

ICHCA
INTERNATIONAL



**ICHCA INTERNATIONAL PRESENTS
TT CLUB INNOVATION IN SAFETY
AWARDS 2025**

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

Since its inception ten years ago this Award has grown in popularity for one reason – safety is at the heart of our industry’s responsibility. The well-being of the workforce and the security of cargo and equipment are at the forefront of operations throughout the world. This is reassuring, however more can always be done to improve safe working conditions. TT Club, together with ICHCA will therefore maintain their efforts to encourage and disseminate innovation wherever possible.

The publication of this Digest, which follows the success of similar reviews of award entries in past years, endeavours to do just that. It details the long list of entries into our Annual Award that represent safety innovations from a broad cross-section of organisations engaged in the cargo handling industry.

It demonstrates the strength and quality of the innovations and reflects the drive by organisations throughout the industry to improve safety standards. It is relatively easy, given the spotlight afforded the winners of the award, to appreciate their relevance to current safety challenges but the high calibre and sheer volume of safety products, processes and concepts developed and offered to the judges of the Award also deserves as much recognition. This Digest fulfils that requirement.

For our part, TT is dedicated to its role as an enabler and communications conduit for innovation in safety. We seek to link those looking to invest in safety measures, operators seeking solutions, and academia and regulators wishing to have a greater understanding of the safety issues, and allow them a forum to create mutual benefit.

I commend this Digest to the reader who is equally committed to safety and in particular draw attention to the topical relevance of many of the innovations which address current and burgeoning safety challenges.

The wide range of these challenges tackled by this year’s award entrants fell into four main categories. Both the advantages of turning data collection in providing insight into safety improvements and the growth of learning technology in training using virtual simulation, featured heavily.

In the operational environment practical products to make handling operations safer and segregating people from machines made up the other two categories.

The segregation issue is crucial as failure to maintain it effectively causes the second



Mike Yarwood
Managing Director Loss Prevention
TT Club
February 2025

highest amount of incidents in cargo operations, and one with the most serious consequences.

Our own, and ICHCA's further aim is to provide a tool kit that helps promote these ground-breaking ideas not just via inclusion in this Digest but by encouraging the innovators to engage in discussion forums, conferences and exhibitions and further papers on safety issues that we organise. Through these efforts, we hope the relevance of the innovative solutions can be honed and their place in established safety practices of the future be cemented.

At TT our commitment to safety, security and supply chain sustainability is demonstrated not just by our support of this award but also through the wide-ranging publications on risk awareness and guidelines aimed at safeguarding supply chain operations that TT produces throughout the year. We are proud to be constantly utilising the experiences of our insured and the resulting measures we develop to help them mitigate the dangers facing all operators across the global supply chain.

THE WINNERS

learning and engaging

2025 Winner



highly commended



safer operations

2025 Winner



highly commended



people and equipment

2025 Winner



highly commended



turning data into insight

2025 Winner



highly commended



1. AUCOS-Systems-GmbH-Logo-CMYK

automatic coupling and uncoupling system operated from the safety of the cab

the challenge

When coupling and uncoupling (disconnecting) the trailer from the tractor unit, the driver must always leave the cab, disconnect the air and energy lines, lower or raise the support legs and then re-enter the cab. When transporting containers, the driver must release or close the locks every time a container is loaded or unloaded, and must also leave and re-enter the cab each time, regardless of whether it is sunny, raining, snowing or icy. These activities often result in accidents, especially in winter, with drivers slipping, bruising or similar.

the innovation

With the three components AUCOS-Coup, AUCOS-Lock and AUCOS-Leg, all the described processes can be controlled automatically from the cabin. The driver no longer has to leave the cabin.

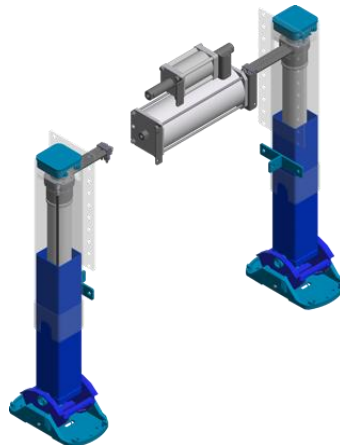
AUCOS-Coup: is the automatic connection for supplying the trailer with air for the brakes, energy for the lighting and any required data exchange.



AUCOS-Lock: remote controlled opening and closing of the twist locks on the trailer. In any desired configuration.



AUCOS-Leg: using the data connection between truck and trailer provided by AUCOS-Coup, it is possible to raise or lower the electrical or hydropneumatic support legs from the cab



how it was implemented

The first installations of AUCOS-Coup were carried out at Long Beach Container Terminal (LBCT) in 2016 on more than 50 tractor units and more than 100 trailers.

Also in 2016, an almost identical number of systems were installed in Vancouver. In 2021, the first systems were installed in the Port of Hamburg and since 2023, the first container trailer with automatic twist locks has been in operation in the Port of Hamburg.

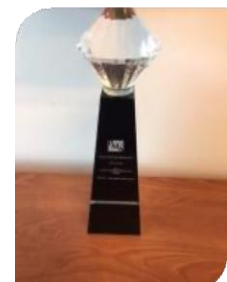
In 2024, the first prototypes were also equipped with the AUCOS controlled leg and presented to the public in September at the IAA in Hannover on a Krone trailer. The Krone trailer presented there was the first trailer on which all three AUCOS controlled components were installed together.



result

In the past eight years, up to 270,000 couplings have been carried out at LBCT and the systems are still in use. All customers are very satisfied with the high availability.

In addition, LBCT was honoured by the Pacific Maritime Association (PMA) in 2017 and 2018 with the 'Overall Terminal Safety Award' for its significant



improvements in workplace safety, due in large part to the use of the AUCOS-Coup.

conclusion

The use of the current version of AUCOS-Coup is limited in Europe to use in closed facilities/terminals due to the lack of CE certification. In the rest of the world, however, the system can already be used on the road.

As we move towards autonomous driving, whether in closed systems or on public roads, automatic coupling on vehicles is almost essential. No one should be allowed to ride on systems with automatically controlled towing vehicles. If the truck or trailer without automatic coupling is tampered with, it must be driven as a unit to the workshop. This always means a significant interruption in the operational process, which can be avoided with AUCOS-Coup.

In addition to a significant reduction in accidents involving people. According to customers, AUCOS-Coup also significantly reduces damage to the cabling between the truck and trailer and leads to a significant reduction in the time required for coupling and uncoupling.

LINK: <https://www.aucos-systems.de/>



2. BOLLARDSCAN

a non-destructive test method suitable for bollards

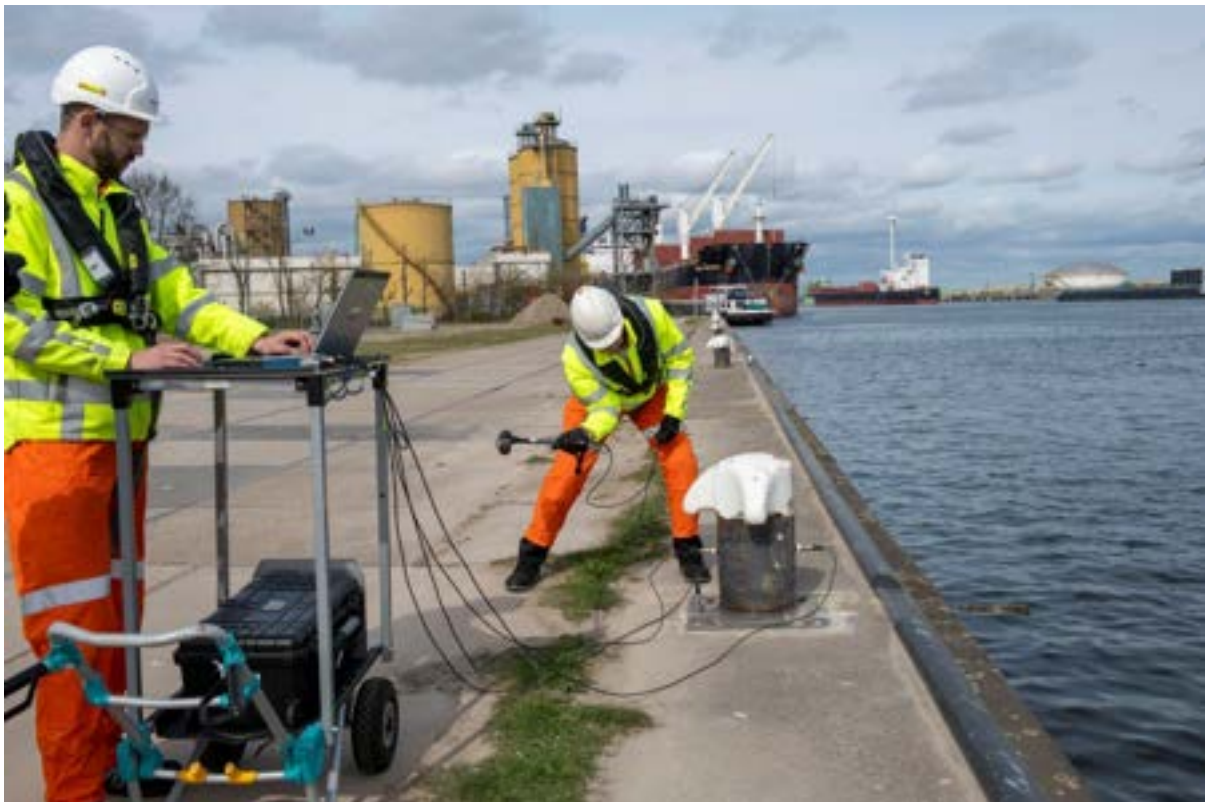
the challenge

The failure of mooring bollards and their anchoring is becoming more commonplace. Both bollards and anchoring can work themselves loose over time and this can not be detected with a simple visual inspection.

Load testing of/bollards can be detrimental to the bollard integrity and actions that risk making bollard integrity worse than it is, should be avoided.

To solve the problem we developed a non-destructive test method suitable for bollards; BollardScan®.

The report delivered to clients is comprehensive and reflects the present state of the bollards and their anchoring making it easy to execute improvements and plan safe operations. It also aims to create awareness of the importance of the correct use of bollards such that all who are involved on the mooring process are aware of the do's and don'ts with bollard operations.



the innovation

What we measure in the vibration test...

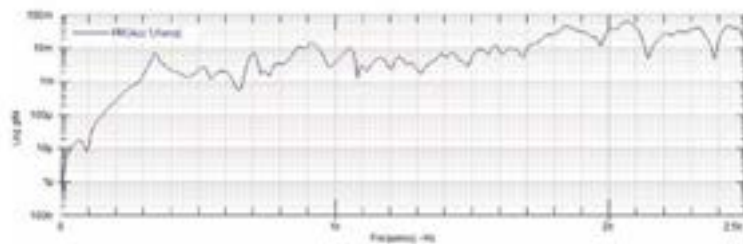
The principal of vibration testing is simple: what goes in must come out.

We excite the bollard and its anchoring. The force used is the equivalent of 10 kilo newtons (kn) for bollards up to a 100 Ton Safe Working Load and 15Kn for greater than 100 Ton Safe Working Load.

A rubber tipped "calibrated" hammer is connected to the recording programme which measures the force used.



The resulting vibration is measured with accelerometers. These are typically used for vibration measurement.



Measurements are taken in three different directions, 0° towards the water, 90° clockwise and 270° clockwise. These three directions will always be within the limits of the mooring line angles and reflect the way the bollard is typically designed and the normal way mooring lines are directed. i.e. out and up.



The positioning of the sensors on the bollard is important. Sensor 1 (the zero degree position) is attached on the seaward side of the bollard, midway on the solid column of the bollard (see image). Sensor number 2 is positioned on the landward side slightly lower than sensor 1. If the bollard is built onto the quayside, sensor 3 is placed horizontally below the 2nd

sensor. If the bollard is sunk into the quayside the sensor is attached vertically on the edge of the baseplate. The exiting of the bollard with the hammer will always be in the direction of the single sensor.

The system has been used to successfully test over 10,000 bollards.

how it was implemented

Implementation was done after independent verification of the system by Vienna Consulting Engineers and Lloyds Register.

We now have agents delivering the service in many countries having built up our client base through demonstrating the service to numerous ports world-wide.

result

We have tested over 10,000 bollards since 2016. The overall failure rate is around 1% with a further 10% typically under active consideration for example with advice on possible corrective maintenance. The remainder typically pass.

conclusion

With the BollardScan method we offer our clients an in depth report on the state of their bollards and where needed we give advice on possible improvements.

It is a fast, accurate and cost effective method and the bollards passing the test will be insured for a period of 3 years.

LINK: <https://bollardscan.com/>

BollardScanTM

3. CEPA CV – LASHING TOOL

an ergonomic lashing tool, training package and safety gloves protecting lashers from injury

the challenge

Container lashing on board is a physically intense and demanding task. Handling the heavy lashing bars and turnbuckles in sometimes suboptimal conditions due to the environment (such as the vessel itself), weather (e.g. frost), can lead to exertional injuries if not performed ergonomically. Data shows that container lashers have the highest frequency of exertional injuries among the Antwerp docker pool, with some experiencing long-lasting effects. Among lashers, we have observed a higher absenteeism, lower retention rates and a higher reskilling rate. Additionally, lashers encounter high safety risks while performing their job, such as hand injuries.



To address the issues above, this question was raised: how can exertional injuries be reduced under current working conditions, and how can safety be improved? Although providing a safe and healthy workplace is a joint effort of the terminal operator and the carrier. Significant transformation within the vessel construction industry is needed before all challenges can be addressed. Furthermore, employers (i.e., terminal operators) have limited influence over physical working conditions aboard vessels. In this context, we have assumed that container

lashers will continue manipulating the existing lashing gear in the current work environment. Therefore, our goal was to provide direct support to the lashers.



the innovation

The Port Work Innovation Hub is an initiative of Ceba to enable innovative solutions for a safe and healthy working environment in the port of Antwerp. Within this framework, Ceba, the unions and the University of Antwerp initiated a study on exertional injuries among lashers caused by container lashing.

The project began by mapping the lashers' working conditions. A test station replicating the onboard lashing platform was constructed at training centre OCHA, in order to simulate the working conditions as realistically as possible. The University of Antwerp departments of physiotherapy and ergonomics studied the lashers' body postures, movements, and the strength needed during container lashing. Video data were used to create a digital model, to measure the strength needed and the physical strain on the body, to identify risk areas.

Multiple lashers participated, providing representative data and essential input on working conditions on board.

In collaboration with University of Antwerp ergonomists and physiotherapists; and a test group of lashers, an ergonomic approach of (un)lashing was developed and translated into a training program and learning modules in a digital learning platform.

Simultaneously, a team of University of Antwerp product developers designed a lashing tool that supports the ergonomic working method. Guided by the digital model's findings and feedback from dockworkers by examining different existing tools, such as simple steel bars, they mapped the different types of lashing systems and incorporated in their design the usability across various turnbuckles. In their research, they included the need to reduce the risk of slipping, losing control of the tool, etc. Several prototypes were tested at the OCHA test station and in the field.

A group of lashers was then trained in ergonomic work methods, including warm-up before and cooldown after work. They tested the most promising prototype of the tool and provided feedback for final development. This testing had a specific scope: the ergonomic impact of the tool on the testers, the durability of the tool in the field and the cultural acceptance among the target audience. The lashers were asked for regular feedback and input. This output was combined in a final design.

In a complementary project, the use and design of specialized work safety gloves were investigated, as the risk of finger pinching during lashing remains above average. In collaboration with different manufacturers of safety gloves, innovations were implemented and after repeated testing, a range of impact-reducing gloves was developed. Different types of gloves were introduced to suit varying weather and work conditions, and comfort needs.

Overall, the innovation resulted in:

- an ergonomic lashing tool
- an ergonomic based training package
- new safety gloves, with an added requirement for mandatory use



how it was implemented

Three spectrums were defined: ergonomics (warm up, working and cool down), lashing tool, and hand & finger injuries caused by impact.

Impact-reducing gloves have been introduced into the work gear assortment and made mandatory for all lashing activities. Awareness campaigns supported this initiative.

The lashing tool was distributed to all container lashers in the port of Antwerp, as an individual tool. Each lasher received a box containing the tool, a manual, a link to an instructional video on Dockwise (Cepa's e-learning platform) and an exercise tool to strengthen their upper body, grip, and wrists. The tool was also added to the work gear assortment.

All lashers will follow a specific training (one full day) on how to lash and unlash ergonomically and how to use the tool. To promote ergonomic behaviour, such as stretching and warming up, an awareness video featuring two famous Belgian actors was created.

result

The ergonomic working method, combined with the lashing tool, reduces exertional stress on the body. The tool stimulates ergonomic movements. The effect on exertional injuries can only be measured on the long term, but preliminary results from a six-month questionnaire among the test group already show a significant positive impact. Since the introduction of the impact-reducing gloves and their mandatory use for lashers, there has been an almost 50% reduction in hand & finger injuries.

conclusion

A scientifically supported study and the involvement of executing employers, unions, and workers has shown significant results and provided a well-supported solution. The insight that there is not a "single" solution to the problem. Instead, the combination of technical (tool), organizational/training (ergonomic work method) and PPE innovations offers a multi-angle successful approach and product.

Users guide and instruction video on: <https://nextlevelcontainerlashing.com/>

LINK: <https://www.cepa.be/>

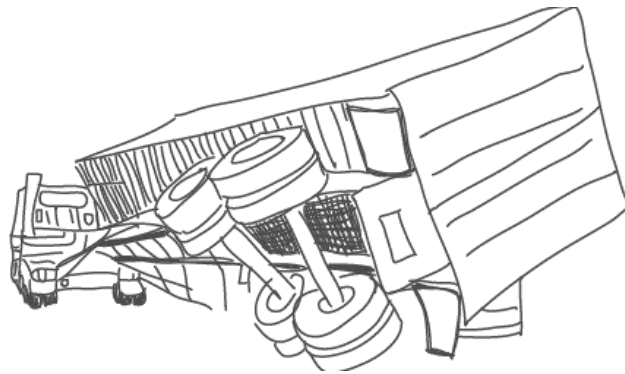


4. CINDICIUM PTY LTD

accurately weighs a container, automatically and securely records and reports the weight wirelessly in under 60 seconds

the challenge

Cindicium's Pondus VGM solution tackles critical safety challenges in container weight verification, particularly those impacting maritime operations under SOLAS (Safety of Life at Sea) regulations. Traditional methods often lead to human error and delays, which can result in mis-declared container weights. This poses significant risks at sea, including vessel instability, overloading, and potential capsizing, all of which endanger crew safety and cargo integrity.



Inadequate weight verification can lead to operational disruptions, legal liabilities, and severe accidents during transit. Pondus enhances maritime safety by providing a risk assessment for each container without the need for physical weighing. This capability allows ports and terminals to effectively identify high-risk containers, ensuring compliance with Verified Gross Mass (VGM) requirements and promoting a safer maritime environment.



the innovation

Pondus automates the weight verification process through a seamless integration with the container handling equipment. When a container is moved by the container handling equipment, data regarding its weight is collected and transmitted to the Pondus cloud.

The cloud platform analyses this data using advanced algorithms and machine learning to assess the likelihood of mis-declared weights for each container, compared to the declared VGM.

The system generates a risk rating for every box, indicating the probability of mis-declaration based on weight. This innovative approach allows ports and terminals to evaluate every container without the need to weigh each one physically.

By focusing resources on high-risk containers, Pondus enhances operational efficiency and safety, ensuring compliance with regulations while minimizing risks across the maritime supply chain. This solution significantly improves how ports and terminals manage weight verification and contribute to safer supply chains.



Photo by Patrick Terminals, Brisbane

how it was implemented

We collaborated closely with Patrick Terminals in Australia to integrate our system with their terminal operating systems, enabling us to receive data from the container handling equipment, such as straddles, forklifts, ASCs, and RTGs. Once the data feed is established, our cloud-based system calibrates according to the performance characteristics of the various equipment, as some may consistently weigh higher, lower, or exhibit erratic behaviour.

