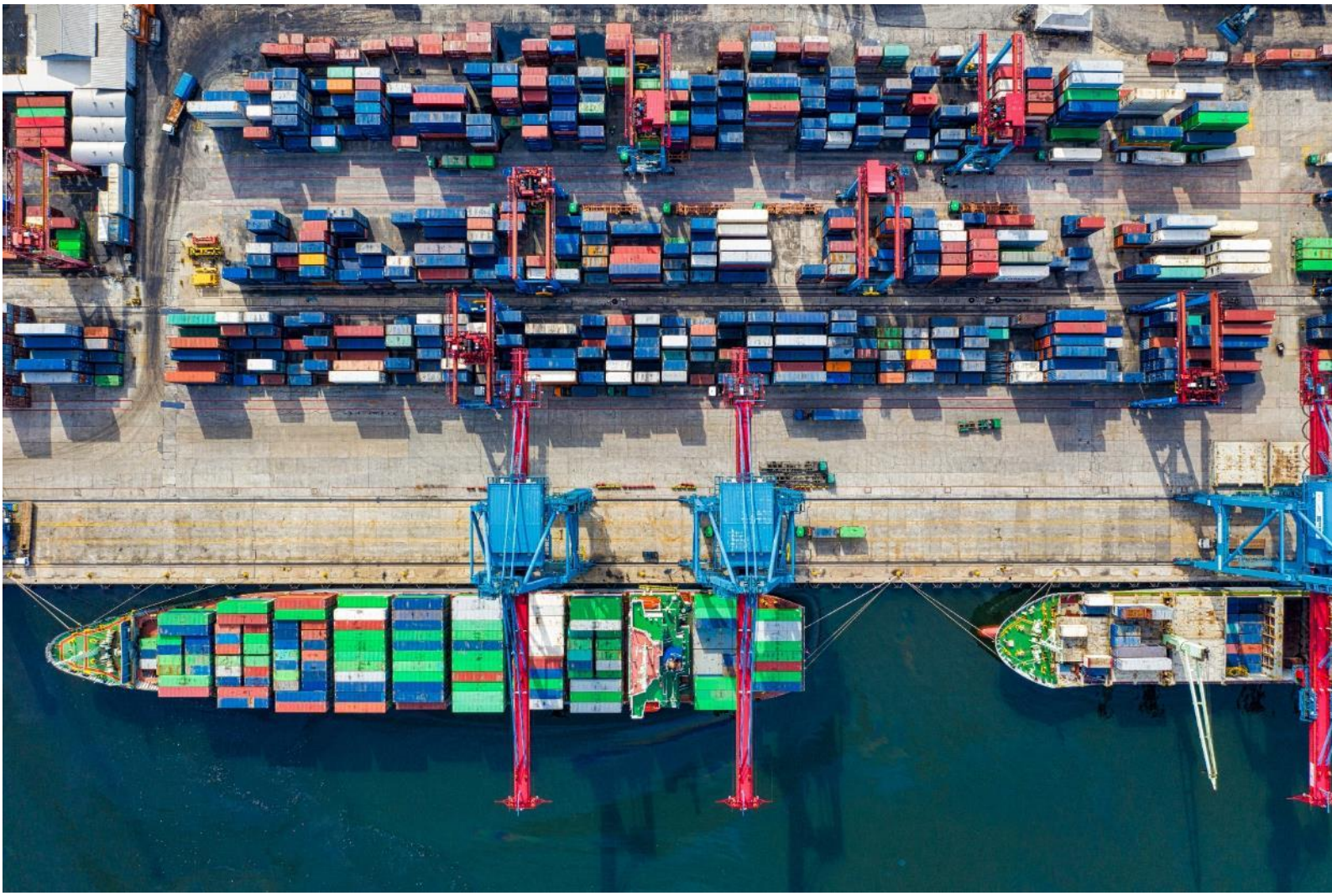
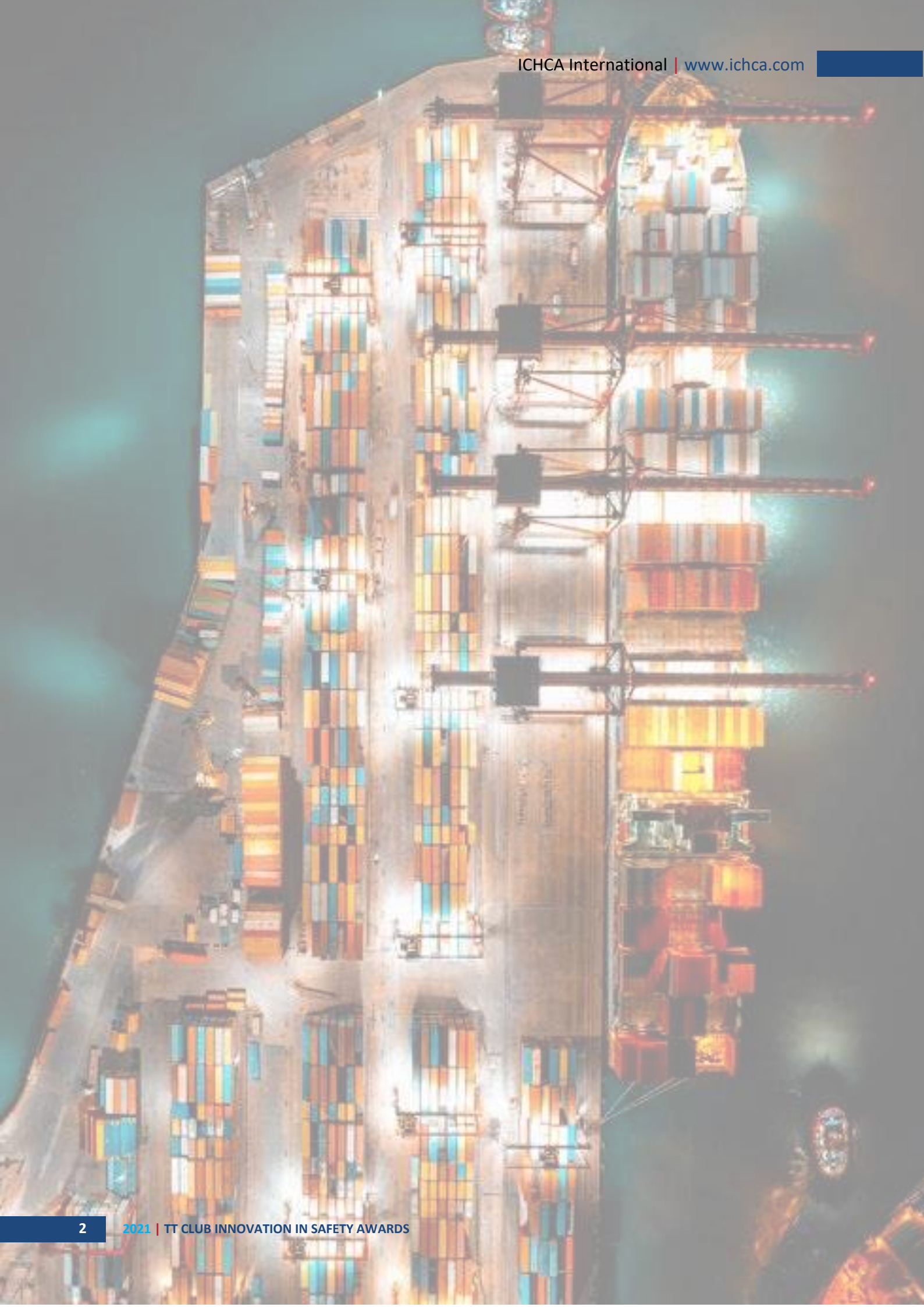
ICHCA INTERNATIONAL PRESENTS

TT CLUB INNOVATION IN SAFETY AWARDS 2021

A digest of entries received & winners announced





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TT CLUB INNOVATION IN SAFETY AWARDS

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TT Club Innovation in Safety Award Foreword

Designed both to encourage safety innovation at a time of increased operational demands on the global cargo handling infrastructure, and to celebrate the practical success of such initiatives, TT Club is proud to be instrumental in this the culmination of the TT Club Innovation in Safety Awards.

Both ICHCA International and TT Club have a fundamental commitment to risk reduction throughout the supply chain and, in particular, to safety within cargo handling operations. Therefore, we are delighted to present in this Digest the efforts of over thirty organisations that made submissions to the 2021 Award, covering products and procedures that have achieved a demonstrable safety improvement in cargo handling and transport. They all deserve acknowledgement as leaders in innovation in the pursuit of safety in our industry.

With over 50% more submissions than in any previous year, we were impressed by the quality of the 2021 entries, as much as the quantity. Needless to say, the judges were challenged in making their decisions by the abundance of creative, innovative and thought-provoking content. It is for these reasons that I am particularly happy to present this Digest of all the entries in the knowledge that any of them will help other organisations in creating a safer working environment within the cargo handling sector.

As a specialist insurer of all aspects of the supply chain TT is a mutual organisation dedicated to reducing risk and improving safety regimes. In this context, the Club is delighted that its past and ongoing support of this award is profiling so many impactful innovations, which we trust will continue to serve the industry into the future.

Peregrine Storrs-Fox,

Risk Management Director, TT Club

1. | WINNING ENTRY - VIKING Life Saving Equipment AS – HydroPen System

the challenge

Fires on board container vessels has been a hot topic for years and remains a serious threat across the industry. The fires have been increasing in frequency and beyond having tragically claimed the lives of seafarer lives and caused severe damage to maritime assets and the environment – they have prompted an increase on cost spent on insurances as well. The industry is calling for direct solutions to address and put an end to the issue.

First responders to a fire on board is the vessels crew, who during their maritime education has become acquainted with fire-fighting. However, not to an extend where they can sufficiently handle complex fires inside containers with a more or less unknown content.

The fire-fighting equipment available on container vessels has not changed much over the past decades. Meanwhile, the size of container vessels has changed dramatically. There is a gap between the exposure to fires on container vessels and the means and technology available for the crew to directly extinguish and/or supress the fire – in a safe and efficient manner. This is especially the case when it comes to fires inside containers located high up in the stack.

the innovation

The innovation that directly addresses the container fire issue is called the HydroPen System. A unique piece of equipment that allows crew to address fires inside containers easily and safely.

Prior to deployment, the HydroPen System is connected to the vessels fire main with the vessels standard fire hoses. The HydroPen System is then deployed on the burning container, whereafter the crew will immediately leave the vicinity of the fire, spending only a very limited time in harm's way, hereby increasing safety dramatically. The alternative would be

to spend time penetrating the container with manual tools, followed by an attempt to fix various kind of spray nozzles inside the burning container.

As soon as the water flow is activated, the HydroPen will initiate a drilling process to penetrate the container structure. When penetrated (in 10 – 30 seconds depending on water pressure), the HydroPen will automatically change mode to spraying water inside the container, hereby extinguishing the fire directly at the source.

The HydroPen System comes with a telescopic lift, meaning that it can be deployed up to a height of 12,5 meters. Deployment can be handled by a single crew member and requires a minimum of training. The HydroPen Systems also allows for foam and CO2 to be used as extinguishing agent.

Enabling the crew to get familiar with the HydroPen System, a training drill-bit is delivered with the system. When mounted on the drilling unit, the crew can train the full process without damaging the containers used for training.

how it was implemented

The HydroPen System has been promoted to the industry over the past 2 years. Various product demonstrations have been carried out and several ship owners have made on-board tests, where crews have successfully trailed the HydroPen System at different locations on the vessel.

The HydroPen System has obtained a Type Approval from BV (certificate No. 62110/A1 BV), based on SOLAS chapter II-2, regulation 10.7.3.

DNV and BV have implemented the technology of automatic penetration and at-height deployment into their own standards of enhancing container fire safety (DNV's CFS Notation and BV's ENHANCED CARGO FIRE PROTECTION FOR CONTAINER SHIPS (ECFP)).

Online HydroPen System training has been developed to support correct usage of the product.

the result

The solution definitely covers a safety need in the market. In the words of a major maritime insurer; "The HydroPen System is a very simple and

effective solution to an industrywide problem."

More than 500 systems have been delivered so far, to vessels ranging from ULCV's down to feeder size. Some vessels are equipped with two HydroPen Systems, which enhances safety considerably.

The HydroPen System has already proven its worth on board a container vessel in two live fire incidents:

In one case, whilst in transit, the crew of a container carrier discovered smoke from a container. The cause was a developing fire and the crew immediately initiated boundary cooling. The HydroPen System was deployed to extinguish the fire quickly and efficiently, with the crew being exposed to a minimum of danger.

VIKING has received feedback from the crew involved in the incident. They are very satisfied with the performance of the HydroPen System, and have shared the following comments:

- The HydroPen is simple to use
- The HydroPen is very fast to mount and can be done in a matter of seconds in cases where the container is accessible
- The whole process of mounting, drilling and penetrating can be completed in under 30 seconds if all is lined up
- The HydroPen is very safe to use as no people are needed near the container while drilling
- Any sparks generated during drilling are instantly extinguished by the water driving the HydroPen.
- The only power source needed is the water from the fire hydrant.

conclusion

The HydroPen System is expected to become a gamechanger within container firefighting. It is strongly believed that the simplicity, effectiveness, safety, and reliability of the system will be a new benchmark when container firefighting is on the agenda.

VIKING Life-Saving Equipment has been invited to participate with the HydroPen System in a 3-year EU funded project, with a focus on optimizing the response towards container fires.

Besides already being implemented in the response set-up on board several hundreds of container vessels, a range of land-based fire-fighting stations within close proximity of maritime hubs, have adopted the solution to tackle container fires.

See the HydroPen System in action on the HydroPen YouTube channel:

www.youtube.com/channel/UCUXGBw9B48fCt3PgS9RCtTw/videos

2. | SHORTLISTED - KALMAR AB – Container checker function

the challenge

Thoroughly inspecting your containers is an important process to guarantee an uninterrupted logistics flow. However, container damage is inevitable and can happen at any stage of its journey – and often container owners or shipping companies end up paying for the costs even when it is not their fault. But most importantly – the risk of something happening while lifting, moving and driving with a damaged container that can weigh up to 45 tonnes is significantly high.

This is why it is of the utmost importance to inspect containers – but one side of the container is very difficult and dangerous to access: the undercarriage. Our solution addresses these issues, allowing the container to be inspected from all angles safely.

Recent studies indicate that 39% of carriers are asked to pay for container/trailer damage even when they were not at fault - 31% say damage claim was over $500. 61% of the companies that paid for the damage said they did it because they couldn't prove they weren't responsible.

This could mean that inspections are not being made as nobody wants to get stuck with the bill - and that can impose a safety threat to the entire cargo handling industry.

the innovation

To solve this issue Kalmar has developed a container checker function for our Empty Container Handlers which allows container handlers to lift and lock the container in a safe

and ergonomically good position when being moved, which allows for effective and safe inspections on all sides and parts of containers, even under the container while lifted.

By inspecting and reporting any damage to the container our customers can ensure safer cargo handling for both their business and other partners who may need to handle and move the container. This innovation will also allow customers to avoid damage claims from others by having documentation of the inspections and the state of the container while in our customers care and responsibility - what it was like when it arrived and what it was like when it left our customers yard.

The 4-point safety functionality that we have put in place:

1. Apply parking brake
2. Adjust mast to vertical position [this is the container lifting mechanism]
3. Lift or lower the spreader [this is the mechanism that holds the container securely] until the carriage with the container is above the inspection support point
4. Activate inspection support key switch for automatic blocking of mast & spreader

You can now safely inspect the underside of the container.

All driving, steering and mast movements on the empty container handlers are blocked for the duration of the checking process. The blocking sequence is completed <10 seconds, which enables a fast process that will not be disruptive to daily operations.

how it was implemented

The complex and technically sound development and implementation of the container checker protection system through a mechanical locking of the mast and spreader for

inspecting the container from the underside, came about at the suggestion of a Kalmar customer, HCS Hamburger Container Service GmbH.

By developing a solution with 2 hydraulic powered mechanical blocking units for the mast and spreader, dual safety sensors on the mast and a spreader positioning initiation and locking key functionality from the driver cabin, the unique Container Checker Solution was created and tested with HCS Hamburger Container Service GmbH.

the result

The first customer to receive the solution, was HCS Hamburger Container Service GmbH:

"Our first system that we used was not from Kalmar and needed more than 30 sec to secure the machine with the container and could only handle 1 container at the time. The problem was that the drivers did not always use it because it took too long to activate and deactivate it. When we first talked about the idea (container check solution) with Kalmar we explained that we need a fast and safe working solution because otherwise the drivers will not use it. With the Kalmar Container checker solution we now need less than 10 sec to secure the container and the machine. Plus we can handle 2 containers during the checking process. The result for us is that we have a safe and fast working solution and the drivers use it. At the moment we are operating with 5 Kalmar DCG100-45ED7 with the Container Checker Solution and we will have 7 in February 2022."

Dr Roland Karnbach, Managing Director at HCS

conclusion

We sincerely hope that this solution can contribute to more containers being properly inspected in our industry in order to eliminate any damaged containers from being in circulation and posing a safety risk for all handlers as well as risking damaging cargo handling equipment as well as the contents of the containers. This solution will also help identify exactly who is responsible for any damage to a container and hold them responsible, which should help them to handle containers with more care in the future, reducing the overall damage rates and safety risks for the cargo handling industry.

3. | SHORTLISTED - PSA International Pte Ltd - Harnessing the power of Video Analytics (VA) to solve common safety issues

the challenge

Working in a busy container terminal poses many hazards and risks for all frontline personnel. As a global port operator, PSA strives to ensure that a safe working environment is provided to all personnel. However, the dynamic nature of port operations and the need for a human-machine interface mean that personnel must be constantly vigilant. They are also required to comply with prescribed safety procedures and requirements at all times. To achieve that, human supervision is often required which is not only labour-intensive but also prone to human judgment errors/lapses. In most instances, timely intervention can prevent a safety incident. Operating large, heavy port equipment requires not only technical skills, but also a safety consciousness to always adhere to standard operating procedures (SOPs) and look out for nearby personnel. Hence, there was a need for a robust and adaptable solution that would provide the relevant controls in various port processes.

To address the safety challenges, PSA has embraced the use of Video Analytics (VA) as a technological tool. Closed-circuit television (CCTV) footage from digital cameras is analysed by VA software equipped to automatically learn and improve via machine learning without being explicitly programmed. This helps to:

- Supplement the need for constant human surveillance/supervision
- Prevent safety incidents from occurring with timely intervention
- Flag up safety hazards that are hard to detect
- Improve the safety consciousness of all personnel

After extensive testing, PSA has found that VA applications are flexible, scalable and effective in enhancing terminal safety. The use of VA augments PSA's existing safety management system and processes.

the innovation

Various VA solutions have been deployed across our PSA business units (BUs) to tackle the following issues:

Human/Obstacle in Gantry Path of Quay Cranes (QCs) and Yard Cranes (YCs)

Existing detection systems utilise infrared sensors or ultrasonic radar systems, which were originally designed to detect neighbouring cranes, have low accuracy and a high margin of error in detecting humans/obstacles. Operators who rely on such systems for crane gantry need to be vigilant with their eyes but have a limited field of vision due to crane structures.

To overcome this, strategically placed cameras can provide a better field of view, with the VA software automatically detecting humans/obstacles and stopping the cranes when necessary.

Twistlocks and Cones Not Removed from Containers

Improper/incomplete removal of twistlocks and cones from containers not only exposes personnel to the risk of being struck by falling objects when the container is lifted but may

also cause unstable stacking of containers. VA allows the quick detection of such twistlock and cone hazards and alerts the YC operator before the container is picked up.

Lashing Safety Violations Onboard Vessels

Lashing operations are highly hazardous and require lashing personnel to comply with SOPs at all times to mitigate the risks. However, unsafe acts sometimes occur and lead to accidents due to the lack of vigilance or compliance to SOPs. VA allows the identification of commonly encountered safety violations from recorded CCTV footage for relevant follow-up actions.

Traffic Violations in Container Yard

There is a high volume of traffic within the terminals and all road users have to comply with traffic rules and regulations at all times. However, prime mover (PM) drivers sometimes flout traffic rules due to various reasons. Recorded CCTV footage can be analysed using VA software to identify commonly encountered traffic violations and the drivers involved for necessary corrective actions.

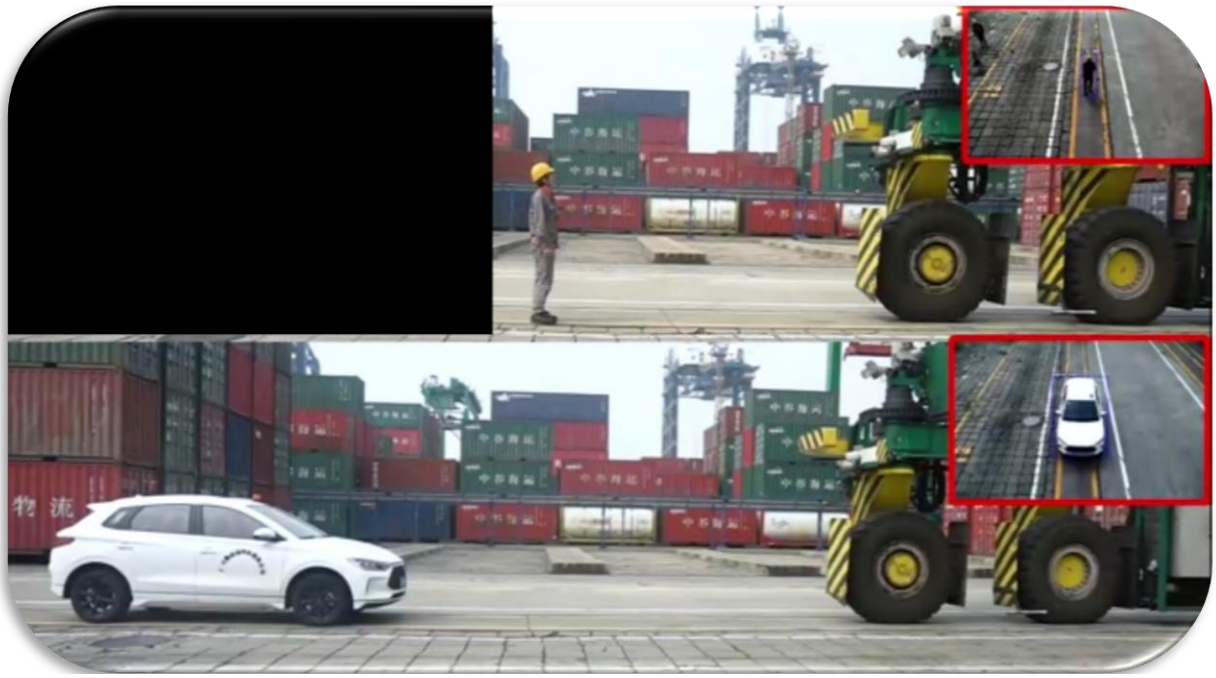
how it was implemented

The use of VA was customised to suit the specific coverage and requirements for the following use cases:

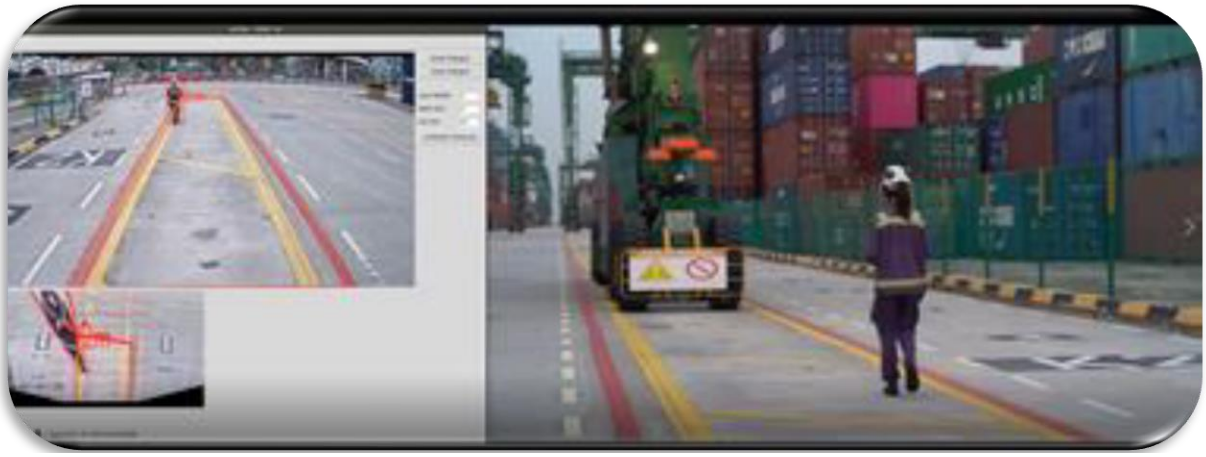
Human/Obstacle in Gantry Path of Quay Cranes (QCs) and Yard Cranes (YCs)

Infrared sensors and ultrasonic radar systems used for collision detection and gantry deviation correction were replaced with cameras, controllers and other supporting electrical accessories. The captured video footage is fed into VA software to be analysed using machine learning, to determine obstacle types, distance to obstacle and movement trends which were translated into immediate intelligent decelerations and emergency controls when required.

Cameras installed on yard cranes



Detection of different obstacle types and application of intelligent deceleration



Detection of human encroachment into gantry path and application of intelligent deceleration

Twistlocks and Cones Not Removed from Containers

Cameras were installed on the legs of YCs to capture footage of the container corner castings while the container is still on the Prime Mover (PM) chassis. VA is employed to quickly detect if twistlocks or cones have not been removed before the container is picked up by the YC operator to be loaded into the yard.

Detection of twistlock (highlighted by red rectangle)

Lashing Safety Violations Onboard Vessels

Cameras mounted on QCs recorded CCTV footage onboard vessels which were then analysed by the VA software to identify commonly-encountered safety violations. The VA software was able to improve its detection accuracy over time through machine learning.

Traffic Violations in Container Yard

Existing cameras in the yard were used and new cameras were added to increase coverage of the travelling lanes, streets and main driveways. For multiple high-risk junctions/areas within the terminal, pan-tilt-zoom (PTZ) cameras at such areas were configured with a fixed home location to maintain the required field of view. Recorded CCTV footages were provided as inputs for the VA software, and the VA software was able to identify vehicles of different shapes and sizes, the direction they are heading towards and the estimated speed of travel.

the result

The use of VA has improved the level of safety within our terminals:

Human/Obstacle in Gantry Path of Quay Cranes (QCs) and Yard Cranes (YCs)

- With the ability to detect small objects such as traffic cones, the accuracy and reliability of the VA-assisted anti-collision system are greatly improved, thereby reducing the possibility of a collision between crane and human/obstacle
- The system further enhances safety by detecting impending collisions which are outside the operator's field of view

Comparison between a yard crane (YC) equipped with Video Analytics (VA) and one without (bottom)

Twistlock and Cones Not Removed from Containers

- Detects twistlocks and cones that may not have been removed
- Eliminates the hazard of being struck by fallen twistlocks or cones, and also reduces the possibility of unstable stacking in the yard

Lashing Safety Violations Onboard Vessels

The VA software was able to identify the following safety violations:

- Lashing personnel coming within 2-container width distance of working spreader
- Non-compliance of extreme row lashing requirements
- Improper usage of Personal Protective Equipment (PPE)

Lashing-related safety incidents were reduced by ~60%, and lashing-related injuries sustained by personnel were reduced by ~55% during proof-of-concept trials in selected terminals.

Detection of Lashing personnel within 2-container width distance of working spreader

Detection of lashing personnel not wearing life-vest at extreme row

Detection of personnel not wearing Personal Protective Equipment

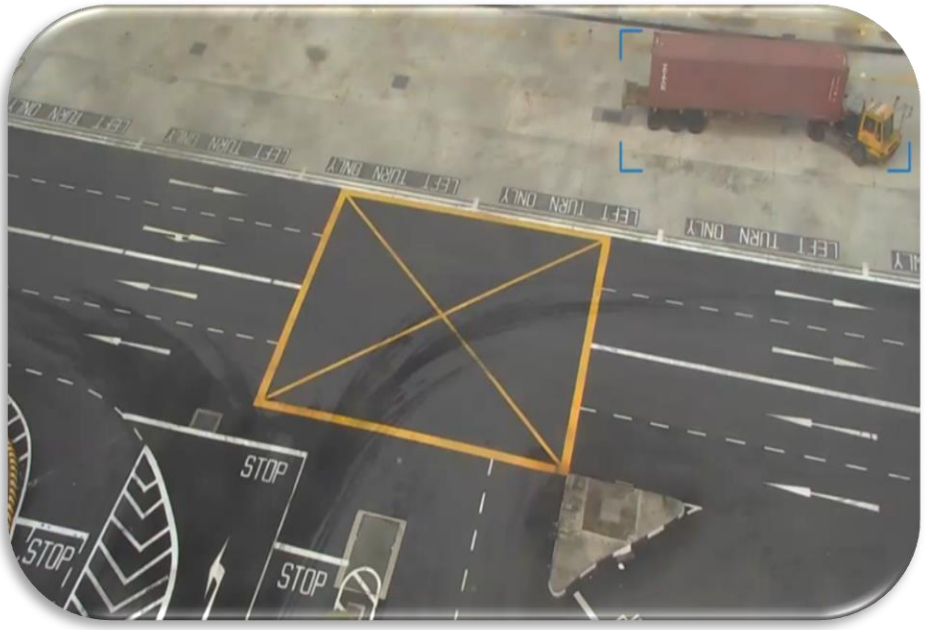
Traffic Violations in Container Yard

The VA software was able to identify the following vehicular safety violations:

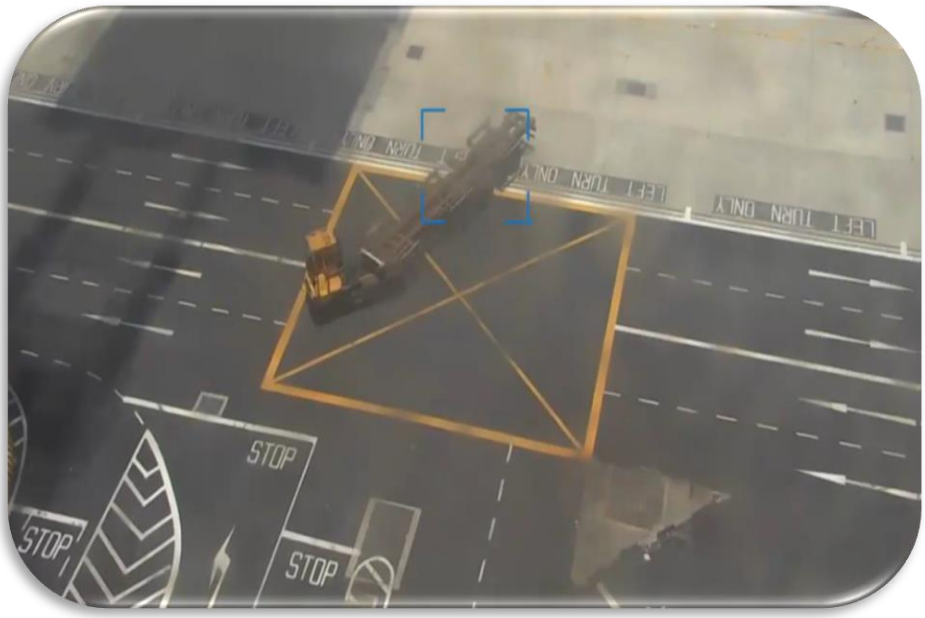
- Making an illegal U-turn

- Failure to follow road markings (e.g. turn right on a left-turn only lane)
- Driving against the flow of traffic
- Failure to stop at a stop-line

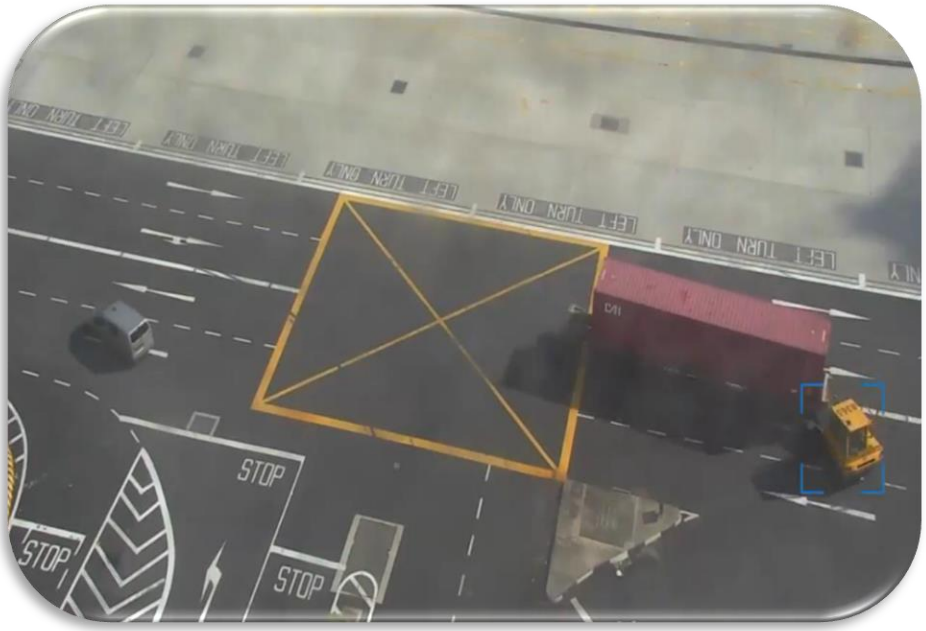
The number of traffic infringements was reduced by ~90% during proof-of-concept trials in selected terminals



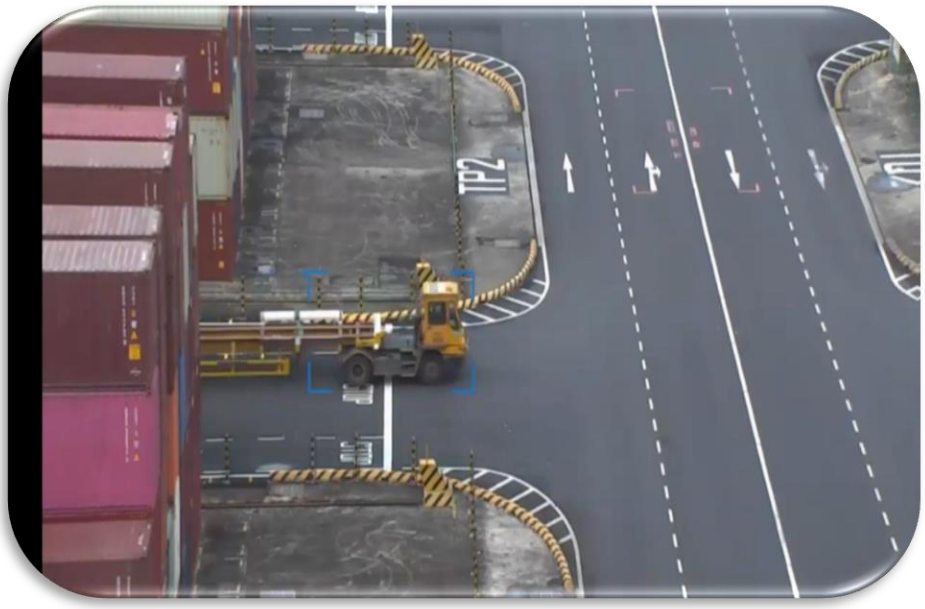
PM driver making an illegal U-turn



PM turning right from a left-turn only lane



PM driving against the flow of traffic



PM failing to stop at stop-line

conclusion

The use of VA as a technological tool has greatly improved the level of safety in PSA. Cameras facilitate the tracking and surveillance for critical areas around the clock, eliminating the need for constant human supervision and thus freeing up valuable people resources for other

important tasks. Such VA software is not subject to human bias, always provides an objective assessment and improves over time with machine learning.

