ambitious, our targets look to exceed UK government targets extensively, and we want to be net-zero by 2030. We think we will smash this target and hit it by 2027 or 2028.

I'm looking after the smart port initiative within the port for which the initial part of that strategy is the implementation of a 5G

network. I see the 5G network as an enabler to many of the projects across the business. Once we have that wireless connectivity in place, and we can connect everything to everything, then the 5G network will act as a data-gathering platform to allow the port access to unprecedented levels of operational data that we've never had before. In the past, we've always relied on the exceptional knowledge of our operational staff, now we will be able to supplement

"I SEE THE 5G NETWORK AS AN ENABLER TO MANY OF THE PROJECTS ACROSS THE BUSINESS. ONCE WE HAVE THAT WIRELESS CONNECTIVITY IN PLACE, AND WE CAN CONNECT EVERYTHING TO EVERYTHING, THEN THE 5G NETWORK WILL ACT AS A DATA-GATHERING PLATFORM TO ALLOW THE PORT ACCESS TO UNPRECEDENTED LEVELS OF OPERATIONAL DATA THAT WE'VE NEVER HAD BEFORE."

“OUR AIM IS TO PROMOTE MARITIME AS AN ATTRACTIVE PROPOSITION FOR NEW COMPANIES. WHEREAS IN THE PAST, WE'VE BEEN SEEN AS A SLEEPING DINOSAUR, THE MARITIME SECTOR IS NOW OPEN, READY, AND RIPE FOR IMPROVEMENT, ESPECIALLY AROUND DECARBONISATION TARGETS.”

that fantastic knowledge with critical information to allow the business to make data-led decisions in near real time.

We can look at the potential scenario planning and optimisation algorithms to ensure we're using the correct resources both manpower and equipment-wise to streamline the operation for the benefit of the customer and for ourselves at the port. We will add sensors to our equipment, plant, and machinery that will provide data to find optimal routes, relieve bottlenecks, and optimise fuel consumption, excessive idling, and emissions from the vehicles. We'll also be able to identify the optimal levels of equipment required. For example, we might be able to reduce the machinery and resources we use but still perform the way we are at the minute by using the equipment a little smarter.

We can use predictive monitoring and Artificial Intelligence (AI) to help with preventative maintenance around the site, we can find areas where we have frequent flooding, potential potholes, issues with street furniture, and missing signage, and we can reduce downtime and repair costs. We'll feed this information into our Digital Twin, which will then help the engineering departments deal with those repairs more quickly and efficiently than they are now.

We're currently trialing the use of AI over CCTV, and this will help us identify areas of poor practice and issues around things like not wearing Personal Protective

Equipment (PPE), and near misses between equipment and pedestrians or people. Our VR simulation tools will then help to target training in specific areas. So, if you notice an issue in a warehouse, for example, we can target training for warehouse staff or quayside operations. We can then use the information from the Virtual Reality (VR) and AI tools to monitor improvements and compliance with best practices or for continuous improvement. Some of the technology may also allow us to relocate staff from the more hazardous areas of operations and allow remote monitoring, keeping our colleagues safer from harm. If we can take people away from the quayside and move them into the back office, there's a lower risk of harm and a more comfortable working environment. They don't have to be outside in the cold and rain.

The wireless network will also allow staff to report issues in real time at the point of issue, rather than requiring staff to return to the office as they do now to log something on a physical desk computer. All our staff will have been issued with smart devices that allow them to access the system's corporate communications across all aspects of the business. And we look to feed data from sensors in real time to operational systems, allowing us to remove the historic paper-based manual systems, spreadsheets, and the dual entry processes that were prevalent in the port. Simply put, we'll be able to do more with less, and as a business will be quicker,

faster, safer, and smarter.

So how do I see the port's 5G private network helping with the decarbonisation targets?

The 5G network will be integral across the business and the data gathered will benefit all our 2050 objectives. From an operational perspective, we anticipate the data around vehicle movements across the sites will help us identify unnecessary journeys and excessive vehicle idling. This is going to lead to reduced fuel consumption and emissions generated once the data is analysed. Our data analysts and environmental team are already creating CO2 dashboards around operational areas of the business to identify where we are undertaking unnecessary or excessive work. So, having this data will allow operations to plan work more efficiently and to utilise the storage that we have in a more effective manner. Learnings from this is already making a huge difference in key areas towards our net zero targets. We can also link building smart meters and water meters around the site to a centralised dashboard, allowing us to identify trends and produce targeted reduction strategies. More importantly, we can then monitor the success of these targets.