After developing calibration curves, we begin risk rating containers by comparing the weights from our data feed with the registered Verified Gross Mass (VGM). This risk assessment uses a scale from 0 to 9, where 0 indicates “not misdeclared” and 9 signifies “very likely

misdeclared.” Containers flagged as high-risk are then moved to the PONDUS stand for weighing. (see picture)

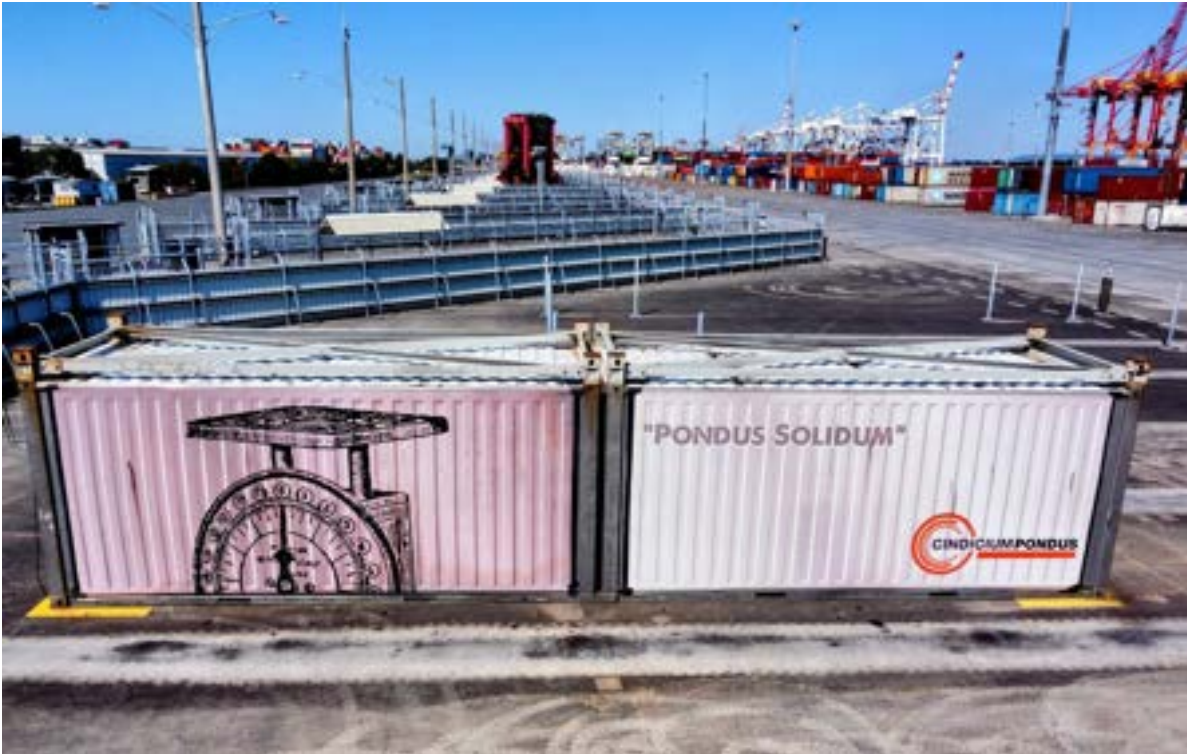


Photo by Patrick Terminals, Brisbane

The PONDUS stand is OIML certified and equipped with cameras that capture images of the containers for identification purposes. This process culminates in issuing a new VGM certificate, ensuring accurate and compliant weight verification for each container.

result

The implementation of our solution has shown impressive results in improving container weight verification. We have discovered that between 5% and 10% of all cargo, both imports and exports, is misdeclared by more than 1 ton. This means that a significant number of containers have incorrect weight information, which can lead to safety issues and operational problems.

By identifying these misdeclarations, Pondus helps terminal operators prevent safety incidents and avoid potential accidents. This not only ensures compliance with regulations but also enhances safety during transport. Overall, the solution has made a noticeable impact in reducing misdeclared weights and promoting safer operations in the supply chain.

LINK: <https://www.cindicium.com/>



5. CU Phosco

an in-tension wire rope system, allowing lighting maintenance operations to be undertaken safely at ground level

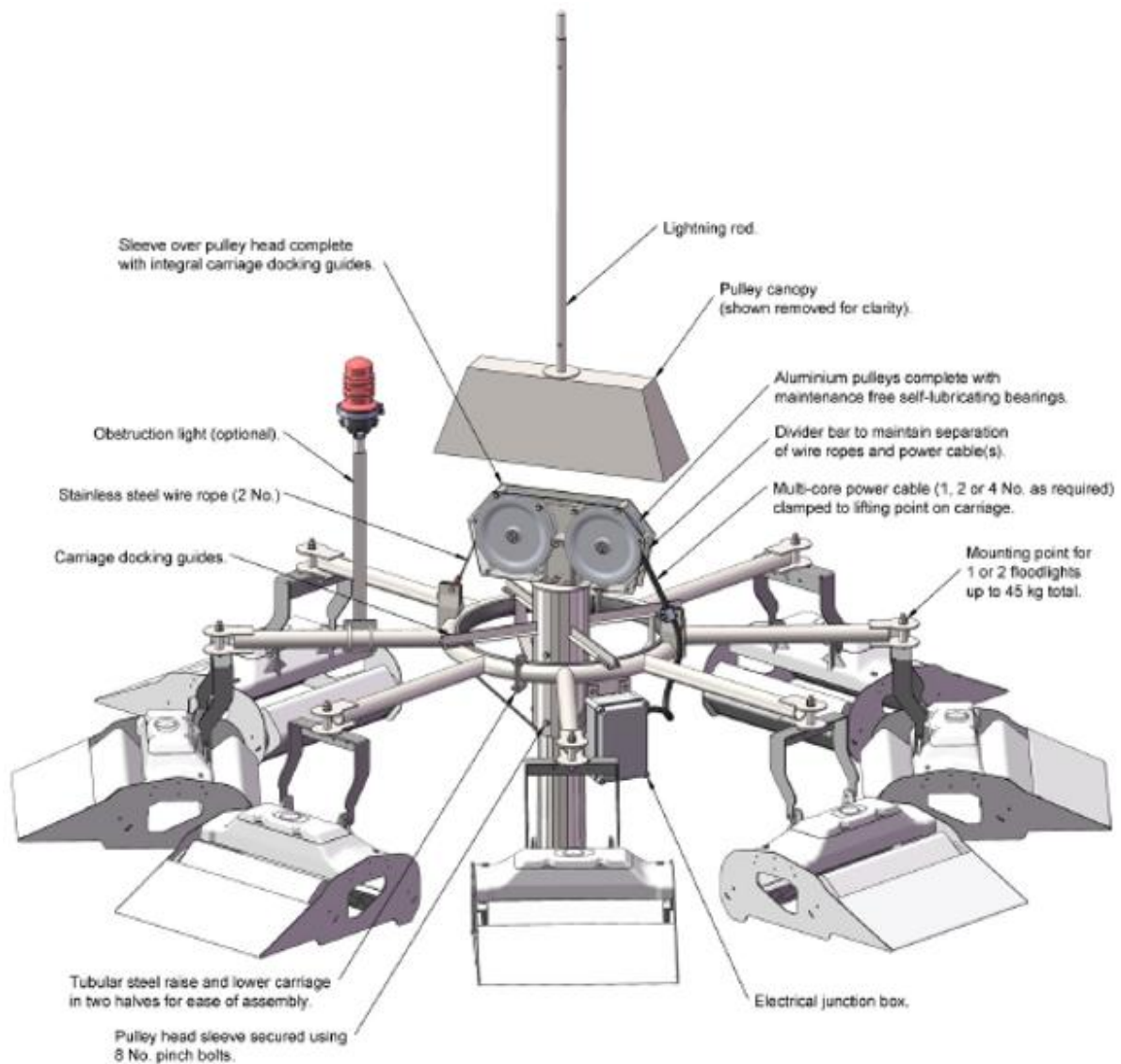
the challenge

High masts can reach heights of up to 60 metres, presenting significant safety risks during maintenance and operation. Traditional high mast systems often require technicians to work at elevated heights, which can be both dangerous and costly, or rely on a raise-and-lower mechanism which traditionally feature a latch that locks the headframe in place to support the luminaires (when raised). However, customer feedback revealed that these systems frequently get stuck due to accumulated, dirt, bird droppings, salt and dust. As a result, even routine maintenance often requires costly, high-access equipment to manually dislodge the stuck carriage, increasing maintenance downtime and exposing workers to potential safety hazards. The CU Phosco In-Tension Raise & Lower High Mast system was designed to address these safety issues head-on. By eliminating latches altogether and using an in-tension wire rope system, all operations occur safely at ground level, drastically reducing the risk of accidents. This in-tension design also allows for targeted operational closures, only affecting the area directly around the mast and limiting the impact on surrounding operations. The result is a maintenance solution that puts safety and efficiency at the forefront, addressing common industry challenges related to high-access maintenance.



the innovation

The CU Phosco In-Tension Raise & Lower High Mast system is a groundbreaking solution for high mast lighting that entirely removes the need for work at elevated heights. Unlike traditional systems that use latches, this system relies on in-tension stainless steel wire ropes holding the luminaire carriage at the top. With no latches, there are no mechanisms to get stuck—a common issue in high mast systems due to dirt, dust, salt, sand and other environmental factors. This smooth, single-action design allows for the carriage to be lowered or raised without obstruction, making maintenance far simpler and safer. Additionally, the system features a patented in-tension winch installed at the mast base which can be operated remotely, further reducing the need for technicians to access high-risk areas. Its adaptable design, suitable for confined spaces and various mast heights, offers a reliable and low-maintenance solution for ports, airports, industrial sites, and other large-scale high mast applications.



how it was implemented

The CU Phosco In-Tension Raise & Lower High Mast system was implemented with a focus on accessibility, safety, and ease of operation. Installation involves placing an in-tension winch at the mast base, eliminating the need for latches, clutches, or brakes, and relying on self-sustaining wire ropes to secure the luminaire carriage. The system's design allows the carriage to move over pulleys at the mast head, a smooth action supported by the wire ropes without additional mechanical supports that could become jammed. Technicians operate the system using a lightweight, reversible power tool that includes a torque-limiting device for controlled lowering and raising of the carriage. A remote-control switch allows operation from a safe three-metre distance, keeping personnel at ground level. This approach can be seamlessly integrated into our high masts, with all components factory-prepared making setup straightforward, safe, and time-efficient.



result

The CU Phosco In-Tension Raise & Lower High Mast system has transformed high mast maintenance by prioritising safety, reliability, and ease of use. Since its implementation, users have reported significant safety improvements due to the ground-level operation, which eliminates any need for high-access maintenance. The In-Tension design keeps wire ropes stable and healthy, reducing wear and tear and lowering long-term maintenance costs. Operational disruptions have been minimised, with area closures now limited to the immediate mast surroundings rather than large areas of operational space. Additionally, the absence of latches has removed the common problem of jammed mechanisms, meaning maintenance is smoother, faster, and more predictable. Clients, especially in high-traffic environments such as ports and airports, have praised the system's efficiency and reliability,

noting that it has significantly reduced maintenance-related downtime and created a safer work environment for personnel.

conclusion

The CU Phosco In-Tension Raise & Lower High Mast system is a meaningful advancement in high mast technology – see animation: <https://youtu.be/CLT8gmvRk7U>.

This low-cost innovation enhances safety in high mast applications by tackling height-related risks and latch malfunctions. With a patented latch-free design, it eliminates costly high-access work, allowing maintenance safely from ground level using a mobile power tool—even in confined spaces. This system not only meets but exceeds industry safety standards, setting a new benchmark for high mast systems worldwide. We're proud to provide a safer, more efficient solution that improves operational reliability in critical environments.

Dustin Nedohin, Business Developer, Elec-Tech Sales Ltd, commented: "We have been installing CU Phosco's raising and lowering systems in Canada since 1992. The worm gear winch system offers clients huge safety advantages as there is no work at elevated height and fewer fail points. The unique system does not require latches that often get jammed on site. When latches jam up, personnel in the field must go up 30m or 40m in a boom to un-jam them. The CU Phosco solution keeps operators safely on the ground. Their system is easy to use, simple, safe, and reliable"



LINK: <https://www.cuphosco.com/>



6. ERBIS

supply chain optimization software

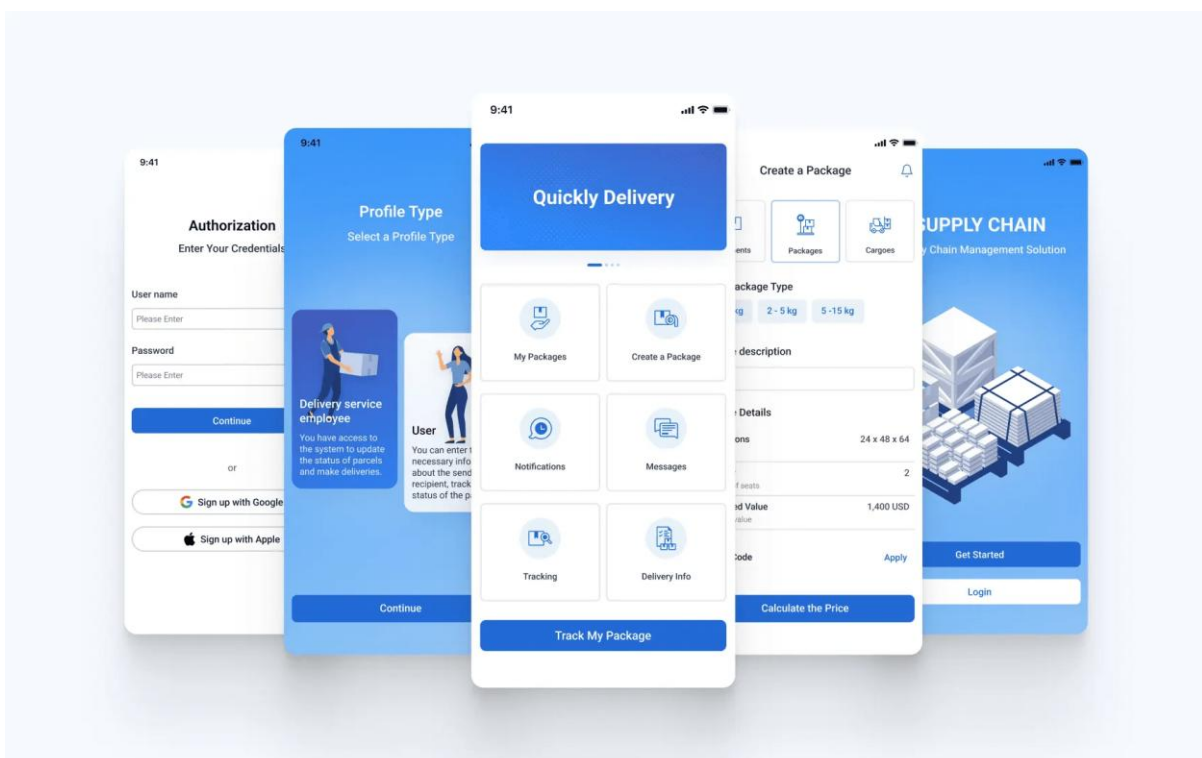
the challenge

Our client, a cargo logistics provider in San Francisco, faced growing safety risks due to their outdated supply chain management software. The legacy system struggled to handle escalating data volumes. It eventually created potential for security vulnerabilities that could compromise customer data and logistical operations. This given, inefficiencies in data handling and user limitations threatened real-time visibility, increasing the chances of delayed shipments, missed compliance checks, and cargo mismanagement, all of which could pose safety hazards. What we actually did was a comprehensive system upgrade to establish a safer, more reliable, and proactive solution that mitigates risks, protects sensitive data, and ensures secure cargo handling.

the innovation

Erbis delivered a cutting-edge supply chain software solution that introduced real-time tracking, automated compliance checks, and advanced analytics for enhanced cargo safety and logistics management. Our new app is built on a microservices architecture, the new system supports high fault tolerance and scalability, which are crucial for safe, uninterrupted operations.

Our solution integrates with more than 40 carriers, providing a cohesive view of shipment data and risk alerts. Key features, including personalized dashboards, real-time notifications, and role-based authorization, empower users to monitor shipments proactively, optimize routes, and maintain strict safety protocols.



how it was implemented

Our development process commenced with an in-depth assessment of the client's needs and logistics challenges. Through collaborative design sessions, we crafted a roadmap that incorporated a shift to microservices architecture, enabling fault tolerance and high scalability. REST APIs were developed for seamless data migration and enhanced functionalities, such as new web forms for cost comparisons across carriers. During implementation, we ensured continuity by supporting existing platforms while introducing advanced tech features. This systematic approach allowed for a smooth transition, minimizing disruption and establishing a robust, safety-oriented system.

result

The new solution transformed our client's logistics operations, resulting in measurable safety and efficiency gains. Operational downtime was effectively eliminated, and real-time tracking minimized the risk of cargo mishandling. Automated compliance checks and data encryption protocols enhanced data protection, supporting industry standards. Users reported a decrease in manual errors and improved response times, directly contributing to safer, faster cargo delivery. Additionally, the system's self-service portals and dashboards improved transparency, reducing support calls and empowering customers to make informed, safety-conscious decisions.

conclusion

Erbis' software modernization project not only addressed the immediate safety concerns of our client's cargo logistics operations, but also ensured sustained operational resilience. Both architecture and real-time data integration capabilities significantly improve risk management and set a benchmark for secure logistics in the industry (we do hope so). With over a decade of expertise in supply chain and logistics software, Erbis continues to prioritize safety innovations that enhance operational integrity, empower users, and secure the movement of goods.

LINK: <https://erbis.com/>



7. FIRE-CONTAINERS LTD

fire safety and electric vehicle containment units with integrated fire detection and recirculating fire suppression

the challenge

Transporting lithium-ion batteries (Lib) or Electric vehicles by sea freight presents several dangers, including the risk of fire and explosion due to thermal runaway, especially if the batteries are damaged or defective. This is exacerbated by the confined environment of a ship, where a fire can spread quickly and cause catastrophic damage leading to total loss scenarios. Lithium-ion batteries are also prone to overheating, which can be triggered by physical impact or exposure to high temperatures during shipping.

The Fire Safety Containment Unit (FSCU) and Electric Vehicle Containment Units (EVCU) developed and patented by Fire Containers limited have been specifically designed to mitigate these risks by providing a secure fully self-contained containment system with integrated fire detection and recirculating fire suppression. It safely stores, monitors and transports Lib batteries (or other flammable substances). Both the EVCU and FSCU contain onboard water tanks and high-pressure water misting systems which filter and recirculate the onboard water back into the firefighting systems.

It is vitally important to detect these fires at an early stage of development and the units fire suppression capabilities rapidly extinguish flame development and cool all cargo within the unit preventing any fire spread inside the units and ensuring the safety of the ship and crew.

The FSCU and EVCU significantly reduces the dangers associated with transporting lithium-ion batteries and electric vehicles by sea freight and provides early warning to crew in the event of an incident.



the innovation

The FSCU is designed to enhance operational tactics by providing a specialised solution tailored to the unique challenges posed by Lithium-ion battery (Lib) incidents.

The Fire Safety Containment Unit (FSCU) offers significant safety benefits in detecting and managing Lib fires. One of the primary advantages is its ability to prevent the spread and reignition of fires, which is a common risk with Lib fires. The unit is equipped with a built-in detection system, fire suppression system and water supply, allowing it to safely contain and extinguish flame immediately on detection and prevent further fire spread. Additionally, all firefighting water is contained within the unit protecting emergency responders, crew and the environment from further toxic hazards.



The EVCU, specifically designed for vehicles, provides a secure environment to transport, and store electric vehicles, minimising fire risks and providing immediate deployment of firefighting capabilities on detection of a fire.

Both units enhance safety and operational efficiency by addressing the unique dangers of lithium-ion batteries. Also, current firefighting tactics on ships relies on applying hundreds of thousands of litres of water to try and contain these types of fires but due to the early detection and recirculating capabilities of the units then very little onboard water is required to control a fire as the principal firefighting tactic is the production of steam to control fire development.

In summary, the FSCU and the EVCU offer a comprehensive solution for safely managing and mitigating the risks of Lithium-ion battery fires.



how it was implemented

In 2023 I was getting regular requests from fire services across the United Kingdom asking how they could effectively deal with electric vehicle (EV) incidents which were becoming more frequent.

Following research, we noticed a disconnect in what vehicle manufacturers were stipulating and what companies were producing to deal with the problem. Namely, vehicle manufacturers were saying do not submerge their Lithium-Ion batteries (Lib) and equipment manufacturers were building 'Submersion' type units to submerge vehicles in water if they had been involved in fire.