The usage of such VA software also provides a higher level of accuracy than conventional systems, with timely feedback and intervention to prevent incidents from happening. If humans/obstacles are detected in the gantry path of a crane, the VA software will instruct the crane to stop before a collision occurs.

In addition, the VA software can also be used to improve the safety consciousness of all personnel. Recorded footage of safety infringements of workers is used in education and training programmes to remind them of the need to follow safety SOPs.

Moving forward, PSA aims to increase the level of live analytics to flag safety infringements in real-time for prompt intervention. This would further enhance the effectiveness of VA and help minimise the occurrence of safety incidents within the terminals.

4. | ALTANA AI - Trusted Shipment Rating

the challenge

Trade policy volatility and the dramatic rise of e-commerce require automated solutions to ensure the safe, lawful, and speedy movement of goods across borders. However, opaque, just-in-time supply chains make it next to impossible to know where our products come from, what's inside of every shipping container, and what the extended network is behind any supplier or customer relationship. There is no shared source of truth between customs authorities and the trading community to facilitate and automate lawful trade.

In recent research, leading logistics service providers and customs authorities reported that without a holistic view of the global supply chain, the speed of growing express parcel supply chains makes risk management especially difficult. Compounded by increasing compliance oversight obligations, the rising stakes of non-compliance, and limited solutions on the market, it was previously hard to know what shipments to trust and which need audit and investigation for tariff evasion, illegal narcotics, weapons, and other risky shipments.

the innovation

Derived from the intelligence of the Altana Atlas, the Trusted Shipment Rating is modernizing trade trusted shipment reporting and preclearance programs. The Altana Atlas helps national security, law enforcement, and intelligence agencies target illicit activity in the underbelly of global supply chains and "see inside the box" before an item is shipped.

Users can identify the shipper and receiver for important transactions, predict the proper customs declarations, and use the Trusted Shipment Rating generated through AI-based compliance risk scoring to distinguish between safe and lawful trade vs. illicit trade in real-time. The rating works to easily target high-risk transactions like tax evasion, counterfeits, fentanyl, or security threats like weapons and explosives that require auditing -- and facilitate the expedited customs clearance and shipment of low-risk transactions across country borders.

The Altana Atlas provides a shared source of truth on the global supply chain and uses AI models trained across both government and private sector data to detect illicit shipments, human trafficking, and other illegal transactions.

Users can gain more visibility across their extended trade networks and utilize the decision support offered by the Altana Atlas. They can see and use the information that matters to them most, answering questions such as:

- Is the good correctly classified?
- Is it similar to other unlawful trade?
- Is it a known risky product or trade lane?

how it was implemented

The Trusted Shipment Rating is currently pioneering a shipment-level customs preclearance initiative with a top global express carrier.

Underpinning the Trusted Shipment Rating, the Altana Atlas monitors and maps global trade regulations and compliance requirements on trade lanes, shipments, and shippers. It leverages a unique federated machine learning approach that learns from sensitive data that would never be directly pooled and shared because of IP, privacy, and sovereignty concerns. The client's private transactional data is then fused together with the Altana Atlas, which learns from billions of global shipments. This enables governments and enterprises to use a comprehensive map of the global supply chain that no individual user would have access to individually.

The Trusted Shipment Rating takes into account many types of risk modelling, such as the likelihood that a shipper has traded with a known restricted party, identifying products that are abnormal within certain trade lanes, or a shipper's known history of misclassifying products. For international shipments, users can employ this generalized confidence rating that is verified by a global express carrier, to show if a shipment or shipper is compliant and compatible with AEO standards.

Users can decide which risks they would like to pay more attention to for auditing, based on their use case. For example, an express carrier client not on bond may underprioritize product misclassification, and focus more on flagging risks around the presence of restricted parties, due to recent regulatory changes.

Individual Trusted Shipment Ratings are also offered to users within organizations that focus more on acute risk detection.

the result

Ultimately, the intended result of Altana's Trusted Shipment Rating is to enable a public-private partnership between shipping carriers and customs authorities.

Eventually, carriers can transmit per-shipment scores to the customs authority to build a stronger trusted relationship, enabling more compliance and faster clearance. Customs can also use the scores to expedite shipments that are deemed low risk, facilitating trade and reducing their operational burden.

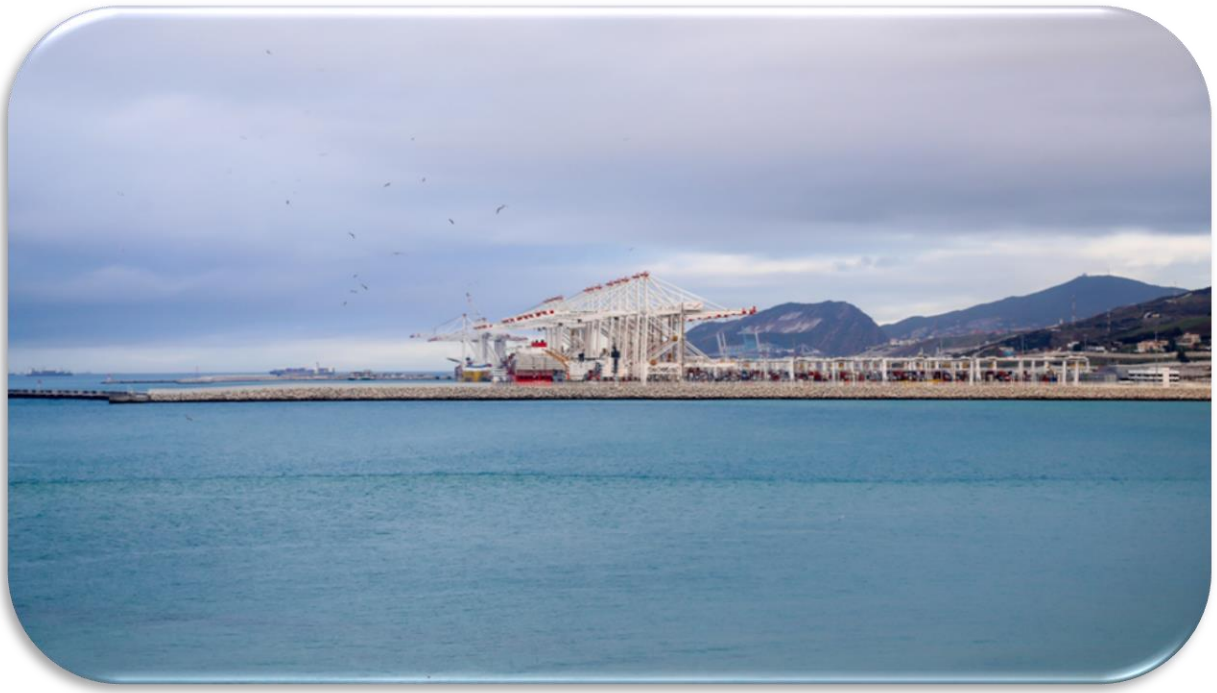
5. | APM TERMINALS MEDPORT TANGIER in partnership with SEAPORTOPX - Wind Resilience Tool

the challenge

Wind-blown containers are becoming typical hazard in large container yards at some locations, and there are countless operation disruptions owing to uncertain wind forecasts and lack of yard stacking wind resilience, causing hundreds of wind related containers toppling events yearly basis. Recovery mode require extra deployment of resources, special handling and exposing people to different risk profiles as non-routine tasks.

While operating in one of the most technologically advanced, safest and efficient terminals, wind forces was and still a significant safety challenge.

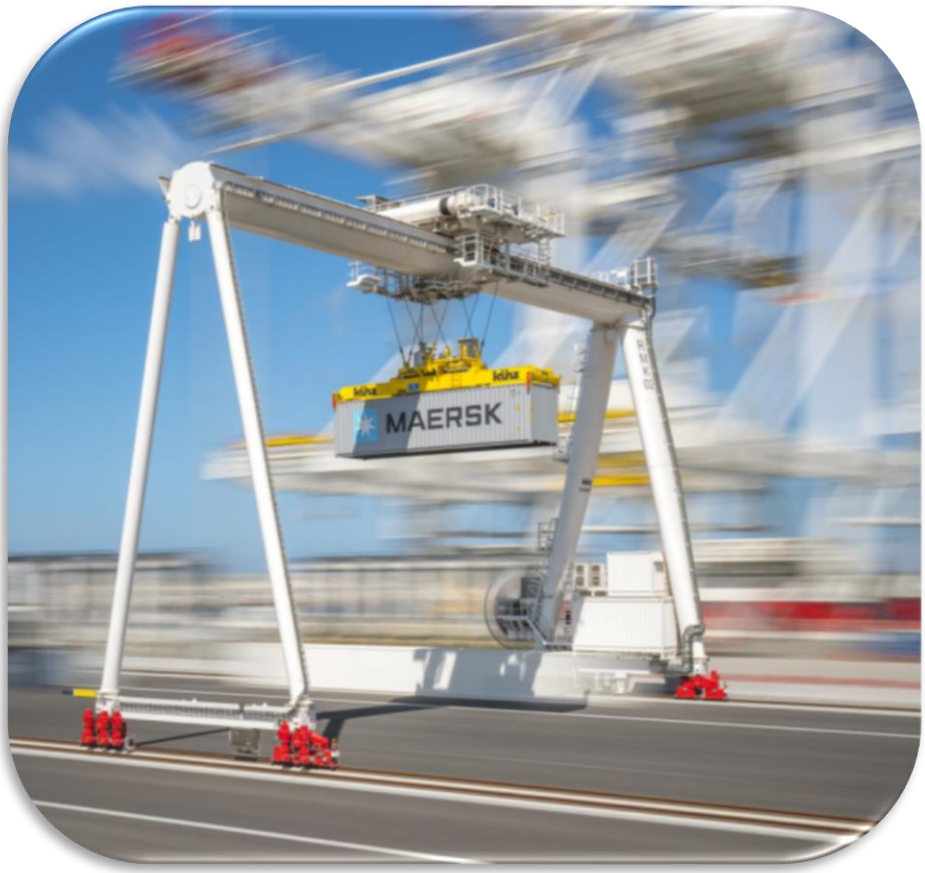
Things that created the burning need to look after innovative and unprecedented solutions, taking advantage of Terminal stacking knowledge and learnings, Weather advanced science, Artificial Intelligence and some basic laws of physics.



APM Terminals MedPort Tangier (TM2)

Challenges to solve:

- Difficulty to identify containers in weak position, with high risk of toppling.
- Wind sensors failures, lagging to detect real potential of wind gusts, which increased risk of containers toppling, with sometimes extreme consequences.
- Wind sensors false alerts, causing unnecessary yard housekeeping and multiple operations disruptions.



Yard Containers Handling Poster (TM2)

the innovation

Wind Resilience Tool is a wind decision support tool powered by a smart AI engine which provides a much more accurate predictions of wind speed and direction at the terminal, automatically alerts users when pre-set wind speed criteria are forecast to be exceeded. And includes local real-time wind measurements within the terminal domain for full visibility of live conditions and model performance.

The tool provides an eagle eye on a live 3D yard refined staking, with a clear visual management system to detect specific containers that are unable to resist upcoming wind gusts. A tool that is powered by a complex AI engine that provides high-resolution wind behaviour predictions as well as real-time advice on safe container stacking strategy. The tool considers multiple parameters in the model e.g. wind speed, direction, wind tunnelling, container position, tier, weight and size to determine the safety margins for each container on yard.

Main outcomes :

- Provide terminal with timely and accurate information to shape micro decisions on live operations to reduce risk, protect assets and enable operations.
- Preventing proactively falling unit events, by performing prompt and targeted yard housekeeping moves only when needed and for specific containers.

- Reduce operations wind related downtime, caused by false wind alerts coming from nearby stations.
- Reduce latency to act when needed when nearby stations fail to predict potential threats.

how it was implemented

Designed, built and tailored based on APM Terminals MedPort Tangier 'TM2' terminal specifications and learnings, in partnership with field experts 'SeaportOPX'. Ground Study and Tool Development took six months, followed by a thorough quality and testing phase to measure effectiveness. It is now ready and deployed LIVE in TM2 Terminal enabling Safer Yard Operations.

Wind Resilience Tool Interface

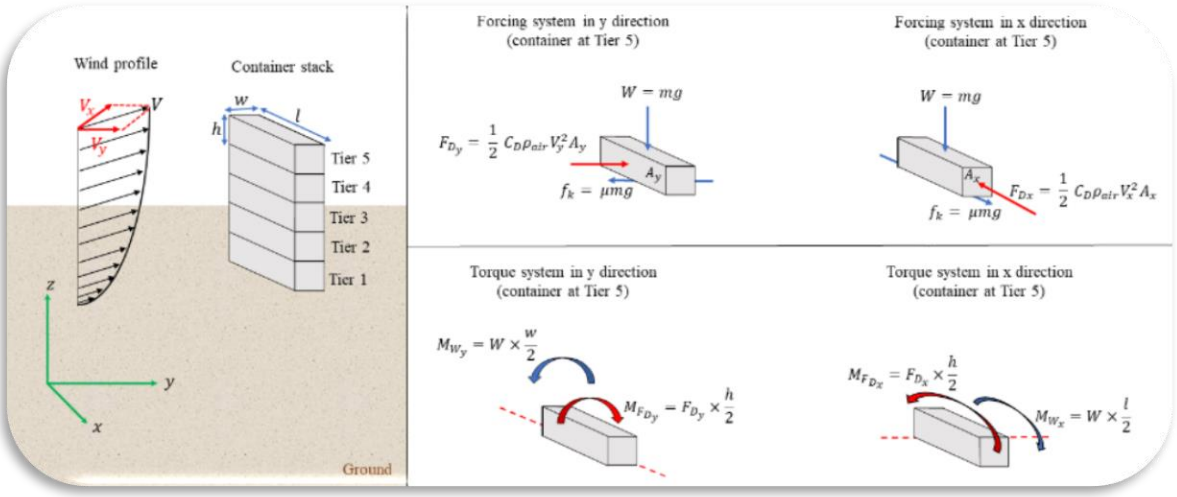
Configuration of the Status thresholds is based on the TM2 Environmental Baseline Study and local wind procedures considering multiple parameters, e.g. gust speed, taking into account sensitivity to winds from a certain direction when the wind hits the container sides making the impact heavier, for example / other parameter considered are the container position, tier, weight and size.

The variation in wind status triggers over time and space can be visualized through the map interface. The map interface captures the location of forecast high wind events to support proactive measures to avoid incidents.

In addition, the system followed quality assurance procedures including running automatic quality assurance checks to ensure the model results are constantly benchmarked against measured data.

Wind Resilience Tool logic works based on the static balance of force and torque system in both x and y directions (in the horizontal plan) of containers at and above each tier.

This logic is briefly described in the following figure for those interested to know more about AI engine physics.

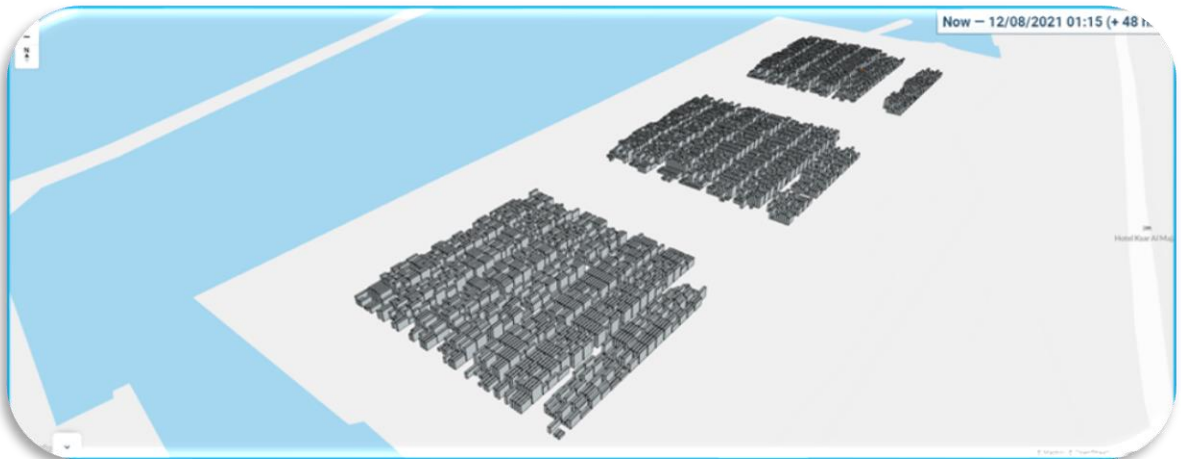


In the figure above, parameters are defined as follows

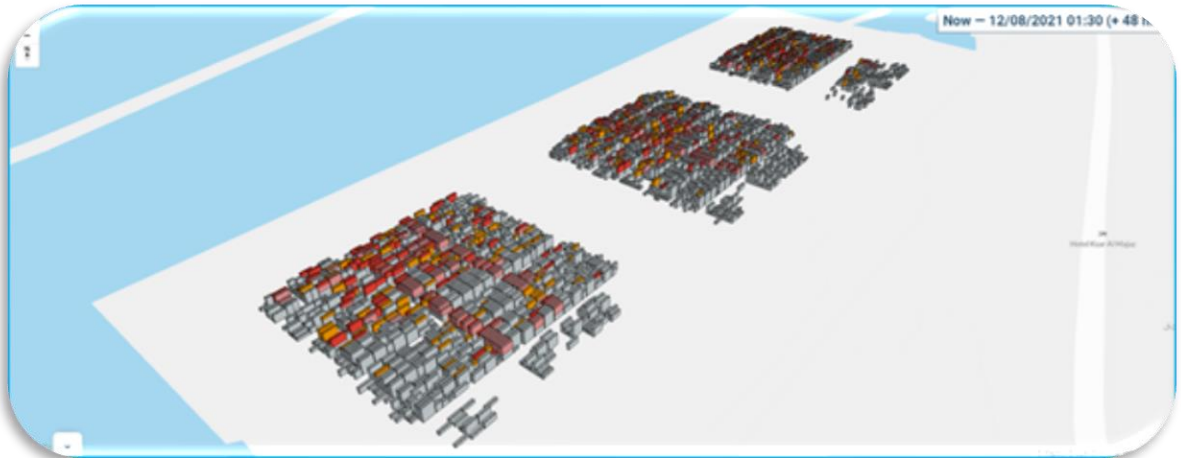
V	Wind speed
V_x	Wind speed component in x direction
V_y	Wind speed component in y direction
h	Container height
w	Container width
l	Container length
m	Container mass

g	Gravity acceleration
C_D	Drag coefficient (=1.2)
ρ_{air}	Air density (=1.2 kg/m3)
μ	Steel-Steel friction coefficient (=0.5)
A_y	Frontal area of orthogonal to y direction
A_x	Frontal area orthogonal to x direction
F_{D_y}	Wind force in y direction

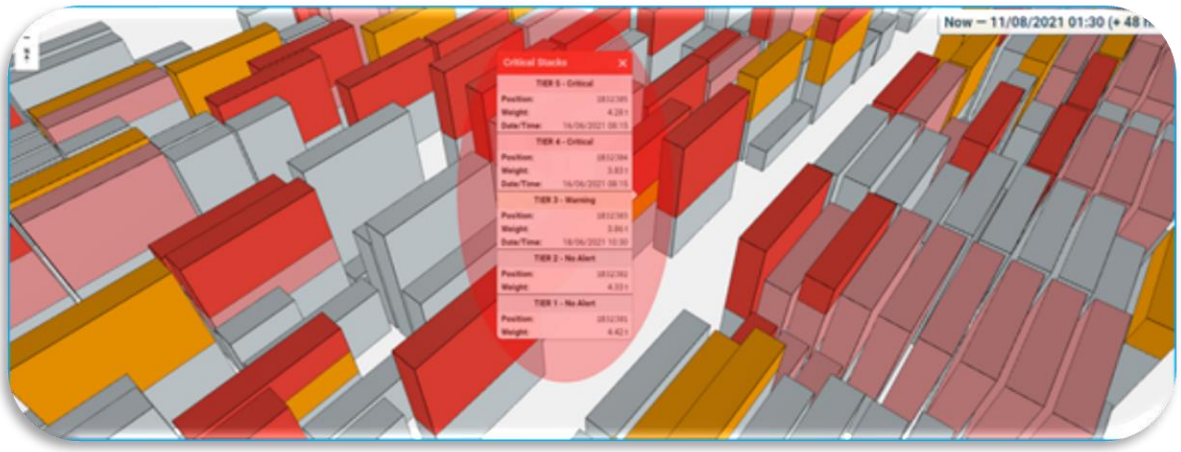
F_{Dx}	Wind force in x direction
f_k	Friction force
W	Container weight
$M_{F_{Dy}}$	Torque due to wind force in y direction
$M_{F_{Dx}}$	Torque due to wind force in x direction
M_{W_y}	Torque due to container weight opposite to wind force in y direction
M_{W_x}	Torque due to container weight opposite to wind force in x direction



3D Live Yard Stacking



Containers with high risk of toppling are proactively highlighted



Hovering over each container stack provides further information about containers at each tier

the result

After introducing the tool into prod, terminal took positive confidence to go through windy periods safely. deploying cutting edge technology and data science to eliminate the risk of exposure to falling containers, increasing safety capacity.

When an upcoming high wind event is forecasted over the next 48 hrs, yard operations automatically receive notifications of any critical and/or warning containers over the yard. Yard operations then takes proactive safety measures accordingly knowing which containers are the most critical at the earliest time to move them around.

The convention colouring for containers in alert from now to +48 hrs is orange, red, and faded red when the containers are in warning, critical, or conditional alert modes, respectively. These alert modes are defined as follows:

- Warning Mode (Orange Colour): A container with 70% risk of toppling due to applied wind force in any directions (x or y directions in horizontal plan).
- Critical Mode (Red Colour): A container with 90% risk of toppling due to applied wind force in any directions (x or y directions in horizontal plan).
- Conditional Mode (Faded Red Colour): A container has 90% risk of toppling due to applied wind force in any directions (x or y directions in horizontal plan), if the container stack in front of it, which itself has 90% risk of toppling due to applied wind force in any directions (x or y directions in horizontal plan), is removed / domino effect.

Sharp positive results, terminal moved from frequent high wind related falling containers in 2019 and 2020 to NONE during 2021. Awarded with total absence of toppling containers during one full year of deployment. An absolute success!

conclusion

With every challenge comes the opportunity to improve and discover hidden strengths, solving problems and leading change for better and safer Cargo Handling is key to safety excellence. At TM2 we believe that safety capacity and fail-safe systems based on breakthrough innovative solutions are critically important to keep ahead and boost safety performance.

Wind Resilience Tool was the fruit of a team of expert's hard work, dedication and passion to Lead with care. The idea matured in the lab moving from high-resolution prediction tool to 2D heat-map proposal and ending up exceeding expectations by deploying 3D flyover map with risk margin calculated down to every container.

The Tool provided extra understanding and new learnings about the wind behaviours and how gust interact with the stacking containers, these insights fuelled Terminal procedures and stacking strategy to balance loads and figure out the best stacking shape possible, with minimal impact on operations flow and high impact on terminal safety resilience. Cause the only way to discover the limits of possible things is to actually to go beyond them setting the stage for new possible limits.

Creativity is thinking up new things. Innovation is doing new things.

Theodore Levitt

6. | APM TERMINALS BUENOS AIRES – Safety Dojo

the challenge

As a port terminal one of the main challenges that we face every day is that operational risks are very different from other activities. These include raising awareness, understanding the specific risk activities, and ensuring that warranty trained people inside our terminal. All these challenges were studied and discussed in the HSE department for our terminal, to try to figure out how to cover these challenges and provide a safe environment to all the people that every day access into our terminal. Raising awareness and providing a safety culture for our people, external contractors, truck drivers and visitors were the main challenges addressed during this project.

the innovation

As a port terminal we want to provide a safe environment for all employees and clients to discover our risks in the most interactive and controlled way every day to raise awareness in every people that arrives to our terminal.

Performing GEMBA´s it was identified that in our terminal we do not have any means to communicate risks in a safe and interactive way, it was always done through training, but we want to create a safe and playful environment available 24/7.

We start to shape this innovation building the first Port Safety DOJO, APM Terminal have 72 ports around the world, any terminal had a specific Port Safety DOJO to train and raise awareness generating a safety culture within all people.

how it was implemented

We start to build our Safety Terminal Port DOJO, designing interactive boards and games to interact with the risk, also built a place protected from the weather and available 24/7.

4 interactive boards are in place to interact with store energy, fire response, lifted cargo and working at heights. Also were implemented interactive stations like the importance of the hard hat use, how to wear a protective harness, lifted cargo prevention, how to use an EAD, safety logging system, correct use of a fire extinguisher.

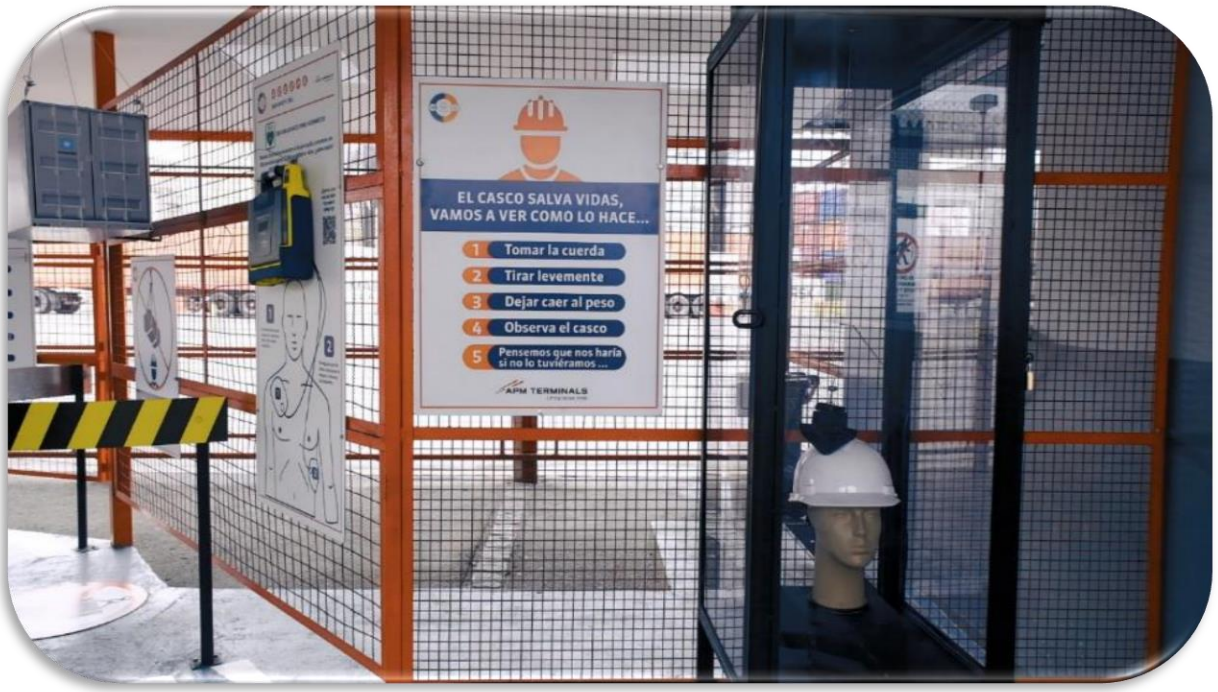
After developed the project a safe place was implemented to be able to identify our common risks, how to proceed in a safe way and interact with them in order to be able to develop our daily tasks having an interactive and controlled place to train daily, this project is designed for all our clients, internal and external who can access every day.

the result

The results were outstanding, raising awareness in our personnel, create commitment on every person that access into our terminal, creating a safety team built by our people, external contractors, visitors involving all in a safety culture to improve safety awareness. Interviews with external truck drivers, external contractors, our own people, stevedores, equipment operators, operations departments, shows the same results, everyone loves the DOJO, most of the external people understand the risk that our employees face every day, an equipment operators understand the risk faced by a stevedore, a place available 24/7 to train in a controlled place, to empower our people in a safety culture.

conclusion

APM Terminal have 72 ports around the world, any terminal had a specific Port Safety DOJO to train and raise awareness generating a safety culture within all people, we have achieved global recognition from our headquarters, other terminals and professionals from other activities. We are really proud with the implementations, our journey continues adding more interactive stations, promoting the DOJO with tours and trainings.