We are working with numerous accelerator programmes and SMEs to try and bring best practices, new emerging technology, and cross-sector successes into the maritime sector. Our aim is to promote maritime as an attractive proposition for new companies. Whereas in the past, we've been

seen as a sleeping dinosaur, the maritime sector is now open, ready, and ripe for improvement, especially around decarbonisation targets.

Initially, the port will be looking at its landside operations and we have an excellent team in place who are looking at those targets. Information from the 5G network will help create targeted strategies for the areas of the business that produce the most emissions and find ways to reduce them. It will also help us with our electrification strategy. If we know which areas of the business are using more diesel fuel or generating more emissions, we can target those areas as a

priority to help with reduction strategies.

When we start to think about challenges and obstacles that we've encountered while looking at digitalisation, the thing we need to understand and probably didn't grasp initially is the sheer size and scale of the challenge. The maritime industry is a very old industry with a lot of old data practices. I think it's generally accepted that the industry is behind the curve when it comes to the implementation of technology. Investment historically has been in plant and machinery around infrastructure and buildings. The IT back end has probably not been

as well funded as it could have been, but this is changing now with Maritime 2050 and the transition to smart ports.

There's still quite a lot to change and a lot of manual processes, spreadsheets, and disparate systems. We are looking at the systems that we've got to see where we can streamline them and make better use of information and systems integrations. The 5G network itself hasn't been without its challenges, the implementation of the physical infrastructure was quite smooth and went in quite well. We did have issues around scale because the size of the site around the port is a vast area of

"ONE THING WE WANT TO DO AT THE PORT OF TYNE AND THROUGH THE INNOVATION HUB IS TO LEAD THE WAY AND PROVIDE THE PORTS THAT FOLLOW US WITH 5G IMPLEMENTATION AND USE CASES."



land and it's constantly evolving. For example, when we planned the network, we had specific cable routes and locations for antennas. During the installation, some of those locations changed. We've taken down lattice masts for health and safety reasons or for lighting improvement reasons. Some areas of land have been demolished and new buildings are being built, we have put in new roads, which have disrupted cable routes. Trying to install a sitewide infrastructure within a port is a constantly changing target due to the nature of how things move and change over time.

Also, with 5G being a relatively new technology, a lot of the use cases we're looking at are new and leading edge. Trying to prove a return on investment for infrastructure enhancements like this is difficult because the data isn't readily available in the marketplace to do that. At the Port of Tyne, we've been really lucky to have a supportive board and leadership team, who can see the future benefits of this technology.

One thing we want to do at the Port of Tyne and through the Innovation Hub is to lead the way and provide the ports that follow us with 5G implementation and use cases. We see the 2050 Innovation Hub here within the Port of Tyne as a lighthouse for

the UK maritime sector and we want to help guide other ports and to collaborate, sharing our work with other UK ports. Our view is that we can become smarter if we work together. There are plenty of opportunities within maritime to work together on non-commercial areas, things like developing 5G use cases, helping realise energy savings, and improving cybersecurity. These are all ways we can work together for the greater benefit of the industry.

The key thing for us is to ensure we can deliver Tyne 2050 to bring our colleagues with us on the journey, so we're putting in a lot of time and effort into digital upskilling. We have provided all operational staff with smart devices so they can now access systems in real time and move away from paper-based forms. They need help and support to do that, and we are providing that, we want to make sure our staff are ready for the future. We want to ensure that the maritime industry is an attractive target for school leavers and graduates with our apprenticeship programme and our graduate programme. We want to bring in fresh blood, fresh ideas, and fresh impetus into our business and the wider sector. It's a long journey and we're just at the beginning. But we're fresh, we're ready and up for the challenge.

ABOUT THE AUTHOR:

Ian Blake, a seasoned Head of Innovation & Technology in the maritime industry, excels in IT Governance, Strategy, Service Desk, Security, and Management. Spearheading the groundbreaking 2050 Maritime Innovation Hub in the UK, he fosters cross-sector collaboration and explores emerging technologies for port advancements. Leading Smart Ports, 5G, Autonomous Logistics, and decarbonisation efforts, Ian holds an MBA in strategic leadership and is a CMI chartered manager.

ABOUT THE PORT:

The Port of Tyne, a key UK deepsea port in North East England, thrives as a vital trade gateway with £150 million (\$190 million) invested in the last decade. Evolving into a major car exporter, it excels in handling diverse cargoes, providing secure logistics, and running a bustling passenger terminal. As a Trust Port, it operates commercially, reinvesting profits to benefit stakeholders. Recognised for innovation, the port envisions sustained growth, contributing significantly to North East England's economy and job market.