The Electric Vehicle Containment Unit (EVCU) was designed by a team combining expertise from the fire and rescue services, design engineering, and the vehicle recovery industry. We aimed to address the unique challenges posed by electric vehicle fires, particularly those caused by lithium-ion battery failures. The design incorporated a mobile containment system with fire suppression and a water supply to provide high pressure water misting to fight the flame front without submersion of the battery packs whilst also cooling the battery packs at the same time and slowing the thermal runaway process.

The EVCU was designed, built and implemented for first responders and vehicle recovery teams to mitigate fire risks during incidents and now remains the only operational unit of its

type in the UK and is deployed on a regular basis for the removal of electric vehicles following accidents or fires.

Since the implementation of the EVCU the Fire Safety Containment Unit (FSCU) has also been developed for safe transport of Lithium-ion batteries.



result

The benefits of Electric Vehicle Containment Units (EVCUs) and Fire Safety Containment Units (FSCUs) are substantial for both safety and operational efficiency. EVCUs are specifically designed to handle electric vehicle (EV) fires, particularly those caused by lithium-ion battery malfunctions. They provide a controlled environment to recover and transport damaged EVs, reducing the risk of fire reignition and ensuring safe handling during and after an incident.

FSCUs are more versatile, addressing the challenges of safely transporting lithium-ion batteries, especially by sea freight. With built-in fire suppression systems and secure containment, FSCUs prevent the spread of fires during transit, mitigating potential hazards to the ship, crew, and cargo. Both units safeguard responders, recovery teams, and the surrounding environment by isolating the fire risks, providing essential protection in high-risk situations.

In addition to improving safety, these units enhance operational efficiency by offering a specialised, reliable solution tailored to modern challenges posed by electric vehicles and lithium-ion batteries. This minimises downtime, reduces the potential for secondary incidents, and ensures that fires are swiftly controlled.

Overall, EVCUs and FSCUs play a crucial role in modern fire management, ensuring the safety of personnel, infrastructure, and the environment.



conclusion

As global lithium battery use rapidly increases, driven by the rise of electric vehicles (EVs), renewable energy storage, and consumer electronics, the roles of the Electric Vehicle Containment Unit (EVCU) and Fire Safety Containment Unit (FSCU) become increasingly crucial. Both units help manage the unique safety challenges posed by lithium-ion batteries, which are prone to thermal runaway and fire risks.

The EVCU ensures safe containment, recovery, and transportation of EVs after accidents, minimising fire hazards caused by damaged batteries. As EV adoption expands, the EVCU provides essential protection for first responders and the public.

The FSCU plays a key role in safely transporting lithium-ion batteries, particularly in sea freight and storage applications, preventing battery fires and ensuring safe transit across global supply chains. Both units contribute to creating safer, more secure battery transport and management systems, addressing the growing risks associated with the widespread use of lithium batteries.

With the continued proliferation of battery-powered technologies, the EVCU and FSCU are essential to mitigating fire hazards, protecting lives, and ensuring the safe and efficient handling of lithium batteries worldwide.

LINK: <http://www.fire-containers.com/>



8. Fraunhofer Center for Maritime Logistics

combining AR and VR technology to remotely support ship captains with the expertise of a shore-based pilot

the challenge

According to International Maritime Pilots' Association (IMPA) data, approximately 19% of pilot transfers in European waters fail to comply with safety regulations. A particular concern is the non-compliant pilot ladder arrangements, which contribute to deadly accidents.

RePO MAN (Remote Pilotage – Operational, innovative and Manageable Alternatives for Navigation routines) addresses this safety challenge by developing a mixed reality solution that enables pilots to provide their expertise without physically boarding vessels. The project tackles several key safety issues:

1. Elimination of physical transfer risks by allowing pilots to operate remotely
2. Maintenance of crucial situational awareness through advanced AR visualization
3. Enhancement of communication between pilots and shipmasters using intuitive visual interfaces
4. Provision of real-time navigational data overlay in the pilot's field of view

The project particularly focuses on maintaining the high level of situational awareness necessary for safe navigation while removing the physical risks associated with pilot transfers. This innovative approach not only protects pilots' lives but also ensures continuous access to vital pilotage services in adverse weather conditions where traditional pilot transfers might be deemed too dangerous.



the innovation

RePO MAN implements a mixed reality solution for remote pilotage, integrating Augmented Reality (AR) and Virtual Reality (VR) technologies to create remote navigation support between vessels and shore-based pilots. The system fuses two primary components:

Ship-side: An AR application utilizing Microsoft HoloLens 2 displays navigational information in the crew's field of view. The system processes real-time AIS data, calculating relative distances and bearings to surrounding vessels. User interaction is implemented through hand

tracking, enabling access to vessel information without physical controllers. The interface design maintains natural visibility while providing essential navigational data.

Shore-side: The pilot's workspace incorporates a VR environment receiving real-time 360-degree video feeds from ship-mounted cameras. This visual input is integrated with navigational data and electronic charts within the virtual space. The system processes and displays AIS data, radar information, and environmental parameters to maintain situational awareness.

The communication framework combines VoIP technology with visual interaction tools. The system enables pilots to designate points of interest and provide visual guidance through markers and indicators that appear in the crew's AR display. These elements are spatially anchored and maintain correct positioning relative to the vessel's movement.

how it was implemented

The implementation process followed a systematic approach spanning development and testing phases. The system utilizes MQTT protocol for data transmission, enabling real-time AIS data flow between ship and shore systems. On the ship side, the AR application was developed using Unity 2022 LTS with MRTK3 integration for HoloLens 2 compatibility. The shore-based VR component incorporates 360-degree camera feeds with Unity-based visualization of navigation data.

Initial development focused on hologram positioning algorithms, adapting the spatial anchoring system for maritime use.

Field implementation involved installation of 360-degree cameras above the ship's bridge, establishment of secure data transmission channels, and integration with existing ship systems. The implementation process included systematic testing of latency, data accuracy, and system reliability under various operational conditions.

result

Testing demonstrated successful data integration and visualization in both AR and VR environments. The system achieved consistent hologram positioning accuracy and maintained stable data transmission during operational testing. Latency measurements showed acceptable performance for real-time navigation support, with AIS data updates matching industry standards for update frequency.

Qualitative assessment by experienced pilots indicated that the system maintained required levels of situational awareness for remote navigation support. The AR interface demonstrated reliable gesture recognition and data presentation in varying light conditions. Shore-based pilots successfully executed navigation guidance using the VR interface while maintaining effective communication with onboard crew.

The system showed particular effectiveness in controlled testing environments, providing a foundation for further development in actual maritime conditions. Testing also identified areas for future optimization, particularly in extreme weather conditions and high-traffic scenarios.

conclusion

The development and testing of RePO MAN demonstrates the technical feasibility of mixed reality solutions for remote pilotage operations. The system establishes a framework for reducing physical risks in pilotage while maintaining operational effectiveness. Results indicate that mixed reality technology can effectively support remote navigation assistance while preserving essential elements of pilot-crew interaction.

Key limitations include the need for reliable high-bandwidth communication infrastructure and the system's dependence on environmental conditions for optimal performance. Future development should address these constraints and expand testing across diverse maritime scenarios and vessel types.

LINK: <https://www.cml.fraunhofer.de/en.html>



9. GCT GLOBAL CONTAINER TERMINALS

stack analysis to determine maximum wind force that containers can withstand at different heights and positions

the challenge

In 2020, GCT Canada identified the need to refine the wind policy at Deltaport. GCT Deltaport is exposed to largely unobstructed Pacific Ocean winds via the Strait of Juan de Fuca. Wind delays had a significant business impact on operations and customer service, and most importantly, safety.

Prior to implementing a comprehensive wind policy, operations lacked clear references, leaving unplanned shutdowns as the only course of action. Even with precautionary shutdowns in place, sudden wind gusts could still create unexpected challenges. Adding to these challenges was the terminals transition to a new yard planning model that does not allow the isolation of empty containers, empty containers being a higher risk to slide or topple. Empty containers can fall into roadways and other areas of operations causing damage and hazard to personnel.

With this wind system upgrade, GCT now benefits from a more accurate wind forecasting model, enhanced insights into which containers and areas are most vulnerable to wind, and an intuitive risk visualization tool available to operations. By anticipating severe winds the day before, operations can proactively plan for early shutdowns and keep people clear from potentially unstable containers. The improved wind system allows GCT to base its wind response decisions on data rather than reactive measures.

Additionally, the system's real-time alerts provide enough lead time to notify incoming vessels of potential delays, allowing for better preparation and minimizing the overall impact on customer service. Ultimately, this upgrade enhances both safety and customer service.

the innovation

Deltaport's operational equipment has been designed with wind resilience in mind, but empty containers remain vulnerable to strong gusts. To tackle this risk head-on, GCT developed the Site Wind Analysis and Monitor (SWAM)— - by cross-referencing a dynamic container stack analysis model fed by GCT's TOS (Terminal Operating System) with advanced wind forecasting technology.

The stack analysis determines the maximum wind force that each container can withstand at different heights and positions in 16 cardinal wind directions. The hourly wind speed and direction forecasting model tailored for Deltaport is 7% more accurate than other sources, and is considered reliable for advanced shutdown planning. This level of precision supports planning and yard reorganization, giving operations the lead time and foresight to keep workers out of harm's way.

In SWAM, a color-coded system is used to display warnings and alerts, enabling operators to monitor conditions closely and take immediate, informed action as needed. This system

allows close observation and proactive response. With the included Sandbox module, teams can simulate container adjustments, test responses, and ensure the safest possible yard configuration ahead of gusts. By enabling real-time risk visualization and proactive mitigation, SWAM is a game-changer for safety at Deltaport. An auxiliary benefit of this analysis is the cross checking of physical stacks and known positions in TOS. If a container is lost or out of place there is an exception/alert list used until the issue is rectified in TOS.

how it was implemented

GCT partnered with the Weather Forecast Research Team (WFRT) at the University of British Columbia (UBC) to improve wind speed and direction forecasts for Deltaport. The WFRT combined the outputs of multiple diverse models and averaged them to minimize potential errors. WFRT's new offering included the maximum wind speed predictions from all models for any given day, allowing GCT to act proactively to gusts.

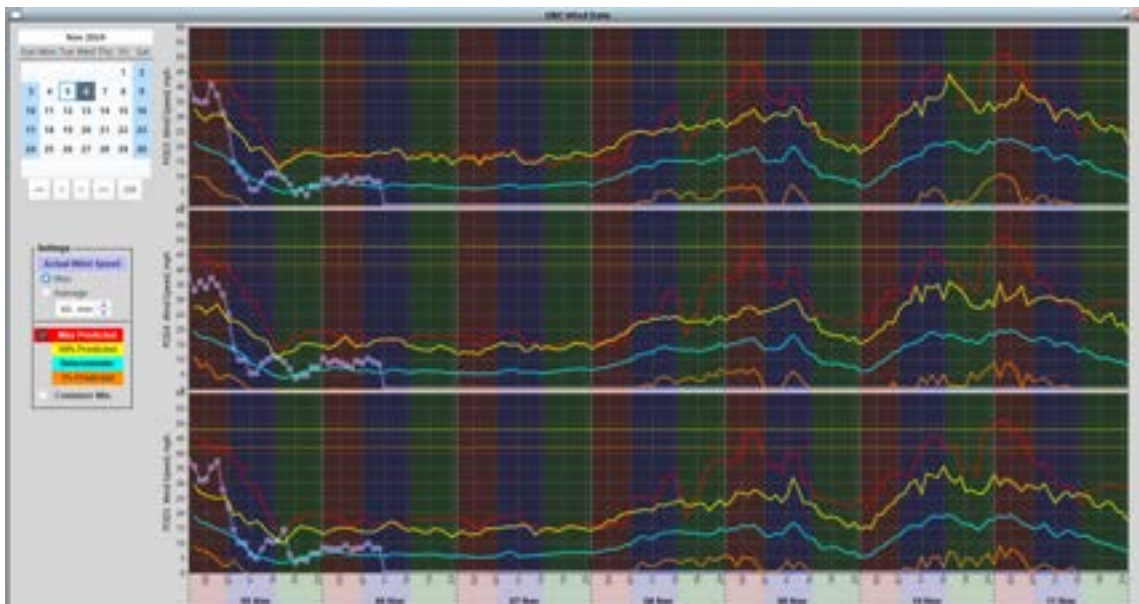


Figure 1. Wind Forecasting and Real-Time Monitoring

CPA Engineering assisted GCT in developing a software tool that analyses the stability of over 18,000 containers on site, assessing both sliding and toppling risks. Considering Deltaport's proximity to a coal-handling operation, the impact of coal dust was also factored into the analysis. An innovative friction test was designed to measure the coefficient of friction between standard shipping containers. GCT can now calculate stack stability on all containers in the terminal with all possible wind directions per container.

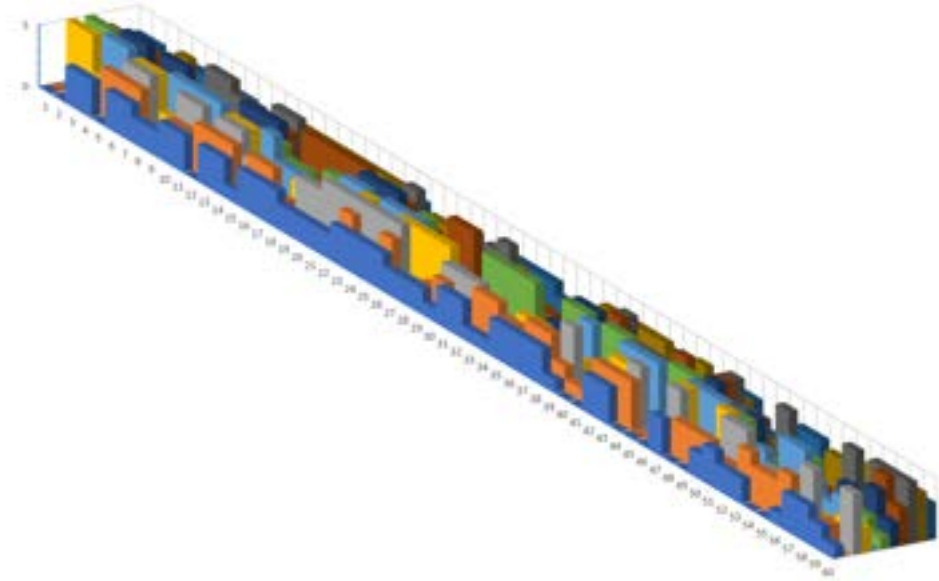


Figure 2. Digital Twin – Stack Profile Simulation

To capture real-time wind data, three new ultrasonic anemometer systems were installed in each yard, positioned to avoid wind obstructions. This data directly feeds back into the WFRT’s computing model, which continuously improves forecast accuracy. The wind data can be played back in the software for historical analysis on events after the fact. A real-time sandbox mode offers a virtual environment for testing risk mitigation strategies, where operations can simulate container movements, experiment with different adjustments, and identify actions that can eliminate risks. The analysis model runs every 10 minutes or on demand using the same yard stack data GCT’s TOS uses to run the operation.

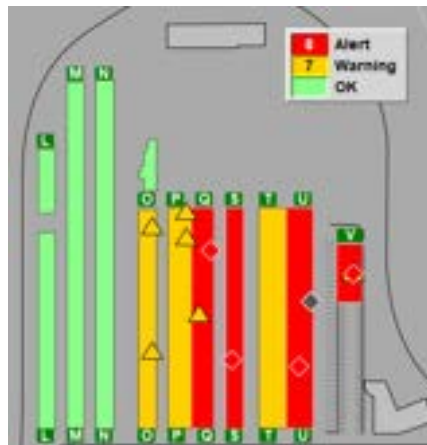


Figure 3 Location Illustration of Containers in Risks



Figure 4 Integrated SWAM System

result

The implementation of the upgraded wind system at GCT Deltaport has significantly enhanced both operational safety and customer service. By integrating advanced forecasting technology, container dynamics studies, and real-time wind monitoring, GCT has shifted from reactive measures to a proactive, data-driven approach in managing wind-related risks. This transformation has been instrumental in preventing potential safety incidents, such as toppling or sliding containers, which pose serious risks to personnel, equipment and customer cargo.

Validity of the model was proven early on in the development of the stack analysis tool. A container was toppled in a stack during a high wind event. The model accurately predicted the wind speed at which this would occur. At this time our terminal was shut down from high winds and so no injuries or near misses were observed but it was a good opportunity to put the software to test and run it through our historical analysis.

With the ability to predict severe weather conditions ahead of time, GCT has successfully reduced the likelihood of wind-related accidents, allowing for well-coordinated shutdowns and adjustments to container placements. These safety measures are not only preventing accidents but are also providing workers and operations teams with the necessary time and information to take appropriate actions, such as evacuating vulnerable areas, securing containers, and ensuring that operations resume safely after severe conditions subside.

conclusion

Managing Deltaport's unpredictable weather has led to a breakthrough in safety assurance, while also improving customer service and contributing to academic advancements. GCT.

views this as a project well worth ongoing enhancement, having established a solid foundation but recognizing areas for future development. The collaboration with the University of British Columbia's Weather Forecast Research Team has also paved the way for further innovations in safety, including the potential integration of AI and machine learning to refine the forecasting models.

Safety is at the heart of every decision and development at GCT, and we are committed to continuously improving our wind risk management strategy. As we move forward, we will continue to gather user feedback, refine our systems, and explore new technologies to ensure the highest level of safety for our team members, customers, and operations. This ongoing focus on safety and innovation reinforces our commitment to operational excellence and the well-being of everyone at our terminals

Additionally, GCT is developing a user manual for this wind risk monitoring software, with the goal of creating a highly intuitive UI that allows operations to use the system to its potential. We are actively gathering feedback from users to refine the software and improve its functionality. At GCT, safety remains our top priority. Stay tuned for updates on our continued progress.

LINK: <https://globalterminals.com/about/about-us/>



10. International Tank Container Organisation (ITCO)

technical guidelines covering safety, intermediate inspection and testing, tank sustainability, repurposing and recycling, seals and gaskets

the challenge

As a completely novel piece of transportation equipment, the tank container presented a completely new set of challenges to manufacturers, operators, and regulators.

The new safety challenges included working from height, entry into confined spaces, handling hazardous cargoes such as polymerizing substances, and disposal of waste from the cleaning process to name but a few.

the innovation

Over the past 25 years ITCO has continuously sought to improve the safety, sustainability and efficiency of the tank container, and promoted these benefits to the user community and regulators. ITCO embarked on a long-term project to develop Technical Guidelines covering these safety aspects, as well other topics including Intermediate Inspection and Testing, Tank Sustainability Repurposing and Recycling, and Seals and Gaskets.

ITCO is currently working on a project to develop a Depot Audit and Assessment Scheme to raise the safety and environmental standards of container depots around the world. The Technical Guidelines are aimed at providing support to tank operators and service providers in order to improve safety performance for employees working within the industry.

In addition, the ITCO E-learning Tank Container Course offers several significant benefits for professionals in the tank container industry. The course provides comprehensive, self-paced learning, enabling participants to gain in-depth knowledge about the safe and efficient handling, transportation, and maintenance of tank containers.

The course also covers the technical aspects of tank containers, such as the types of containers, their design features, and the various safety measures required for their use. This ensures participants are well-versed in the technicalities of handling hazardous and non-hazardous goods, which is critical for compliance with legal and environmental regulations.

Moreover, the ITCO E-learning course is an excellent way to stay updated on industry advancements. As technology and regulatory frameworks evolve, the course material is regularly reviewed to ensure it reflects the latest industry standards.

how it was implemented

As a relatively small industry association, with limited financial and human resources, ITCO had to rely on the resources contributed by its members participating in targeted industry Work Groups. ITCO was able to support part-time consulting resources comprising mostly retired technical experts who could drive the development and lead the Work Groups. However, without this committed, professional leadership and support the results would have been delayed, or less productive.

result

ITCO has the Vision of being the Tank Container industry association of choice by 2030. We have demonstrated value to our members' around the globe, and today have approximately 180 members from all stakeholders in the industry. The technical guidelines developed by ITCO have achieved general acceptance as being the industry standards for safety and operational performance, and ITCO members proudly show the ITCO logo on their websites as a demonstration of the standards being employed.

conclusion

ITCO is constantly striving to improve performance in the areas of safety, sustainability and efficiency. The equipment is manufactured to the highest standards, and the current Digital Twin project is designed to ensure the highest levels of data integrity at the time of custody transfer of equipment between stakeholders in the tank container eco-system. If there are any questions about the safety standards of tank containers, we have attached three photographs





The three photos were taken after the 2015 Tianjin disaster. The photos showed that three tanks had been exposed to extreme heat which completely melted the aluminium walkways, distorted all the carbon steel frame work, and destroyed the insulation material and cladding. Once the tanks had been lifted from the wreckage and taken to a nearby yard they were inspected. The product was still in the tanks and they had not leaked. Although the product inside had been badly damaged by the intense heat, the tank shell had not leaked!