EL CASCO SALVA VIDAS,
VAMOS A VER COMO LO HACE...
1 Tomar la cuerda
2 Tirar levemente
3 Dejar caer al peso
4 Observa el casco
5 Pensemos que nos haría si no lo tuviéramos ...
APM TERMINALS


GRACIAS POR SU VISITA
MAERSK

7. | AREMA – SSE Tablet

the challenge

Have safety advisors 100% on site for safety visits. Reduce time to prepare report and delays to send to the managers. Facilitated the realization of visits through digitalization.

the innovation

Safety visit process was with a paper form to be filled during the visit then scanned, add the photos, and send to the managers. Half of the time was spent to do the report instead of being on the field. Using a software online to digitalize the forms allow to save time, to raise effectiveness on many aspects.

how it was implemented

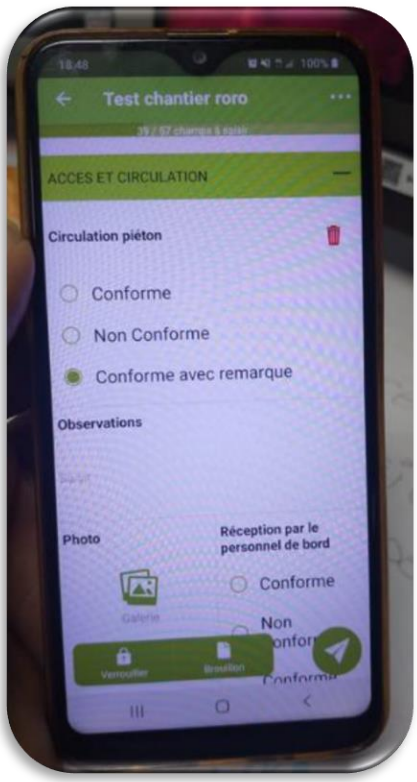
After research on the web, we finally have found a software adapted to the need. Develop our own software was expensive and limited for any evolutions.

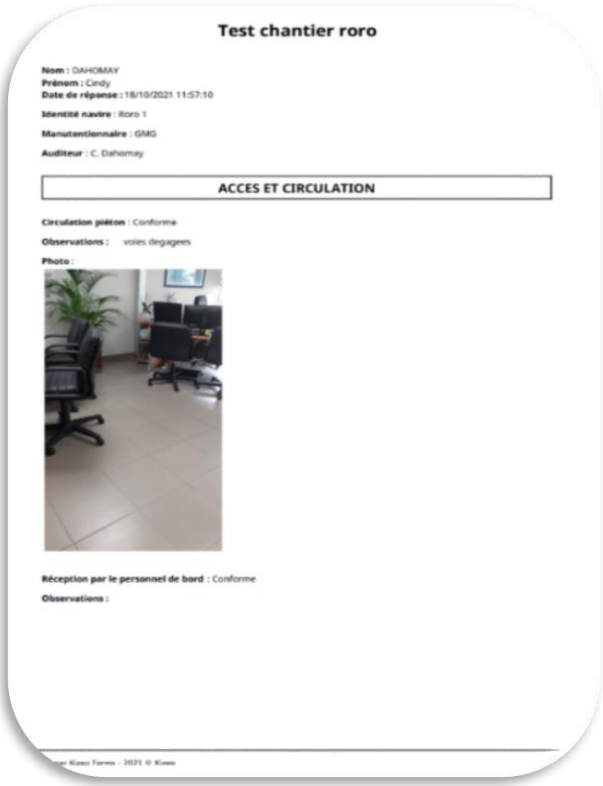
the result

The safety advisors have felt proud to be considered and provided with digital tools. The managers have found useful to be reported about any observations just after the visits. We are waiting for some development to have a greater report.

conclusion

To be generalized on all terminals.





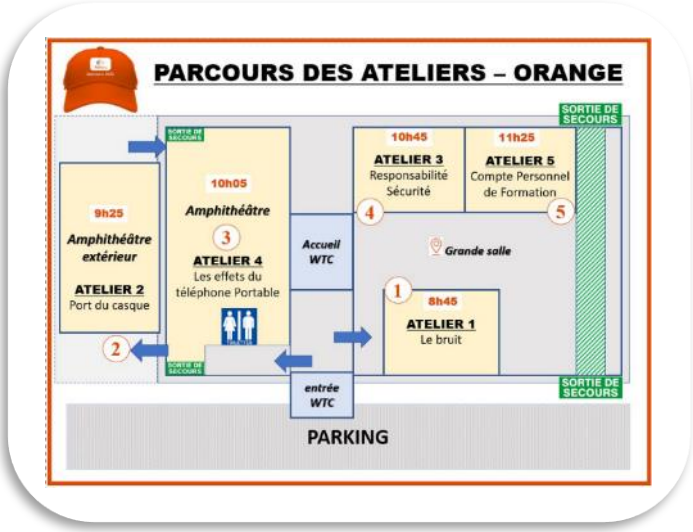
8. | AREMA (No2) – SSE Seminar

the challenge

Many repetitive incidents on the terminal. Difficulties to sensibilized the stevedores during operations. Find a way to have a great impact on these repetitive safety aspects.

the innovation

We have convinced the management to organize a one-day seminar with several workshops focused on our main issues (wearing the helmet, use of cell phone, safety responsibility, wearing ears).



how it was implemented

We have hired a space close to the terminal with zones dedicated for each workshop. We have divided the stevedores by groups and each group has to do each workshop.

the result

Great feedback. It was a first and the behaviour on site change on a visible way.

conclusion

We have decided to do it every 2, 3 years due to the organisation behind.

9. | Bintulu Port Holdings - 'Cantonization' of operations

the challenge

We have implemented the concept of 'cantonization' of operations, whereby different aspects of the operations and areas in the port were demarcated as 'cantons' with defined virtual parameters and distinct demarcations to ensure better monitoring and, if necessary, segregation of any areas that may be affected by the pandemic.

One of our major challenges in implementation this cantonization concept is commitment from our employee such as not notifying immediately when there is a COVID-19 positive case or close contact in their canton.

Other challenge is the confusion arise in notifying our Company's Crisis Management Team.

Glitch in the system (notification form)

the innovation

The purpose of this innovation is to avoid closure of the whole premises and operations if a positive COVID-19 cases is detected. Only the affected canton will be closed temporarily for the purpose of cleaning or disinfection in the area.

The main purpose of introducing of this concept is to prevent the spread of the coronavirus (COVID-19) in BPHB Group.

BPHB Group Crisis Management Team Walkabout led by Group CEO to ensure Cantonization Concept complies with Pandemic SOP

how it was implemented

The workplace or premises are divided into main canton and sub-canton according to the size of the occupied division / department / office / unit / section. Only the affected canton will be closed temporarily for the purpose of cleaning or disinfection in the area.

Each Canton will be headed by General Manager / Senior Manager / Manager of the division / department / unit / section. The canton's head shall monitor the implementation of the COVID-19 preventive measures as per advice by BPHB Group. Each of the canton will be responsible with their own area.

the result

We able to ensure our Port doesn't face total closure although COVID-19 positive case detected in our premises and port operation is continuously carried out as usual. Our operation is vital to our community as we are the main port in ensuring continuous supply of essential goods to the community and surrounding area.

conclusion

In Malaysia, we are the first port or organisation to introduce and implement such concept and is considered successful in preventing COVID-19 from affecting our operation and keeping our employee, port user, shipping community, contractor and stakeholder safe while working in our premises.

The following is the link of our national newspaper cutting on the implementation of cantonization concept which announced by our Group CEO, Dato Mohammad Medan Abdullah.

https://sarawakvoice.com/2021/02/03/bintulu-port-creates-green-bubble-for-workplace-safety/

BPHB Group CEO – Dato Mohammad Medan Abdullah

10. | BLOK Container Systems – Blok Rig

the challenge

In straddle carrier operations, pin-men carry out twistlocking on moving containers hanging from the crane in all weathers and light conditions which can be extreme and impact on visibility and safety.

Current practice 3 x crane steps = safety Issues + 120 seconds cycle time

Manual pinning also slows up the crane productivity some 30 seconds or more per container (amounting to a large 25% of the average cycle time) and puts the pin-men under additional pressure, with vessels and terminal management incentivised to maintain schedules.

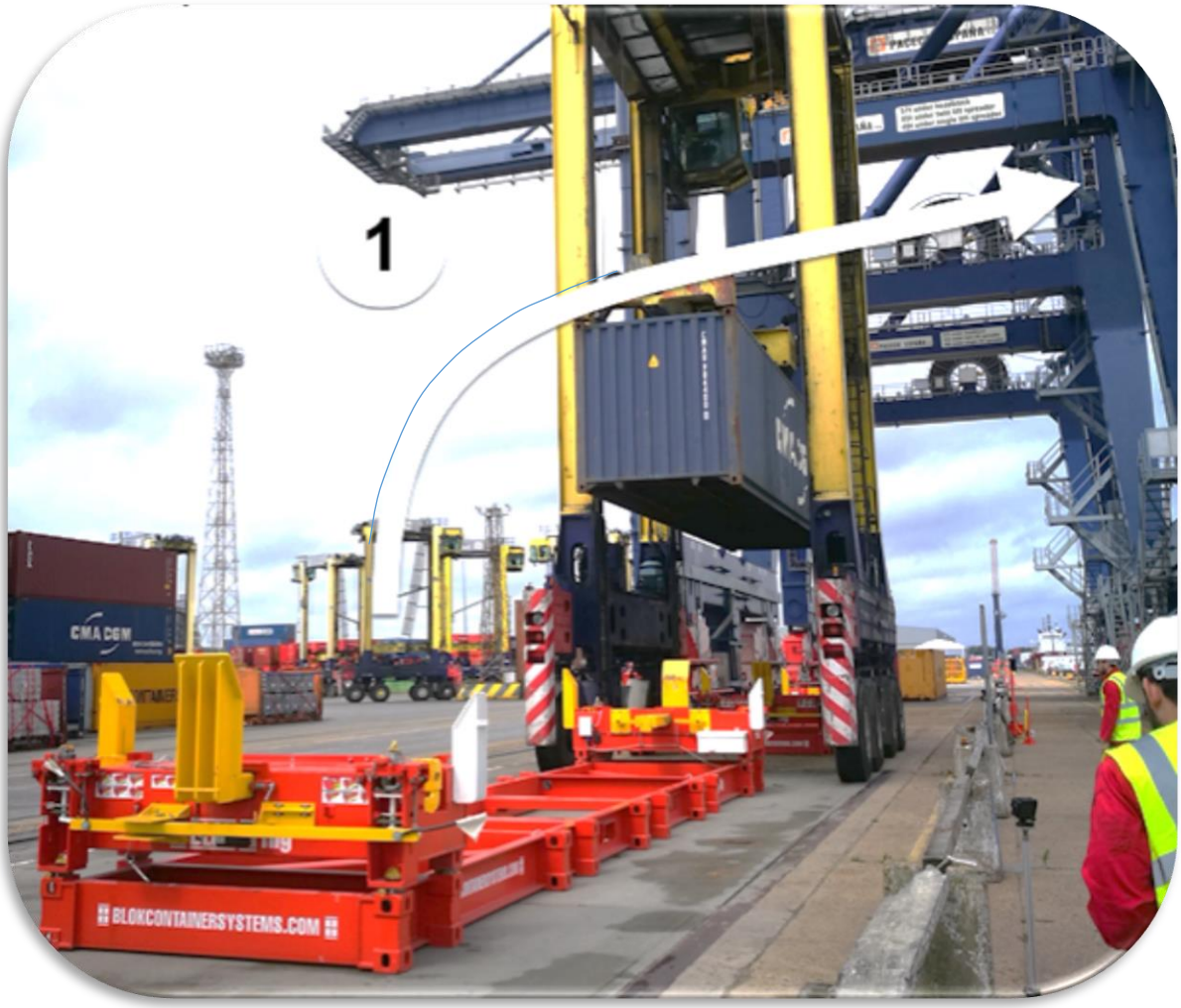
Twistlocks are also often poorly maintained making manual turning difficult. If these are not turned fully during locking there is a risk of these locks falling out of the container onto men below. Furthermore incomplete locking can contribute to container losses overboard.

By putting the container down on a BLOK Rig pinning machine the crane is free to move away allowing the pin-men to work safely and more quickly with 'machine assisted' pinning. With machine assistance the lock is fully rotated ensuring it will stay in the container corner casting.

There are several locations on the quayside for pinning machines to be located to suit terminal objectives or additionally on a crane leg platform. The BLOK Rig is moveable by crane or straddle carrier to any location.

Not all twistlocks on any given ship are the same. They should be so but are not, as locks from different vessels can get mixed on some quaysides. Thus the machine assisted pinning also allows for manual intervention where necessary in a safe environment, without the crane spreader overhead, to cope with this inevitability.

Safety, productivity and versatility are all improved by the use of these innovative new machines.



Improved process 1 x crane step = extra safety + 90 seconds cycle time

BLOK RIG 'MACHINE ASSISTED' PINNING - V5 - 20ft, 40ft, 45ft, 8ft~2.55m wide

the innovation

BLOK Container Systems is pioneering 'machine assisted' pinning for container terminals with a new device called a BLOK Rig.

The machine assists pin-men to fit and remove twistlocks by remote control in a safe zone on or adjacent to the quay of a straddle carrier terminal. Containers are transferred between straddle carrier and crane via the BLOK Rig.

All Semi-Automatic Twistlocks (60%-80% of all locks depending on the terminal) just need to be placed on machine prior to the arrival of the Straddle Carrier for loading and removed from the machine in a reverse process for unloading. The simultaneous fitting and removal of 4 locks takes less than 10 seconds). For Fully-Automatic Twistlocks or other exceptional locks, a rising frame is used for manual fitting and removal and also safely achieves crane productivity gains.

- Cranes can now safely achieve their optimum cycle with less concern for pin-men and achieve maximum speed of loading and unloading.
- One BLOK Rig can feed up to two cranes when located remotely from the crane and achieving one man per crane working in extra safety and comfort.
- When the BLOK Rigs are in the remote location, total safety under the crane comes from there being no pin men working there. BLOK Landing PADs are put there to cushion containers and speed connectivity for manual or automatic (safer) operations.
- Two BLOK Pads under the crane set side by side enable the use of the BLOK Spreader for tandem empties increasing crane productivity and safer connectivity still further.

how it was implemented

The BLOK Rig Pinning System has been developed and tested at London Container Terminal Tilbury over the past three years with the full involvement of management and quayside staff at the terminal.

The equipment has been developed in the UK, West Midlands, a centre of engineering excellence. In addition to private investment, additional grant support has been gained from the European Regional Development Fund with advice from Coventry Council, the Regional Growth Hub and the Department of International Trade.

LCT have a proud safety record so all improvements and modifications have been made in iterative stages to reach a developed solution that fully meets the terminal safety brief yet speeds up pinning, further improves safety and provides financial returns over and above the manual process.

the result

The result has been that we have produced a product and universal pinning system for straddle carrier terminals that meets the needs of the industry now.

- It is quicker than manual pinning
- It is safer than manual pinning

- It makes loading and unloading containers more profitable for terminals
- It increases terminal capacity and facilitates tandem lifting
- It makes better use of the restricted space at the quayside
- It makes terminals more attractive to their shipping line customers by speeding turnaround time, saving fuel and emissions.

BLOK Rigs used in tandem for double productivity with BLOK Spreader

The latest iteration of a BLOK Rig is able to manage every type of twistlock so far encountered above and below deck. It is undergoing final testing prior to production and full implementation in 2022. The interest is such that demonstrations are being organised for leading maritime industry terminal operators in response to Worldwide interest.

conclusion

Pinning has been a hazardous manual process throughout the lifetime of the container industry and the industry now manually handles around 2 billion twistlocks per year.

We now have the first solution that mechanises the majority of pinning practice and can cope with the variety and condition of twistlocks currently in use. The BLOK Rig is the first step on a journey that will make container quay sides safer, more efficient, more profitable and lead to further iterative steps in automation and safety.

Manual twistlocking of containers suspended under cranes is a universal bottleneck which hampers the attempts of shipping lines to reduce time in port, maintain schedules without excessive speed and be able to reduce fuel use and emissions. Reducing emissions clearly leads to a safer and healthy environment which is a key motivation for BLOK Container Systems.

BLOK Team

11. | KALMAR AB (No 2) – Extending Tilting Spreader

the challenge

Bulk handling has long been recognized in other volume industries as the most effective method of distribution. With the ongoing globalization of supply chains, movement of dry bulk products is increasingly undertaken by utilizing ISO containers. The Dry Bulk Shipping Market is expected to reach a market volume of 6,800 million tons by 2027, as more containerization occurs for bulk goods. The types of goods that are driving the increase in usage are:

- Recycling (metal, concrete, plastics & rubber, paper, etc.)
- Energy (biomass, waste-to-energy, wood chips, etc.)
- Agriculture (grain/cereal, coffee, sugar, fruit, crops, fish, etc.)
- Mining (iron, ore and other metals)
- Chemical (all types of fluids, chemicals, fuel sector and similar).

Unloading bulk material is done by tipping the container, usually at height, which brings about two main challenges:

- Emptying the container completely (stuck material)
- How to keep the container closed until time/place for emptying is right

Although serious accidents during unloading may be rare, these may constitute a serious safety threat to personnel, drivers or operators surrounding the equipment. The consequences may include increased unloading time, unsafe operating conditions, product spillage or damage or the injury of drivers and operators.

the innovation

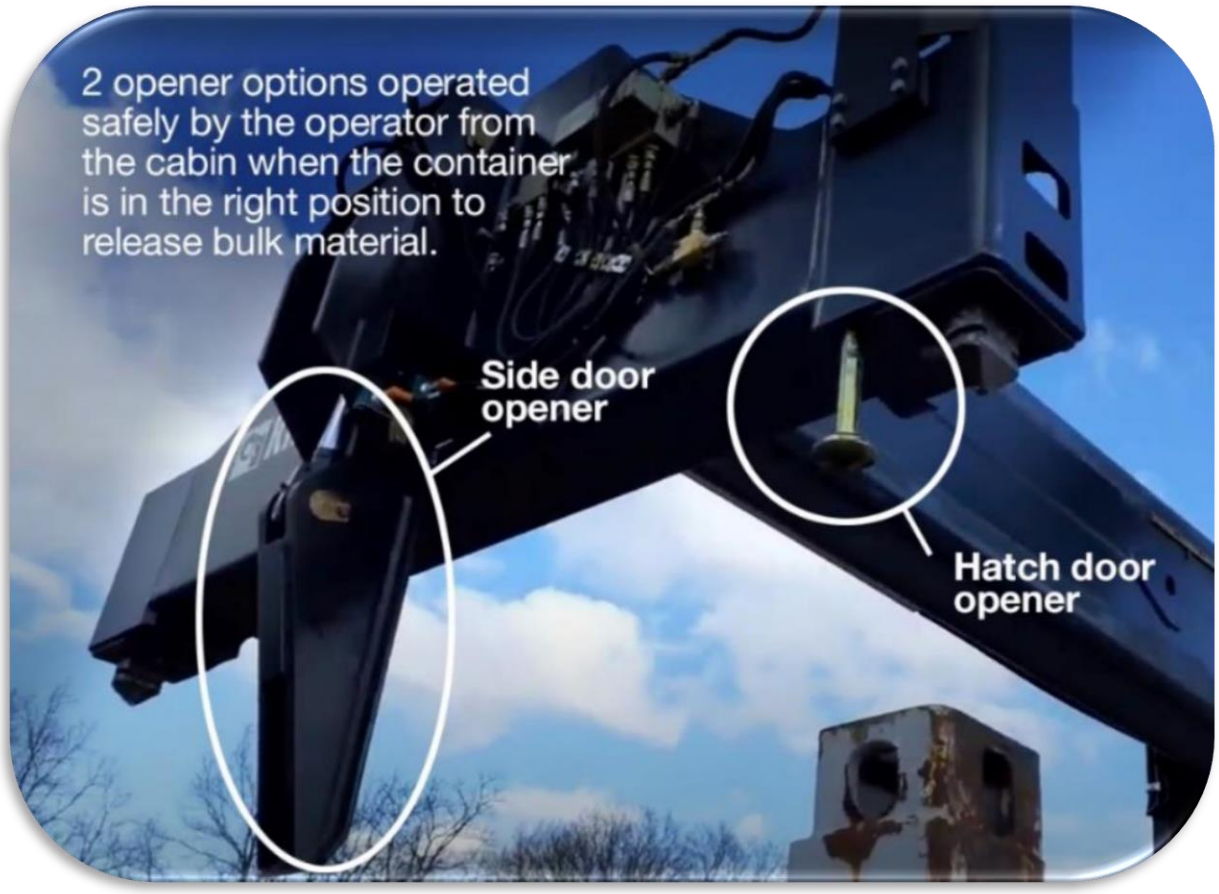
Kalmar's optional Extended Tilting Spreader provides a versatile, safe solution for emptying bulk material from standard ISO 20'-40' containers. The spreader can be tilted up to 55° to unload dry goods precisely and quickly from the container.

By providing tilting angles up to 55° sideways, perpendicular to the truck direction, the tilting spreader provides a safe, quick and flexible method for handling and emptying bulk material such as grain, pellets, scrap, and other loose materials.

The doors are kept closed until the proper positioning is obtained, which helps the operator control the emptying of the container more precisely, reducing spillage and waste. This is achieved as when the container is tilted, the doors are held closed until the opener is safely activated by the driver from the cabin to allow the doors to swing open and the load to flow out.

There are 2 opening options:

- Side door opener
- Hatch opener.



An additional option to ensure the extra safe emptying of the container was developed – a container shaker functionality which is operated from the cabin by the operator. This ensures the safe removal of any stuck material inside the container, without human intervention. Keeping clear separation of people from the containers while being unloaded.

how it was implemented

There was close cooperation between Kalmar and Bromma, which ensured a seamless and effective development of this solution, which is the first and only solution available in the marketplace with a 55 degree sideways tilt for 40' containers.

The solution was tested together with our customers to ensure that the optional functionalities for the container opening and shaking were according to market/customer requirements and ensured the necessary degree of both safety and operability to ensure

safety-efficiency. Since its introduction it has been sold to approximately 30 customers around the world and we expect the number to increase in the years to come with the rapid increase in bulk goods being transported in containers.

the result

The result is the solution called the Bulk Handling Tilting Spreader which offers the safest way to empty a container with bulk material safely, automatically and without human intervention.

The spreader can still be used as a traditional top lifting spreader with full capacity for horizontal lifts for handling containers but has the additional functionality of tiling with a slightly reduced capacity to ensure stability.

conclusion

We strongly believe in this solution as it is accessible to everyone and makes handling bulk materials much safer and more effective, reducing waste, improving productivity and keeping our customers' staff safe.

Furthermore - and as mentioned above - the solution is versatile as traditional horizontal top lifting of containers is also possible with the spreader solution thus offering a 2-in-1 solution for a more sustainable approach instead of one machine for one cargo handling application and one for bulk material handling.

12. | Checkmate Flexible Engineering Ltd – Manifold Systems

the challenge

Checkmate Flexible Engineering manifold systems has been engineered to secure cargo in ocean going pulp carriers by automatically maintaining the correct working pressure within the rubber airbags used to secure the cargo. Further, the system is supplied as a sealed unit complete with anti-tamper devices that provide assurances to the user that the manifold system is in safe working order.

When using airbags to secure pulp cargo, the air bags can experience large variations in pressure due to changes in atmospheric pressure and temperature during a passage. Additionally, the cargoes will compress during transit due to accelerations in pitch, roll and yaw, opening gaps between the cargo and leading to movement of the stow, resulting in serious damage to the cargo.

The manifold system addresses the above and many safety aspects by avoiding the need for ship's staff to enter the cargo hold to check air bag pressures are being maintained and removes the risks associated with over-inflation which could result in serious injury.

Finally, the manifold system has been designed with simplicity in mind and is both quick and simple to implement allowing users instant improvements in safety.

the innovation

The transport of pulp in ocean going vessels presents many challenges and requires an efficient securing system that can adapt and compensate for movements that can occur during the voyage. The use of rubber air bags has proven to be the perfect solution, offering robust and cargo friendly alternative to traditional cargo securing methods. To complement our rubber air bags we developed a manifold system which keeps airbags correctly inflated at all times with no need for crew intervention.

The system rapidly inflates up to thirty airbags simultaneously, using the ship's own dried air supply and then maintains the pressure to a pre-set value for the duration of the voyage, ensuring the sustained security of the stow. It is also designed to cope with critical events, including air leaks of up to 5 litres/minute. Should any bags burst or leak excessively, inline control valves ensure that pressure is accurately maintained in those remaining intact.

how it was implemented

As the pulp carriers have driven to achieve higher efficiencies the residual space within the cargo hold has reduced, limiting access for crew to inspect and maintain the pressures within the air bags as a result of compression of the cargo due to movement of the vessel. This was resulting in increased cargo damage and insurance claims; therefore the carriers and pulp produces sought a solution from Checkmate.

Several design iterations were explored until we arrived at the manifold system which provided the optimal solution by maintaining constant pressure within the air bags eliminating the need for crew intervention, regardless of whether or not there is access to the

cargo hold. The system was developed in close collaboration with the world's leading pulp carrier to facilitate field testing onboard vessels.

the result

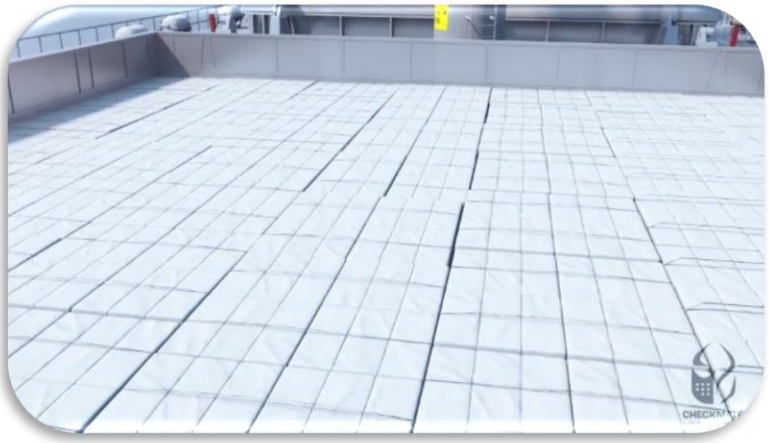
Since its launch in 2005 our rubber air bag pressure maintenance system is the only solution recognised and approved by the major pulp producers. Our manifold system is in use worldwide and adopted as standard equipment by the world's largest ocean pulp carriers.

The results of the system's implementation are:

- Reduced cargo damages
- Reduced insurance claims
- Reduction in accidents and near misses
- Increase in cargo handling efficiencies
- Reduced operational costs
- Improved customer satisfaction

conclusion

Checkmate Flexible Engineering's Air Pressure Maintenance System ensures less movement in the cargo hold and has been proven to reduce the overall number of airbags needed, saving money, and ensuring safety during transit. Its cost effectiveness is clear, and this is demonstrated by its sales success. The system has improved the ocean transportation of pulp worldwide and is appreciated by the pulp producers, carriers and end users.

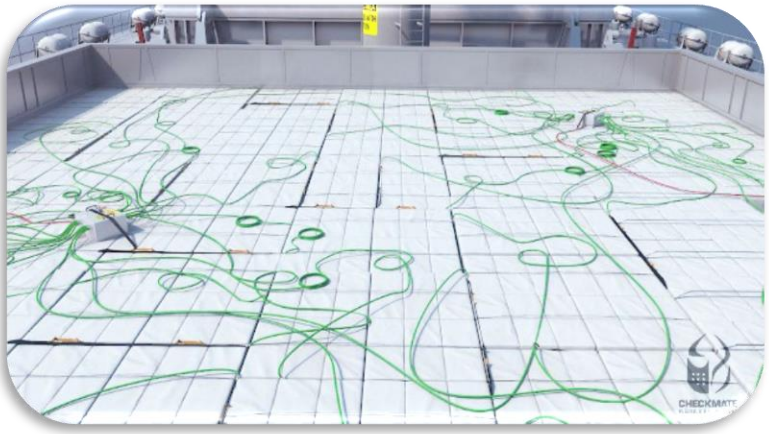


Pulp stowed within the cargo hold using traditional securing methods and without the use of air bags.

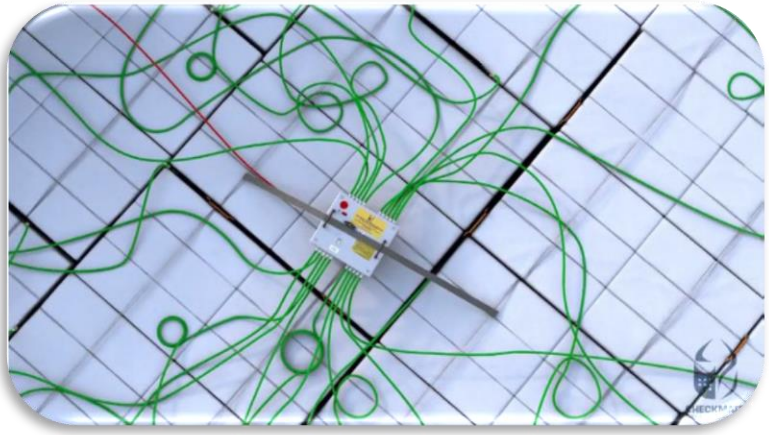
During voyages, a vessel will experience adverse weather, these changes in sea states can make the vessel move drastically in pitch, roll and yaw.

These adverse sea states can create high forces applied to the top tiers of cargo causing the pulp to compress creating gaps between the cargo and movement of the stow. In turn resulting in serious damage.

Cargo be being secured using Checkmate rubber air bags.

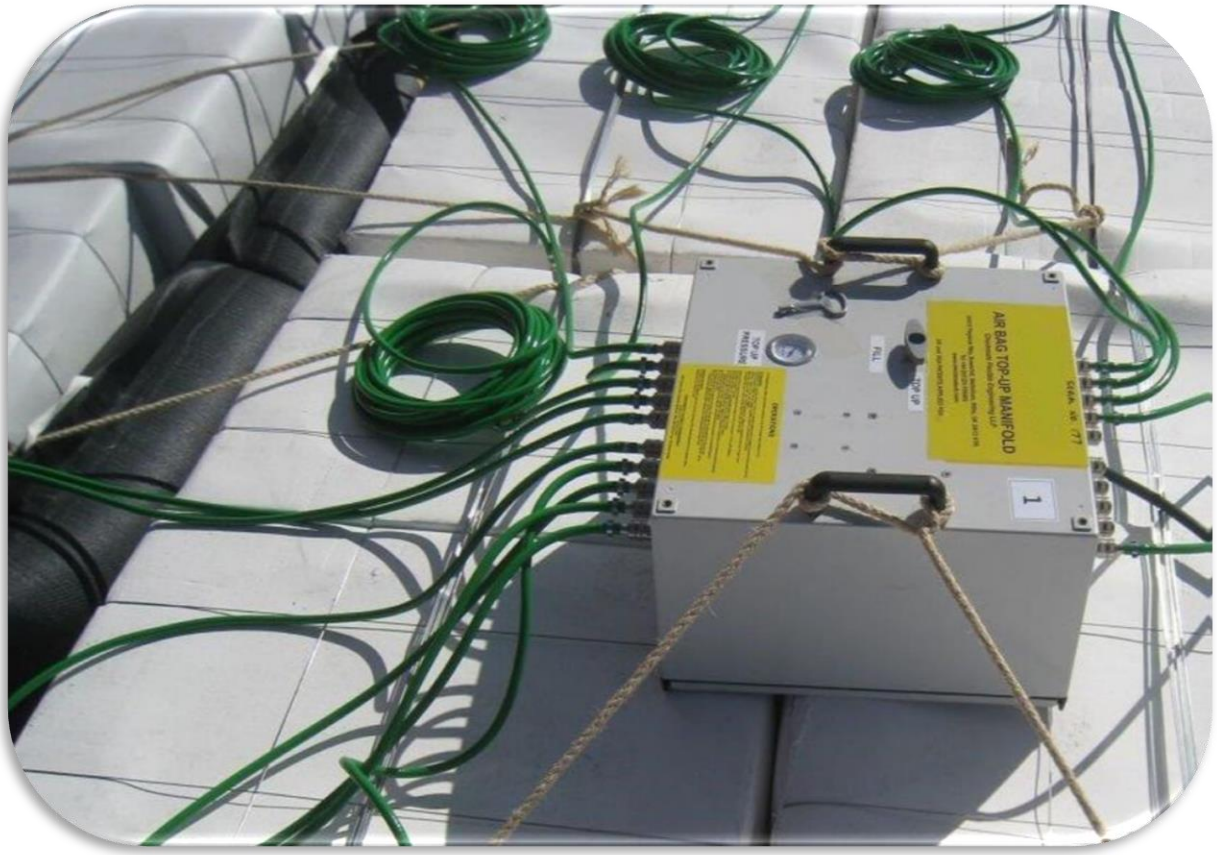


Cargo secured with Checkmate rubber air bags and connected to our air pressure maintenance system, Manifold System.



View highlighting the compact design of the manifold system.

Stow arrives perfect intact with no damage using Checkmate Manifold and Air Bag System.