LINK: <https://www.international-tank-container.org/>





11. International Transport Workers Federation/ITF Seafarers Trust

occupational safety and health in ports App to help port workers to be safer and healthier at work, whilst strongly promoting worker participation in all occupational safety and health activities

the challenge

Port workers in the Arab World region were experiencing a high level of serious accidents and fatalities due to poor infrastructure, working with old or damaged equipment, a lack of health and safety policy and training. There was also a lack of consultation on these matters between the management and the workers. The ITF Seafarers' Trust were initially contacted by the ITF affiliated unions in the region for assistance and, together with the ITF Dockers' Section, met to discuss a way forward. The outcome was to develop a course that would train workers on the fundamental principles of occupational safety and health in a port environment. Following evaluation of the initial project, and given the enthusiasm of participating unions, a second iteration of the training was developed; this time an app-based approach with a clear focus on the port environment.

Plans to hold workshops in the region were derailed by Covid-19, instead we shifted our attention to creating new language versions for Latin America and the Caribbean.

Whilst the circumstances in this region are very different, in many ways they share the same challenges around occupational safety and health and had a similar desire to address them from the 'shop floor'. Learning from the Arab World experience, we developed an accompanying Trainers' Manual and rolled out the project during the first quarter of 2024 holding a series of three Training the Trainer (TtT) workshops for representatives from 19 countries from the region.



the innovation

The OSH Ports App aims to help port workers to be safer and healthier at work and strongly promotes worker participation in all occupational safety and health activities.

The overall goal is fewer injuries and fatalities and an increase in worker participation in OSH activities at all levels in ports and terminals.

Written by a leading industry expert, it was reviewed and revised by the ITF Dockers' Occupational Safety & Health Working Group (DOSH) of leading trade union OSH specialists from across the globe. It is based on the best industry research and practice and can also support existing workplace training initiatives.

It consists of 5 Modules:

- Module 1: Introduction to OSH Ports.
- Module 2: How and Why Things go Wrong.
- Module 3: Hazard Identification and Risk Assessment.
- Module 4: How to Control Risk.
- Module 5: Information and Communication.



Participants must successfully complete assessments at the end of each module to progress through the app and pass a final assessment to receive a certificate on completion.

The course is supported by the International Training Centre of the International Labour Organisation (ITCILO).

As well as the training modules, there is a link to videos of workers' personal experiences of health and safety incidents in their workplaces within their regions.

It is aimed at all port workers, not just health and safety representatives, and is available in English, Arabic, Spanish and Portuguese. The project includes a Trainers' Manual, publicity material, support with stakeholder engagement and TtT workshops.

how it was implemented

The OSH Ports App was originally developed to be used individually on a mobile phone or laptop. It was launched through participating unions in the Arab World in February 2020 where it reached over 1,400 registered users, of which some 300 went on to complete at least one module and 66 completed the training and received certificates. We were able to actively monitor and report on participation which led us to conclude that more support around delivery was needed – hence the trainers' manual and TtT workshops.

We asked our unions in the region to select certain individuals with a responsibility for health and safety and the capacity to train their co-workers to receive the training via a workshop where upon completion they would receive a certificate supported by the ILO Training Centre in Turin.

From January 2024 the training in Latin America and the Caribbean was delivered via workshops in Barbados, Argentina, Brazil and Panama by staff from the Dockers' Section and Seafarers' Trust.



This face to face training allowed for more in depth engagement on the subject as well as support with technical problems. This approach has resulted in a much higher activity and certification rate relative to registration

result

The initial result in the Arab World was that a large number of participants used the app and this has led to an increase in awareness of health and safety and a basic understanding of identifying hazards and risk in the workplace.

The result of our training workshops in Latin America and the Caribbean was that all 59 participants successfully completed the course and received their certificates.

Several of our participants have now completed training of other workers in their ports or have presented the training to their local management with a view of implementing the training in the coming weeks. One success story is in Barbados where the Barbados Workers Union have delivered 5 training workshops in the port of Bridgetown to 49 port workers from all categories of staff, including management.



Before the training the port workers had little or no involvement in assessing risk and implementing control measures at the port but since the training workshops the participants are working together with management to identify hazards, assess risk and implement effective control measures. This has led to a closer working relationship between the port workers and management and a change of culture in the workplace with workers being more confident to raise issues of health and safety and report hazards and near misses.

conclusion

The OSH App was successfully launched in the Arab World in 2020 and since then we have expanded the offer to Latin America and Caribbean with Spanish and Portuguese versions along with a trainers' manual and training workshops. The latter were delivered in the Latin America/Caribbean region where we continue to support our unions in these regions to train other workers in their ports. In total we have directly trained 59 workers from 19 countries from the 4 workshops held across the Latin America and Caribbean region and we are seeing some really great results and a real change in improving the working conditions and attitudes of our affiliates towards health and safety in their ports.

Whilst holding the training sessions we also developed network groups between the participants where they can share ideas, experiences and incidents that have occurred at their ports and also ask questions of each other and the ITF.

In 2025 we will be going back to the Arab World region to deliver 3 training workshops to further develop and support our unions there after the success we had in Latin America.

In 2026 we plan to expand the project to Africa and in 2027-28 will take the training to Turkey. This will mean translating the app into new languages and updating the app to take in some of the feedback we received from the participants during the training.

LINKS:

<https://oshports.org>

<https://www.itfglobal.org/en>

<https://www.seafarerstrust.org>



12. KALP GmbH

automatic lashing platform that inserts and removes twistlocks and stackers fully automatically, eliminating the need for personnel work near or under suspended loads

the challenge

Even in the most modern container terminals, twistlocks and stackers are still removed from or inserted into container corners by hand. And this despite the fact that the manual lashing process has long been identified as one of the last major safety risks in terms of work safety.

Both work in the travel area of horizontal transport under the gantry crane and work under suspended loads repeatedly result in serious injuries to stevedores, including death.

Numerous attempts to develop technology to eliminate the need of personnel working in the vicinity of suspended loads have been made during the years but with no or limited success.

the innovation

The ALP (Automatic Lashing Platform) is the only system on the market that can insert and remove twistlocks and stackers fully automatically, eliminating the need for personnel to work nearby or under suspended loads. The ALP operates independently of external power supply through an internal hydraulic system that utilizes the weight of the container and spreader.



It has magazines that store over 1,000 twistlocks or 2,000 stackers (depending on sizing). This is equivalent to a bay of an Ultra Large Container Vessel.

The ALP can also be monitored and operated from a safe distance by integrating it into the terminal's own network and the corresponding integration software, or by using a handheld device.



how it was implemented

The ALP was integrated into a German terminal in Aug. 2021 and is used there in real operation. To ensure error-free handling, the relevant terminal employees (gantry crane and horizontal transport drivers) were instructed by KALP GmbH in the use of the ALP.



result

During the deployment of the ALP, there is no longer any need for personnel to be on duty under the gantry crane with suspended loads. In addition, an increase in productivity was observed during operation.

The general acceptance of terminal operators and employees working with the ALP (gantry crane and horizontal transport drivers) was also observed.

conclusion

In order to really fully automate a modern container terminal and, above all, to fulfil all safety aspects, the use of employees in the hazardous area under the gantry must be eliminated. The ALP has shown that it is possible to operate without the need for employees to be next to suspended loads. This means that the ALP closes the last remaining gap in terminal automation and one of the last major risks for terminal employees.

In addition, the ALP can be used in any terminal. In modern greenfield as well as existing

brownfield terminals. For running the ALP no changes in the terminal infrastructure are required.

The ALP is the missing link in terminal automation and a huge upgrade for each terminal safety concept!

LINK: <https://www.kalp-gmbh.eu/>



13. Lokistix

temperature-resistant box with a modular inlay, embedded electronics module and cloud-based monitoring and analytics to protect cylindrical, prismatic and pouch cells of all sizes and chemistries during transport and storage

the challenge

With our safe and intelligent packaging solution for lithium-ion batteries (LiB), we combat the dangerous effects of thermal events during transportation and storage. LiBs are classified as dangerous goods because they carry the risk of emitting toxic gases, catching fire or even exploding after an internal short circuit. In logistics, this failure can be caused by manufacturing defects, thermal or mechanical abuse or combinations thereof. Once a battery cell experiences such a thermal event, commonly known as a thermal runaway (TR), it is very likely to infect neighbouring cells, triggering a chain reaction. This in turn is known as thermal propagation (TP). The thermal energy released during this reaction is highly dependent on the chemistry, capacity and form factor of the battery, as well as the type of fault causing the TR. Accidents in the past have resulted in warehouses catching fire, ships sinking, trucks breaking up and, unfortunately, loss of life. Our innovative packaging solution combats both TR and TP of LiB cells during transportation and storage. On the one hand, we reduce the risk of TR to reduce the likelihood of an accident in the first place. On the other hand, we prevent TP, minimizing the impact of a thermal event.

the innovation

The Lokistix LiB cell packaging solution consists of a temperature-resistant box with a modular inlay, an embedded electronics module, and cloud-based monitoring and analytics software integrated into the Internet of Things. Its purpose is to protect cylindrical, prismatic and pouch cells of all sizes and chemistries during transport and storage.



It comes in standard sizes of $\frac{1}{4}$, $\frac{1}{2}$ or an entire Euro pallet ensuring compatibility with existing infrastructure. The box improves cleanliness, as it is sealed off from the environment shielding dirt and particles. The inlay provides passive-preventive cooling through an innovative material that can absorb and dissipate heat in the event of an impending TR significantly reducing the chances of a thermal event. If the malfunction is too severe, and we are unable to stop TR, we have a pressure relief valve that allows the hot vent gases to quickly escape from the box without heating the neighbouring cells, preventing TP. These features significantly increase safety and can lower insurance premiums due to the reduction in incidents.



Our electronics module monitors GPS, temperatures, acceleration, and humidity of the cells, which enables an early warning system for thermal events and increases transparency throughout the supply chain. In addition, cells damaged during transportation can be sorted out immediately upon receipt without having to carry out an incoming goods inspection. This reduces cycle time and the risk of faulty cells in the assembly line. The data can be accessed through our cloud-based dashboard or existing 3rd party systems.

how it was implemented

Our box can be acquired as a product by LiB cell manufacturers, freight forwarders and carriers, original equipment manufacturers (OEMs) or anyone requiring a transportation or storage solution for LiB. As reusable packaging solution, the boxes will circulate between sender and receiver or be used as storage containers in warehouses. The collected data will be made available through our cloud-based dashboard or integrated in existing software such as Enterprise Resource Planning (ERP), Transportation Management Systems (TMS), or Supply Chain Visibility Platforms (SCV). In addition, truck drivers, train drivers, ship captains and airplane pilots as well as the fire department are to be warned immediately via their smartphones if a thermal event occurs. The fast first response is one of the most important factors when it comes to impacts of TR and TP events, which justifies the additional effort. Monitoring, analytics, and alerting software will be a license-based service. Our future

activities will be related to packaging solutions for transport and storage of entire battery modules, packs, and vehicles

result

We are still in the product development and implementation phase of the project and expect to have a prototype by Q1 of 2025 as well as a minimum viable product by Q4 of 2025. This includes testing and verification as well as certification for dangerous goods.

conclusion

We live in a world where the production of LiB plays and will continue to play an important role in decarbonisation. Demand as well as the requirements to power- and energy-density will increase, which consequently leads to more incidents with bigger impact. Regulating bodies such as the national fire protection agency in the United States are working on stricter regulations in regard to safety along the entire battery supply chain. All these trends and developments point towards a huge market to be addressed by the Lokistix battery packaging solution. We are eager to contribute to a safer, more transparent as well as more efficient future of transportation in an uprising industry. Please feel free to reach out at any time to learn more about our solution. We are happy to introduce you to the details of our innovative approach.



LINK: <https://www.lokistix.com/>



14. Melius Italia Srl

smart PPE for detecting falls, tracking motion, and providing contextual awareness, such as worker-down detection or unsafe movements

the challenge

Combining protective gear with advanced smart sensor systems significantly improves worker safety by continuously monitoring worker activity, the environment, and the proper use of PPE.

Sensors embedded in protective clothing and accessories can track important data, such as movement, GPS location and in some cases environmental hazards.

Sensor fusion and machine learning are powerful techniques that form the support of reliable event detection algorithms. These algorithms are designed to eliminate false alarms while ensuring that true threats are accurately identified and addressed, which is vital when making life-saving decisions.

In particular, inertial sensor fusion and IMUs (Inertial Measurement Units) are core technologies in smart PPE. They are used for detecting falls, tracking motion, and providing contextual awareness, such as man-down detection or unsafe movements.

Smart PPE systems are often connected through IoT networks, which offer seamless connectivity and interoperability with other devices and systems in the environment. This integration enables remote monitoring of workers, especially in high-risk environments or when they are working alone, allowing supervisors or safety personnel to respond quickly to potential hazards or accidents in real-time.

the innovation

Miniature wireless sensors with low-power consumption AI algorithms can be seamlessly integrated into PPE without compromising its ergonomics or aesthetics.

This wearable technology should provide protection exactly when and where it's needed most, while also supporting the worker without causing any interference or invading privacy. Achieving this level of technological optimization requires specialized expertise in intelligent sensing, combined with precise garment design and manufacturing.

how it was implemented

As a software-focused distributor, we implement smart PPE systems in several steps:

- **Management Platform:** Create a cloud-based or local dashboard to monitor worker safety metrics, generate reports, and manage risk assessments. Include real-time alerts for supervisors when critical events occur.
- **Connectivity:** Ensure seamless IoT integration for data transmission using protocols like BLE, LoRa or Wi-Fi. Develop customized apps for workers and supervisors to receive updates and alerts remotely.

- **Privacy & Security:** Implement secure data transmission, role-based access control, and ensure your algorithms focus on safety data without compromising worker privacy.
- **User-Friendly Interfaces:** Create intuitive mobile apps that allow workers and supervisors to easily access safety information and alerts without interrupting tasks. Include training tools to ensure proper system use.
- **Testing & Updates:** Conduct pilot programs, gather feedback, and continuously optimize the software for real-world use. Ensure compatibility with sensor hardware and provide ongoing software updates.

By focusing on seamless integration, real-time monitoring, and privacy, you'll enhance the value of smart PPE solutions for your clients.



result

The result of smart PPE systems with integrated software was a significant improvement in workplace safety and operational efficiency. Here are the key outcomes:

- **Improved Worker Safety:** The real-time monitoring capabilities ensured that potential hazards like falls, unsafe movements, and some dangerous environmental conditions were detected and addressed immediately. This reduced the risk of accidents and injuries, especially for lone workers or those in high-risk environments.
- **Efficient Incident Response:** With instant alerts sent to supervisors, safety teams could respond quickly to incidents, minimizing the impact of emergencies. The system's accuracy helped prevent false alarms, ensuring that resources were focused on real threats.
- **Better Compliance and Risk Management:** The platform enabled companies to track PPE usage and ensure compliance with safety protocols. Automated reports and data analytics helped identify potential risks and improve safety measures over time, supporting ongoing risk management.
- **Seamless Integration and Ease of Use:** The software's seamless integration with existing PPE and easy-to-use mobile apps allowed workers to carry out their tasks



without interruptions. The user-friendly interface and training tools ensured quick adoption and effective use of the system.

- **Data-Driven Insights:** The collection of detailed safety data allowed companies to gain insights into patterns and trends, leading to proactive safety improvements. This data also helped in better decision-making for safety investments and protocols.
- **Enhanced Privacy and Security:** Robust data security measures ensured that worker privacy was maintained, building trust among employees. Role-based access control kept sensitive data secure while allowing supervisors to access necessary safety information.

Overall, the implementation of smart PPE systems resulted in a safer, more efficient, and data-driven approach to worker safety, helping companies reduce accidents, improve compliance, and enhance overall productivity

conclusion

In conclusion, the implementation of smart PPE systems with integrated software led to a significant boost in workplace safety and efficiency. By enabling real-time monitoring, quick incident response, and accurate risk detection, these systems reduced the likelihood of accidents and improved compliance with safety protocols. The user-friendly design facilitated seamless integration without disrupting worker tasks, while robust data security maintained privacy. Ultimately, companies benefited from data-driven insights that helped them proactively address safety concerns, leading to a safer, more efficient, and well-managed work environment.

LINK: <https://www.meliusitalia.com/>



15. OVERHEAT - Innovative Strategies for Containership Fires Prevention and Management

OVERHEAT project to investigate the use and development of technologies to prevent, detect, manage and respond to fire accidents on board containerships

the challenge

Maritime transport has historically represented the centre of global trade moving 90% of the goods' volumes and values worldwide. Containerships are built with the same design as the older smaller container ships, disregarding possible consequences that could impact safety. Cargo fire represents one of the most important threats for cargo ships. Fire accidents can cause large losses of humans and/or cargoes and unvaluable damages. People are not always well trained and misunderstandings on the correct procedures to be adopted might lead to catastrophic situations. The "Innovative Strategies for Containership Fires Prevention and Management" (OVERHEAT) Project (Horizon Europe funded) has the goal to prevent, detect, manage, and respond to fire accidents on board containerships. The project will develop a Digital Solution that will increase the situational awareness of accountable people to promptly react during fire accidents avoiding cascade effects. Special attention will be given to seafarer Safety Culture to better understand how people perceive safety onboard and company's strategy to safety management. This approach allows to identify, describe, and structure weakness and strengths of safety. In addition, a novel training on fire management will be executed. The project proposes a truly new generation of digital fire management solutions to increase safety. The impact of the proposed solution will be initially evaluated by performing validation activities utilising ad-hoc facilities in Italy and France. Afterwards, demonstration activities will be executed in a real environment to prove the OVERHEAT concept.

the innovation

The OVERHEAT project all along its lifetime will investigate the use and development of several technologies to prevent, detect, manage and respond to fire accidents on board containerships. In particular, different sensors will be investigated such as: IOT sensors, temperature sensors, Thermal Imaging Camera (TIC), smoke detector, sniffer smoke detector, CO/CO2 detector, and gas detector. The OVERHEAT project will also investigate the use of Unmanned Aerial Vehicle (UAV) equipped with thermal cameras to provide to the first responders a clear picture of the fire accident indicating where the fire started, giving the possibility to promptly intervene and avoid a cascade effect. The UAV will be installed on board the ship. All information coming from sensors and UAV will be integrated in an intelligent system called Digital Solution (DS). The DS will show all necessary information to the crew and to the ashore operators to increase the situational awareness of cargo ship in distress. Along the project, a Safety Culture assessment will be performed to better understand how people perceive safety onboard. In addition, based on the results of the Safety Culture assessment, one of the outcomes of OVERHEAT project is the definition of best

practices for firefighting methods and fire prevention. Finally, a novel training for seafarers on fire management will be executed along the project.

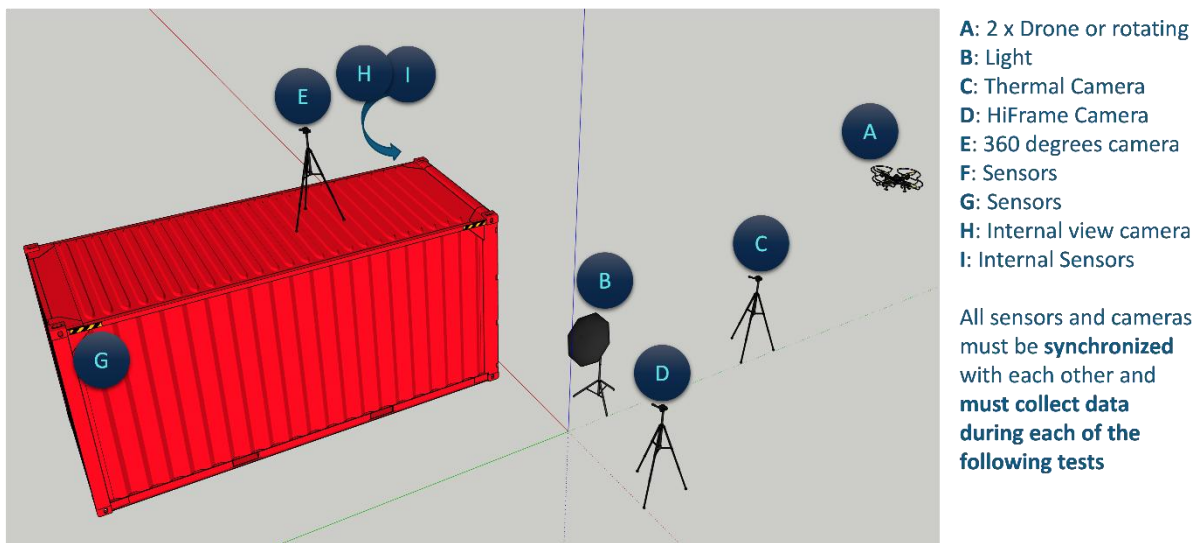


figure 1: Discovery tests

how it was implemented

Although the OVERHEAT project has just started (officially on January 1st, 2024), a clear idea on how to implement the solutions has already been planned, and some preliminary results are already available. In detail, the project will finish with a Technology Readiness Level (TRL) of 7. This means that the development of the digital solution and the implementation of IoT sensors will allow the OVERHEAT project to progress from a lower TRLs to TRL 7. Several infrastructure and associated components (such as, Unmanned Air Vehicle, IoT sensors, Digital Solution S-100, etc.) deployed in the OVERHEAT project will allow to progress on TRL, stepping forward from TRL 5 to TRL 6 by performing initial validation activities based on multiple applicable Use Cases. Both, simulation (already being carried out) and demonstration activities, are and will be conducted. In particular, five scenarios in different European countries (Genova Port (Italy), Brest port (France), Valencia port (Spain), Bremen port (Germany), and Gdynia port (Poland)) will be described and detailed during the research activities to collect the first evidence of feasibility and potential benefits brought by the implementation of the concept. The impact of the proposed solution will be initially evaluated by performing validation activities in simulated environment utilising ad-hoc facilities in Italy and France, respectively at the Italian Maritime Academy Technologies (IMAT) centre and the École Nationale Supérieure Maritime (ENSM) centre. Demonstration activities in real environment will also be executed allowing the progress of OVERHEAT project results from TRL 6 to TRL 7.

result

OVERHEAT project has started from less than one year and for the moment just some tests on the containers (simulating fires on them with detection made thanks to installed sensors, thermal cameras, and drones) have been carried out. The preliminary results are:

- installed sensors can effectively detect and identify smoke and gas (CO₂)
- the difference between the walls irradiated by the sun and those not irradiated reaches up to 30 degrees
- the detection of gas and smoke directly on the vents is 4 times more effective than detection after the vents
- none of the radio signals examined during the test (BLE, WiFi, WiFi 5) are able to receive or transmit from inside the container when the doors are closed
- in consideration of the damage detectable on the walls of each container it is essential to stay within the profile of the container grooves
- the distance between sensors and the location where the event occurs is decisive for the detection speed
- it is not possible to drill holes to the containers
- heat transfer within the container may take several minutes

The research activity has high expectations for the project since some real trial have been executed to demonstrate that drones (equipped with thermal cameras) are capable to provide a clear picture and share a Common Operational Picture (POC) to the first responder in order to prevent, detect, manage, and respond to fire accidents on board containerships

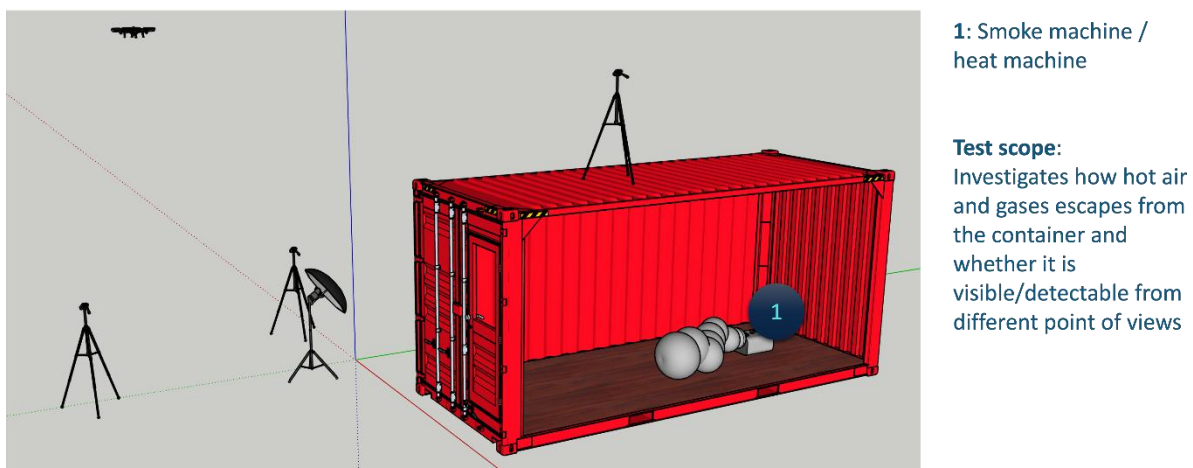


figure 2: Discovery tests

conclusion

The OVERHEAT project proposes innovative solutions to tackle an important topic: fire accidents on board containership. The OVERHEAT has the ambitious goal to prevent, detect, manage, and respond to fire accidents thanks to the development and investigation of several technologies. OVERHEAT project brings together research centres, industry, universities, and

different highly recognised in their own fields stakeholders (e.g. maritime company, firefighters, port authorities). The main technologies we are presently investigating and developing are the use of several sensors, thermal cameras, Unmanned Aerial Vehicles and the integrated digital solution. In addition, the proof of concept will be performed through five use cases with scenarios in different European countries by executing validation activities that include simulation (ad-hoc facilities will be used) and real size demonstration activities. The outcome of the project will provide key results to be explored such as a safety culture assessment and the development of best practices to be applied in the near future. This work has received funding from HORIZON Europe with grant agreement No 101076633 (OVERHEAT project) under European Union's Horizon Europe Innovation Actions Framework Programme

LINK: <https://overheat-project.eu/>



**Funded by
the European Union**



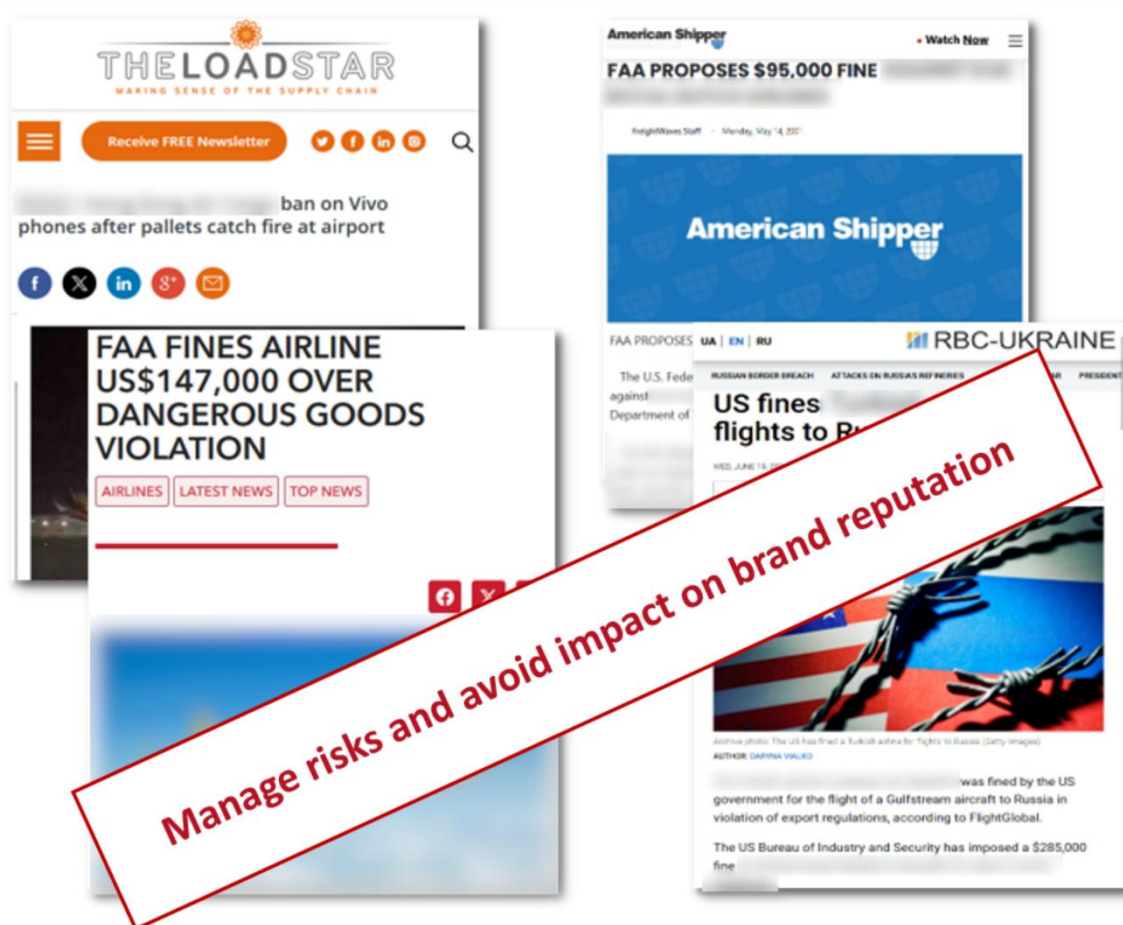
16. Pandora Intelligence

data-driven risk assessment of cargo shipments starting from bill of lading, leveraging data sources and generating actionable and predictive intelligence to prioritise highest risk cargoes

the challenge

Cargo and freight companies, such as carriers/shippers, freight forwarders, and other logistics operators, are required to comply with international laws and regulations. These continuously increasing compliance and safety measures extend beyond the cargo itself, encompassing the shipment stakeholders and process. With the grow of e-commerce and specifically battery-powered devices, the increase of dangerous goods in cargo represents growing concern for safety in the shipping process.

Cargo and freight companies face significant challenges arising from resource constraints. These limitations involve financial constraints, technological gaps, and a scarcity of human resources, impeding their ability to timely assess cargo risks in-depth and with consistent quality. This obstacle not only heightens the risk of non-compliance, but also hampers their ability to minimize risks related to dangerous goods, resulting in additional costs and delays, impacting their competitive position in the industry



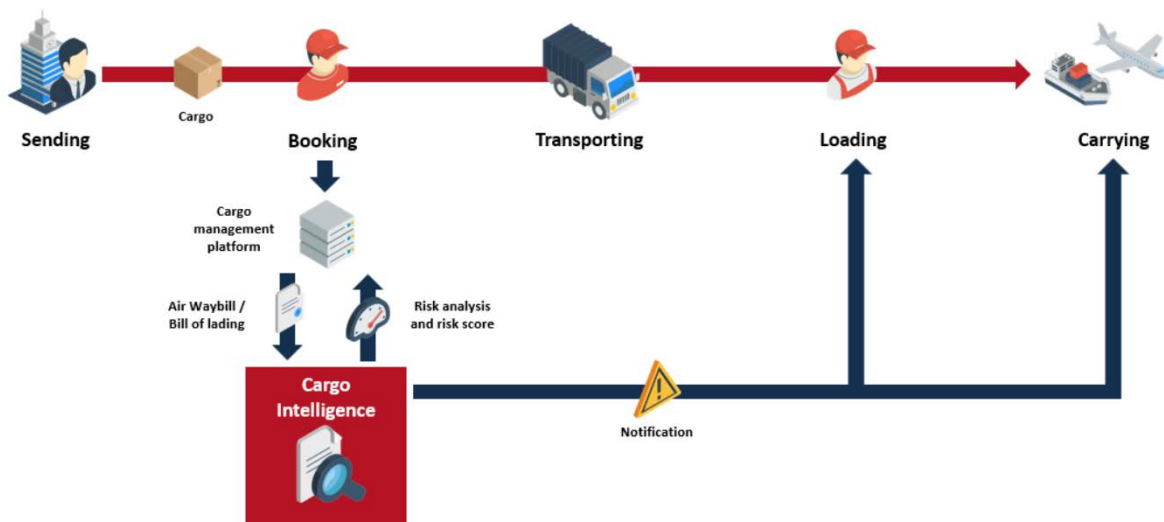
Sanctioned entities, restricted / controlled goods, strategic (military and dual use) goods, and dangerous goods are often detected too late in the cargo journey, while most of the required information is often already available at booking!

the innovation

With a goal to empower cargo and freight companies in identifying (safety) risks and mitigating them to an acceptable level, we decided to build Cargo Intelligence.

Cargo Intelligence provides a data-driven risk assessment of cargo shipments, taking the air waybill / bill of lading as starting point. Then, leveraging numerous open (or closed) data sources, Cargo Intelligence generates actionable and predictive intelligence. This empowers analysts to focus on decision-making (instead of data-gathering), and prioritize their work on the cargo which poses the highest risk to their business.

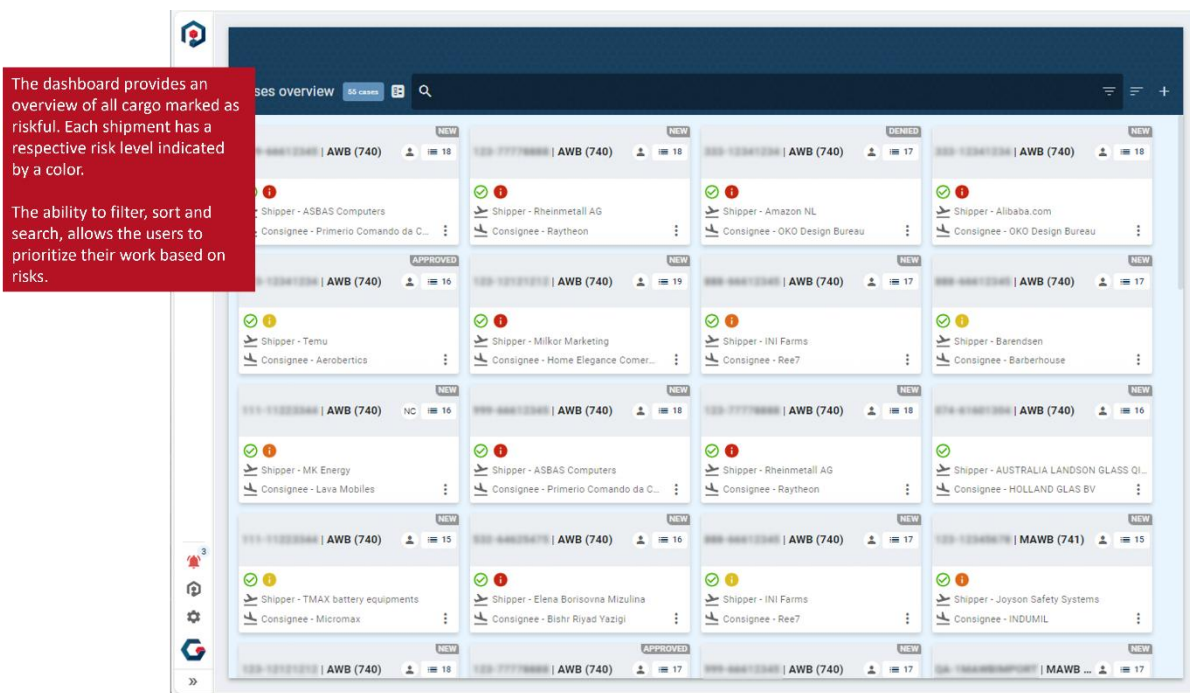
Using our API, a copy of the air waybill / bill of lading is sent to Cargo Intelligence to perform the risk analysis early in the journey (at origin or pre-acceptance) and avoid potential disruption of operations and business.



By automating and enhancing the cargo screening using our AI models we:

- avoid false positives (wrongfully detected risks which burdens the teams)
- make it possible to detect dangerous goods, even when hidden (undeclared)
- enable detection of embedded dangerous goods (e.g. devices with lithium batteries)
- make it possible to process high volumes of cargo in a timely manner (a few seconds instead of hours per shipment)
- provide consistency in the risk assessment (in contrary to analysts which might have different knowledge and expertise)

This results in the ability to make faster, more accurate and consistent decisions in the screening process, and ensure compliance and safety



how it was implemented

To replace carriers/shippers static lists which were resulting in too many false positives and mismatches (even when using smart, configurable, algorithms), we built AI models to interpret text as humans would do. With that capability, we started teaching those models which text (paragraphs or sentences) include information about goods that could represent a risk for cargo carriers/shippers (e.g. types of dangerous goods).

After processing large volumes of cargo shipments we realized that despite an exceptional precision in the detection of risks, it was still important for our specialists to regularly train the AI models due to the changes in market trends and new products or technologies being developed (e.g. replacement of NiMh and NiCd batteries with Li-ion or Lipo technology).

Therefore our ultimate solution has been to replace our AI technology with models fed on all publicly available information.

By assessing the background and/or business of the consignor and consignee, by looking into countries of origin and destination, and by correlating all of it with the information available in the goods description, it became possible for our Cargo Intelligence solution to precisely pinpoint the cargo which might represent compliance and safety risks. By doing so, we can empower carriers/shippers to act before cargo potentially gets stuck in their warehouse, or before it mistakenly get loaded in their planes or vessels.

result

Since implementation of Cargo Intelligence, detection of risks (previously undetected) rose by more than 18%, and false positives declined by more than 84%; most importantly, not a single fine has been imposed.

The screenshot displays a risk analysis dashboard for AWB (740). It is divided into three main sections:

- Summary:** Shows a risk level of 'High'. It includes an 'Original document' (999-66612345.xml) and a 'Risk summary' section with three paragraphs of text detailing risk factors for the shipper, consignee, and goods.
- Shipper:** Lists 'ASBAS Computers' with an address in Utrecht, Kingdom of the Netherlands. The risk level is 'Low', and the risk summary is 'Dangerous goods found on company website'.
- Consignee:** Lists 'Primerio Comando da Capital' with an address in Sao Paulo, Brazil. The risk level is 'High', and the risk summary is 'Found in sanction lists'.
- Goods Information:** Shows a risk level of 'Medium', a risk summary of 'Dangerous goods risk', and identification as 'Second hand laptops'.

A red callout box on the right states: "The risk summary, provides the risk narrative for each shipment. Empowering the users in making substantiated decision in a timely manner."

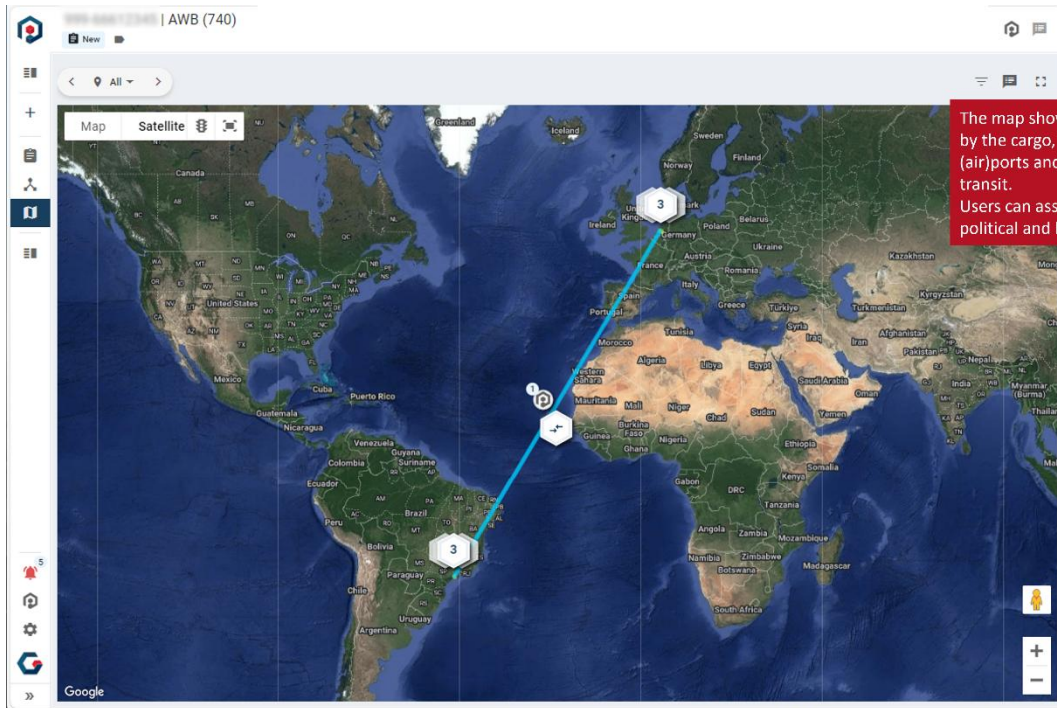
By taking away all the cumbersome work (data gathering, research, list checking, etc.) we enabled analysts to spend their time on what they are good at: making decisions.