13. | Cindicium – Pondus System

the challenge

162 IMO members enacted SOLAS regulations in 2016, yet in 2019/20- surveying 65,000 containers in three Australian terminals showed >20% mis-declared by > 1 tonne. Imports were worse suggesting a global problem remains.

The problems of wrongly declared containers are well understood. They threaten the safety of the entire container chain and the general public (see photos for examples)

The problem was defined as at what point in the container change can we make the biggest difference. After one attempt aimed at the point of loading, we found that the best point would be the stevedores. Targeting this point is not new but instead of attempting more or more accurate weighing alone, we came up with a rigorous, statistical technique which could assess all containers and then process in more detail those that appeared to be high risk.

Cindicium partnered with Patrick and Maersk in Australia to develop and test a connected, AI-based evaluation and measurement system using behavioural economics and rapid feedback to change container chain behaviour.

the innovation

Our approach applied system thinking to uncover the reasons behind poor compliance and develop an innovative way to eliminate the problem at low cost.

Rather than seeing the problem as one of weighing, we approached it as a combination of behavioural economics, operations research, flow management, information technology and communication.

Patrick and Cindicium jointly developed new processes based on the practical operation and possibilities inherent within a modern container terminal, and Cindi then developed the enabling technologies so the new approach could be implemented in safety and without hampering the flow of containers through such terminals. With strong support from Patrick Management, support from Maersk and funding from Macquarie Bank we built and jointly tested “proof of concept”, and “proof in use” prototypes.

The Pondus system inserts a super accurate weighing device (the Pondus) into a terminal and then uses AI and big data techniques to identify “risky containers” which are then accurately weighed.

Our intelligent technology evaluates every container, we then check weigh those of highest risk, and provide updated accurate weights to the next entity in the supply chain; Patrick has introduced a mild price signal that is already changing industry behaviour towards correct declaration of their loads.

How it was implemented

Initially we searched for an existing device or technology that could undertake the check weighing component of the process. Most existing devices fell well short of the requirement and so we developed a new weighing device to support the process.

We built a technical proof of concept for the Pondus in Sydney. This concept weighing device could accurately weigh a person or a container.

We then built a full size Pondus stand and tested it in a live environment at Patrick, Brisbane. This test was designed to confirm the stand's performance but also to test the capability of the IoT, Cloud and AI technologies for assessing all containers passing through the yard.

Proof of concept Pondus under test in Brisbane

Production Pondus being moved at Brisbane

We sought input from Statisticians, Actuaries, and Insurers as we developed the concept. We also road tested a number of communication approaches balancing statistical rigor against ease of communication and understanding.

We confirmed the process outcome in three main ways. One was to conduct extensive and detailed analysis of the algorithmic elements during the 2-month intensive trial, the second was to ensure that the weighing stand met OIML R76/class 3 which is the gold standard for weighing, finally we have established processes that allow customers to freely challenge any assessment if they believe that we are in error.

Because significantly mis-declared boxes are subject to an administrative charge, we have encouraged others to challenge our results which by necessity means we are actively looking for negative results.

the result

Introduction of the initiative has been well supported because of a good level of workforce consultation and the avoidance creating extra work when introducing new processes.

The system has met its goals and while we are still refining its efficiency, we have interdicted hundreds of wrongly declared containers from the container chain.

This means no overweight boxes on our roads and no wrongly declared containers being loaded onto visiting vessels. Patrick is rolling out the technology to its other terminals and Cindicium are in discussions to roll it out elsewhere in Australia and beyond.

There has been a certain amount of push back from some trucking operators.

Of the few challenges we have had, the majority are highlighting issues at container originators. We have found numerous issues related to training and understanding of SOLAS, such as forgetting to convert declarations from pounds to kg, forgetting to allow for the tare weight of the box etc.

Many workers in the container chain would be unaware of any real difference in their working day except that they know that the risk of a dangerously mis declared box is reduced.

Video of Pondus in use in Brisbane

https://www.linkedin.com/posts/patrickterminals_pondus-at-patrick-terminals-brisbane-autostrad-activity-6790029416601919488-LtJi

conclusion

Pondus is in its early stages of deployment. The technology has proven stable and our implementations have been straightforward.

We are entering this award to spread the news that there is a simple. Practical, sustainable and scalable way of solving the issues of mis declared container weights.

Support from the shipping lines has been most helpful and there appears to be a real appetite for the concept

14. | CMA-CGM Guadeloupe - Military "sandbox" method to carry out preventive scenarios

the challenge

A large number of crisis scenarios to be tested on the operating terminal.

It is always a bid deal to carry out crisis scenarios without disrupting operations, without constraints, and availability of premises, people and equipment

the innovation

In order to prepare the teams for the management of crisis situations on a more regular basis, limiting operational constraints, the scenarios are reproduced and played in a room.

how it was implemented

We have made a miniature of the terminal and we are using Lego pieces to represent the different actors and equipment.

We have set up rules for the game to allow the implementation of the selected scenario, the learning by the different actors and the findings for improvement.

the result

The participants have enjoyed the exercise and were surprised at the effectiveness of the results without being on the field.

Several different scenarios can be easily set up and played.

conclusion

Solution to be generalized on all port terminals to facilitate preparedness for crisis situations

15. | ConexBird - Measurement technology/equipment for collecting container specific data

the challenge

Damaged shipping containers are ubiquitous amongst intermodal logistics, with up to 20% of containers having some damage present at any given time. In addition, the rough conditions and ever-growing lifespans containers are subjected to have weakened their strength and durability. Damages and weaknesses in containers can have very serious consequences, such as container drops, container-floor collapses and container-stack collapses (on land and at sea). These incidents have caused fatalities in the past, and are growing in prevalence; according to the World Shipping Council, over 1,500 containers are falling off ships and into the sea each year. Besides the obvious risks to crew onboard vessels where this happens, containers lost overboard will often float just under the surface for some time before sinking, posing a further hazard to additional ocean-going vessels

the innovation

ConexBird provides a solution to analyse the physical structure of shipping containers. Through its ground-breaking combination of vibration analysis and machine learning, ConexBird is able to immediately identify damages and structural deficiencies in containers which would otherwise have gone undetected, thereby preventing damage-related incidents such as those described above. Vibration analysis is an existing measurement technique which is widely used across engineering: however, no one has yet attempted to apply it to the inspection of shipping containers.

ConexBird has developed hardware that can perform this from container cranes while they are in use, allowing data to be generated without interrupting process flow. Additionally, the unprocessed vibration measurements are not interpreted directly by a human being (as is typical in other applications of vibration analysis) but by a machine-learning algorithm, which continuously improves its accuracy and versatility as ConexBird's presence grows. ConexBird's primary customers are container owners such as shipping lines and leasing companies, whose economic benefits from using ConexBird insight dovetail with the improved safety obtained through stronger, smarter container fleets. Secondary markets for ConexBird insight are found in other container stakeholders such as terminal/depot operators, insurance companies, freight forwarders and cargo owners: terminal operators, in particular, see potential in ConexBird's ability to identify critically-damaged and dangerous containers upon arrival.

how it was implemented

ConexBird has developed measurement technology and measurement equipment for collecting container-specific data. When empty containers arrive (via sea, rail, or road) at a terminal or depot, ConexBird measurement equipment, installed on top-loading container spreaders, reads physical vibration measurements across each container's structure as it's being lifted. This data is then processed in the cloud by our machine-learning software, which generates an individual assessment of the container's durability and availability. The processed results are accessible online within seconds as value-adding insight.

ConexBird's business model revolves around the sale of this container insight to interested parties, which is typically done on a per-measurement basis. ConexBird assumes responsibility for the hardware and software costs needed to supply this insight.

the result

ConexBird has been measuring containers for over a year now, and has begun generating durability insight which allows container owners to reduce the overall prevalence of container damage within their fleets — and, therefore, of damage-related incidents. This is possible due to the established correlation between a container's durability level (e.g. measured by ConexBird) and both the likelihood and severity of future damages to its structure: by removing unexpectedly weak, fragile units from circulation, container owners are able to improve the safety and productivity of their asset pools. Further safety benefits are obtained by offering second- and third-parties the opportunity to learn more about the structural condition of the containers they are moving, handling or using. With pre-existing container damage being a significant contributor to containerized cargo damage, ConexBird insight will also improve cargo safety across the intermodal supply chain.

conclusion

ConexBird offers an entirely new source of information for the container shipping industry. Recent turbulence and congestion across global supply chains has highlighted the need for fast, intelligent, data-driven decision making; overdue systemic improvements to visibility and

automation have brought safety improvements alongside productivity gains. Furthermore, with shipping's considerable environmental impact now under the spotlight, efforts are ramping up to improve the methods and processes used to move goods throughout our modern, globalized economy.

At ConexBird, we see these changes not merely as beneficial for our growth, but as necessary for the health and prosperity of the global supply chain and those who make it tick. We would welcome the recognition and exposure the Innovation in Safety Award would bring to our solution, since it would be a major boost forward in our mission to make container logistics faster, smarter and greener for everyone.

16. | CTAA FTA ASPA - Heavy Vehicle Safety & Safe Container Loading Practices Awareness Campaign

the challenge

Cargo inside shipping containers that is inappropriately packed, poorly restrained (or unrestrained) and/or unevenly weight distributed can cause serious heavy vehicle road safety issues. This includes the heightened risk of truck rollovers, load shifts contributing to road accidents, accidents unloading containers, and heavy vehicle axle mass breaches.

Australian heavy vehicle accident data (National Transport Insurance, 2018) shows that significant on-road incidents involving container-laden heavy vehicles are 36% more likely to result in a truck rollover compared to vehicles carrying general freight. A common factor in these incidents is vehicle instability caused by the load inside the container.

Under Australian "chain of responsibility" road laws, all parties in the supply chain have responsibility for on-road safety. However, importers must rely on exporters in the port of origin to correctly pack and restraint loads inside containers, while audits of containers packed for export in Australia have found an unacceptable number either being overloaded or with poorly restrained cargoes.

The safety innovation proponents concluded that existing guidance material in Australia and internationally on the correct packing and load restraint of cargo inside containers is not well understood within the container logistics chain in Australia and overseas.

The available guidance includes the Australian Load Restraint Guide and internationally the IMO/ILO/UNECE Code of Practice for Packing of Cargo Transport Units (CTU Code).

The safety challenge was to raise the awareness of supply chain participants about the availability of best practice guidance and create key tools to enhance knowledge and provide usable resources.

the innovation

Funded through Australian Government safety funding, with industry in-kind contributions, a Heavy Vehicle Safety & Safe Container Loading Practices Awareness Campaign was developed to:

- Highlight the impacts on heavy vehicle safety of inappropriately loaded, poorly restrained and/or unevenly weight distributed shipping containers; and
- Promote best practice in shipping container packing, cargo load restraint and weight distribution, including the provision of materials to assist importers to engage with their packers overseas, and for exporters to review their packing practices and associated container logistics chain impacts.

In collaboration with WiseTech Academy (a division of leading technology company WiseTech Global), a unique on-line Training / Awareness Course was developed covering:

- Introduction and impact of unsafe container loading practices
- Safe container loading practices;
- Packing and minimising risks for containerised cargo transport
- Heavy Vehicle National Law and Chain of Responsibility
- Practical application of the Heavy Vehicle National Law and Chain of Responsibility
- Truck rollover prevention
- International organisations and conventions for safe container transport

In addition to the online learning tool, the campaign resources were distributed via unique website landing page: https://www.ftalliance.com.au/safe-container-loading-practices-heavy-vehicle-safety

Container Packing Checklist:

CTAA / FTA & APSA collaborated with the five key international organisations – the Global Shippers Forum (GSF), ICHCA International, TT Club, World Shipping Council (WSC) and the Container Operators Association (COA) – to distribute the international Container Packing Checklist - https://www.ftalliance.com.au/data/news_attachments/container%20packing%20checklist.pdf

Importers & exporters in Australia are being encouraged to share the Checklist with their packers overseas and in Australia to assist with implementing best container loading practices.

how it was implemented

A national project steering group was formed to guide development and delivery of the initiative, calling in experts in load restraint, maritime & landside transport operations, legal, insurance and cargo handling, including representatives from CTAA, FTA, APSA, ICHCA Australia and Thomas Miller Group (representing TT Club).

The overall Campaign was launched virtually on 17 September 2020, with a media statement from the Australian National Heavy Vehicle Regulator (NHVR) – see: http://ctaction.com.au/wp-content/uploads/2020/10/0918-NHVR-Media-Release-Safe-Container-Loading-Practices-and-HV-Safety-Campaign-Launch.pdf

The media statement was augmented with video messages from the (then) Deputy Prime Minister, and Minister for Infrastructure, Transport and Regional Development, the Hon. Michael McCormack, and by the NHVR CEO, Sal Petroccitto.

Awareness of the campaign was bolstered by advertisements placed in major Australian transport logistics trade publications:

Due to COVID-19 stay-at-home and travel restrictions, face-to-face seminars across Australia were changed into a series of unique series of Webinars delivered throughout October 2020 and early November 2020 on specific campaign topics:

Implementing Best Practice Container Packing

Tuesday, 13 October 2020 (12.00pm to 1.00pm AEDT) = 305 registrants

Overseas Packing Requirements to Facilitate Onshore Biosecurity Treatments

Thursday, 15 October 2020 (12.00pm to 1.00pm AEDT) = 434 registrants

Chain of Responsibility and International Transport Obligations

Wednesday, 21 October 2020 (12.00pm to 1.00pm AEDT) = 272 registrants

Chain of Responsibility and Container Transport

Wednesday, 28 October 2020 (12.00pm to 1.00pm AEDT) = 243 registrants

Insurance & Commercial Considerations

Wednesday 4 November 2020 (12.00pm to 1.00pm AEDT) = 182 registrants

the result

A total of 1,436 participants were involved across the five Webinar events. The video recordings of the Webinars are an enduring outcome from the project, with interested people able to view the recordings online.

Between the initial launch and the formal conclusion of the campaign at the end of December 2020, over 230 people had registered to complete the self-paced online training / awareness course.

The online learning resource now endures as an industry-specific online training tool, and is being incorporated into the Australian Diploma of Customs Broking (and future Diploma of Freight Forwarding) delivered by WiseTech Academy.

See: https://wisetechacademy.com/course.asp?id=74

In addition to the online learning tool and the Webinar recordings, the campaign resources remain current on the unique website landing page for the project.

See: https://www.ftalliance.com.au/safe-container-loading-practices-heavy-vehicle-safety

The international Container Packing Checklist has been downloaded numerous times from the website landing page, and all participants in the campaign continue to encourage importers to share the Checklist with their overseas exporter partners and their container packers.

Also, Australian exporters continue to be encouraged to incorporate the Checklist into their container packing and logistics processes to minimise the supply chain risks of poorly loaded, poorly restrained and uneven cargoes inside shipping containers.

conclusion

Promoting best practice shipping container packing, cargo restraint and weight distribution, and raising awareness of the negative heavy vehicle safety impacts caused by poorly packed, secured and loaded containers, has a direct positive impact on heavy vehicle safety in Australia, as well as general safety outcomes in the container logistics supply chain.

The campaign and its enduring materials and resources was a first within the Australian container transport logistics sector.

The safety campaign was cross-jurisdictional and open to all to participate, with a clear objective to ensure that the project learnings and outcomes were shared as broadly as possible across Australia.

The outcomes, learning materials and advice are an enduring legacy that can be used for years to come.

17. | DP World - HSE Management Software Solution

the challenge

To meet the HSE reporting needs of the DP World global network that spans across 181 business units in 64 countries, made up of logistics, marine services, ports and economic zones with over 56,000 employees a best in class HSE management software solution was required. The system had to be mobile to eliminate paperwork, effectively track information and provide field-based access.

The solution had to provide management with live dashboards and predictive analytics to effectively manage risk. The software had to be responsive to the business and adapt to rapid growth and an increasing variety of activities and operational locations.

A new and centralised digital ecosystem was needed to:

- Adapt to expanding and changing business requirements
- Provide HSE data in real time
- Remove manual intervention and effort to generate reports
- Provide reliability and functionality on both desktop and mobile devices (Android and iOS)
- Align with internal processes
- Provide delegation of authority in accordance with organisation structures
- Reduce costs by eliminating multiple systems and licenses in place across the portfolio

No off-the shelf product could address all our needs although extensive evaluations had been undertaken.

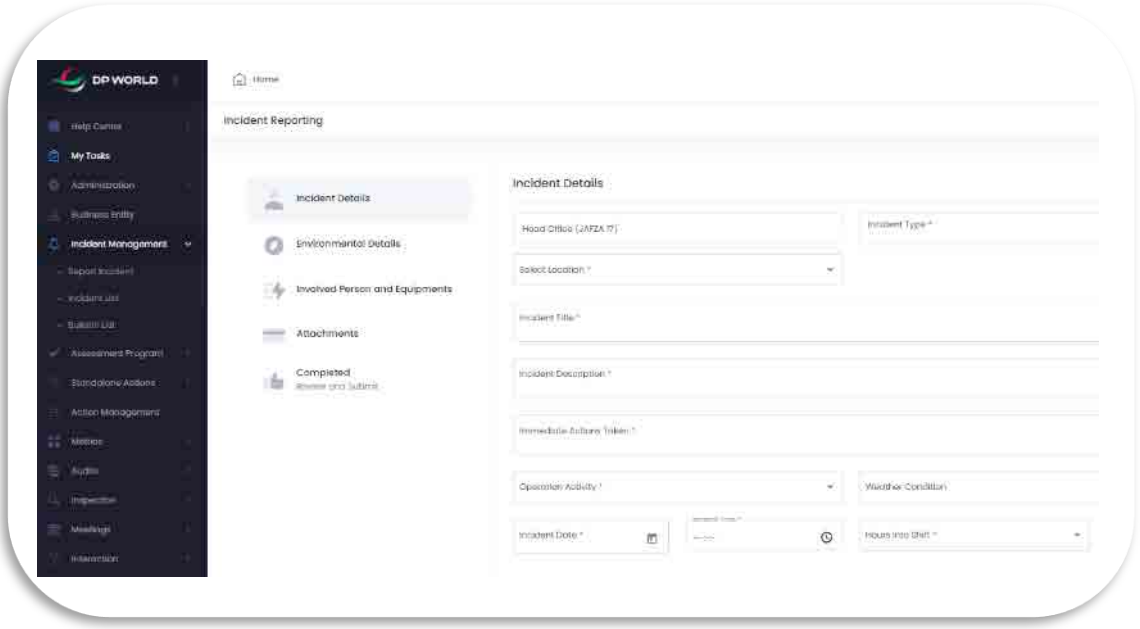
Incumbent systems were old and the operating platform had become unstable and inflexible impacting the productivity of business users.

the innovation

Our innovation was “Development of the marine industries most integrated and mobile management system for live HSE performance tracking and real-time management notifications.”

Our Application:

- Provides predictive analytics against industry incident trending for better management oversight.
- Integrates with Marine Tracker to:
  - Record real time information about vessels
  - Optimise vessel safety inspections
  - Track history against IMO registration
- Is hosted on a combination of .Net (SQL) framework and Angular due to robustness and relevance against business requirements



Example incident reporting module from the HSE Application noting the left menu navigation and other available modules

Through a 12-month process of gathering requirements and documenting specifications the system architecture was created consisting of the following:

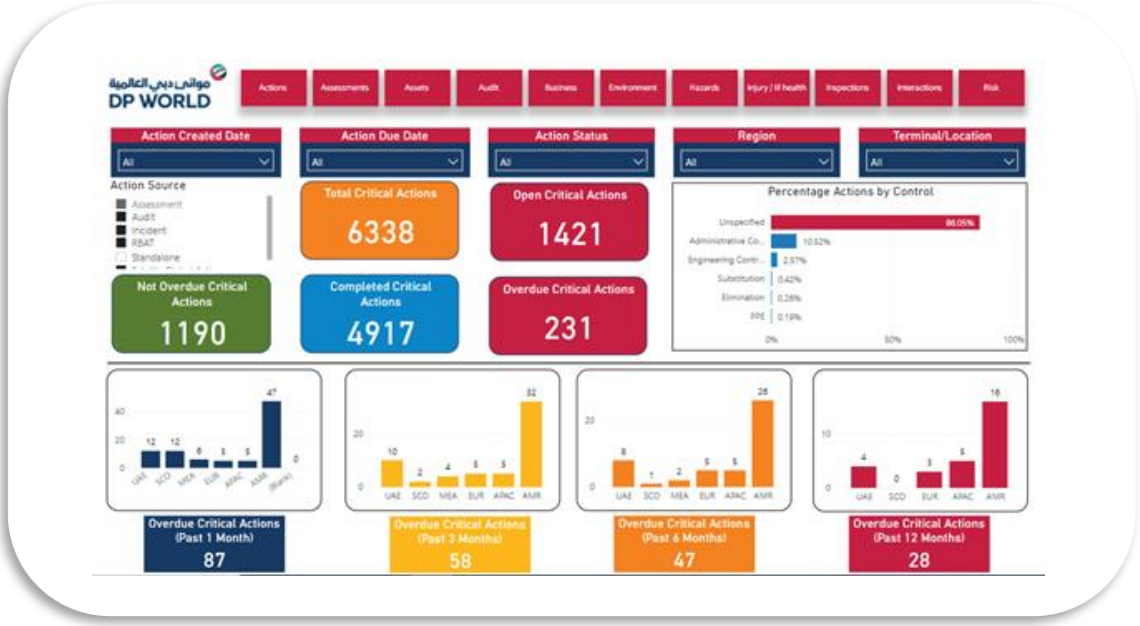
MODULE	FUNCTION
Incident Management	Reporting and investigation of HSE and asset related incidents and action assignment.
HSE Assessment	Set minimum requirements, identify critical items and report and track levels of compliance.
Action Management including Standalone Actions	Manage actions or create and assign actions.
Dashboard	Data visualisation and predictive analytics of performance data.
Metrics	Verification and validation of HSE data.
Audit	Create, schedule, perform and manage audits, design checklists and assign actions.
Inspections	As above. Additionally complete vessel inspections, share results, monitor and report on common issues and with shipping lines.

MODULE	FUNCTION
Meetings	Book meetings (linked with Outlook and MS Teams), create agendas, record meetings, attendance and assign actions.
HSE Interactions	Record scope of interactions, track and assign actions.
Hazard Reporting	Report hazards and assign corrective actions.
Risk Management	Report current and emerging risk, HSE profiles and Risk Baseline assessments.
HSE Awards	Submit and rate applications for annual internal award program.

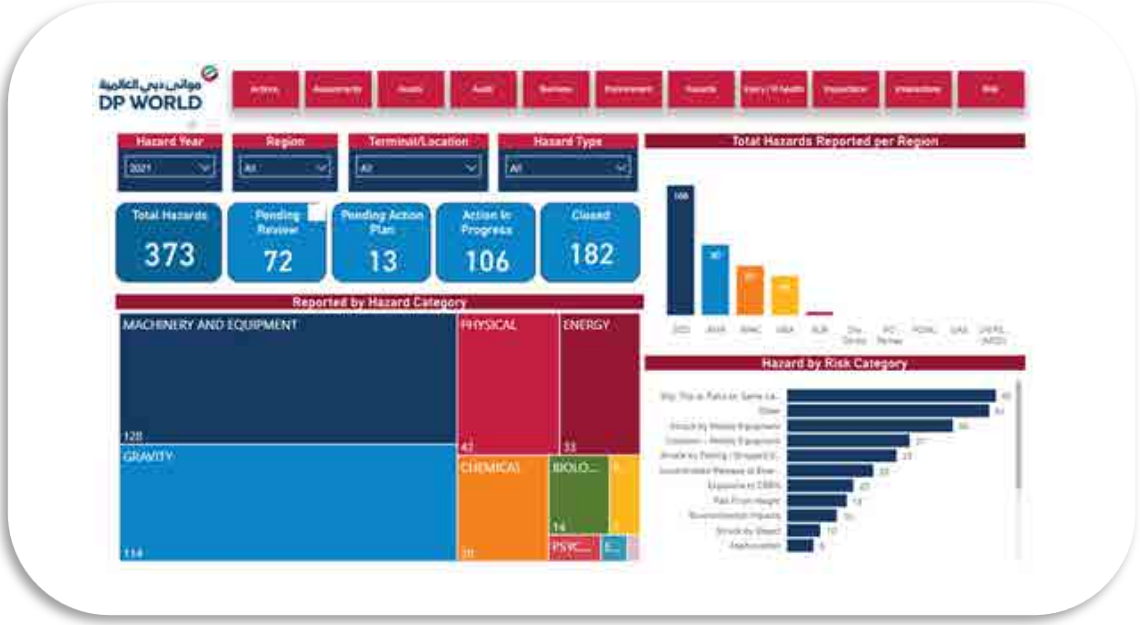
how it was implemented

The roll-out of our Application was incorporated into the group Strategic Plan to ensure resources were available and supported by Senior Management. A detailed project plan was developed including communication and change management activities. Project risks were identified, and mitigation plans established and tracked throughout the project.

The project team consulted with users throughout the design phase. Governance and oversight of the project was provided by a Steering Committee consisting of key operational stakeholders.



Example PowerBi Actions Dashboard



Example PowerBi Hazard reporting Dashboard

In-house IT Developers built the modules as Progressive Web Applications (PWA) according to our specifications. PWA permits the same Application to be used on both desktop and mobile devices eliminating the need for multiple environments and coding as well as allowing efficient deployment of system upgrades.

Over 50 Super Users from across the business participated in testing and provided feedback on the functionality and performance prior to launch. Microsoft Azure DevOps was used to systematically create and assign test cases and capture and track user feedback and enhancement requests.

A phased approach to the global launch of each module was used. Historical data was migrated and old systems archived. A total of 13 modules have been launched since January 2021.

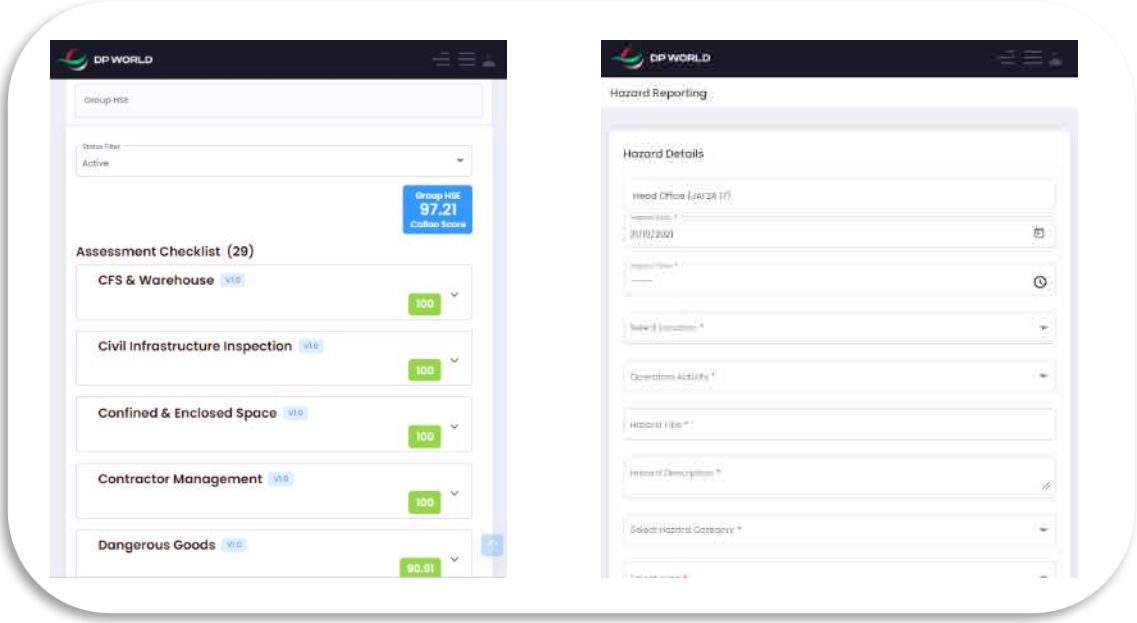
Training was delivered and resources including virtual tutorials, videos and fact sheets published. Existing IT Help Desk teams were upskilled in the new HSE Applications to provide 24/7 support and assistance.

A corporate-wide PowerBi license was procured to ensure all users have access to real time HSE performance data and can filter and drill through results.

the result

- New Application successfully launched, globally, with 13 modules and additional administration and help centre features
- Nearly 4000 registered users accessing the system via their desktop and / or mobile device

- Reduce costs to business – annual licenses fees for local systems, local IT support and external vendors eliminated
- 50% reduction of help desk tickets
- Dedicated “My Tasks” page to enable users to quickly identify and manage assigned tasks / activities / approvals
- Centralised action management with the ability to prioritise each action
- Improved transparency of HSE records and information to meet internal governance requirements
- Ability to benchmark and share lessons from across our global network
- Self-management of site specific content e.g. equipment pick lists, worker details, user access and approval workflows ensuring that the system set-up remains relevant according to local needs and requirements
- Improved data accuracy through in-built validation and verification processes
- Compliance with data protection laws and internal information security policies
- Dashboard refreshed every 30 minutes providing global, regional, country and site based filters, drill through and export functionality
- Reduced time and effort to generate management reports across all levels of the organisation
- Increased skills and capabilities of employees involved in the design, testing and implementation of the Application



Example: view using mobile device and view using mobile device

Feedback from users:

- “Well accepted in our region in terms of ease of use and functionality”
- “Process alignment has improved efficiencies”

- "Look and feel of the Application is modern and clear with nice visuals"
- "A quality product has been delivered for our business"

conclusion

The project scope and expected deliverables were achieved in 2021. The business is now requesting additional modules be developed for Return to Work, Permit to Work and Health Surveillance – all of which are being considered for future versions of our Application. Translation services are also being evaluated with a solution expected for deployment in 2022.

The project team and Steering Committee continue to collaborate and monitor the HSE Applications utilisation and performance.

Business users continue to have the ability to submit suggestions and recommendations to improve the system functionality.

Our Application provides HSE performance data across our portfolio and is used for strategic decision making, annual planning; in particular, setting KPIs, improvement targets and objectives and drives continual improvement globally.

The DP World HSE Applications can be scaled and adjusted to other industries and organisations wanting to use best in class technology, improve and align their digital HSE eco-system to internal needs and requirements, provide real time access to HSE data….. ultimately achieve positive HSE outcomes and performance.

18. | Euroports – Train Wash Station

the challenge

After loading train wagons with dry bulk, the top needs to be evened out and the covers cleaned. Before, employees had to climb up with brooms and work at height unprotected as there was no means of securing fall protection in a workable manner for the job.

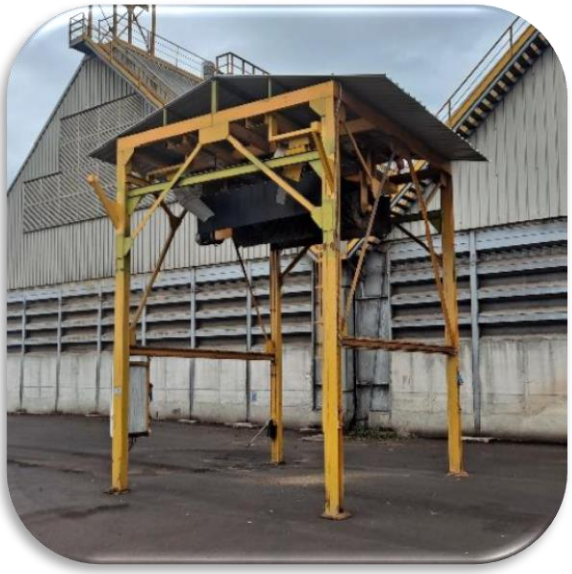
Likewise, after loading scrap metal, a cover net needs to be installed on top for safety reasons, which also needs to be done with ladders and by climbing on top.

the innovation

Rather than looking for ways to individually protect our employees, the local team applied the so called 'hierarchy of controls' and thought of ways to eliminate the risk by making it unnecessary to climb on top. For the dry bulk operation, a so called "train wash" station was designed and manufactured and certified with the help of a local construction company. A similar construction was devised to put the safety cover in place after loading scrap metal. After that, it is tied to the wagon (potentially also trucks) from within a safety basket or manlift, again eliminating the need to use ladders and work at height unsafely. The certification process for this installation is currently in progress.

how it was implemented

The "train wash" was constructed and CE certified with support of a local construction company and then put to use by instructing the local employees.



For the cover net station, the same process is ongoing, and it is expected to be certified and put to use shortly.

the result

Result was (respectively will be) as intended, i.e., eliminating the need to climb up and manually perform these tasks by climbing on top of the roof (netting installation pending certification).

conclusion

By eliminating the need to work at height, the risk of falls and serious injuries is significantly reduced. As a positive side-effect, the operation is much smoother and quicker, saving time and resources.

Cover Net Station:

19. | Exis Technologies - Hazcheck Detect

the challenge

Over 60 million packed containers are moved each year, and 10 per cent are declared as dangerous goods. Some ships carry more than 1,000 containers with dangerous goods on any given voyage. Many significant ship fires are attributed to misdeclared dangerous goods. Mistakes can be made due to lack of competence, unfortunately in some cases, cargo is deliberately declared incorrectly to save cost or time. In other cases, the cargo may have been properly declared, but mistakes are made with packing and stowing the cargo in the container. Unless the container is physically opened and inspected, there is no way of knowing whether the cargo is safe for transport.

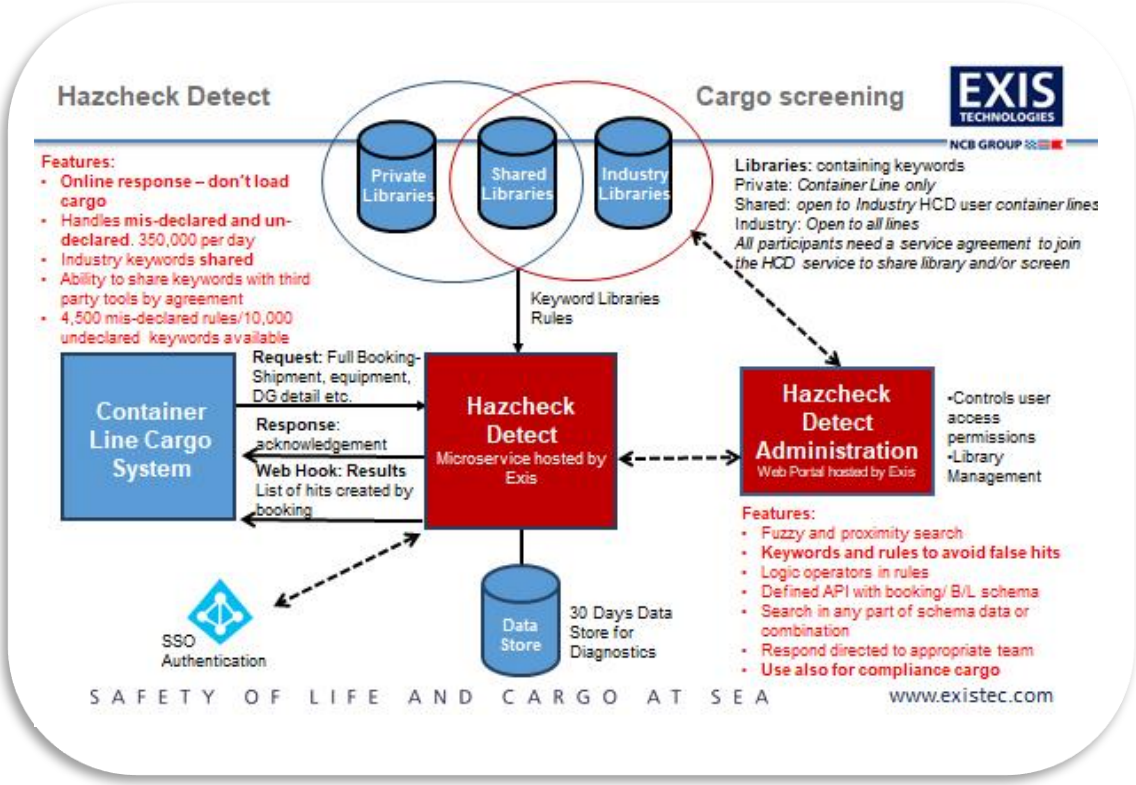
In recent years there has been an identified increase (www.cinsnet.com) in the number of cargo incidents on board container vessels, with approximately 4 ship fires per month, many as a result of misdeclared or undeclared DG. In 2018, the Maersk Honam container vessel erupted into flames killing 5 crew. It is believed that misdeclared DG cargo was the cause. Misdeclared or undeclared DG goods tragically endangers lives and can lead to significant pollution at sea. In response, Exis Technologies in cooperation with the container industry, developed an innovative Software as-a Service (SaaS) solution to screen cargo at the booking stage for potential undeclared and misdeclared DG cargo, with a view to preventing serious incidents at sea which may result in loss of life, cargo and/or damage to the environment.

the innovation

Hazcheck Detect is a real-time cargo screening solution which scans all booking details for keywords, validates against rules and highlights suspicious bookings to identify misdeclared and undeclared dangerous goods (DG) and other compliance cargo. The tool uses around 10,000 keywords to find undeclared dangerous goods, working through 4,500 ‘rules’.

Undeclared DG – checks focus on cargo that is not declared as DG; suspicious items are looked for that perhaps should be declared as DG.

Misdeclared DG – checks focus on cargo, which is declared as DG, but not declared as the correct DG.



Cargo screening allows non-compliant cargo to be detected within seconds rather than days. Last minute changes to bookings, declarations, Bills of Lading and shipping instructions can be picked up as they occur. This immediate response avoids such cargo from being loaded onto a ship thereby avoiding the risk of fires at sea.

Maersk Line was the first customer signed to the new tool. Hazcheck Detect is currently doing 13 million screenings a month. With 500 'hits' a day around 40 or 50 containers a week are stopped from being loaded onto a ship. With manual procedures used before Hazcheck Detect was available it would have been days before this crucial information was known.

A successful indicator of the solution is the ability to detect undeclared and misdeclared Hazardous goods in a cargo booking in less than a minute - previously the manual time for this was 48 hours. 350,000 transitions per day are now being screened.

how it was implemented

Initial research was gained in cooperation with CINS to gain insight on the key challenges of detecting undeclared or misdeclared dangerous cargo - we needed to fully understand what happens now and why. The project commenced in March 2019 with a team of 6 developers and project manager. From this we developed a Functional Specification and user case, with

software development starting in April 2019. An innovative approach to development was also used, using agile project management we involved Maersk at every stage of the process, this enabled us to reduce our project time, share our development experiences and ensure the solution was going to achieve our objectives.

As part of the development innovative ideas made our product unique, such as the development of a bespoke fuzzy matching solution, with the ability to identify deliberate obscure or mistaken declarations of hazardous cargo. Also the ability to scale and process significant amounts of data using modern cloud technologies.

Hazcheck Detect was officially launched in September 2020 with Maersk as the first customer and since then we have been engaging with other container lines, with an additional three shipping lines interested, including one further line that has signed an agreement.

Henrik Lauritsen, Director at Maersk, commented in 2020 after signing to Hazcheck Detect, "Exis Technologies has developed a solution that could be used industry wide and allows easy sharing of keywords and rules between industry partners. This is very important so that container lines know that partner lines are searching using the same criteria."

the result

The Software as a Service (SaaS) solution is designed to significantly reduce the amount of misdeclared and undeclared DG cargo carried in Container vessels at sea. Annex III of the MARPOL Convention forms the Regulations for the prevention of pollution by harmful substances carried by sea in packaged form. Shipping lines using this screening service can check shipping information for their booking data in a much shorter time. A manual task that would have previously taken up to 48 hrs to achieve, typically more time than a vessel would remain in port. The task can now be completed in a matter of minutes and users can expect to see a significant reduction of cargo incidents at sea. Using actual data collected by CINS (www.cinsnet.com) and projecting based on industry volumes, it is estimated that there are more than 600,000 containers shipped with undeclared DG annually; each container could lead to an incident. Using a similar projection based on container cargo inspection data collected by National Cargo Bureau, it is estimated that there are more than 500,000 containers shipped annually with poorly packaged or stowed DG. Poor packaging or stowing can lead to leaks and/or fires.

Exis Technologies already sells Hazcheck Systems for declared DG to 9 of the top 10 container lines, so engagement with those existing customers will be an integral part of entry into the marketplace.

conclusion

Hazcheck Detect is designed as a Collaborative Solution involving industry sharing standard libraries and common terms in the form of a shared rule database. Rules can be added to, or amended, based on industry input and feedback. Rules are defined and improved by each participant to avoid false positives in the search process. Machine learning will be added to the process as the dataset grows. The solution is interactive, giving a response in seconds and can search for undeclared DG but also misdeclared DG. Therefore, the solution will not be stagnant it will continue to evolve, adapt and grow with the industry.

The global shipping industry has been disrupted over the past two years due to container shortages, lack of vessel availability, delays at ports and a significant rise in global container freight rates. The chemical industry has been impacted with shortages and higher market prices.

There have also been accusations that shipping lines have been turning away shipments of hazardous materials, which is being investigated by the Federal Maritime Commission (FMC), America's shipping regulator (JOC.com 05/11/21). Can insurance companies help to encourage shipping lines accept hazardous materials shipments amongst the chaos? Implementing tools like Hazcheck Detect which offer prevention, rather than putting out fires after the fact, can help shipping lines to ship DG more safely without the risk of high costs associated with damaged goods and ships.

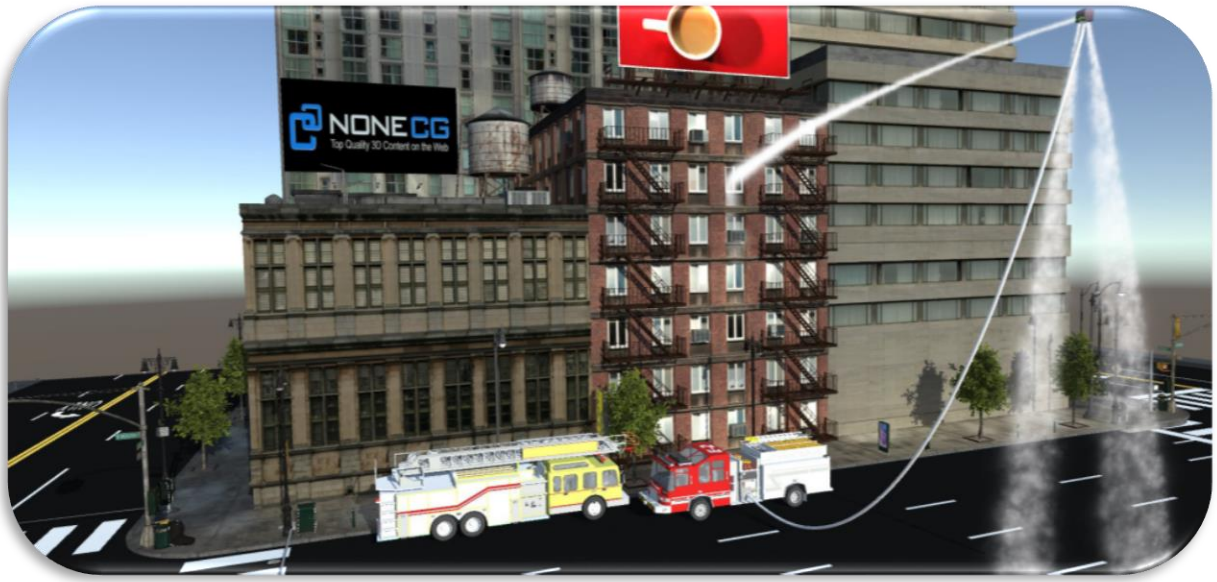
20. | FireFly Suppression Drones – FireFly Drone

the challenge

Shipboard fires (Shipping container fires, petroleum fires, engine room fires...) are difficult to suppress due to factors such as isolated location, cargo containment, limited shipboard firefighting capabilities and limited trained firefighting personnel. Suppressing shipboard fires is subject to weather conditions, pitching/rolling vessels. And confined spaces, and below deck firefighting is subject to intense smoke heat and flames.

the innovation

Our FireFly Drone, is truly innovative, is flies with Hydrodynamic Vectored Thrust, (Water pressure). It does not need propellers or batteries, getting its flight thrust from water pressure supplied from a fire hose. Our drone is small (1 cubic foot / .3 cubic M) in size and weighs 45 Lbs / 20 Kg. The drone can fly directly to a fire and suppress a fire at very close range .5m and can be on station suppressing the fire as long as water is supplied to the drone



via the fire hose. The drone can supply a continuous water suppression of up to 750 Gpm / 2800 Lpm from the tethered 2.5' 64mm) fire hose. The drone is also fireproof with 5 layers of fireproofing including water cooling. It is waterproof with a positive buoyancy; the drone would have the ability to float. And the drone will have onboard colour cameras, thermal cameras, Lidar and thermal temperature sensors, and two way verbal communications (speaker and microphone). The drone has the ability to see its ongoing suppression of the fire and react by moving and increasing its suppression as needed. We have designed the drone for one purpose...to fight fires, either topside or below deck on a ship. This capability can be done remotely from the safety of the bridge or other safe remote location.

how it was implemented

Our FireFly "Maritime Suppression version" is currently being Developed as a pilot project. We are defining the role of our drone in shipboard fire suppression. We are consulting with

various agencies to evaluate our preliminary capabilities, and further define the drone's role in shipboard fire suppression. We are utilizing modern development and Manufacturing tools, such as DDM (Direct to Digital Manufacturing) (CAD / 3DDesign / Modelling /Engineering / Simulation), and additive manufacturing, 3D printing. We also extensively use COTS/MOTS(Common/Modified Off The Shelf components). We are currently seeking funding to produce a Production Ready Prototype.

the result

We have Vetted our drone design, through engineering, extensive research of the core technology, and interviews with trained firefighting personnel. We believe our drone will be able to perform as a frontline firefighting apparatus for fire teams and companies on the fire line. We are producing Digital Twins of our different versions of our drones.

conclusion

Our fire suppression drone will change the way fires are fought. From suppressing, high-rise fires (above 20 floors) to shipboard fires, and volatile & dangerous industrial fires, involving dangerous toxic chemicals and volatile petroleum products. Our drone is designed to directly replace firefighters in these situations, so firefighters are not exposed to hazardous situations which are inherently dangerous to life (IDTL).

21. | Geollect - Geonius

aspects of innovation

Geollect are at the cutting edge of location intelligence technology. We look for data, we listen for it, and we dig for it 24/7. Data that can fill the gaps, inform, and predict rapid changes in global issues and measure the associated risks, thereby enabling industry and government to stay ahead of all situations in near real time, whether they are related to weather, health, geopolitical, civil disturbance, criminal activity (including piracy) or supply chain disruption. We also provide an historic assessment capability, looking at past events to identify lessons that can improve efficiency, safety, and security understanding. All of our insights are served out through world leading visualisation platforms for easy data exploration by end users.

We are transforming the way organisations around the world think and make decisions. By locating and mastering complexity amongst overwhelming mountains of data, we create simplicity for faster, more accurate decisions. We provide understanding. The versatility and applicability of our product and service solutions has seen them employed across multiple sectors. Our success stories demonstrate how we have provided dynamic insights and geospatial awareness for decision support to a network of high-profile global clients in the defence, marine insurance, and cruise line industries. Geollect's network of clients create a more powerful offering, adding sector specific expertise to our products and services, a key part of which, is the shared experience of 'what works' in distinct but comparable contexts. This provides insights across multiple verticals instead of stove-piped understanding of risks and threats to business operations or safety. Simply put, shared ever evolving knowledge and understanding.

the challenge

Over 80% of goods traded worldwide travel on one of over 90,000 cargo ships sailing the world's oceans. Right at the heart of it all is the container and it is estimated that there are between 25 and 40 million containers in use globally. We are in the midst of the biggest spike in lost containers in seven years with more than 3,000 boxes dropping in to the world's oceans last year alone.

Geollect have conducted in-depth investigations into container loss on behalf of the TT Club. Using our Geonius platform, we ran detailed analysis of loss events and identified patterns of activity. Geollect assess the loss of containers to be a result of a combination of various factors centred around synchronous and parametric rolling. There are many issues that contribute such as weather, sea state, inadequate planning, lashing safety issues, ship handling shortfalls, and issues with ship stability as a result of container stack collapse due to mis-declaration of cargo weights to name a few.

Most container losses have occurred in the North Pacific during the winter; however, this is a global problem. Increasing size of vessels and carrying capacity is the common thread, combined with the hydrodynamic forces exerted on containers and the way they are stowed and lashed. Class societies urgently need to shed further light on causes of these issues.

Geollect monitors and assesses the environmental and ship operating factors that contribute to loss events providing early warning and lessons identified to vessel operators.

the innovation

Geollect have designed and built a sector-specific intelligence platform called Geonius. It was built to allow industry experts to visualise, interrogate, exploit, and fuse multiple data sets to create understanding in an ever changing and complex world whereby definitive answers are challenging to come by. Coupled with a team of maritime professionals, our proprietary platform takes a human-centred, data-enabled approach, keeping the subject matter expert at the heart of the knowledge creation and decision-making process. We provide enhanced visibility of issues and assessments of causes to reach definitive answers, enabling understanding for safer decisions for safer outcomes.

Geollect's team of marine experts, data scientist's and intelligence investigative professionals were able to make significant links between fused dataset patterns that were key in understanding their relevance in all of our investigations into cargo loss incidents.

how it was implemented

Geollect took 12 case studies of container loss incidents across the globe over the past 10 years and harnessed masses of relevant data to extract insights and patterns. This allowed for trends to be identified in previous incidents and establish a knowledge base for reference to take forward in to future decisions. The process incorporated the creation of machine learning and algorithms within relevant datasets, to support the analysis of expert human

operators, and reach conclusions on causal factors and more crucially safer ways to combat this risk and implement safer working practises.

the result

A number of investigatory reports were submitted to the TT club with conclusions on causal factors and safety issues. These could be cross checked and assessed for measures of effect on all container loss incidents. The reports highlighted key themes apparent across all case studies and recommendations for change could be formed as a result. The process identified common hazards and risks that could be mitigated or eliminated moving forward in to the future, with the correct control measures put in place across all container operations.

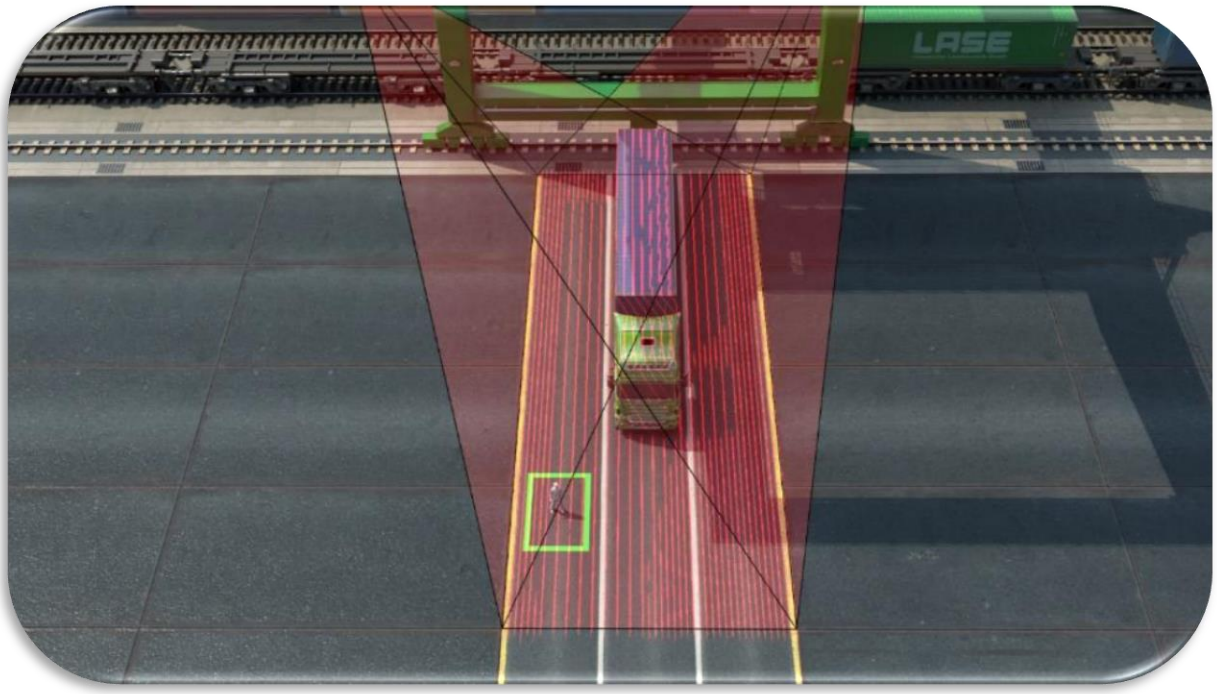
conclusion

Please see this video showcasing a snapshot of the safety investigation https://www.youtube.com/watch?v=u1CI-mxjZYM. The work that Geollect conducted was for the benefit of marine cargo operations and the associated safety considerations for equipment and the preservation of human life, for all stakeholders involved. Recent incidents, including the Ever Given situation in the Suez Canal, have raised awareness of global shipping and the importance that global supply chain efficiency has in everyday life. Whether it is the fuel in your car, the food in your kitchen or the furniture in your living room, it is highly likely those items all spent some time in transit on a ship.

22. | LASE Industrielle Lasertechnik GmbH - LaseASTO (Area Surveillance Truck Observation)

the challenge

The transfer area under the crane, where the load will be handed over between the crane and the truck chassis, could be very dangerous, as machines and humans have to interact closely. While loading or unloading the container, the LaseASTO system locates the truck, container and driver as well as other irregular objects/subjects and determines if any danger could arise, in order to prevent dangerous situations. It is important to note that it is a passive working system! No need of a transponder that people have to wear. That is a big issue (safety challenge) for the terminal operator; they cannot ensure that every person wears a transponder.



the innovation

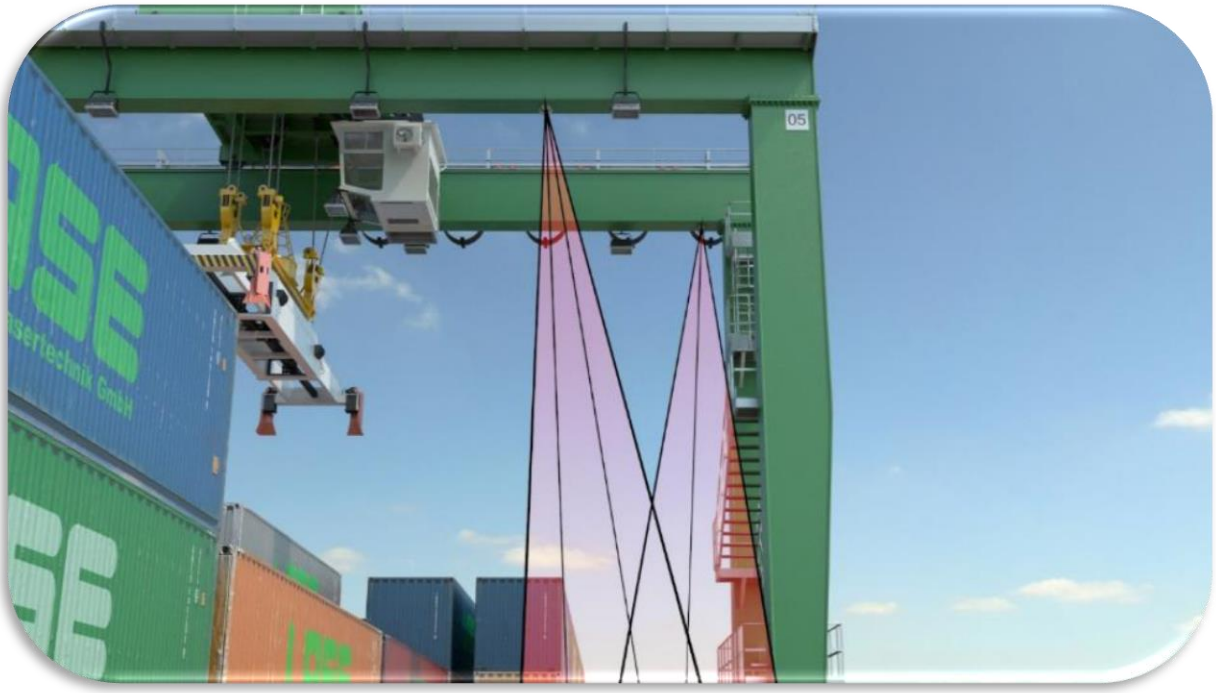
Currently, no other system is available on the market that uses multi-layer or 3D laser scanner data to observe the interchange area between RTG/RMG cranes and truck chassis.

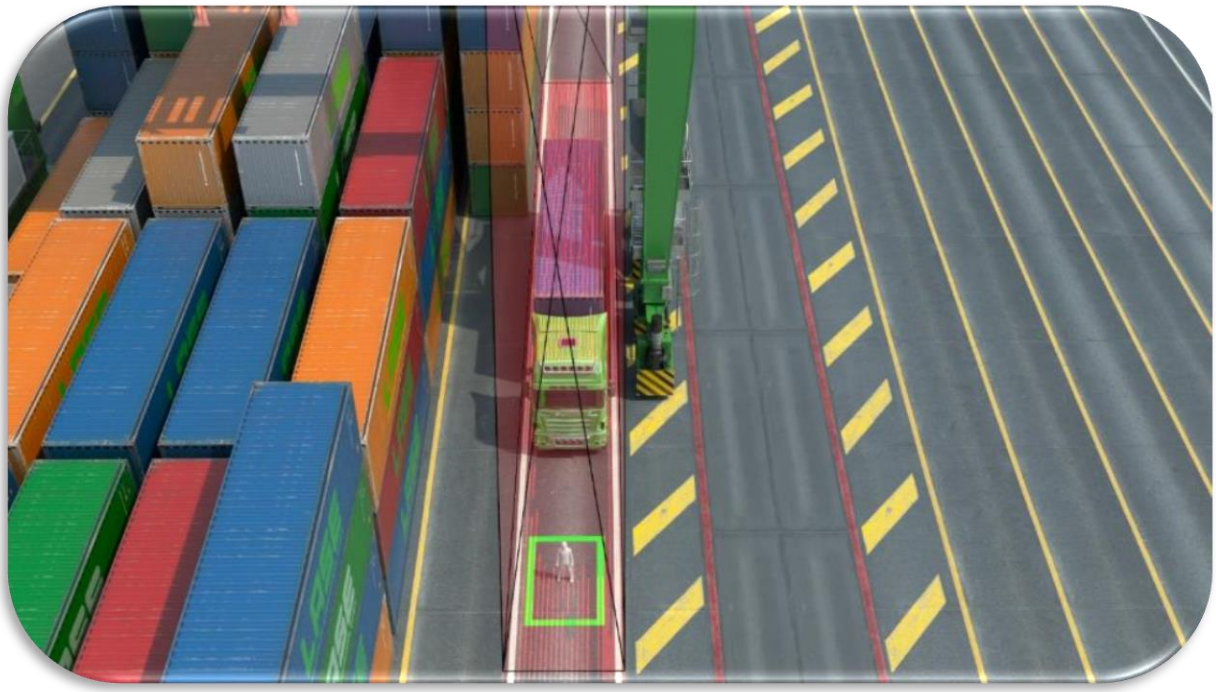
The LaseASTO (Area Surveillance Truck Observation) system is a safety system with two multi-layer laser scanners. It is installed at RTG/RMG cranes and observes the critical transfer area in the truck lane under the crane. The system detects and tracks objects and people within this hazardous area, e.g., the chassis and the driver. Thereby dangerous situations that might occur during the loading or unloading of chassis can be identified and prevented.

how it was implemented

The system consists of two multi-layer laser scanners installed on the two main girders of an RTG/RMG crane. The field of view of each scanner covers one side of the truck chassis as well as the area in front or the rear. In total, the whole surrounding of the truck chassis will be surveyed.

The application gets the data of the scanners and transforms them into a 3D point cloud. Within the point cloud, any objects are identified and classified. By observing the objects over time, they can be tracked.



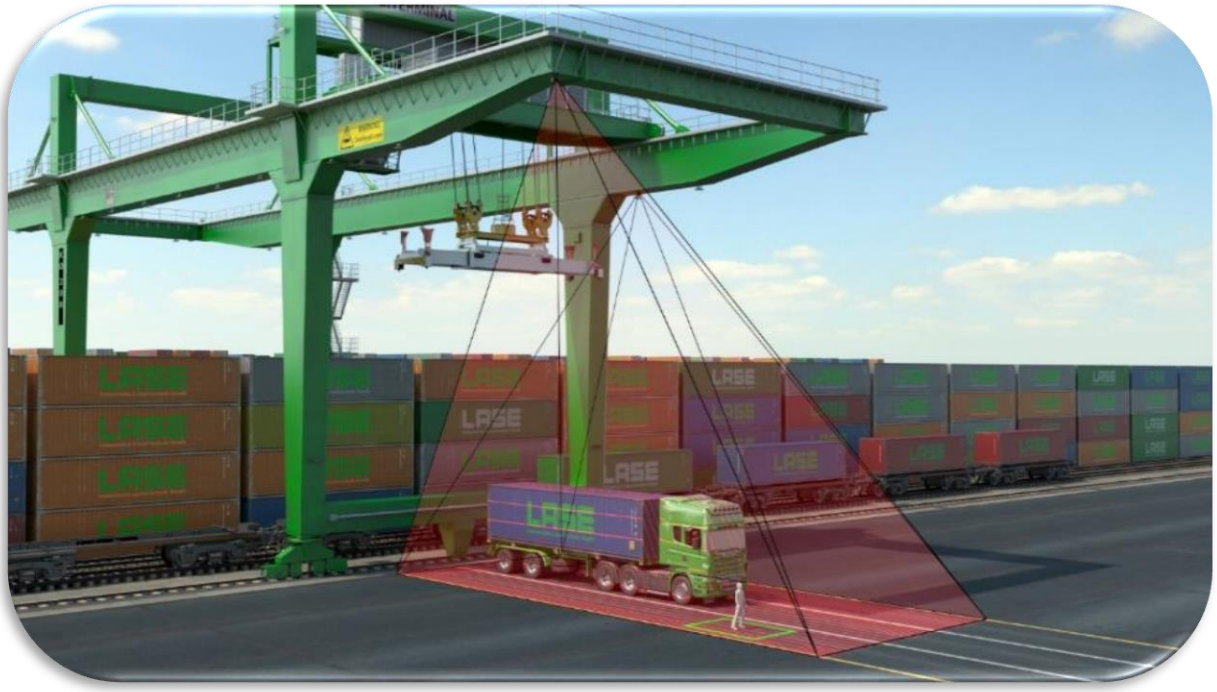


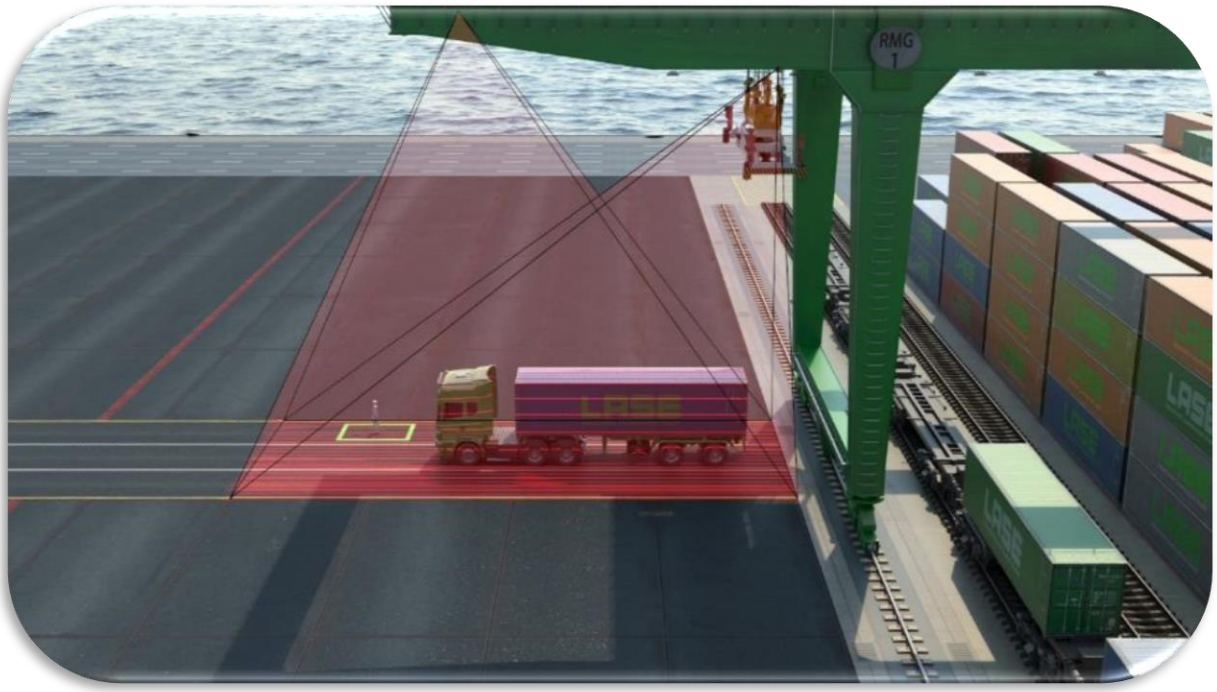
According to the position and the classification of the objects, the system generates an alarm and stops the operation when people enter the restricted area during the loading or unloading process of a container.

the result

The result is a reliable safety solution that reduces the number of accidents within the crane systems. On the other hand, this application ensures compliance with and observance of specified safety areas.