In addition, with the risk levels being suggested by Cargo Intelligence, the analysts could suddenly also prioritize their work by first clearing cargo which poses the highest risk to the business.

The screenshot shows a network graph titled 'OVERVIEW' for AWB (740). The graph visualizes the relationships between different entities and their associated data sources:

- Shipper:** 'Shipper - ASBAS Computers' is connected to 'Shipper open source links' and 'http://www.asbascomputers.nl/'.
- Consignee:** 'Consignee - Primerio Comando da ...' is connected to 'Consignee open source links'.
- Goods:** 'Goods' is connected to 'Route of 999-66612345 | AWB (740)'.
- Other entities:** 'US OFAC Specialty Designated Nat...', 'Shipper open source links', and 'Goods' are also interconnected.

A red callout box on the left states: "The graph provides users direct access to all the information underlying to the risk analysis. It provides an overview of how the pieces of information related and how the AI-models concluded the analysis."



So far, the visible results have been the sharp decline in fines (and undesirable brand exposure for non-compliance), a lower impact of risk management on operations, with the ability to prioritize handling of potential high risk cargo by both the analysts and the handlers, and the ability to clear all of the cargo timely and proactively with risk assessments being performed pre-acceptance. The consistency added by the automation resulted in less human-errors, thereby a reduced dependency on manual labour and thus cost savings related to the staffing challenges.

LINK: <https://www.pandoraintelligence.com/>



17. Port Skills and Safety Ltd

emergency flash cards to support discussions on emergency exercises that can also be used to test the reliability of emergency plans and challenge employees' knowledge

the challenge

Port Skills and Safety Ltd is the professional safety and skills membership organisation for UK ports. We work in collaboration with our members to promote best practice and innovation, develop guidance and deliver services to drive continuous improvement in safety and ensure a highly skilled workforce.

Emergency planning is vital to safe operations in the port sector and knowledge and training forms the foundation for this. The Emergency Flash Cards developed by PSS, provide a framework to test and strengthen emergency planning.

The cards allow operational teams to run drills and training sessions in a structured way with minimal preparation. They help to prevent teams running the same tried and tested emergency drills where everyone knows exactly what is going to happen and how to deal with it. They ensure that emergency planning incorporates the type of unforeseen events that a real emergency would involve

the innovation

PSS worked with The Workboat Association to develop a set of Emergency Flash Cards to support discussions on emergency exercises. The cards can be used to test the reliability of existing emergency plans and challenge employees' knowledge.

Similar to a deck of playing cards, the emergency flash cards are easy to travel with, fitting into a pocket or bag. The cards can be used in operational settings during working hours, without the need to remove workers to training facilities. This provides a flexible solution, which can be easily used by operational teams.

The deck includes coloured 'suites' for weather, location, incident type, severity and variables. The cards have countless scenarios which can be achieved by selecting a combination of



factors, either completely at random, or by selecting the desired location or type of emergency.

The features of the colour coded cards include pictograms and easy to understand descriptors which allow users to adapt the scenarios to their specific working environment. They are highly visible and engaging for users.

The cards were developed using industry knowledge to produce lists of emergency types and scenarios. Weather and wind conditions were planned to reflect real port challenges, including wind speed limits for crane operations. The number of scenarios allows numerous potential incidents to be generated.

how it was implemented

The cards were printed, presented in plastic cases, and sold at PSS and other events. Demonstrations highlighted the ease of use of the cards with participants able to understand the process in minutes.



Users are free to experiment with ways to use the cards to suit their operational needs. Some users chose to totally randomise the card selection and then discuss the results in team briefings, whilst others chose specific locations and emergency types to allow more in depth discussion within their teams. They have also been used as part of recruitment exercises to gauge applicants' ability to adapt to random and evolving events.

The variable cards, which is played once the team have begun resolving the emergency, adds the realistic element of an evolving emergency such as rescue equipment failing, weather worsening or the severity of the incident increasing.

The flash cards are an inexpensive and fun way to boost toolbox talks, create engaging emergency drills and get teams talking.



result

The cards have proved popular with members and non-members across the port sector with many organisations buying multiple packs to deploy across teams. Feedback has been overwhelmingly positive, with many port members implementing them within their workforce and finding a noticeable change after doing so.

User feedback has described the cards as 'easy, engaging, useful and adding something different our drills'. One user said the cards had encouraged engagement and collaboration as they require open discussion with co-workers.

Feedback has shown that the Emergency Flash Cards not only strengthen users' current knowledge but also encourage them to discuss responses to scenarios that may otherwise be overlooked or unplanned for.

For example, a port member has rolled out the use of Emergency Flash Cards across all their sites giving them to each shift team. They carried out an emergency planning exercise with the fire emergency card pre-selected to test the teams understanding of fire response. Just a few weeks after undertaking the exercise, their site was able to effectively execute a seamless response when a fire broke out in real life, preventing harm and minimising potential damage it could have caused.

The Emergency Flash Cards have supported members in continually improving the skills and knowledge of employees by providing a mechanism for emergency planning to be discussed and practiced at an operational level.

conclusion

These cards are a very simple innovation that have provided an effective tool for discussion on emergency scenarios.

The example given where the impact of a fire was minimised because the team were well versed in the emergency plans demonstrates the effectiveness of the cards.

LINK: <https://www.portskillsandsafety.co.uk/>



18. Psychology Applied

Learning from normal work is a research-backed framework based on human and organisational performance, Safety II, and human factors that allows for identifying precursors of accidents before they happen

the challenge

Over time, hazardous industries have made significant strides in safety through learning from incidents. Many companies have approached near-zero accident rates in the past decade.

However, this success has created new challenges.

- As operations become safer, there are fewer incidents to learn from, reducing traditional opportunities for improvement. This creates a paradox where success limits one of our primary learning mechanisms.
- With low incident numbers, injury rates become statistically unreliable as performance indicators. Traditional safety metrics lose their effectiveness, making it harder to measure and validate safety performance improvements.
- Focusing solely on unsafe behaviours is no longer sufficient to drive further improvements. Organisations need to develop new approaches and methodologies to continue reducing risk in already-safe environments.
- Despite overall improvements, some accidents still repeat themselves. These recurring events are particularly frustrating, mirroring past incidents we should have already learned.

Only a very small percentage of all activities result in an undesired event, and the vast majority of activities are completed without a problem. As a result, it's easy to think that no additional work is needed in the shadow of success.

Does it mean all those activities that didn't result in an event went perfectly?

Rarely is attention paid to how the activities were completed, what challenges were encountered, and whether seeds of a future accident were evident.

The key question becomes: How can organisations continue to learn and improve their safety performance when there are fewer adverse events to learn from? We must find new ways to drive improvement when unintended consequences are absent.

the innovation

Learning From Normal Work – is a research-backed framework based on HoP, Safety II, and Human Factors that allows for identifying precursors of accidents before they happen.

'Normal work' is about how people adapt to changing conditions and challenges as part of their job.

Consider using a crane to lift a load. Every time an operator performs this task, the situation may differ.

They might face less time available than planned, additional people in the area, a colleague being off work, or unavailable correct tools such as lifting slings.

It's easy to see how these factors can increase risk, and yet, none of them would be classified as a hazard because none is a direct source of harm. Popular approaches to safety management focus on controlling identified hazards but miss a whole world of organisational factors.

Adapting to overcome these various challenges is part of what needs to be done. It's 'normal work'.

Learning from normal work (also known as pre-accident investigations, or learning from success) is about proactively looking into the things that make work difficult and increase the chances of human error or non-conformance.

What does this mean in practice? Simply put, the conditions that will create our next accident exist today, and we can find and address them before they lead to an accident.

how it was implemented

Implementing Learning From Normal Work (LFNW) involves a structured, three-phase approach tailored to organizational needs.

Phase 1: Foundations and Alignment

- **Internal Presentations/Webinars:** Short sessions introduce employees to LFNW, its benefits, and practical applications.
- **Leadership Workshop:** Senior leaders explore LFNW tools, developing a tailored deployment plan.

Phase 2: Site Enabler Program

- **Mindset Shifter Course:** An 8-hour session for site leaders, aligned with industry guidance (IOGP 642), transitions teams to proactive learning and risk reduction.
- **Facilitator Training:** A two-day workshop equips HSE and operations professionals with skills for learning reviews and facilitation.
- **Mastery Coaching:** Continuous support ensures facilitators improve their effectiveness in applying LFNW tools.
- **Competency Pathway:** A six-month program provides champions with expertise across 12 key areas to drive safety transformation.
- **Supervisor Training:** A one-day workshop to develop foundational LFNW skills such as asking neutral questions and conducting walk through talk through.
- **Workers Training:** highly visual and engaging session aiming to help workers understand different types of error traps and differentiate from hazards.

Phase 3: Company Enabler Program

- **Integration Workshop:** Senior leaders plan how to embed LFNW into processes like risk assessment, behavioural observations and incident investigation.

- **Company-Wide Awareness:** 2h e-learning course to align employees with LFNW principles and skills.

result

Risk Reduction Without Waiting for Failures

- LFNW enables organizations to identify precursors of accidents when no incidents have occurred. By focusing on everyday work practices and adaptations, it surfaces hidden vulnerabilities before they escalate into significant issues. One company achieved 37% reduction in incidents over 18 months even though the effort was not triggered by the accidents.

Enhanced Understanding of Work Realities

- By uncovering the gap between "work as imagined" and "work as done," LFNW helps organizations understand the real challenges employees face. This understanding leads to practical improvements in procedures, tools, and systems.

Identification of Error Traps

- Error traps are conditions that increase the likelihood of error or non-compliance (see examples below).
- LFNW integrates error traps into processes like behavioural observations, leadership visits or risk assessment, helping organizations recognize and address factors that increase the likelihood of mistakes.

Improved Leadership Engagement

- Leaders gain deeper insights into operational challenges through better conversations with workers. LFNW fosters a culture where leaders ask questions like, "What makes the job difficult?" and "How can I help?" rather than focusing solely on verifying compliance.

Overcoming procedural non-compliance

- LFNW identifies procedural non-compliance that makes sense in context and addresses it by improving systems rather than punishing individuals.

Hands-on Tools and Visible Operational Improvements

- LFNW tools uncover constraints, inefficiencies, and error traps, leading to operational improvements. For example, through walk through talk through, teams may identify and address design flaws, missing tools, or procedural conflicts before they escalate into incidents.

Examples of tools:

Discussion cards – is a tool to facilitate conversations about potential error traps in the workplace, helping teams identify and mitigate risks before they lead to incidents. Designed based on cognitive interviewing techniques the cards show 100 error traps in 12 categories.



conclusion

We offer many other tools to help companies identify precursors of incidents but do not have enough word count to describe them all. They include checklists, templates, and guides for various groups in organisations.

conclusion

ERROR TRAPS EXAMPLES AND A CASE STUDY

Error traps are any conditions that increase the likelihood of a person making a mistake.

Example: 1



Hazard is the toxin in the lubricant spray that has the potential to cause harm if ingested.

Human error (which can be unhelpfully interpreted as an unsafe act or violation if the rules say “use the correct can”) is taking the lubricant by mistake instead of taking the cooking oil spray and using it for cooking.

Error trap is visual similarity of the bottles. The colour, font type and position, logo, black line are the elements that make it look similar and therefore easy to confuse.

Example 2:



In the illustration above, the visible error traps include:

- the pipes that prevent the worker from getting closer to the panel
- the colour of the buttons – if the worker is colour blind, they will not see the difference between the buttons' colours
- size of labels – difficult to read from a distance

But, importantly, there may be many error traps that are not visible, such as:

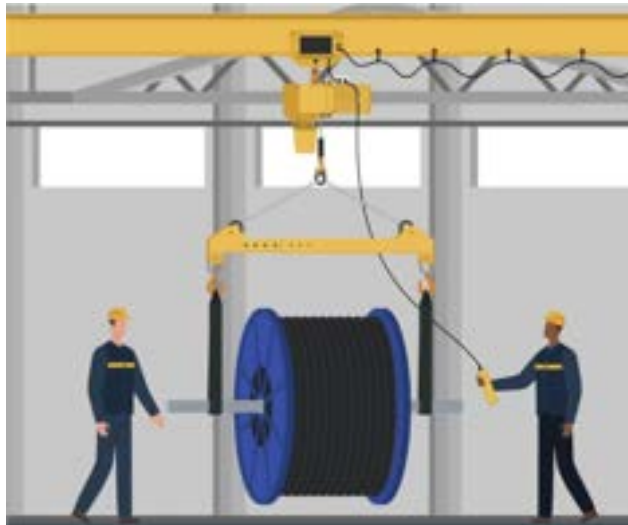
- the time is 3.30 am, and the worker is tired and sleepy
- the worker is alone
- the work instruction that was given is out of date and does not describe how the task should be actually done
- the radio allowing contact with the control room is not working

Perhaps it is easy to see that as these conditions accumulate, the likelihood of making a mistake goes up.

CASE STUDY:

We talked to a team of crane operators about “what makes their work difficult”.

The team shared challenges of lifting a 7-ton spool with a 10-ton crane. The spool needed to be lifted 6 inches (15 cm) and moved across the room—a task that seemed simple but presented issues.



The operator had to stand uncomfortably close to the spool, placing them in the line of fire. This was due to the cable-controlled crane system, which limited their position and visibility, necessitating the use of a spotter. The spotter, positioned on the other side of the spool, had difficulty seeing the operator, and they relied on verbal commands. This setup, combined with the crane's left, right, forward, and backward buttons, increased the risk of directional errors, especially given the limited visibility. When two people face each other and they point to the same direction, left for one, is right for the other.

The team recommended replacing the cable system with a remote control and introducing directional indicators like East and West. Aligning equipment with these indicators allowed the operator to move freely and always know the direction of movement.

These changes eliminated the need for the spotter and verbal communication, significantly reducing the potential for a life-changing injury if someone were struck.

Key observations:

- the same findings would have emerged after an accident.
- changing operator behaviour without altering the work setup would have limited impact.
- the improvements needed were within managerial control, not the operators'.
- the identified issues were not hazards and wouldn't appear in a traditional risk assessment.

LINK: <https://learningfromnormalwork.com/>



19. PsyFyi Limited

an advanced data collection tool that enhances onboard safety by identifying both behavioural and environmental risks through daily questions to seafarers

the challenge

The maritime industry is accustomed to collecting data on machinery to promote safer operations, yet very little is collected regarding the human element. This reinforces the perception that seafarers are considered a cost rather than an asset.

Collecting data on seafarers' daily lives—how efficiently and effectively they live and work together—is a key component in identifying gaps and risks, and in determining what can be done to address these.

For example, we are actively working with an owner facing retention issues. After offering higher salaries, the company was disappointed to discover that crew members were still leaving after their second rotation.

We deployed SeaQ for a period of one year, and during this time, we asked 30 questions in rotation each month to collect trend data. This allowed for a statistical analysis of the responses, focusing on the importance of each issue, crew satisfaction with it, and follow-up questions to gather additional input for both positive and negative responses.

the innovation

SeaQ by PsyFyi is an advanced data collection tool that enhances onboard safety by identifying both behavioural and environmental risks through daily questions to seafarers.

SeaQ offers customized questions via social media platforms that seafarers use every day, while the interactive dashboard and regular reporting are tailored to support each company in driving actionable change to improve safety.

There is no onboard implementation, no downloads, or additional costs for the seafarer, and all collected data is anonymous, in compliance with GDPR. The quick and easy interaction (roughly 9 seconds per day) is the reason we have a 92.6% usage and reply rate across our users

how it was implemented

We work directly with the owner to create bespoke questions focused on the seafarers' experience onboard. We specifically examined their safety culture and whether the company's high safety values were being observed onboard.

We then produced a unique QR code, which was printed on posters and displayed around the vessel. The seafarers used their personal mobile phones to interact with SeaQ daily, answering 1–3 questions.



result

The live dashboard allowed the PIC to review results in real time, and the quarterly face-to-face reports enabled PsyFyi and the owner to discuss best practice management developments and implement changes onboard.



conclusion

We are now in discussions to run SeaQ across this owner's entire fleet of 800 vessels, focusing on seafarers' communication with each other, with shore and office personnel, their motivation, and their ability to report concerns appropriately.

As SeaQ monitors trends, we will also be evaluating any changes made by the company to measure their effectiveness and to determine whether they have had a positive, negative, or neutral effect.

LINK: <https://www.psy-fyi.com/>





20. RAM Spreaders

spreader designed to address the challenges faced in manual lashing; a mechanised solution for automatic latching and unlatching, safe lifting, securing and transporting of pipes

the challenge

PIPE HANDLING

Traditionally, pipe stevedoring and handling have been carried out manually by workers using slings, chains, or other tools. This process demands intense physical effort and exposes workers to dangerous conditions.

High Risk of Injury

- Falling & Swinging Loads

Workers are under and alongside swinging and skewing pipes to help orient them into the correct stowage location in the ship's hatch. This can result in accidents such as slip or crush injuries, head trauma, or even fatalities.



- Physical Strain

Risks of musculoskeletal injuries due to repetitive lifting, pulling, and adjusting pipes to control the load and ensure the correct orientation in the ship's hatch.

- Quayside Dangers

High risk from working under suspended loads and interacting with horizontal transport, such as quayside trucks.

- Risks at Sea

Varying sea conditions and the relative motion of the two vessels make pipe transfers from one ship to another even more difficult. Pipes can swing wildly out of control in the ship's hatch, so control of the swing and skew is critical.



Human Error

Pipes may be incorrectly lashed, leading to unsecured loads that can shift or fall during transport. Inconsistent tension on slings or chains can cause imbalances, increasing the risk of accidents

the innovation

The RAM Pipe Handling Spreader is designed to address the challenges faced in manual lashing, providing a mechanised solution for lifting, securing, and transporting pipes and offers numerous benefits:

Enhanced Safety

- Automatic latching and unlatching

Pipes are connected automatically by the pipe arms, dramatically reducing the risk of manual handling injuries by removing the need for stevedores to physically handle pipes. Workers are no longer required to have direct contact with the pipes, reducing the chances of crush injuries, falls, and other accidents.

Due to the RAM Pipe Spreader's gyroscopic control units (the first of its kind to have complete 360-degree rotational control), the spreader remains in one orientation during the load 'swing' when the operator controls the angled position with a remote control. This allows accurate placement of pipes, saving time and allowing the operator to control the load at a safe distance without the need for ropes or slings.



Several safety features prevent falling pipes, including a series of sensors that measure the load of each pipe and can stop operations if the loads are unbalanced. The system also has a series of 'landed' and 'locking' pins to ensure all pipes are secured before lifting. There is also

a redundant 'load weight' and 'camera' system to weigh and detect any potential fallaway when hoisting the pipes.

Although automatic pipe handling spreaders require an initial investment, they provide long-term cost savings in reducing the number of compensation claims, fewer work stoppages and reduced downtime from incidents

how it was implemented

A customer approached RAM Spreaders to help with a major offshore project, handling pipes between Indonesia and Australia. Working together they produced the Universal Pipe Handling Spreader, which is capable of handling up to 3 pipes of between 11.8 and 12.7 meters in length and diameters of between 16 to 60 inches.

The pipe handling spreader was deployed at the port of Batam, Indonesia, loading the offshore pipes from the quayside into the shipping vessel's hatch. Another RAM pipe handling spreader was installed on the shipping vessel's crane to transfer pipes into a transshipment vessel near the coast in North West Australia before being transferred again into the pipelaying vessel.

result

The pipe spreaders used are only one small part of the innovations across this project regarding safety and productivity.