The result of the process described above leads to more safety, less accidents, and costs.





23. | Maersk TMS - Digital tool to implement Behaviour Based Safety

the challenge

In our fast-growing Logistics and Services portfolio in Asia Pacific, one of the increasing demands, especially from Manufacturing Industry customers, was the question on how Maersk does Behaviour Based Safety to develop and grow a positive safety culture at the front line.

At the moment we did not have a BBS program and while we were hearing the "Voice of the Customer," there was nothing in place to hear the "Voice of the Frontline"!

Added to that, to develop a seamless Behaviour Based Safety program that would really influence the frontline, we had to overcome the major challenge of cultural differences and language barriers across 13 countries in APAC (including Oceania).

the innovation

Keeping with our goal to digitalize safety and to leverage technology, we had to develop a digital tool to implement Behaviour Based Safety

Moreover, to develop something using resources available internally with no dedicated budgets was an interesting challenge

We leveraged the O365 platform and used Microsoft Forms to develop our Behaviour Based Safety Tool. We call it iFound!

A very good example of now necessity becomes the mother of invention! It was complicated and we faced many technical challenges; but we got through and launched this tool in 13 different languages

how it was implemented

We ran a pilot first in a few countries so that we could get a chance to capture initial feedback and adjust any questions etc. before the final launch. We also took the opportunity to get

the “buying in” from regional leadership and we launched a training program for the effective use of this tool.

Most importantly, this tool was not advertised as a “to safety, by safety, for safety” initiative.

This project was launched through the 6 Area Managing Directors in Asia Pacific and with support from the Regional Managing Director – Asia Pacific.

A top-down approach was taken to drive this initiative from Leadership with the overarching concept of “Leading with Care”

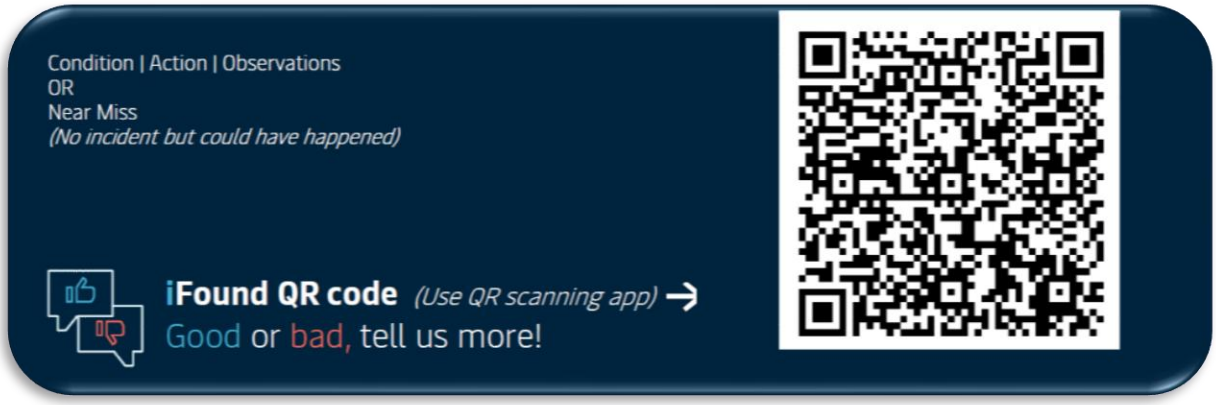
The attached ppt describes our journey and a more details on what this tool looks like. A simple QR Code scanning methodology is our lever to drive Safety Differently and Behaviour Based Safety at the frontlines in the Logistics and Services business within Asia Pacific

the result

Engagement with the frontline is being effectively driven through leadership at site and area level. The workers know that their voice is being heard and we are developing a strong people focussed safety culture at our sites

Action items coming through from iFound help the HSE Manager’s to run analytics to see where the pain points are and if something needs to be done differently at leadership level to re-align and steer in the right direction

Some of the areas have launched more customised and tweaked versions of iFound to include Safety Audits and Gemba Walks as part of the platform, thereby giving a good example of further leveraging and upscaling technology



conclusion

This entry is on behalf of the Thailand, Malaysia and Singapore area cluster (TMS) in Asia Pacific, where iFound was upscaled to iFound 2.0

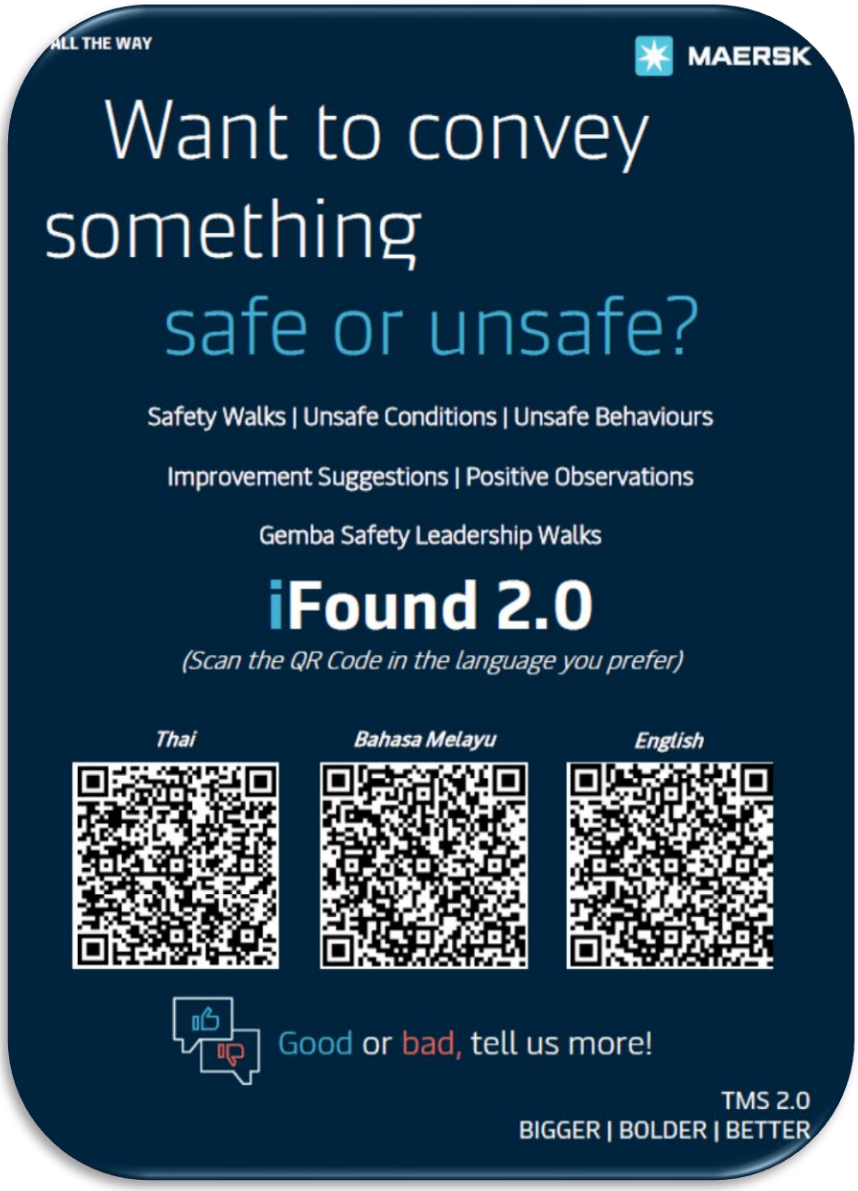
This area has incorporated Safety Audits and Gemba Walks within the iFound platform and has fine-tuned the process in 3 languages- Thai, Bahasa Melayu and English to drive participation and engagement from frontline workers.

Further, a Rewards and Recognition program has been launched as driver for Behaviour Based Safety with the underlying catch phrase “If you see it; you own it!”

iFound is available for access to any field worker who may not have a Maersk ID/ Maersk email address and the platform does not give access to upload photographs

iFound 2.0 is available to all Maersk Employees and Contractors who have a Maersk ID/ Maersk email address. This platform gives access to attach photographs on every submission.

We have 462 responses in iFound 503 responses in iFound 2.0 till date and all of this has been done “for free”: leveraging internally available technology and creativity via O365 suite



24. | Port of Virginia - Artificial Intelligence for Video Processing

the challenge

In 2003, ConocoPhillips conducted a major study of workplace mishaps that produced several useful conclusions. For every 300,000 "at-risk" behaviours, there are 3,000 near miss events, 300 recordable injuries, 30 Lost-Time Injuries, and 1 Fatality. These at-risk behaviours, at the foundation of the triangle, are causal in a high percentage of workplace mishaps and include such topics as ignoring standardized procedures, taking shortcuts, being over-confident, and failing to properly plan work tasks.

At the six terminals operated by Virginia International Terminals, at-risk behaviours are causal in the significant majority of mishaps and include numerous specific examples.

- Distracted operations
- Motor carriers standing outside of their cabs while waiting for container delivery
- Straddle carriers entering under the STS while the spreader bar is coming in-shore
- Straddle carriers departing the container stacks without stopping
- Speed limit compliance
- Stop sign compliance
- STS cranes striking objects parked on the tracks during gantry
- Vehicles parked at the STS crane legs being struck by straddle carriers

While there are many aspects to mishap prevention, this project focuses on using the innovation of artificial intelligence for video processing to reduce at-risk behaviours before they end in a mishap.

the innovation

Virginia International Terminals employs a two-pronged approach to the mishap prevention challenge. The first prong is based on a traditional approach that includes the development and communication of reliable standards (Operational Standards), followed by publishing a process that encourages excellent leadership and recognition of excellence for compliance with the standards as well as laying out graduated consequences for non-compliance (Terminal Safety Excellence Program). The second prong of preventing mishaps applies technical innovation to obtain 24/7 visibility of key operational areas in order to correct at-risk behaviours. This innovation includes multiple layers.

The initial layer of this innovation is to deploy affordable pole mounted and mobile equipment mounted cameras to record terminal operations. The next layer is to sample the work environment by downloading one hour of recorded video from approximately 10 different cameras, identifying excellence or non-conformance for the targeted behaviours, identifying

the persons involved, writing and communicating the citation, and then administering the appropriate consequences. The final layer, which is the primary innovation layer, is to use "Artificial Intelligence for Video Processing" to multiply the effectiveness of the program by over 100 times. Instead of downloading video from the cameras and reviewing the one hour segments, custom AI algorithms are developed and deployed to monitor the video streams and to report on the behaviours of interest. Instead of reviewing one hour per week per camera, the AI reviews 168 hours per week per camera.

how it was implemented

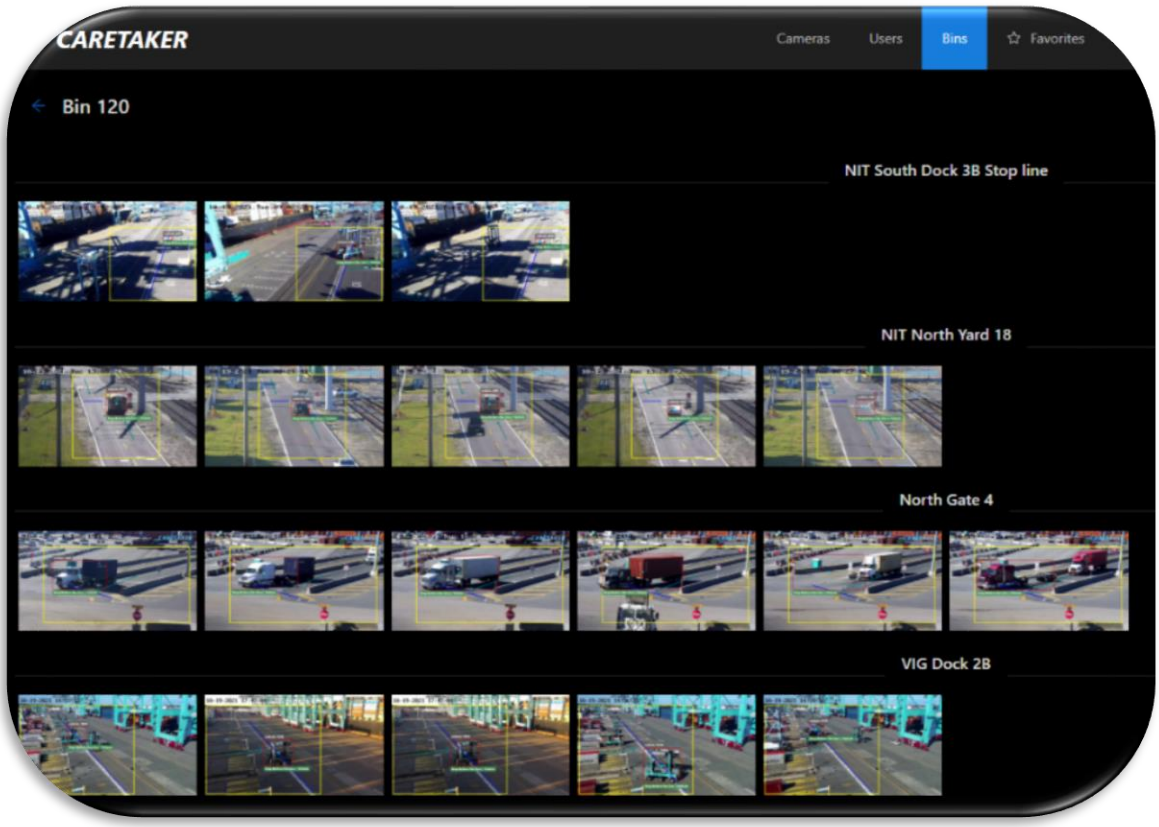
The vision for the application of this AI technology is simple. What the FAA is to airline ground and flight safety, the AI system will be to marine terminal operations.

Virginia International Terminals has worked on this pioneering effort with Loko AI, LLC of Irvine, California to develop proof of concept computer vision algorithms that detect equipment parked on the crane tracks, monitor stop-bar non-compliance, and identify PPE and speed limit non-compliance, all customized for 10 different locations. For example, a single camera that costs $1,100 can now observe any key area of the terminal, 24/7, to identify and report on PPE.

In another example, Straddle Carrier traffic was declared as a "key risk" prior to the deployment of this capability. Now, the Loko AI algorithm identifies and reports on any vehicle not following the procedure for entering the berth highway, 24/7, at Norfolk International Terminal and Virginia International Gateway Terminal.

In a third example, over-the-road trucks and terminal vehicles have presented a significant risk due to speeding. Now, the Loko AI algorithm identifies and reports on any vehicle not following the terminal speed limits, 24/7.

As the non-conformities are detected around the clock, they are presented to terminal management in a system that is called the "Caretaker." The process is simply to review the Caretaker video clips, identify the equipment operator or pedestrian, and then transmit the citation.



the result

There are 165 managers, assistant managers, and police officers who are certified to write Terminal Safety Excellence Program citations. The average number of citations written each year from 2019-2021 are listed below.

This chart means that out of approximately 12,000 individuals who work on the terminals, more than 1 in 4 were properly thanked each year for safe work practices. Conversely, the enforcement team cited 1,284 individuals as a warning for at-risk behaviours, provided remedial training to 277 individuals who received a 2nd citation, and suspended 55 individuals each year who received a 3rd or subsequent corrective citation. It is noteworthy that 16% of all corrective citations were issued based on terminal recorded video and the artificial intelligence algorithms that were deployed in 2020 are included in this percentage of virtual citations.

The impact of this program, when combined with the terminal video capabilities, and multiplied by the ever-present artificial intelligence, can be seen in several key performance indicators. The Port of Virginia conducts a quarterly compliance audit that measures over 2,500 line items. This audit score has improved from 84% in 2019 to 91% in 2021. The overall OSHA Total Reportable Injury Rate has been reduced from 4.40 to 3.45 during the same period against an industry average of 5.2. Finally, the number of Straddle Carrier damage incidents has been reduced by 52% and the number of injuries to Straddle Carrier operators has been reduced by 51%.

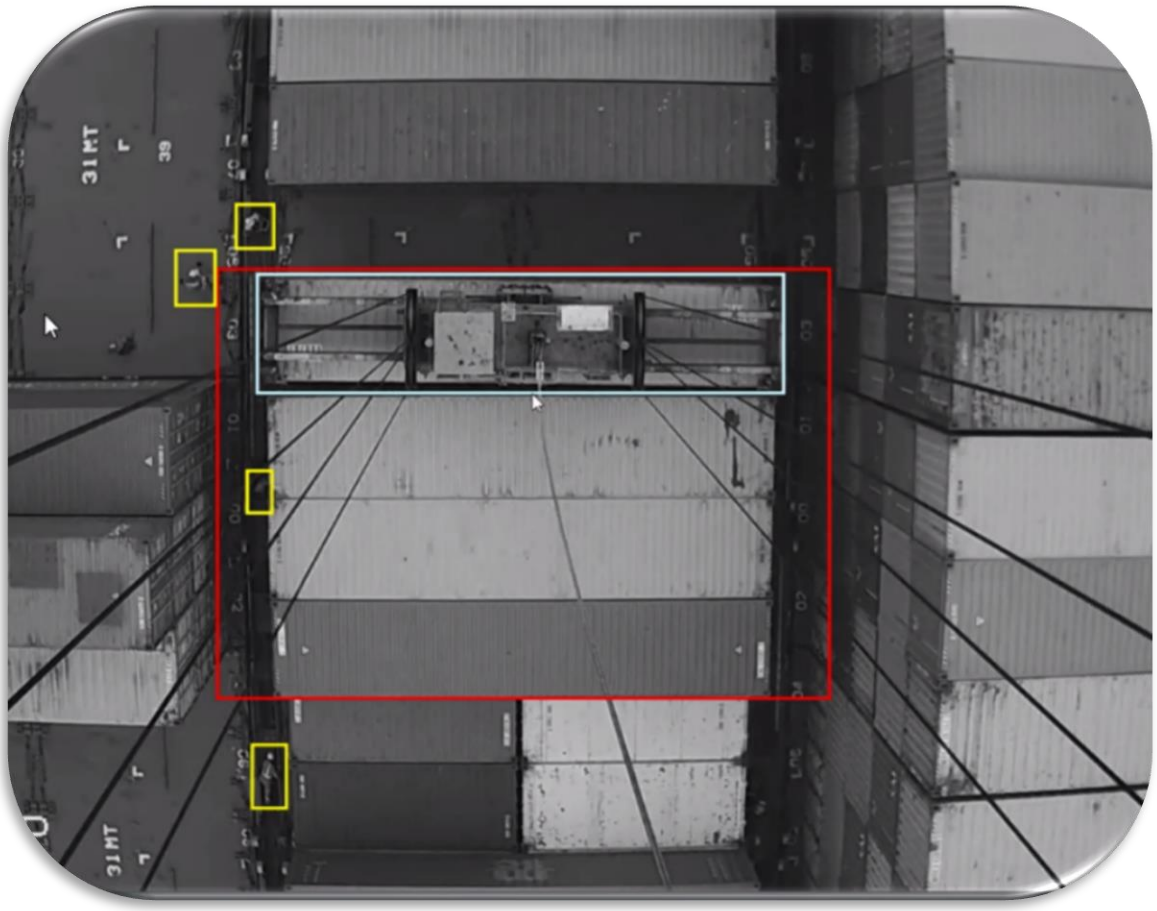
TSEP Program Overview for 2019-2021 Average Annual Results

Recognition of Excellence		3,415
Non-Compliance		1,284
Virtual Citations		16%
Consequences	Motor Carrier	Terminal Patrons
Level 2/Remedial Training	194	83
Level 3/One Week Suspension	27	21
Level 4/Significant Suspension	3	4

conclusion

The requirement for terminal leaders to motivate employees with respect to safe operations is a traditional and important process. The use of recorded video to assist in this process, combined with a capability to electronically identify individuals, is a major innovation that is effective at motivating safe behaviours. The development of artificial intelligence algorithms to monitor the video streams 24/7 is a further major innovation that actually enables a continuously and intelligently monitored workplace. Moving forward, custom algorithms will be deployed to mitigate new hazards. For example, in the past year, three longshore workers on separate occasions were standing in an adjacent isle from a container being lifted and were injured by falling twistlocks. One had a grazed shoulder blade, one had a bruised shoulder blade, and one had a fractured shoulder blade. The response to this issue is to ensure that all employees understand that the acceptable place to stand is at least one container width offshore of the container that is being lifted. To motivate 100% acceptance of this concept, which was recommended by senior longshore workers, the AI algorithm pictured below is being developed to coach those who continue to stand in an unsafe position. The other algorithms being deployed next year are in the other figure below.

In closing, this overall process is very effective at encouraging safe behaviours and is sure to be present in the Port of Virginia for many years to come.



Scope of Work #1

NIT Gate 5a Pedestrian PPE (Current Algorithm)
NIT Gate 5b Pedestrian PPE (Current Algorithm)
VIG Marine Building Turnstiles PPE (Current Algorithm)
NIT South Yard 1A STOP Bar UTR (Current Algorithm)
VIG Gate 2 STOP OTR at DA Exit (Current Algorithm)
NIT South Transfer Zone 2C – SPEED ZONE (Current Algorithm)
VIG 02S1-Vehicles and cargo may not park on crane tracks (Current Algorithm)
NIT South Yard 2B Pedestrian Crossing Prohibited (New Algorithm)
VIG 34S3 Security Gate 4 Rail-Prevent Pedestrians from entering (New Algorithm)
VIG Yard 31A - Pickup Truck Corral Entry Distractions/Seatbelt (New Algorithm)
VIG Safety Vision STS 11 - Deckman or Lasher position (New Algorithm)
NIT Safety Vision STS 16 - Deckman or Lasher position (New Algorithm)

25. | Port Otago - Permit to Work system

the challenge

Historically, our Permit to Work process was simply a permission slip that allowed contractors to enter Port Otago sites and provided no oversight in terms of high-risk work that may have been carried out. The old process did not apply to everyone, nor did it address specific high-risk activities. It is worth noting that some areas within our business had made attempts to introduce Work Permits for some high-risk activities, the permits themselves were inconsistent; were not fit for purpose; and, when permits were issued, they were not visible to our wider business.

Basically, this meant we had the potential for unsupervised, unapproved high-risk work to be carried out across our business without sufficient risk assessment and control. It also meant that high-risk activities were not communicated well across the business and the potential for conflicts between activities was a very real risk.

Looking at this it was clear to the safety team that we needed a brand-new fit-for-purpose' permit to work system that would address the intrinsic risks of the many high risk activities that were being conducted within the business.

the innovation

Port Otago's new Permit to Work system has been designed to manage critical risks by providing clear oversight of high-risk activities and by ensuring thorough risk assessments are being conducted prior to any high-risk activity being approved. Not only does each of our new individual permits now contain its own bespoke risk assessment, but each individual permit also requires a broader Job Safety Analysis is conducted as part of the permit to work approval process, thus ensuring thorough planning and risk management of all high-risk activities at Port Otago.

The evaluation of permit to work applications at Port Otago is completed by one of our 45 trained Permit Issuers. The role of the Permit Issuer is to ensure that a safe system of work have been established by the Permit Receiver. Once the Permit Issuer is satisfied that the proposed system of work is safe and adequate controls have been arranged the Permit Issuer raises the Permit in the Port Otago online permit register which then generates a unique Permit identification number for the job and makes the high-risk work visible to all everyone across the business.

We have 13 different permits within our permit to work system, including permits for working at height; confined space entry; energy isolation; excavation; special crane lifts; and hot work. Where more than one permit is required for a particular job, a Master Permit is used so that each high-risk activity can be carried out in a coordinated and controlled way.

how it was implemented

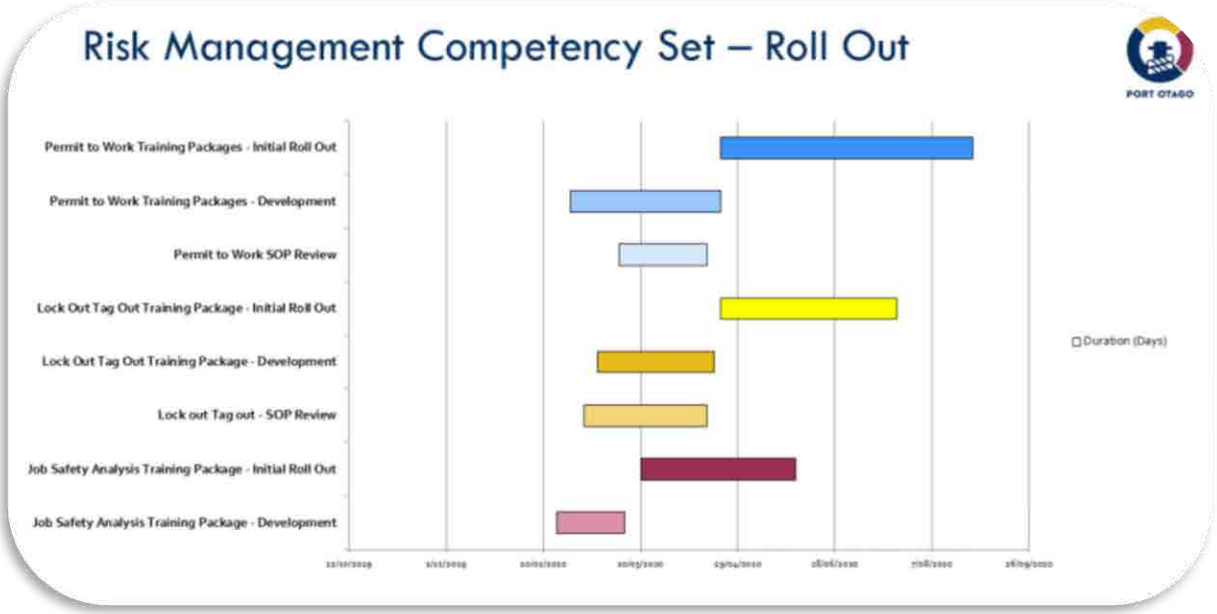
A Training Needs Analysis (TNA) was undertaken to find out if the workforce had the necessary underpinning knowledge/skills to participate in new Permit to Work System. As a result, it was discovered that there was a knowledge gap around workers understanding of

Job Safety Analyses and Lock Out/Tag Out isolation practices. We also identified that our Permit to Work procedures were not fit for purpose.

Our TNA also identified that before we could implement a robust Permit to Work system we first needed to develop new Lock Out/Tag Out isolation and Permit to Work procedures that were fit for purpose and needed to consider all of our users. We also needed to develop new training and assessment packages for Job Safety Analysis risk assessments; Lock Out/Tag Out isolation; Permit Receiver; and Permit Issuer.

The development of this new critical risk control system was an ambitious project but one we were keen to get up and running as soon as possible. The new permit to work project was initially kicked off in March 2020 with the Gantt chart below indicative of the many streams within the project.

Unfortunately, this projects timeline was disrupted by the COVID-19 outbreak and a number of our initial timelines changed as a result of the lockdowns and the required social distancing protocols.



Pre Covid Plan (March 2020) for developing procedures and implementing training

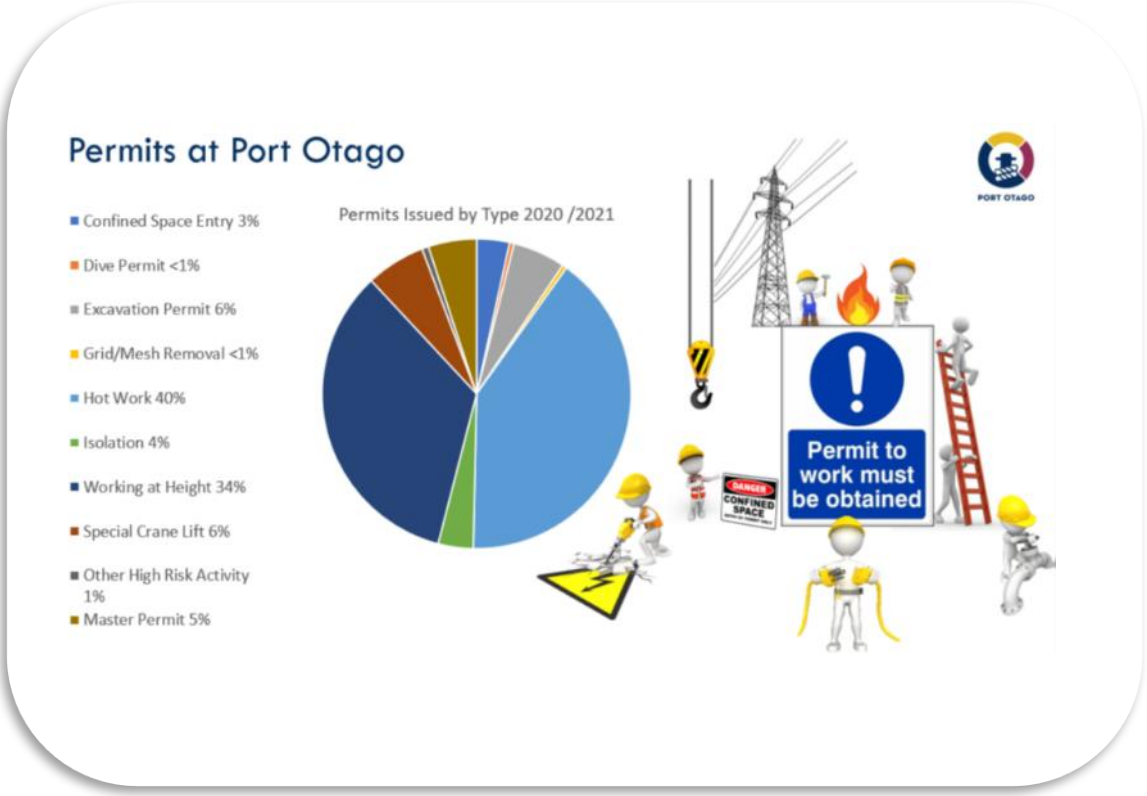
the result

While the COVID-19 pandemic delayed the roll out of the training portion of this project, we have still managed to reach more than 90% user training completion across our business as well as 100% training completion for our high use permit groups such as our Maintenance team. A number of our regular contractors have also completed the Permit Receiver training.

From the beginning of the new Port Otago Permit to Work system in June 2020 until May this year, 435 individual permits had been issued for a range of high-risk activities (see the slide below for breakdown). This means that 435 high potential, high-risk tasks were

managed with a higher level of oversite and risk assessment than they would have otherwise received.

As of October 2021, a total of 572 permits have been issued at Port Otago and new permits are raised on a daily basis. In a short period of time permit applications have become a normal part of the job now whenever our workers are planning any sort of high-risk work, and we think this is a great result.



A slide from our Permit Receiver training package

conclusion

Port Otago's new Permit to Work system has been successful in achieving its objective of providing a formal layer of supervision and compulsory risk assessment for intrinsically high-risk tasks. This outcome is the culmination of a broader project that required the roll out of the pre-requisite competencies: Job Safety Analysis; Lock Out/Tag Out isolation and the roll out of their training packages; the development of the new Permit to Work procedure; the online Permit Register; and the required Permit Receiver and Permit Issuer training programmes. Now that more than 90% of our 300 staff and many of our key contractors have completed these new key training elements, Port Otago is now successfully operating a new integrated Permit to Work system in its daily activities.

One of Port Otago's Permit-to-Work stations showing selection of our Permit to Work books.

26. | Qingdao New Qianwan Container Terminal Co Ltd - Crane Windproof Anchoring System and Method

the challenge

How to anchor the quay crane safely and quickly to prevent damage in the face of instantaneous gale?

Quay cranes overturning accidents are often caused by typhoon or hurricane, which will not only affect the wharf production, but also cause serious economic losses to port enterprises, as well as casualties. Since the quay crane is located at the forefront of the wharf, it has a large windward area and a high centre of gravity. Once an unpredictable gale hits, the safe operation of quay cranes will be seriously affected. Therefore, strengthening the prevention of instantaneous gale and improving the response speed of cranes protection are the key safety challenges we need to solve in quay crane wind protection work.

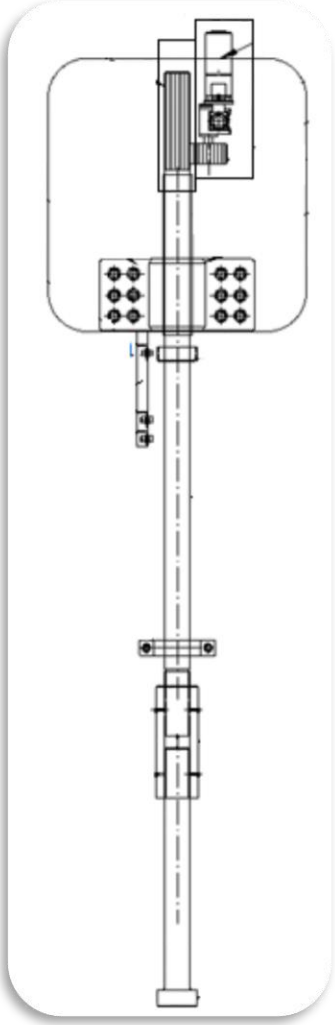
Nowadays, ports windproof measures are limited to passive prevention both at home and abroad. Manual wind-proof rod or cable is one of the most powerful and critical devices in preventing extreme weather. However, it requires plenty of personnel to operate on site. If each quay crane is equipped with 4 people, it will take 15-30 minutes to complete the windproof securing and release of the quay crane. If instantaneous gale occurs, there is not enough time for operation and will cause safety hazards to operators. Especially in automated container terminals, on-site operations are unmanned, it is difficult to mobilize huge personnel to intervene in windproof anchorage immediately. Therefore, there is an urgent need for an automatic, efficient and fast quay crane wind protection system solution.

the innovation

The name of this innovative project is the Crane Windproof Anchoring System and Method for the automatic container terminal, which has been successfully applied to the second phase project of the Qingdao New Qianwan Container Terminal. Quay crane windproof anchoring system, the first application in the port industry, has two modes: standard mode and gale warning mode, which can satisfy the demands of both normal terminal dispatching operation and rapid response during gale warning. From technical aspect, we designed a new type of ground windproof anchoring foundation, an automatic quay crane anchoring device and remote windproof anchoring human-machine interface. Meanwhile, we proposed a remote automatic wind-proof anchoring control method. Through programming, the windproof anchoring system can remotely monitor the automatic quay crane and operate the windproof anchoring of quay crane.

Compared with conventional manual anchoring method of the quay crane, the quay crane windproof anchoring system has the advantages of simple structure, fast anchoring speed, convenient maintenance, and good wind-proof and anti-overturning effects. In terms of patents, the Crane Windproof Anchoring System and Method won national invention patent, the patent number is ZL 2017 1 0331856.0. Also, the project was authorized by the Japan Patent Office, (certified by the International PCT), the license number: 6560460. In the year 2020, this innovation has been granted national invention patents in European Union,

Germany, France, the United Kingdom and the United States, with patent numbers EP3447022, DE60201701 9187.6, FR3447022, GB3447022 and US10807836 respectively.



Automatic windproof anchoring device:

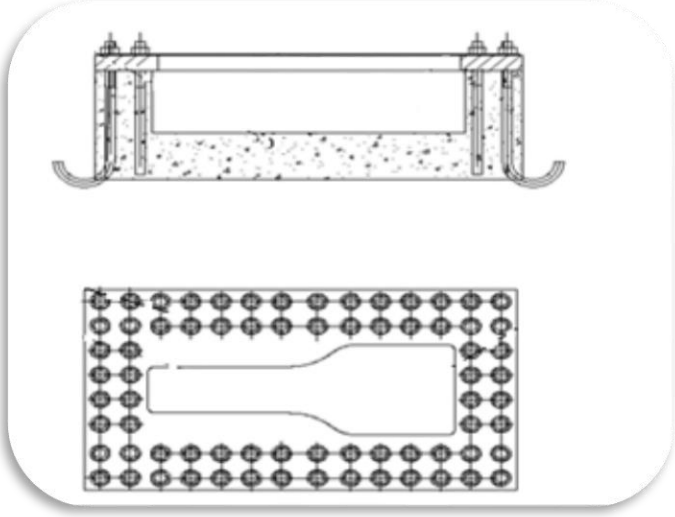
how it was implemented

The remote-control module of the windproof anchoring system receives the windproof anchor command.

The module judges whether four windproof rods are corresponded to four groups of ground windproof foundations, respectively. If yes, the system controls the operation of the crane driving device, which drives the driven device to drive the tie rod body to rotate downward with respect to the tie rod nut.

The module judges whether the lock pin reaches the set depth of the lock pin fixing groove. If yes, it determines whether the crane has moved to the set anchoring position; if yes, the module controls the driving device to work in reverse, so that the tie rod body rises.

The module obtains the driving torque of the driving device and determines whether the driving torque reaches the set torque. If yes, it controls the braking device to work, the lock pin will be restricted in the lock pin fixing groove by the restriction of the first notch to realize the fixed connection between the pull rod body and the ground windproof foundation.



New type of ground windproof anchoring foundation

Therefore, the four wind-proof tie rods and four anchor plates of the crane are in an anchored state simultaneously, and the windproof anchoring system makes the crane in a wind-proof anchored state, preventing the crane from overturning or moving in a gale. Finally, the remote-control module can upload the anchoring completion signal to the windproof anchoring system.

Operation steps can be adjusted appropriately according to the situations.

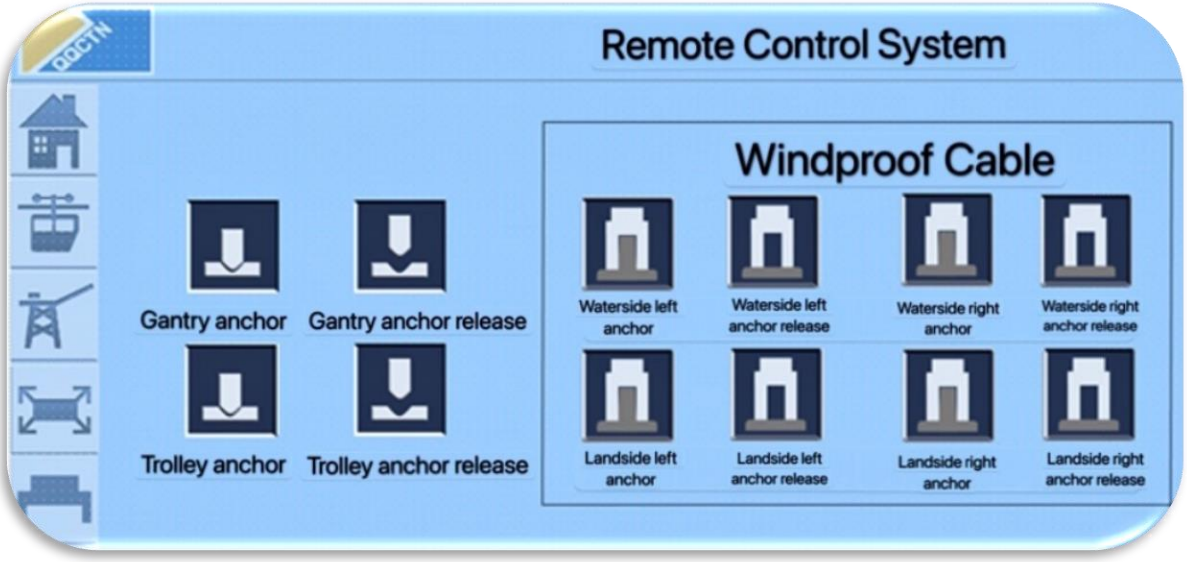
the result

Shortened response time

The operator can quickly respond to wind-proof actions through the human-machine interface. When instant strong wind occurs, the time for the windbreak cable to be anchored and released is shortened from more than 15 minutes to less than 2 minutes.

Improved windproof rating

After using the windproof anchoring system, the crane's windproof rating can be reached up to 55m/s.



Cost effectiveness

From economic aspect, the setting of the wind-proof cable of the quay crane no longer requires on-site personnel. Each quay crane only needs to add four sets of automatic anchoring devices, and four sets of anchor plates on the ground respectively, the total investment value of each quay crane is about 200,000 yuan. After implementation, a certain number of personnel can be reduced on site as ground windproof anchoring can be done automatically. Assume reducing 1 person per machine, at least 100,000 yuan of labour costs can be saved each year, meaning the project cost can be recovered in two years. Also, since

windproof anchoring foundation is simple and without hinges, post-maintenance is not required, the maintenance cost is also saved.

Improved safety level

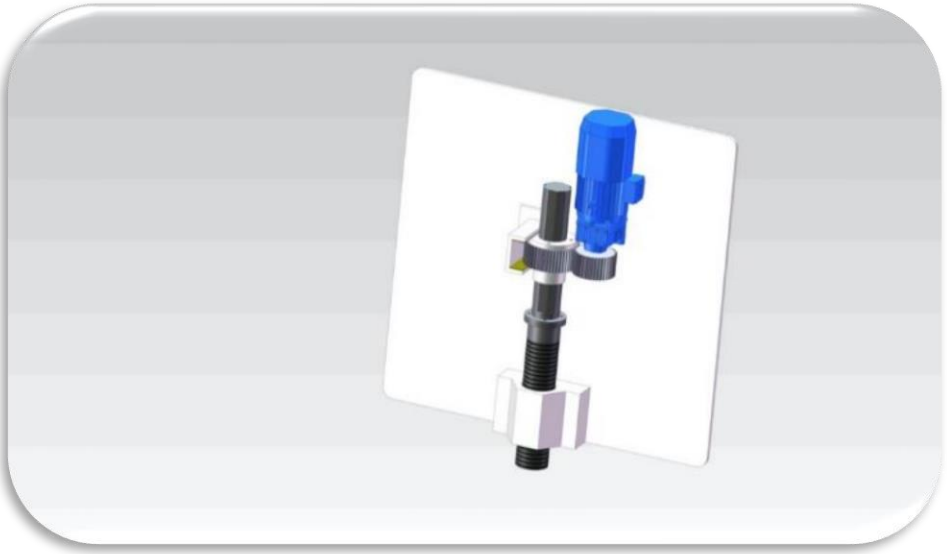
When the hurricane comes, no personnel are on site, so there is no risk of personal injury during the crane anchoring process, which improves the safety of crane loading and unloading.

Industry Competitive Advantage

This innovation improves the publicity effect of the automated terminal and promotes the innovative development of enterprises and port industry.

the conclusion

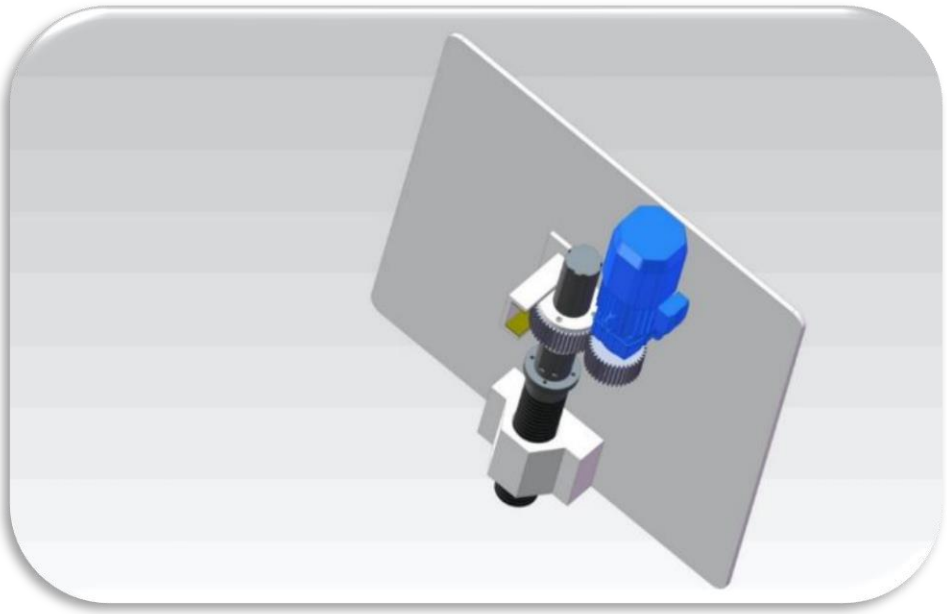
This project has been successfully applied to the second-phase quay crane of Qingdao New Qianwan Container Terminal, which is the first application in the port industry. The crane windproof anchoring system is reliable with quick emergency response speed, which improves the ability of the quay crane to prevent instantaneous strong winds and raises the safety of terminal by a level. At the same time, the automatic anchoring system realizes remote control without of on-site personnel. It completely solves the shortcoming of manual anchoring, such as maintenance difficulty and time-consuming, and greatly improves the working environment of the terminal. In addition, the anchoring process is safe and reliable, the anchoring windproof grade meets the requirements of use, its application effect has reached the expected purpose.



The inward operation process of automatic windproof anchoring device

Due to the advantages of rapid anchoring setting, no need for on-site personnel, safe and reliable anchoring effect, this project has a good prospect for promotion and application. Although the project itself is designed for quay cranes in automated container terminals, its

design scheme and control principles are also applicable to quay cranes in conventional container terminals. For quay cranes that cannot be controlled remotely, the operation interface can be installed in the quay crane driver's cab, which can also achieve quick and automatic anchoring operations. For other large-scale shore cranes, such as portal cranes, gantry cranes, etc., research can be conducted on basis of the design principles of this project, to realize rapid windproof and automatic anchoring.



27. | Reeferpulse - Tech helps predict maintenance needs for rotating machineries aboard ships

the challenge

Reducing machine hazards and machine-related injuries.

All rotating machines on board ships (motors, pumps, fans, compressors) need maintenance, and our Artificial Intelligence technology, combined with health monitoring system from HAT Analytics (https://hat-analytics.net/), can detect when these machines will need crew attention due to unbalance, misalignment, rotating looseness, bearing wear, cavitation etc, months in advance, and before the machine breaks down, thus reducing the risks of personnel injuries and or fire and hazards on board.

The technology behind health monitoring, which is vibration analysis, is continuously gaining ground in maritime industry; when coupled with Artificial Intelligence and Machine Learning technologies, can produce their results with limited staff on board, faster turnaround, and higher accuracy.

A survey of 10 shipping companies, including over 45,000 machineries, run from 2016 to 2019 by FNT Sea Services, showed that Vibration Analysis (VA) based maintenance programs improve machinery reliability by up to 10%. It also shows that VA programs can reduce the ratio of unacceptable machinery conditions ratings 5-fold, from 4,90% to 0,97%, over a 4 year program.

Since the vast majority of machine-related personnel injuries on board ships are caused by poorly maintained machines, this means that VA-based maintenance programs will reduce the risk of personnel injuries from machineries by 5!

the innovation

Our innovation comes into play to simplify and ease the Vibration Analysis programs on board most ships and facilitate its implementation:

Our technology “learns” from vibrations collected by sensors attached to rotating machines, and automatically detects the “normal” vibrations from the “abnormal” or “unusual” vibrations, and qualifies these into type of issues (misalignment, bearing wearing out, etc.), with a severity level for each abnormal event.

Based on referenced data bases, vibration data coupled with Artificial Intelligence solutions will inform the ship operator and technical staff of each issue severity level, with logs and event documentation (machine ID, type of event, severity, date and time of measures).

how it was implemented

We are designing the Machine Learning an Artificial Intelligence modules for HAT Analytics, a company specialized in vessels rotating machinery health monitoring, and certified by Lloyd's Register as Digital Twin developers and by ABS as condition monitoring providers with remote portable system HAT and in collaboration with the EU-funded program AI4EU (https://ai4eu-support-program.fundingbox.com/).

HAT Analytics may integrate our technology to enhance the accuracy of their existing and future monitoring systems embedded health diagnostics algorithm for their clients’ vessels rotating equipment, resulting in more efficient and regular process (vibration analysis can be performed even when no expert can board the ship, as during pandemics).

the result

Although the development is still under way and the solution being trained with a larger test data base, the current results of the program show high accuracy in fault detection.

These promising results open the way for industrial integration and for launching Machine Learning based monitoring systems and processes, bringing easier to use, more accurate and faster vibration analyses processing to the maritime market. This technology will eliminate the need of generic limiting values and arbitrary assessment criteria which are in many cases not suitable for the vessel environment. Every equipment health condition will be evaluated based on real and objective fault descriptors and condition assessment criteria.

conclusion

Artificial Intelligence is a very powerful tool to perform regular and auto adaptative tasks, which usually require an expert eye on site.

Because of pandemics, of travel constraints, flying experts on board ships across the world is not always easy, and Artificial Intelligence kicks in, by automating the qualification of data and facilitating the data collection processes.

In our case, Artificial Intelligence and Machine Learning will help improve an existing process and contribute to simplified, regular maintenance schedules and safer shipping.

Our contribution helps also reduce carbon footprint (lesser trips for tech personnel) and to more efficient maintenance programs as testing can be performed more frequently and early diagnostics enables the proper parts to be shipped on site, on time and for a precise job.

28. | Rombit - Social distancing and contact tracing feature

the challenge

In the ongoing COVID pandemic, businesses want to ensure continuous operations. Employees need to take precautions and mandated health & safety personnel needs to act in real-time when a positive COVID case is detected.

Addressing these issues is possible using wearable technology. However: companies want to avoid one-time investments that will be useless in years to come (in a post-pandemic world).

For industrial, construction and logistics companies the most challenging safety issues are:

- Incident prevention: Struck-by accidents: vehicle collisions, falling objects (under crane), …
- Incident prevention: Permit to work authentication & training checks, operator check-in during service rounds, …
- Incident response: Lone worker accidents: man down, unresponsive operators, …
- Incident response: Evacuation management: smart mustering, operator location during calamities, …
- The pandemic accelerated the need for innovations in the connected worker field, with scores of companies looking for solutions that improve operator/contractor safety, security, and efficiency.

the innovation

In March 2020, immediately after the first signs of an impending pandemic, Rombit expanded its upcoming wearable product launch (Romware ONE) with a social distancing and contact tracing feature. It was hailed as the go-to solution for blue-collar workers and was highlighted in news outlets across the globe: New York Times, Washington Post, CNBC, Al Jazeera, Le Monde, …

The wearable product was and is attractive because of:

- Accuracy and reliability: the distancing is configurable and supported < 5cm accuracy
- Usability: the device is be worn around the wrist, upper arm or in a chest or trouser pocket. It weighs 50 grams and is the size of a matchbox. It has one button, is fool proof and does not need a manual or training.
- Plug & play factor: Each wearable has a nano-sim inside to ensure data communication without the need to integrate with company systems. You open the box and it works immediately.
- Industrial grade: IP 67, rugged shock-proof design, for maximum endurance and reusability.
- Privacy: — explained in the 'implementation' below.
- From the start, Rombit encouraged customers to look at the bigger picture. Our wearable devices support many other use cases.

Exactly the same device (Romware ONE) is able to:

- Prevent vehicle-pedestrian, vehicle-vehicle and crane-related accidents.
- Prevent unauthorized access to areas, vehicles, and check for service-round compliance.
- Respond automatically to falls, shocks and no-motion events, including accurate positioning.
- Respond automatically to calamities (evacuation events), including accurate positioning
- … And several other safety, security and compliance features.

how it was implemented

Key stakeholders are SHEQ personnel and local site/service managers. We typically form a small steerco with these two roles present. Given the plug & play factor, implementation is easy and IT supported is not necessary.

There are three main concerns when planning a volume rollout:

- Privacy: The dataflow is designed in such a way that no PRI-sensitive data is required. The solution is fully GDPR (EU) compliant and was approved for use by the Federal Belgian Data Protection Agency (GBA). In addition: Rombit does not own the data, the data stays in the customer tenant for 14 days before being deleted — to compensate for the virus incubation time.
- Change management: The technology works, the customer has confidence. The toughest step is convincing large numbers of (blue-collar) workers to adopt the technology and not boycott these new safety aids. Privacy assurance is key, but a continuous feedback loop and operator consulting rounds makes for a successful volume rollout. For this Rombit uses an application (MeetRoger) to train and consult both middle-management and end users.
- Local issuing and charging: Rombit designed a 3-second automatic issuing protocol, scanning the device QR codes and attaching them to operator aliases. The wearables boast a 24h battery-life. Charging takes 45m. To assist in mass-charging and dispensing, Rombit designed and implemented a charging cradle, able to support up to 300 devices in one charging station.

In addition: Device management and device updates are automatic given the continuous LTE (telco) connection

the result

Today, over 100 companies use the devices of Rombit to support worker safety. The pandemic accelerated the market and Rombit business plan significantly. Our IoT devices are in high demand.

In 2021, only after a few months of operations, many customers expanded the COVID application with Lone Worker Support and Collision Avoidance.

Typical Lone Worker Support use case: automatically detecting falls, SOS button, worker health and well-being acknowledgement, incident response through voice, text and control room integrations.

Typical Collision Avoidance use case: Warn drivers and pedestrians of an impending collision; basically, protecting people from getting run over by a forklift truck. Meanwhile additional data on near-misses and dangerous location heat maps are sent to the cloud platform for further optimizing safety and operational quality.

The combination of those features is unique and answers to the most common requests from SHEQ personnel. (Source: online searches, site clicks and Rombit trade show feedback.)

The biggest customer that started with COVID, only to expand to Lone Worker Support and Collision Avoidance is Southwire, a US-based steel wire company, with over 4.000 active devices across 7 sites and the wish to expand to all 60 of them. The demand is so high that big corporates are progressing much more rapidly than usual.

Other operational features that can be remotely upgraded on the same device (Romware ONE) are:

- Permit to work checks (and SHEQ/ORM) software integration
- Evacuation management
- Behaviour-based safety monitoring for industrial truck drivers (internal logistics)
- Perimeter security management

conclusion

The success of the COVID application and subsequent remote safety feature upgrades confirms Rombit's plan and ambitious land & expand goals.

Celebrating success however is not the plan going forward. The goal for 2022 is to quantify and report safety risks in such a way that the insurance community sees Rombit as a natural data partner.

In this respect the first steps have been taken already with both Belgian and US-based insurers.

Federale Verzekeringen/Assurances Fédérales, market leader in Belgium for occupational accident and liability insurances in the construction and logistics sector, confirms that they will actively connect "high-risk customers to the Rombit solutions". In addition, they pledge to lower their premiums from day 1 when certain safety measures have been met by implementing Rombit's devices.

Operational data can then only support a further lowering of premiums in the years to come.

29. | SECompanion GmbH - CompanionFLEET

the challenge

In the field of carrying out and monitoring high-security transports, we are faced with the challenge of having to process a lot of different data and information from a wide variety of places in the company and from external bodies. This process is time-consuming and error prone.

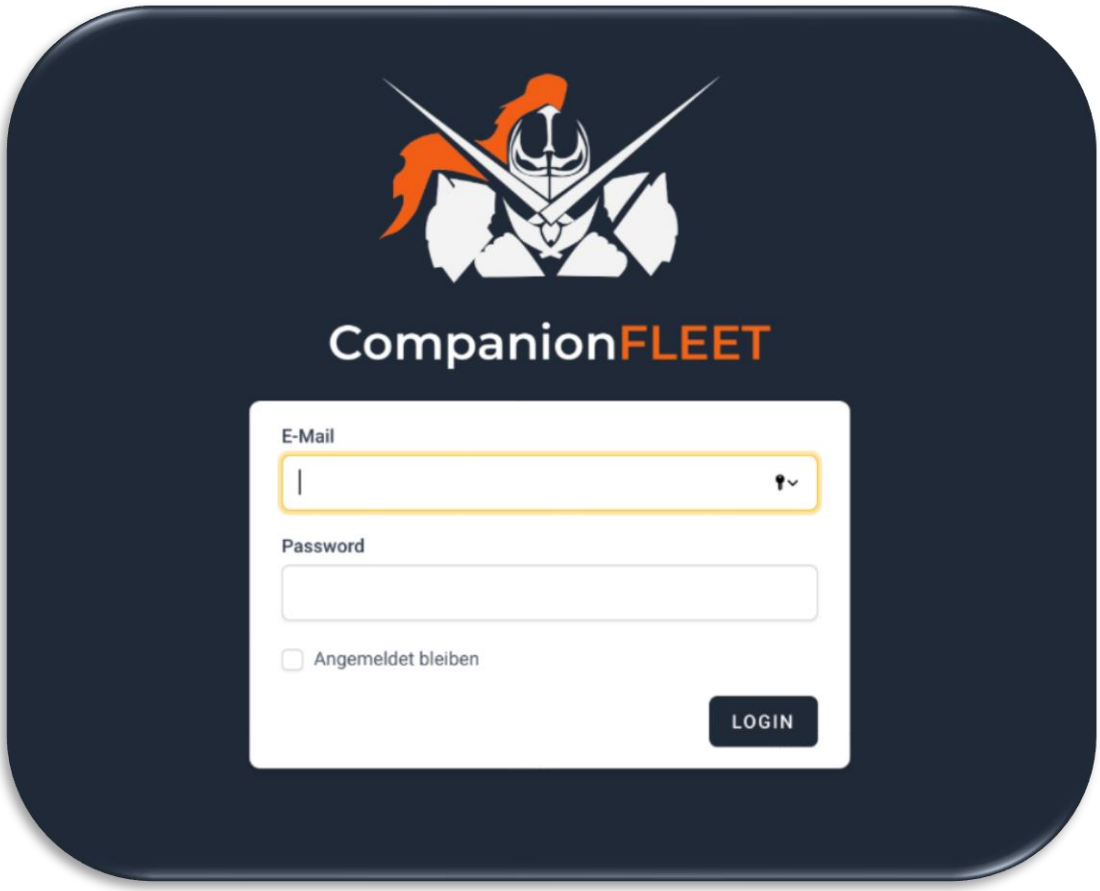
Wouldn't it be nice to collect everything in one platform and coordinate it from one place and automate it to a certain extent in order to save time, costs and valuable resources?

the innovation

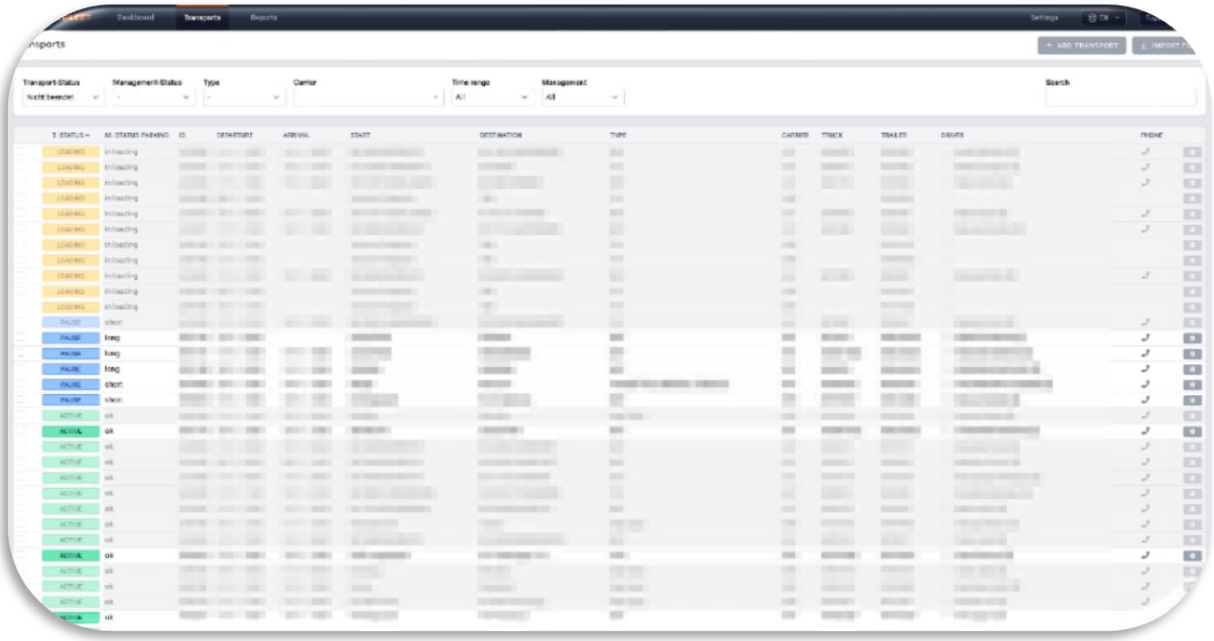
As a security service provider and supplier of an alarm monitoring and intervention solution for high-security transports in Europe, we are permanently confronted with this issue. We no longer see the solutions from a multitude of Excel lists and dozens of different monitoring systems and management platforms as state of the art and therefore decided in April 2021 to create a holistic solution. We call this solution CompanionFLEET. The first step in our development process was to consolidate a wide variety of data sets, such as driver data, vehicle data, route information, security parking and security-related information. This step was the basis and provided us with an internal workload reduction for our own Alarm Monitoring and Intervention Centre (AMIC). However, this was not enough for us, as our customers from the logistics sector and industry continued to transmit their data to us in the traditional way. So, we expanded the repertoire in order to also meet the customers with our innovation.

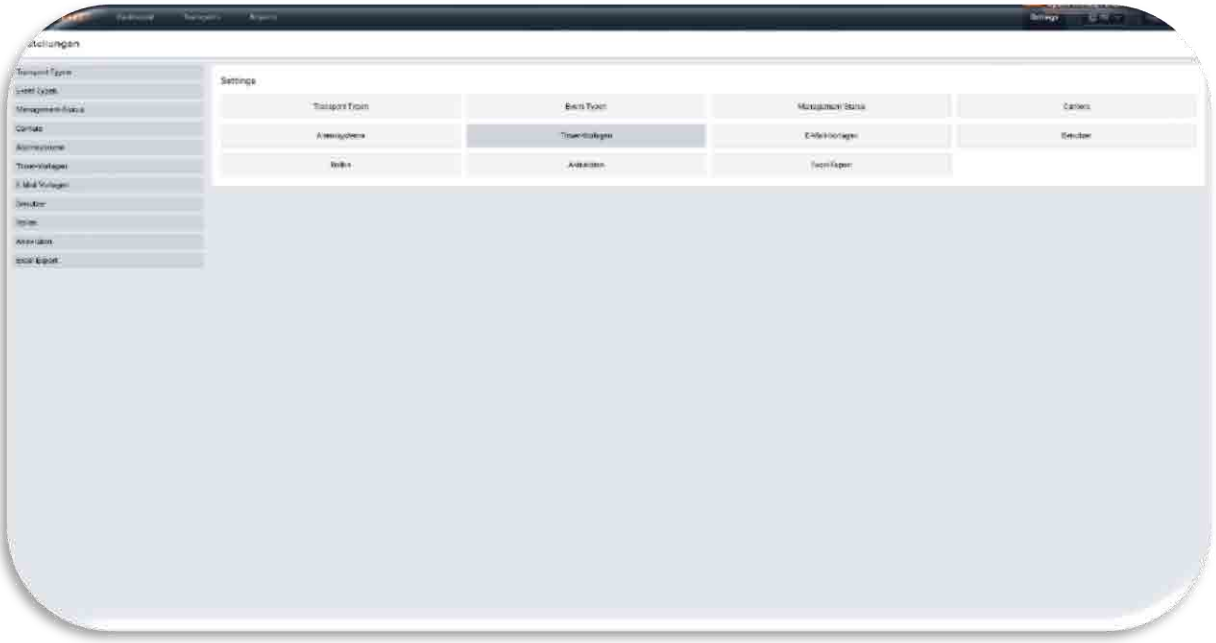
how it was implemented

The beginning of the implementation was the internal use of the new solution to simplify our monitoring of security transports across Europe and at the same time to create a database.