RAM have worked with their customer to provide a safe, innovative solution to load pipes. This system is one of several innovations in this project that make it safe and reliable.

conclusion

The comparison between automatic pipe handling spreaders and manual lashing is clear: Automatic pipe handling spreaders offer superior safety and efficiency. While manual lashing exposes workers to significant risks and slows down operations, automatic pipe handling spreaders eliminate many hazards and significantly speed up the pipe handling process.

For industries reliant on the transport and handling of pipes, investing in automatic pipe handling technology is not only a safer option but also a smarter long-term investment for operational success.

LINK: <https://www.ramspreaders.com/>



21. SDC Engineering B.V. – SDC SAM

system that combines Finite Element Analysis, user data integration, intelligent inspection workflows to detect structural vulnerabilities, adapt maintenance schedules, and extend structural asset lifespan

the challenge

SDC SAM addresses the challenge of maintaining structural safety in complex assets prone to structural failures due to fatigue, buckling, and corrosion from operational stress and aging. Traditional maintenance approaches often rely on reactive methods, increasing risks of failures and non-compliance with safety standards.

Using FEA analysis, SDC SAM provides a digital twin of the asset for precise monitoring of its conditions. By incorporating inspection data, it allows to dynamically update asset models, recalculate fatigue life, and adjust inspection intervals to target high-risk areas. This proactive approach prevents failures, reduces downtime, and extends safe operating lifespans.

The platform's centralized system ensures all asset information, from global conditions and localized vulnerabilities, is accessible for maintenance and compliance. SDC SAM enables effective monitoring and management, reducing risks while optimizing operational efficiency.



the innovation

SDC SAM is a software that combines Finite Element Analysis results, user data integration, and intelligent inspection workflows in a web based, cross-platform interface to detect structural vulnerabilities, adapt maintenance schedules, and extend structural asset lifespan which helps to avoid downtime and accidents.

Approach based on simulation results allows to dynamically update asset models with inspection data, and integrate structural information from sensors or third parties to maintain precise recalculations of structural integrity and proactive maintenance planning.



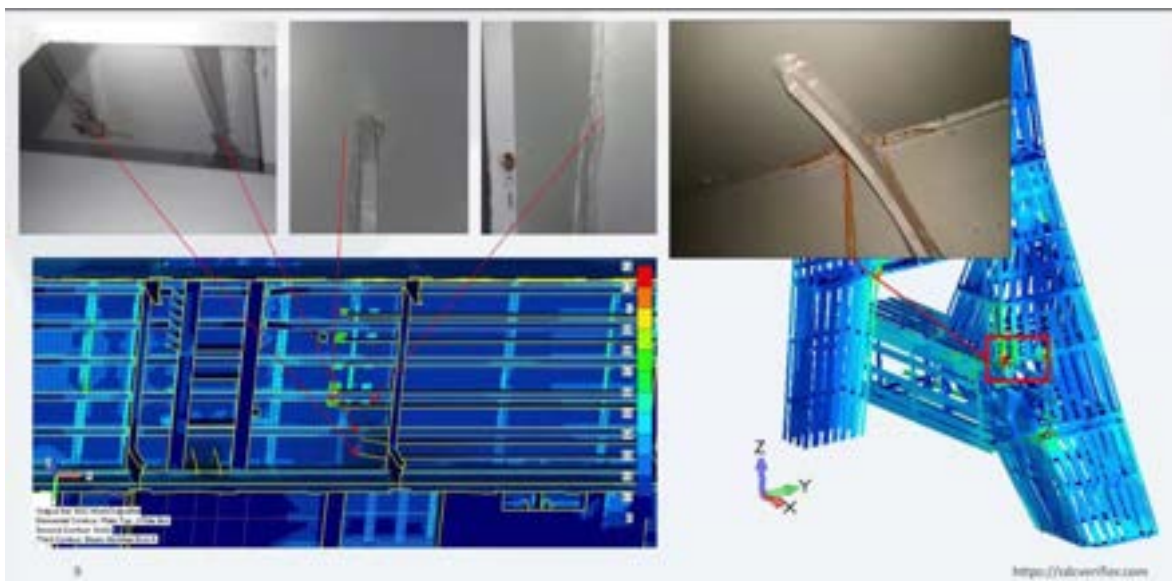
The platform tracks risks like crack propagation and stress redistribution across critical points, ensuring maintenance is targeted effectively. Its modular design supports multiple assets, detailed inspection points, and integration with existing PLM/ERP systems. User-specific access enhances collaboration among engineers, inspectors, and third-party service providers.

By reducing inspection times, optimizing maintenance schedules, and ensuring compliance, SDC SAM delivers measurable improvements in safety and operational reliability.

how it was implemented

SDC SAM was developed using expertise from SDC Verifier to create a modular, scalable online platform tailored for structural asset management.

The development process included identifying key industry pain points, such as inefficient inspections and fragmented data management. Pilot programs tested features like peak detection for stress analysis, crack tracking, and life extension calculations in real operational



settings. User interfaces were developed for accessibility, with role-based permissions enabling collaboration across teams.

result

While still in its early adoption phase, SDC SAM has demonstrated clear benefits.

Pilot program within the terminal allow having the structural health data and results always up to date. This helps to keep 60 year old cranes running without downtime. It also shows a clear reduction in inspection time, since the technicians have continuous access to simulation data in a web interface that is easy to access both online and offline. FEA based approach results in 95% accuracy in stress results and fatigue predictions, and the ability to dynamically adjust maintenance schedules based on real-time data.

Solution adopters report improved safety outcomes and better maintenance efficiency. Centralized structural data provides actionable insights, avoiding downtime and extending asset lifespans. These results highlight SDC SAM's potential as a transformative tool for structural asset management.



conclusion

SDC SAM delivers a comprehensive solution for structural asset management by combining advanced digital twin technology, real-time data integration, and proactive maintenance strategies. Its ability to reduce downtime, enhance safety, and extend asset life sets a new standard in structural management.

As adoption continues, SDC SAM's practical application ensures its adaptability across diverse industries, positioning it as a leading innovation for improving structural safety and efficiency.

LINK: <https://sdcverifier.com/>



22. SSA Marine RTG proximity system

AI driven camera system on RTGs to identify pedestrians and vehicles within the travel zone with automated responses depending on proximity including alarms and fail-safe halt function

the challenge

One of the critical risks that is present within SSA Containers affiliated operations is the risk of plant vs pedestrian worker incidents and accidents. This is especially true for SSA Containers affiliated terminals where there is a significant amount of plant operating near workers, particularly RTGs. This proximity of operation has created a risk where workers can be fatally struck by an RTG when inspecting containers or machinery within the terminal. Several controls (e.g. wheel guards) have already been installed on RTGs to combat this risk however so far none have been fully effective in preventing workers being run over by RTGs.

the innovation

SSA Containers affiliates have partnered with a company called Strata to explore an AI driven camera system. This involved the installation of 4 cameras, one on each leg of the RTG. In addition to the cameras, a flashing strobe, 100 dB alarm, and camera screen for the operator was fitted. Strata's system uses the cameras to identify pedestrians and vehicles within the travel zone. The system has three zones (red 0, yellow 1, and green 2) of detection with automated responses to each zone. If a worker and/or a vehicle is detected in a green zone the RTG operator is made aware of the zone breach on the screen inside the cab. If a worker or vehicle is detected in the yellow zone, then an alarm is sounded to alert both the worker on the ground and in the cab.



Location of cameras on RTG

RTG will enter a slow down mode if yellow zone is breached by a pedestrian or vehicle. If they enter the red zone, then the machine automatically comes to a halt to prevent the worker from being run over or a vehicle from being struck. The camera system has both conventional cameras and infra-red cameras to allow for full detection during both day and night, as well as during inclement weather.



Monitor position in RTG cab

how it was implemented

SSA Containers affiliates partnered with Strata to implement the system on 1 of their RTGs at a Long Beach terminal. A trial was run to investigate the technology and test its effectiveness before being fully rolled out to all RTGs within the terminal.



person in the safety zone

The Strata project consisted of three different phases.

The first phase was the installation and integration of Strata cameras into our RTGs. The second phase was a data collection period, where the system was learning and being fine-tuned. The third and last phase was full implementation in the field with fine-tuning centred around reduction of false positives and effectiveness.

result

The introduction of the Strata pedestrian detection system led to an immediate culture and behaviour change among those working around RTGs. This change resulted in a reduction in the number of events being detected and a reduction in the number of near miss incidents being recorded of RTG worker interactions.



conclusion

The Strata pedestrian detection system has significantly improved the controls in place to prevent workers being fatally run over by RTGs. In addition to this it has also prompted SSA Containers affiliates to take a deeper look into how pedestrian detection systems can be incorporated into plant and equipment to further reduce the risk that plant and equipment present to pedestrians. Strata pedestrian anti-collision camera technology is currently being tested on additional equipment in Southern California such as forklifts.

LINK: <https://www.ssamarine.com/>



23. SSA Marine SuitX exoskeleton

lightweight exoskeleton which uses springs to store and release a worker's energy while working, reducing the force required, assisting the lift and decreasing risk of musculoskeletal injury

the challenge

Musculoskeletal injuries are one of the most common risks to which employees working for SSA Conventional affiliates are exposed. These injuries can be especially prevalent when SSA Conventional affiliates are loading and unloading stores and bags on cruise ships. The activity of loading stores and bags is highly manual with each individual bag being required to be lifted onto trolleys, then onto a baggage belt and then back onto trolleys to the vessel. These bags weigh up to 30kg each and there are generally thousands to be loaded per shift. The challenge is finding a way to reduce the level of musculoskeletal harm and fatigue that was occurring to workers within the operation.

the innovation

SSA Conventional affiliates have partnered with Ottobock to trial and potentially implement their SuitX exoskeleton. The exoskeleton has two parts. One part supports a worker's back and the second supports the worker's shoulders. The SuitX exoskeleton uses a number of springs tied to an adjustable exoskeleton to store and release a worker's energy while working. This alleviates the amount of force required as it uses the worker's own lifting and carrying motion to help with the lift.

The system also does not require any external power source and is a slim and lightweight design so it is easier to use in a congested environment.



how it was implemented

SSA Conventional affiliates implemented the SuitX exoskeleton system by distributing the system across three different cruise operational sites in Florida, primarily in relation to the lifting, carrying, and moving of luggage. The system supports workers' shoulders, backs and legs, where the greatest strain typically occurs.

Each of the three sites received a set of exosuits to trial, and staff members were encouraged to integrate them into their daily routines where applicable. This hands-on approach allowed a variety of employees across different roles to evaluate the exosuits' effectiveness in real work conditions. After using the exosuits, workers at each site provided feedback through structured polls featuring multiple-choice questions about functionality, comfort, and overall experience. Additionally, SSA Conventional affiliates gathered verbal feedback to capture more nuanced insights.

result

The introduction of the SuitX exoskeleton system resulted in a significant drop in the level of effort required by workers to lift bags. This also reduced the fatigue levels of the workers and has led to a reduction in the number of musculoskeletal injuries. In addition to this, the workers also gave really good feedback on the system and were fully in support of the system as was their union.

The combination of anonymous polls and direct conversations enabled collection of comprehensive data on the exosuit's performance across all test locations. The feedback informed SSA Conventional affiliates about potential benefits, limitations, and areas for improvement, offering valuable insights into how the exosuits could be effectively integrated to enhance worker well-being and efficiency in labour-intensive roles.





© Ottobock

conclusion

SSA Conventional addressed a significant safety challenge—musculoskeletal injuries from lifting heavy bags in its cruise ship operations—by implementing the SuitX exosuit system. This exosuit was designed to reduce strain on workers' shoulders, backs and legs, supporting them in tasks involving heavy lifting and repetitive bending without requiring an external power source. It uses springs to store and release energy, effectively alleviating some of the physical effort needed for each lift and improving worker comfort and ergonomic form while lifting.

The trial involved three Florida cruise operation sites, where employees incorporated the exosuit into their routines to evaluate its impact. Feedback was gathered via anonymous polls, with multiple-choice questions on functionality and comfort, as well as open-ended responses. Verbal feedback was also collected, enabling SSA Conventional affiliates to capture detailed insights into the exosuit's effectiveness.

The results of the trial have been positive, showing a noticeable decrease in fatigue and musculoskeletal strain in the back and lower body among workers that have practiced exosuit use while performing their job tasks, along with strong approval from both employees and their union. This trial highlights the SuitX exosuit system's potential to improve safety and efficiency in labour-intensive roles and the potential to reduce the amount and cost of musculoskeletal injuries.

LINK: <https://www.ssamarine.com/>





24. Straatman Mooring Systems

permanently installed bollard equipped with sensors to measure loads on mooring lines and communicate them in real-time to a dashboard and log of load, direction, angle, tide, weather and vessel history

the challenge

Until now it was impossible to measure mooring line loads of moored vessels continuously. The lack of measured data means that designs are based on maximum forces based on the mooring lines MBL or computer models. For the Port Authority and Terminal Operator it is important to know exactly what the loads on the mooring lines are, especially in case of bad weather or for ports dealing with strong currents, high winds, and frequent passing vessels.

Why is measuring load crucial?

There is a significant safety risk when the loads on the mooring lines are too high. It can cause line breakages and vessel drifting, endangering port staff and marine vessels. Imagine a stormy day with high waves, strong currents, and gusts. A disaster can strike if the load on the mooring lines becomes too much. Ropes snap, ships detach, and serious accidents will happen. And it's not only just about material damage, which can amount to millions of euros or dollars; there is also a significant risk to people on the dock if the ropes break.

In 2007, during a storm in the Port of Rotterdam, a ship was blown away from the dock. It drifted and hit a pier at the MOT terminal, causing 150 million in damages. A similar incident happened more recently in Antwerp. A ship was blown off the dock and crashed into a container crane on the other side, causing it to collapse. And these are just a few examples. These problems are likely to become more common with climate change. Additionally, ships are getting bigger, which increases these risks.

Continuously measuring loads on the mooring lines and the real-time monitoring will therefore increase safety as you know exactly what is happening

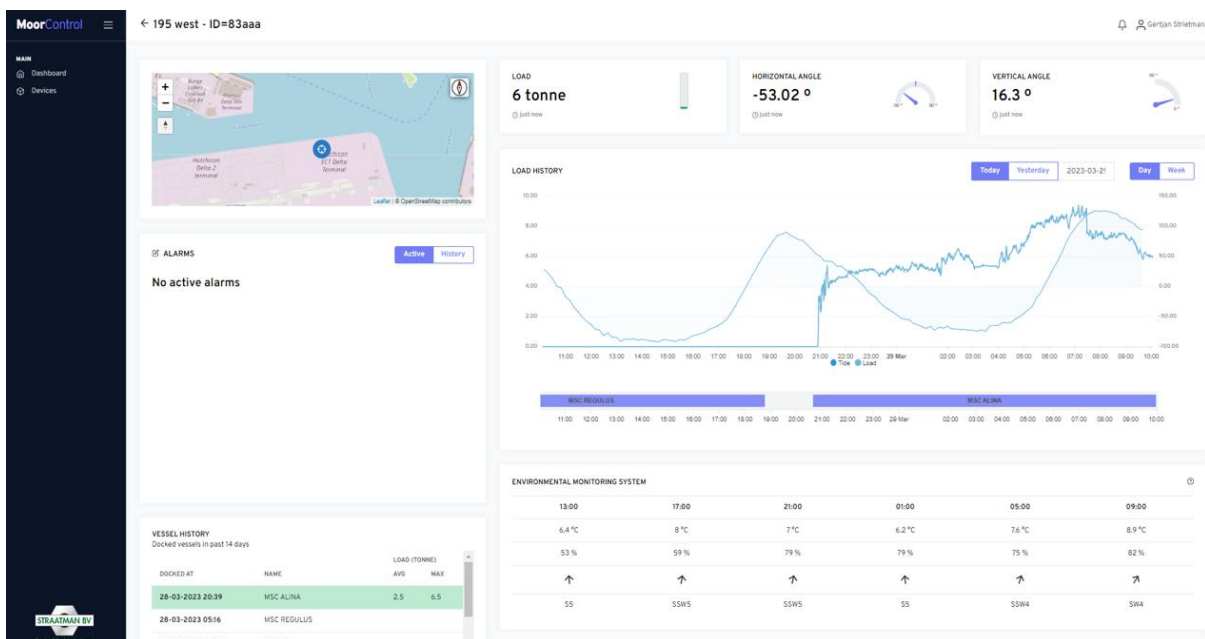
the innovation

In close cooperation with the Port of Rotterdam, we developed the Smart Bollard. The Smart Bollard is similar to a standard bollard and is permanently installed on quays; however, equipped with sensors, it measures the loads on the mooring lines. The measurements are communicated in real-time and the actual data is available for the port authority and the terminal operator. The systems dashboard displays and logs pivotal data for analysis like load on the line, line direction and angle, tide level, weather conditions, and vessel history. Administrators can conveniently add users, set alarms, and integrate the data into other systems through the provided API. The application can be used for all seagoing vessels, such as container and bulk carriers and cruise vessels.

The Smart Bollard increases safety for operators and assets by real-time monitoring of the vessel and therefore helps to prevent unsafe situations.



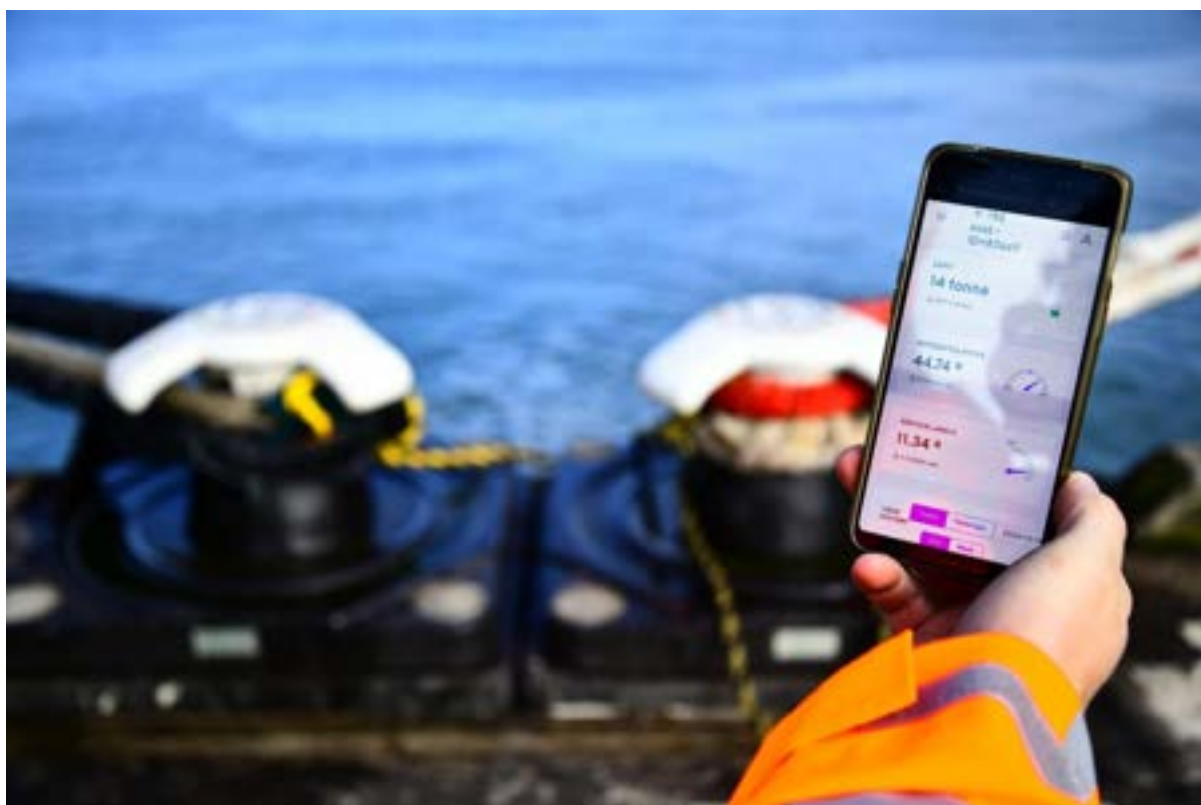
Besides, the Smart Bollard will increase efficiency by gaining a complete overview of the mooring forces in all conditions, which will result in more efficient use of the port. This will, for example, give the possibility to moor larger vessels on quays. Furthermore, it can reduce costs by making data-driven decisions, which can lead to a reduced need for expensive resources such as tugs.





how it was implemented

The Smart Bollard has been carefully developed and tested over several years. Our engineers put a lot of work to make sure it is reliable, accurate, and durable for the tough conditions in the maritime industry. Many prototypes were improved through repeated testing. Computer simulations were used to check its strength and performance under different loads.