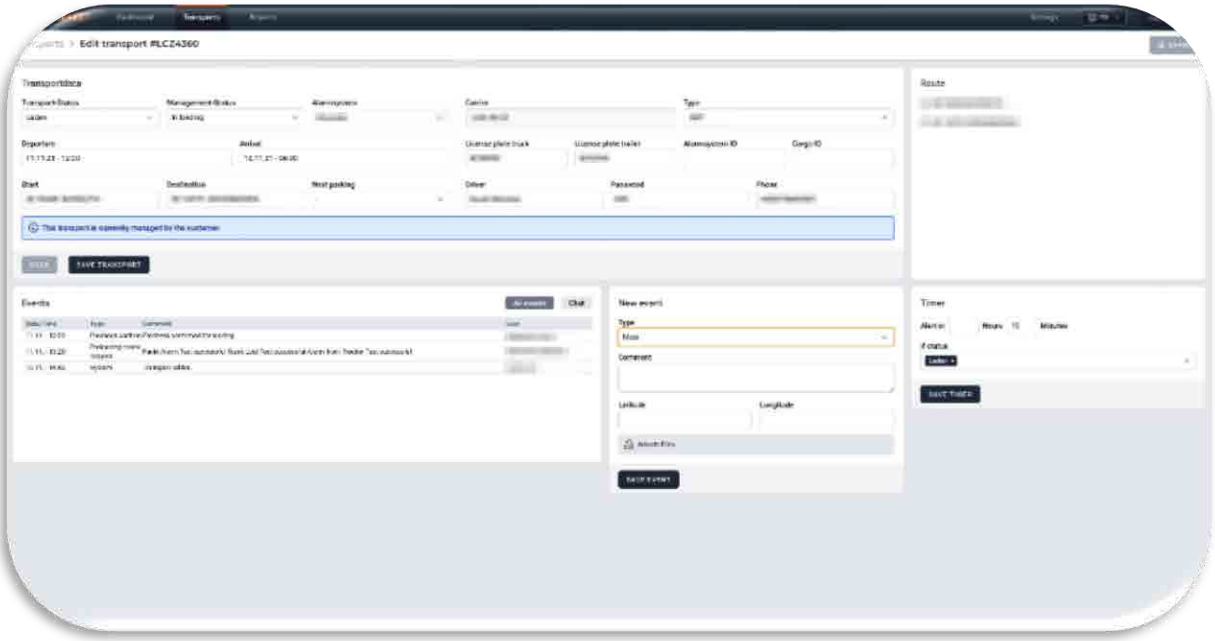
For security reasons, we host the database and the platform in our own cloud. After we were successful with the internal use and could prove the hoped-for reduction in workload, it occurred to us that this way of working would also be useful for our customers. Our clients get access on demand via their own accounts and can only access it from specific, approved





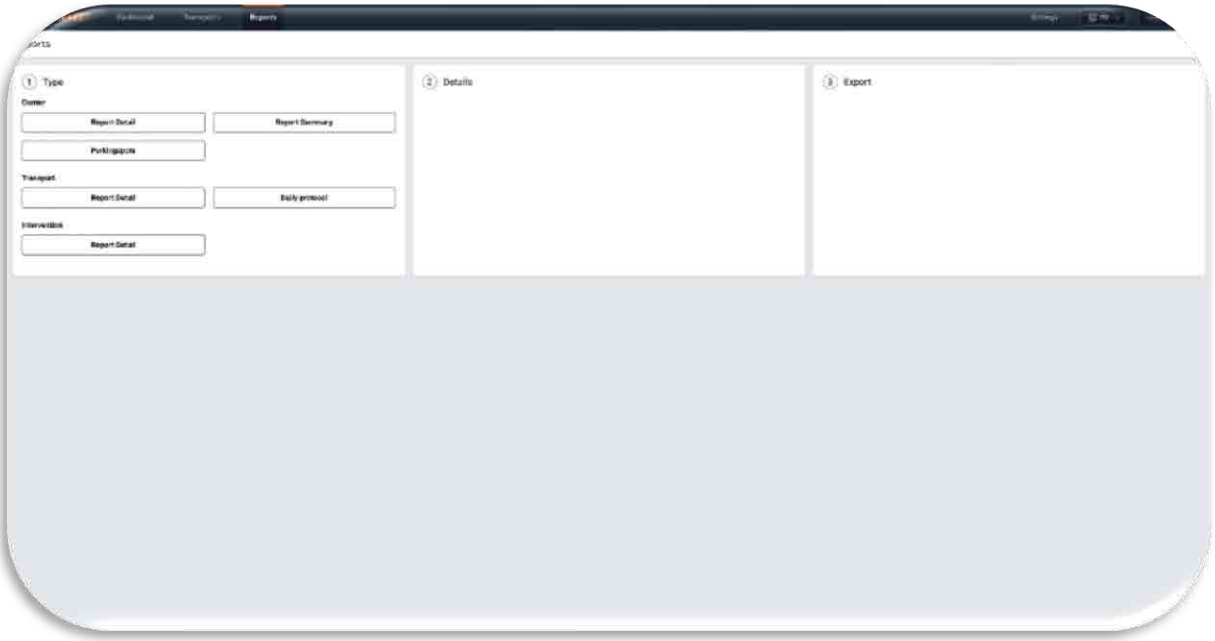
locations and named IP addresses. In the meantime, each user can be assigned individual roles and the associated possibilities for action and control. However, the assignment of access permissions can also be generally controlled at the company or customer level, as well as at the manufacturer level (e.g. pharmaceutical/tobacco industry or maybe even insurer in the future).

This ensures that everyone always sees exactly what he or she needs to see in order to be able to manage their own tasks efficiently and without complications. The need-to-know principle is also applied to the allocation of rights and thus the system also contributes directly to the protection of information.



the result

Our results so far are impressive: our customers currently report an increase in the speed of the settlement process of up to 600% compared to the traditional method. In addition, the same amount of work can be done with only a tenth of the telephone calls and emails that were previously necessary. Furthermore, we have developed a non-editable reporting module that documents the incidents for each transport separately. Even though this is already a great result, we are far from being satisfied or done with it. Development is continuing - modules for AI-supported route planning including route risk assessment and apps for drivers and security field agents will follow in the next few months. The software will live and evolve with your database. A long-term goal is the precise prediction of the arrival time of transports at the customer's site with a deviation of reality from the calculated time of less than 10 minutes per transport day, whereby the arrival time can be recalculated and automatically updated with every kilometre or mile the transport approaches its destination. In addition, security parameters are taken into account by the AI, which can then help to calculate a more secure and smooth transport flow.



conclusion

In a nutshell, we haven't reinvented the wheel, but we have already been able to make it much rounded for everyone involved. Fewer staff will be able to plan, manage, handle and monitor more shipments in less time - from order placement by the industry to the goods on the retailer's shelf. All stakeholders involved will be able to inform themselves about the current status in real time without having to rely on external information providers, depending on the depth of integration, in some cases even through their own, already known system solutions. However, the potential of our solution is far from exhausted and therefore we would be pleased if you would also contact us to communicate your individual needs and participate in the process of development to make the world of security transportation a little bit brighter for everybody.

30. | SIBRE - GUARDIAN System

the challenge

Pre – Snags detection system, and first and unique system able to detect not only in hoisting but also during lowering operations.

Impact during entry into the vessel cell

GUARDIAN System can also recognize and inform about abrupt movement events during STS cranes operations, which are increasing nowadays due to bigger vessel, taller cranes and higher speeds and productivity required.

The GUARDIAN ecosystem is essential to operational resilience in the face of adverse operation events by anticipating and preventing snags, and collision warnings (abrupt operations).

While avoiding snags has a direct impact on safety, employing advanced tools such as Guardian Analytic and Collect, to reimagine processes and better predict how abrupt operations will impact end user assets, and productivity, will also have an incalculable influence on deeper insights for improve safety during operation.

Guardian main safety challenge are:

- Snags protection throughout the complete operation – not only in hoisting but also with unique lowering detection.
- Proactive operations. See hidden anomalies and remedy incidents before they impact.
- Perfect tool for finding root cause and taking better corrective action with GUARDIAN Vision and Collect.
- Quicker response to challenges. Identifies and resolves inefficiencies more quickly for continuous improvement

Impact with vessel track guide during and after impact

the innovation

The GUARDIAN ecosystem is a portfolio of business-ready tools. The GUARDIAN ecosystem includes the hardware products GUARDIAN SLP and Vision, and the software platforms Analytics, and Collect.

These tools, protects, and what is more, provide a range of tools to achieve unique performance feel for each crane operation, in terms of operational quality and smoothness.

GUARDIAN SLP is an anti-snag solution based on an inertial sensor located on the crane's headblock. SLP provides STS cranes with an advance trigger of dangerous manoeuvres before the snag occurs, allowing to the crane a reduction in hoist speed or stopping the hoist system to prevent snags. Furthermore, in combination with the SIBRE super-fast SLP braking system, it allows a much faster hoist stop, thus improving prevention time and safety.

Impact due to one twistlock not being properly unlocked

Moreover, not only can SLP protect the crane during the hoisting operation, but also during lowering, thus provide this protection throughout the complete operation as none other system.

GUARDIAN Analytics is a SaaS (Software as a Service) cloud platform for generating, monitoring and sharing a unique Motion Intensity KPI. GUARDIAN Analytics allows real-time measurement, analysis and display of the Motion Intensity of each STS operation. These includes impacts (abrupt movements) of cranes against vessel during operations

GUARDIAN Vision is an all-in-one intelligent camera solution. Vision can record all events detected by SLP, whether it is a snag or abrupt movements that are detected.

GUARDIAN Collect is a SaaS solution for auto-exporting video events recorded by GUARDIAN Vision or other video recording systems in the terminal.

how it was implemented

It has been partially implemented in APMT, DPW, MSC, Evergreen and more terminal operators are joining during upcoming projects.

As reference project, SIBRE count with MSCT Valencia with full GUARDIAN tools implemented in the whole terminal.

Hardware system (SLP and Vision) are integrated into terminal STS cranes, meanwhile software (Analytic and Collect) is implemented in SIBRE Cloud. Both technology areas, OT and IT, are integrated using 4G mobile technology or IT end user network, by latest secure VPN technologies.

the result

GUARDIAN SLP is successfully running in some of the most important Terminal Operators. Whereas other tools of GUARDIAN ecosystem have been also recently implemented and successfully in operation.

Results:

- Reliable --> zero false negatives and zero false positives for snag or abrupt movement detection
- Robust --> zero hardware breakdowns
- Safe --> zero crane outage due to snags
- Productivity --> 5 minutes average for re-starting the system after a snag is detected

These results confirm that GUARDIAN is a very reliable and robust system.

Benefits in short:

- Increase crane safety, productivity, and efficiency
- Enhance the crane´s automation and digitalization
- Reduce crane downtime
- Reduce stress and increase the lifespan of crane assets
- Perfect tool for finding the root cause and taking faster corrective action

- Contribution to crane Product Lifecycle Management using video for crane events insights
- API for growing data set contribution to support maintenance and business operation
- Brand new data insights into crane operation movement and trends
- Improve operational visibility; gain deeper insight for TOS and other similar platforms

conclusion

GUARDIAN is a unique and disruptive set of tech products. GUARDIAN SLP is the only product capable of predicting and preventing snag situations during hoisting operations, as well as during lowering, and is matched by no other system.

Furthermore, GUARDIAN Analytics generates a brand-new KPI called Motion Intensity. This data provides full value insights into crane operation movements and trends.

Additionally, GUARDIAN Vision and Collect offers clear, deep understanding of any problem or situation as never seen before. By recording seamless video monitoring of events, this new platform will contribute to growing crane knowledge for improving productivity, efficiency, and safety.

What is more, as is the case with any data mining process, Motion Intensity KPIs can be crossed with other data such as weather condition, vessel name, crane type, and operator ID, to extract and discover patterns to make the most of the data.

By combining GUARDIAN Motion Intensity with other terminal data and information on crane manoeuvres, the business can extract valuable insights to improve operations, enable innovation and create new business models. In this way, it will be possible to classify other performance factors, such as the vessel, to anticipate future problematic operations. This will enable a never seen prediction of potential safety issues.

Pre-snags detected before the container got stuck

See the promo video:
https://youtu.be/8fZjpsfCGAI

31. | Vaisala Oyj - WindCube® Scan lidar -technology

the challenge

Due to climate change ports are experiencing the negative effects of global warming first-hand, from rising sea levels and extreme weather conditions to erosion. These extreme events are causing ports millions of euros in damage in repair and downtime, not to forget worker safety. Cranes and vessels are often prone to damage and collapse, and some buildings may not stand up to extreme winds, creating serious safety and operational hazards.

According to the United Nations Port Industry Survey on Climate Change Impacts and Adaptation (2017) extreme winds is the climatic factor with the most significant impact on port operations, like infrastructure, ship and terminal operations. It is forecasted that extreme wind events might become stronger in the future due to global warming. Many European, North American and Asian ports reported lack of readily available information (past and present data) regarding very significant port operational and infrastructure design parameters such as wind speed and direction and number of days of high winds, wave height, period and direction and precipitation.

According to World Ports Sustainability Report 2020 significant number of ports still lack the basic response procedures for extreme weather assessment, contingency plans and warning systems in order to deal with the extreme weather events effectively and safely.

A better weather understanding, AI modelling and hyperlocal wind near casting is needed in order to more effectively mitigate the risks related to extreme weather events at ports, enhance the safety of crew, ships and port operator assets and improve the up-time of terminal operations.

the innovation

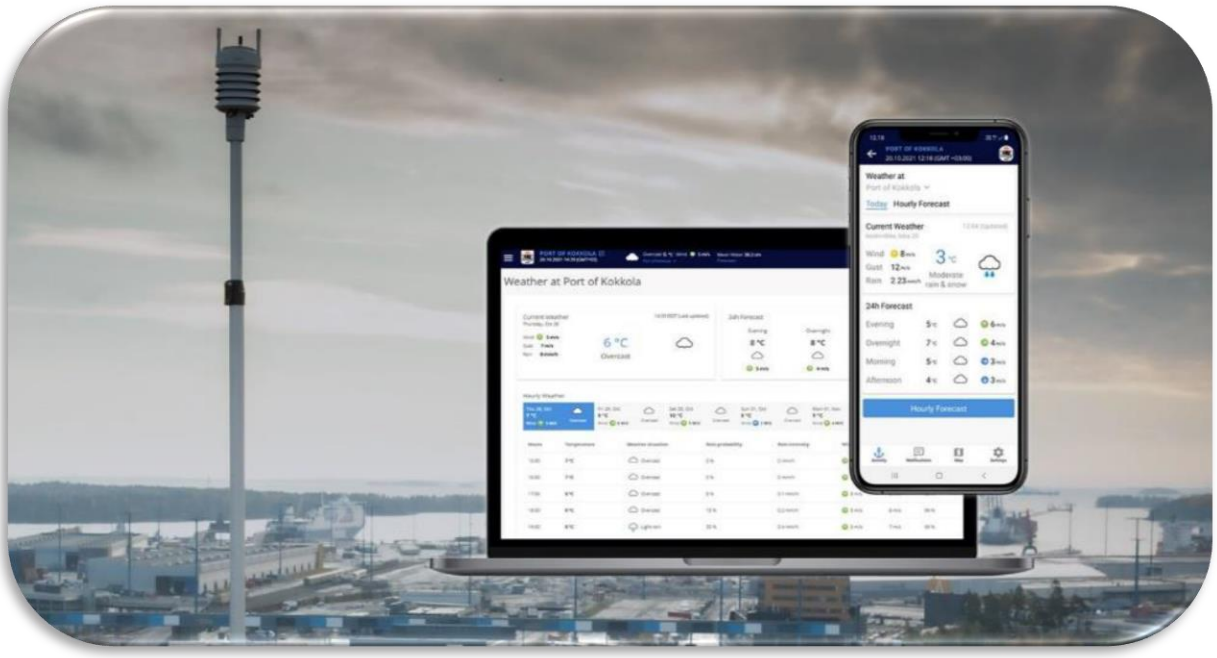
Vaisala has been successfully working for over 85 years with the innovative and world leading weather measurement technologies serving globally most of the worlds meteorological organizations and other industries. Our WMO reference-grade meteorological weather systems and solutions are being used by several ports around the globe to adopt to the climate change impacts at ports and to enhance operational efficiency and safety.

During the last years Vaisala has had an increased focus to develop the best of class Port Wind Awareness solutions including:

- Vaisala WindCube® Scan remote sensing lidar that provides precise, spatial wind data at ranges up to more than 10km and creates a virtual dome around the port area, allowing users to measure, understand, and act on current — and ever-changing — wind conditions to maximize safety, efficiency, and operational continuity at ports.
- Vaisala BeaconTM Station plug-and-play weather station that provides measurements, data collection, and data visualization in one compact environmental monitoring solution that enables operators to monitor conditions around their port. It accurately captures wind speed, wind direction, air pressure, temperature, humidity, and rainfall data for a localized area and delivers it via a secure, wireless data transfer for effective forecasting and planning.
- Vaisala Weather API that utilizes the most advanced modelling techniques to create accurate and reliable near casts enabling ports to enhance their operational decision-making.

how it was implemented

Vaisala is involved in two industry research projects where its WindCube® Scan lidar - technology is being used for better understanding of downbursts and other wind conditions



in port area. The aim of the research projects is to construct forecast-models and wind prediction tools to enhance port construction and design, optimization of port operations and safety as well as to improve prediction of wind loads on ships and their response including drift angle, berthing loads, and mooring line loads. Wind engineering group at the Department of Civil, Chemical and Environmental Engineering (DICCA) at the University of Genoa began a project to understand wind fields and optimize wind forecasting in selected European ports. the Department is using the Vaisala WindCube® Scan to search for downburst outflows, gust fronts, and waterspouts produced by thunderstorms approaching from the sea.

Separately, Maritime Research Institute Netherlands (MARIN) launched the Wind Loads and Securing Ships Joint Industry Project (WindLASS JIP) to develop a practical wind load prediction tool. MARIN partnered with Vaisala for WindCube® Scan lidar technology that would provide high-resolved 3D wind measurements above several European seaports. The project looks to gain an understanding of the 3D wind fields in exposed ports and waterways, as well as the influence surrounding buildings, container stacks, and other vessels have on that 3D wind field. Vaisala also recently announced partnership with technology company Unikie to improve situational awareness of ports with hyperlocal weather insights provided by Vaisala BeaconTM Station.

the result

Through the major wind analysis project together with the Department of Civil, Chemical and Environmental Engineering (DICCA) at the University of Genoa WindCube® Scan technology provides important information on how lidar can be used for updating decades-old forecast models—and creating new ones—for use in port construction and operations. The project is providing extensive, promising data that could enable everything from wind tunnel testing of new building designs to new classifications for the types and severity of storm-related structural damage. Once the test campaign of MARIN WindLASS JIP project has been concluded the results will allow to develop improved wind models for wind engineering that take into account the complexity and turbulence of wind in seaports. These new models will form the basis of a dynamic wind load and mooring analysis tool that WINDLASS JIP participants can use to refine mooring protocols, reduce wind-induced incidents, minimize wind-related damage, reduce costly downtime, and improve overall operations in their ports. A better understanding and modelling of the wind in ports will help improve the safety of ships and the up-time of terminals.

conclusion

With the help of more accurate observations on wind and weather conditions combined with hyperlocal nowcasts for the area, ports can better adopt to the effects of extreme weather events caused by the storms and climate change. Vaisala's wind mitigation technologies can help ports to optimize their just-in-time operations, enhance safety and manage the risks related to extreme weather impacts by being fully aware, alerted and well prepared.

Vaisala is calling the port industry globally to work together for co-creating innovative solutions utilizing latest weather observation and forecasting technologies and creating the best risk mitigating practises for climate change resilient, safer ports of the future.

32. | Yardeye GmbH - Real Time Locating System (RTLS)

the challenge

Since 2020, DP World Vancouver has been busy expanding and converting the old terminal into a new, future-oriented layout with new, state-of-the-art technology. DP World Vancouver is one of the three main container terminals at the Vancouver gateway and handles about one-fifth of the goods shipped in containers at the Port of Vancouver. The implementation of a (semi-)automated system will expand the terminal's capacity to 1.5 million TEUs per year, an increase of two-thirds of its current capacity.

To accomplish this project without endangering personnel, Yardeye's Real-Time Locating System was installed to protect people and equipment during full operation and ensure that an attached load never passes over personnel or equipment. For example, when loading containers onto trucks, it was important to ensure that truck drivers in the cab were not put at risk. Therefore, a dynamic Collision Avoidance System is installed on Rail Mounted Gantry cranes to prevent accidents with personnel and trucks.

the innovation

With Yardeye's unique Real Time Locating System and Collision Avoidance System, DP World Vancouver is able to create a safe working environment for its personnel.

This includes the following safety and operational goals for the RMG crane:

- In the train handling area all personnel are tracked and protected during their working processes at any time. Thus, no loaded or unloaded spreader passes over personnel or equipment.
- In the truck handling area, all trucks can be loaded and unloaded in parallel operation without the driver having to leave the cabin.
- Enabled by the Yardeye solution, personnel and automated cranes work together simultaneously. Therefore, the safety function can be realized without performance loss or additional downtimes.

how it was implemented

The scope of supply includes a Real Time Locating System (RTLS) and Collision Avoidance System (CAS) for RMGs in train and truck operations. Yardeye uses different technologies to implement the RTLS for personnel in the crane train-handling area and for the trucks underneath the cantilever. The machines and personnel are tracked by a combination of GNSS and RFID technology, whereas the personnel is tracked solely by RFID, due to reasons of battery life. The exact positioning of personnel and machines in the yard together with a direct interaction with the crane control system realizes the CAS, which ensures by slowing down and braking the cranes that no suspended load is ever endangering personnel.

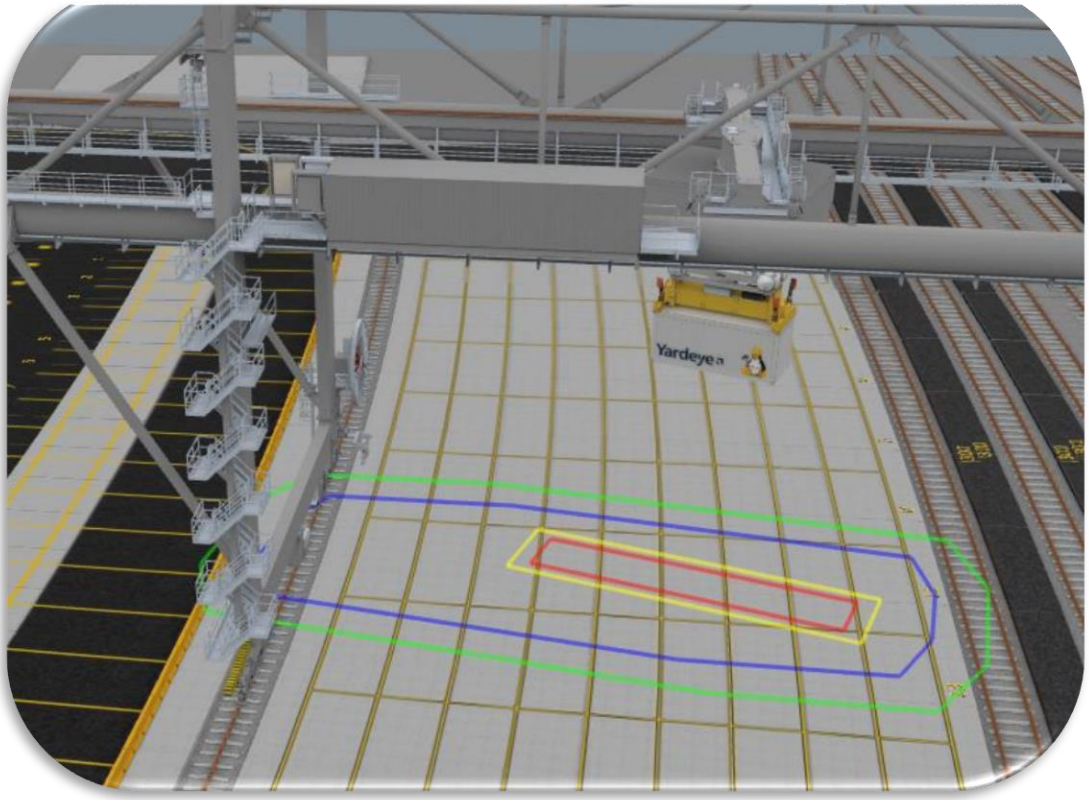
If a person or vehicle enters the station area, a virtual safe zone (called halo) will be created around them. If these halos overlap with the crane's CAS zones, the crane automatically stops or computes a collision-free path to the target. This process prevents accidents and, despite a fully or semi-automated environment, allows personnel and machine to work together effectively at the same time.

Yardeye's Yard Map creates a digital twin of the yard that allows terminal operators to have full control over what is happening on site. This Yard Map includes various features such as status information, halo visualization, virtual fixed working zones for maintenance operations, replay function for historical yard analysis and more. The yard map also displays information about the position, heading, positioning source and status, connectivity, signal strength and LED status of an object.

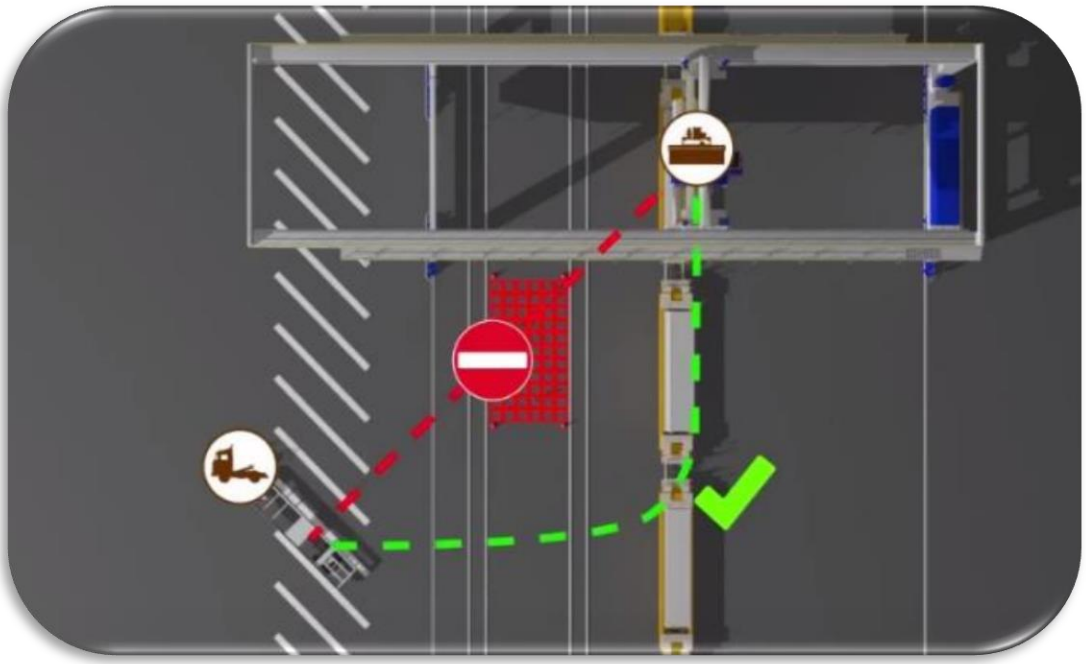
the result

This project is expected to be substantially complete by mid-2022, so final results are yet to be obtained. However, Joel Werner, Director, Engineering & Projects at DP World Canada states: "[…]CEP will increase terminal capacity by 70% with only a 15% increase to the terminal footprint. This is an ambitious goal, and the Yardeye RTLS technology is critical to realizing the required operational efficiencies while meeting DP World's commitment to the safety of all personnel working on the terminal."

The Yardeye RTLS will provide a dynamic collision avoidance system for people and trucks to protect them from the spreader or trolley of the Rail Mounted Gantry crane. To increase yard efficiency, it will provide precise positioning for accurate Terminal Operating System functionality.

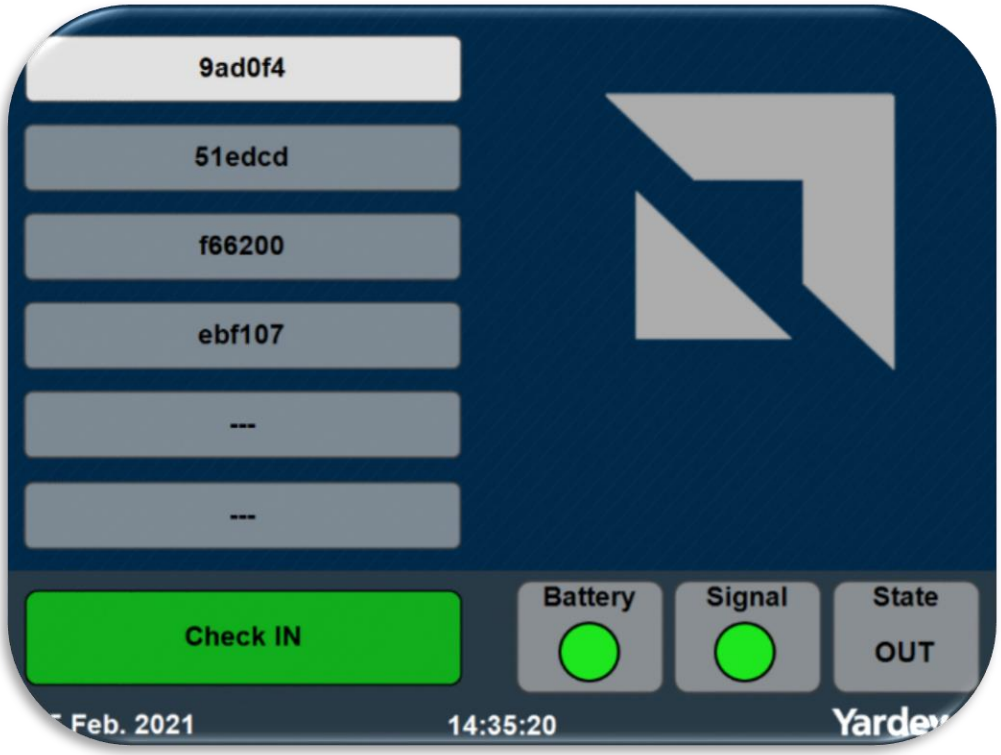


The different CAS zones of the crane's spreader shown in Yardeye's Yard Map



The Green Path shows an optimised path to prevent collisions with the fixed working zone

Personnel Tracking by RFID Technology



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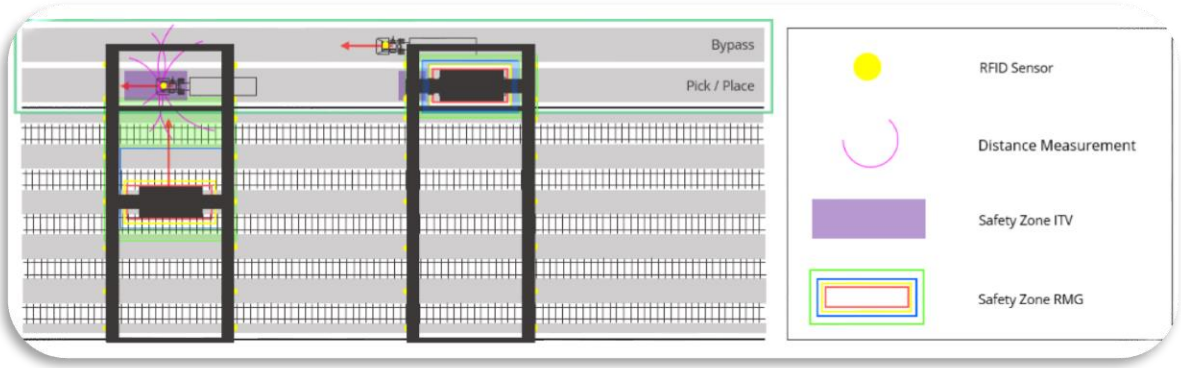

Safety helmet with RFID Tag

Yard Map gives an overview of equipment and personnel on site

conclusion

Yardeye's vision states: "Allow workers worldwide to come home safely and maximise yard performance." As one of the largest terminal operators, DP World Vancouver used the terminal expansion to close the safety gap of automated equipment and personnel working together thanks to Yardeye's RTLS and CAS technology.

Yard Map shows detailed info about equipment

Yard Map shows halo zones and historical path of equipment

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Established in 1952, ICHCA International is an independent, not-for-profit organisation dedicated to improving the safety, productivity and efficiency of cargo handling and movement worldwide. ICHCA's privileged NGO status enables it to represent its members, and the cargo handling industry at large, in front of national and international agencies and regulatory bodies, while its Technical Panel provides best practice advice and develops publications on a wide range of practical cargo handling issues. Operating through a series of national and regional chapters, including ICHCA Australia, ICHCA Japan and Correspondence and Working Groups, ICHCA provides a focal point for informing, educating, lobbying and networking to improve knowledge and best practice across the cargo handling chain.

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