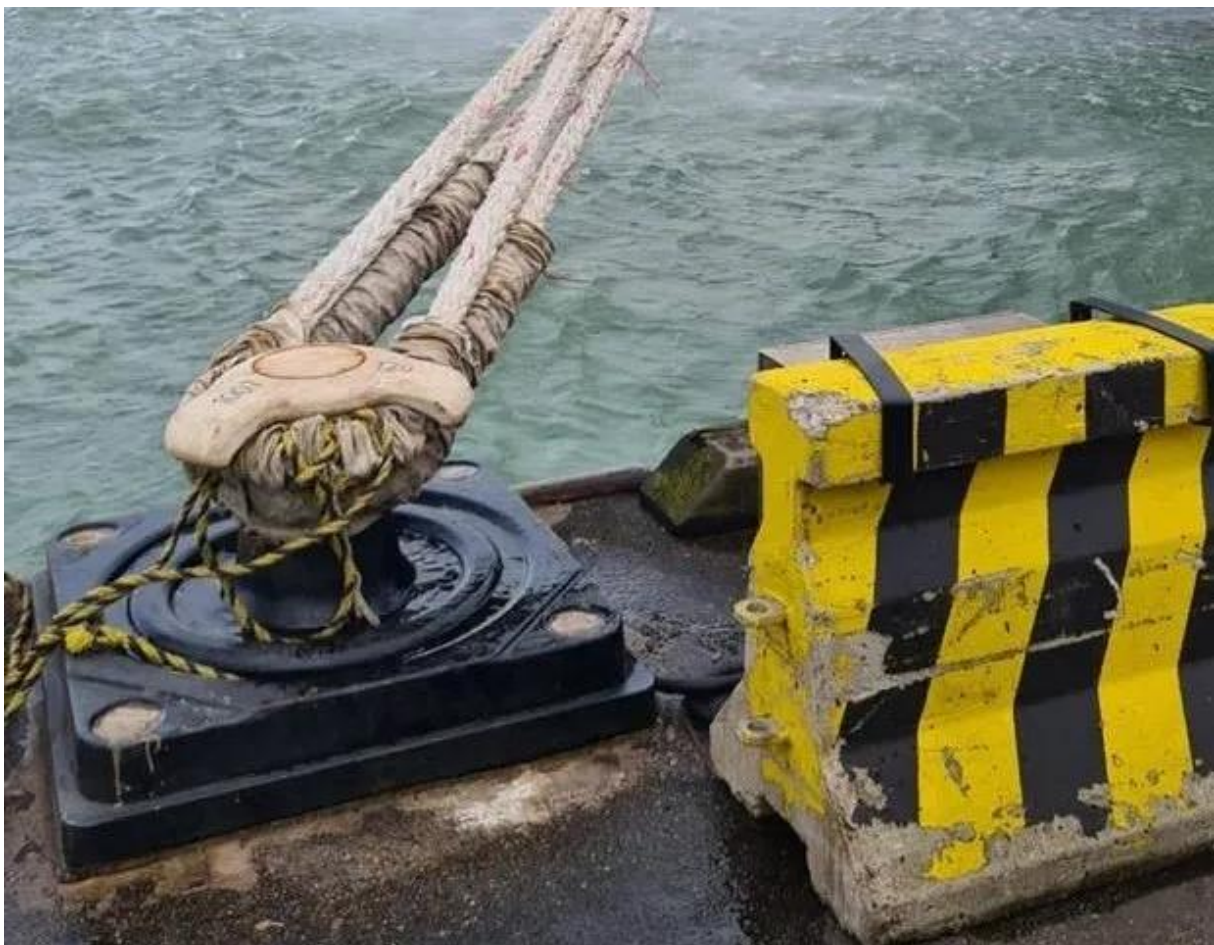


All this detailed work has created a strong and effective solution that meets the needs of the maritime industry.

The Smart Bollard has been tested many times in our test bench. After the successful tests in the test bench, the Smart Bollard was installed as a pilot at ECT Delta terminal at the port of Rotterdam in January 2021. This bollard position is used very regularly and therefore provides valuable measurement data. Various tests were carried out during the pilot. Several measurements have been taken by KRVE with a load cell between the bollard and line. In addition, measurements were taken with a test frame from BollardProof.

result

The successful trial of the Smart Bollard at the Port of Rotterdam, has demonstrated its efficacy in improving port efficiency through digitization. Nowadays, we installed 6 pcs of Smart Bollards at the ECT Delta terminal and 108 pcs along the new Prinses Amalia quay of the Port of Rotterdam. Besides the Port of Rotterdam, we have installed Smart Bollards at the Port of Valencia (MSC Terminal) and Port of Antwerp.



conclusion

The real-time monitoring and data collection from the Smart Bollards will lead to more efficient port operations, and help to prevent unsafe situations while vessels are moored.

We have created an animated video that explains the Smart Bollard:

<https://www.youtube.com/watch?v=HUaGkqjp3RY>

LINK: <https://mfstraatman.com/en/smart-bollard>



25. The Lab at Brookes Bell

The Lab at Brookes Bell's Non-Invasive Inspection Service provides full material evaluation to assess the structural integrity and safety of a vessel and also offers significant cost savings to vessel owners and operators

the challenge

Non-destructive testing (NDT) is essential for various industries, particularly those involving critical infrastructure like ships and offshore vessels. It is also crucial for the safety of these types of structures as it allows for the early detection of potential flaws and structural weaknesses without causing any damage. Regular inspections help ensure that materials are free of defects, such as cracks or corrosion, which can compromise the integrity of the vessel. By maintaining the safety and reliability of these structures, NDT plays a vital role in preventing accidents, protecting lives, and ensuring compliance with regulatory standards.

NDT encompasses several techniques such as ultrasonic testing, radiographic testing, magnetic particle testing and electromagnetics, all aimed at identifying material defects without compromising the integrity of the structure. Understanding the specifics of each method, their applications, and the regulations governing them can enhance safety measures and operational efficiency.

Regulations governing NDT practices in maritime industries are primarily set by international organisations and national authorities. The International Maritime Organization (IMO) provides guidelines for the safety of ships and offshore structures, which include provisions for regular inspections. Additionally, classification societies, such as Lloyd's Register, DNV, and Bureau Veritas, establish standards for NDT practices that shipowners must adhere to for vessel certification. Compliance with these regulations ensures the integrity and safety of maritime operations, protecting both human life and the environment.

the innovation

The Lab at Brookes Bell's non-invasive Corrosion Inspection Service – CMAP.

For over half a decade, The Lab at Brookes Bell has been developing and testing its comprehensive corrosion mapping service, known as CMAP, across all manner of inspection scenarios for the maritime sector.

At its core, The Lab's non-invasive CMAP technology has been developed to offer full material evaluation to assess the structural integrity and safety of a vessel and also offer significant cost savings to vessel owners and operators. The system is used to identify and understand the extent and severity of corrosion onboard a vessel while it remains in operation and without the need to remove the existing coatings. It enables owners to accurately understand the required repairs ahead of time before the effects of corrosion become too severe or result in significant lay-up time, resulting in improved cost management decisions for services and repair plans, as well as reduced downtime of the vessel. By using CMAP analytical data, vessel owners have the confidence to know their vessel remains in compliance with Lloyds Register.

The Lab's CMAP service consists of a highly refined Pulsed Current Array (PECA) inspection technique, the results of which are modelled using Brookes Bell's 3D data visualisation software and linked to a visual dashboard that creates a CMAP overview that highlights the condition of the vessel's steel, remaining wall thickness and material loss. For clients, CMAP provides comprehensive and easy-to-interpret data that enables them to make quicker and more accurate decisions and have a greater understanding of repair materials and repair time all resulting in significant cost savings.



The Lab at Brookes Bell team using CMAP technology to scan a vessel's deck

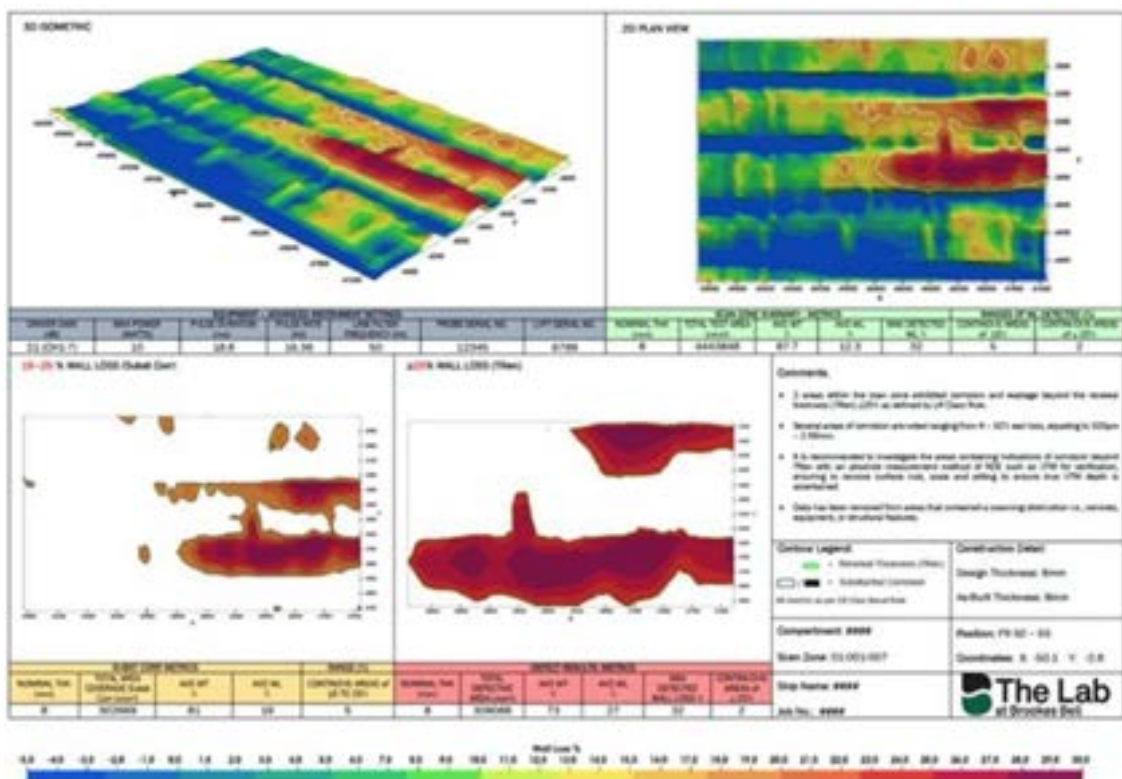
how it was implemented

PECA has been successfully deployed in offshore environments with ISO, ASME & API accreditations, and now the scanning technology has been improved upon and refined by The Lab for the marine sector. The method is proven to be an accurate tool, highlighting the condition of the steel, the remaining wall thickness/ material loss without having to prepare surfaces. To improve the usefulness of the scanning technology The Lab developed an in-house marine analysis and modelling software (CMAP).

In 2023, The Lab at Brookes Bell received official accreditation from the British Royal Navy's Warship Technical Authority (WTA) and classification society Lloyd's Register for its CMAP service.

The technology was tested and honed on the Royal Navy's Type T23 frigate vessels, landing platform docks, and several Ro-Pax ferries and superyachts in the commercial sector. This wide range of vessel types exhibit a range of corrosion that is typically seen around the world and enabled The Lab to develop a more comprehensive understanding of corrosion methods and how to use CMAP more effectively. CMAP has now been rolled out across the entire Royal Navy fleet.

The PECA technology developed by The Lab is the most thorough corrosion mapping and detection solution on the market due to its ability to assess through a myriad of surfaces, coatings and coverings, such as SynDeck, Camrex and hull fairing compounds, wooden teak and composite coverings, ceramics, antifouling and other cementitious screed and underlays. It is also effective on steel surfaces and can penetrate steel through paint coatings.



A sample report showing areas of corrosion

result

CMAP reports are particularly important for vessel owners and operators, as well as those involved in the management and maintenance of vessels. Corrosion on a vessel can often

compromise structural integrity and consequentially cause safety issues, which can culminate in expensive repairs, personal injuries and loss of earnings due to vessel downtime. The collective global cost of corrosion to shipowners is estimated to be as high as \$80 billion according to The Association for Materials Protection and Performance (AMPP).

By utilising CMAP technology and having a comprehensive understanding of corrosion issues affecting a vessel that may require immediate attention and forecasting repair costs prior to the vessel entering dry dock, ship owners and operators can make more informed decisions about the required repairs for their vessel and engage with stakeholders to provide cost-effective repair solutions ahead of time.

An example of how CMAP can provide cost benefits, for a typical superyacht, replacing teak decking on a selected area of the yacht could cost more than £150,000. This does not take into consideration additional costs from the shipyard for removing the teak and any other associated costs. Opposed to this is the cost for our technology to scan the same area of deck through the teak (therefore negating the need to remove it in areas where corrosion is not present) which would cost approximately £20,000 – equating to an estimated saving of over 86%. This provides considerable cost and time savings and reduces wastage from the unnecessary removal of teak deck.

conclusion

The Lab at Brookes Bell's CMAP technology is used by vessel owners to identify onboard corrosion and make more informed and quicker decisions for repairs, resulting in significant cost savings and reduced downtime. This tool translates data into visual and actionable findings so owners have a better understanding of issues affecting their vessel including the full safety of the vessel and its crew.

The early identification of corrosion benefits ship owners and operators in many ways: Identifying areas of potential failure allows crew and passengers to remain safe as they can be quickly cordoned off or repaired; Identifying areas of corrosion without removing decks, coverings or coatings allows for scanning to be done while the vessel or structure is still in service; Understanding the extent of corrosion allows for more cost-effective repairs or refits without the need for unnecessarily long downtimes or overordering of steel plates and other components.

With The Lab at Brookes Bell creating, developing, testing and implementing this unique approach to corrosion mapping, Brookes Bell has shown real innovation – helping to provide a quick and cost-effective method of ship and offshore vessel maintenance and providing a safer environment for both crew and passengers.

LINK: <https://thelab.brookesbell.com/>



26. Villari

wireless sensor technology that continuously monitors structural integrity using passive magnetic flux leakage to identify structural deformation or crack growth; a non-invasive inspection that eliminates the need for frequent manual check-ups

the challenge

The transport and logistics industry depends heavily on steel-based infrastructure—like cranes, bridges, and other heavy lifting equipment—to support massive operations. This reliance on steel structures brings an inherent challenge: fatigue cracks and other structural damages develop over time due to constant use, environmental stressors, and heavy repeated loading. These undetected cracks pose serious risks, as they can result in sudden equipment failures, costly downtime, or fatal accidents. Historically, ensuring safety and structural integrity has required frequent manual inspections, which can be time-consuming, labor-intensive, and often require workers to access hazardous or confined spaces. This raises both the likelihood of injury, overall costs and operational downtime, making the inspection process a critical safety and efficiency issue for the industry.

the innovation

Villari developed a pioneering solution consisting of wireless sensor technology that continuously monitors structural integrity using passive magnetic flux leakage. The system involves installing wireless sensors on critical points of steel structures to detect minute magnetic field changes caused by emerging cracks or stress points. These sensors use the Earth's magnetic field to identify variations in the steel's magnetic field due to structural



deformation or crack growth, without requiring complex infrastructure or constant recalibration. This data is then transmitted wirelessly to a central platform for real-time analysis and reporting, enabling a non-invasive, continuous inspection that eliminates the need for frequent manual check-ups. Villari's innovative technology shifts from reactive to proactive safety measures, allowing operators to stay informed of potential issues before they become severe.

how it was implemented

Villari's implementation process is highly scalable, requires no surface preparation, and is designed for minimal disruption to operations. Installation begins by identifying critical stress points on steel structures where cracks or weaknesses are most likely to develop. If asset owners lack the internal expertise for this assessment, Villari partners with engineering services firms specializing in structural analysis. These experts evaluate the structure and recommend optimal sensor placement to ensure comprehensive coverage of high-risk areas.



Once these critical points are identified, Villari's sensors can be installed within minutes. They transmit data wirelessly via LoRa (Long Range) technology to a secure platform, where Villari's algorithms analyse it to monitor crack growth potential. This data is continuously updated in an online environment accessible from anywhere with an internet connection. Through this system, operators can remotely and continuously monitor asset conditions, reducing the need for frequent manual inspections and enabling a proactive maintenance strategy. Additionally, the accumulation of historical data facilitates a data-driven maintenance approach, offering valuable insights into structural health trends over time.

This implementation model has been highly effective for major clients, including Eurogate, Port of Antwerp, ProRail and Hutchison Ports and has become a trusted solution for safety and asset management in demanding operational environments.

result

The implementation of Villari's continuous monitoring technology has yielded substantial benefits, particularly for critical and high-value assets like cranes and bridges. By enabling continuous monitoring, Villari's sensor system provides improved safety and significantly reduces the need for labour-intensive manual inspections, particularly in dangerous locations. This approach has led to enhanced safety for both the assets and maintenance personnel. Continuous monitoring reduces the risk of unplanned downtime due to early detection of structural weaknesses, leading to timely, planned repairs. Additionally, the end-of-lifetime for



each asset could now be precisely assessed – and increased – through the valuable data acquired.

conclusion

Villari’s sensor technology marks a significant advancement in industrial safety and asset management. By moving from frequent manual inspections to continuous, automated monitoring, the solution improves operational safety, reduces costs, and extends the lifetime of critical steel assets. The deployment of Villari’s technology not only lowers risks for workers by minimizing the need for physical inspections in hazardous zones but also helps transport and logistics companies optimize maintenance schedules and prevent expensive, unexpected failures and downtime. As industries continue to prioritize safety and efficiency, Villari’s model could become a standard for infrastructure health monitoring, setting a new benchmark in proactive safety and operational resilience for transport, logistics, and beyond. Villari aims to be the global leader in advanced steel structural integrity monitoring, revolutionizing the way industries realize asset lifetime extension. Guided by integrity, expertise, and accountability, offering disruptive solutions clients can trust.



LINK: <https://www.villari-technology.com/>





27. Voxel

AI-powered site visibility platform seamlessly integrates with existing camera systems to transform video footage into real-time, actionable insights, enabling businesses to proactively prevent incidents, enhance operational efficiency, and foster a safety-first culture without compromising privacy or compliance

the challenge

Workplaces, especially in industries like logistics, warehousing and manufacturing, face persistent safety challenges, ranging from slips, trips, and falls to severe injuries and fatalities (SIFs).

Traditional safety systems often react only after incidents occur, missing opportunities for prevention. Additionally, the sheer volume of video and operational data from surveillance systems remains untapped, offering a missed opportunity to address safety risks proactively.

Voxel empowers safety leaders to identify potential hazards before incidents happen by leveraging AI-powered analytics within the Voxel Platform. By analyzing video footage from existing camera systems, Voxel detects unsafe behaviors, potential violations, and environmental risks. This innovation enables organizations to address safety proactively and systematically, reducing SIF events and creating safer workplaces.

the innovation

Voxel is a worksite visibility platform powered by AI, transforming traditional safety management. Using advanced computer vision, Voxel's platform integrates seamlessly with existing surveillance systems to ingest video footage. The technology provides actionable insights by flagging potential hazards.

Beyond serving up analytics, Voxel's solution improves safety training, highlights operational inefficiencies, and supports compliance efforts, creating a multi-faceted approach to



workplace safety. Organizations using Voxel have reported not just safer workplaces but also enhanced productivity.

how it was implemented

Implementation begins with integrating Voxel's platform into an organization's existing camera systems. The AI models are trained to detect risks tailored to the organization's safety requirements, such as slip-and-fall hazards, improper use of equipment, or potential confined space entry risks.

Training sessions are conducted with safety teams to maximize platform effectiveness, and an easy-to-use dashboard provides real-time alerts and historical trend analysis. Feedback loops are created to continually refine AI algorithms, ensuring the system adapts to the evolving workplace dynamics.



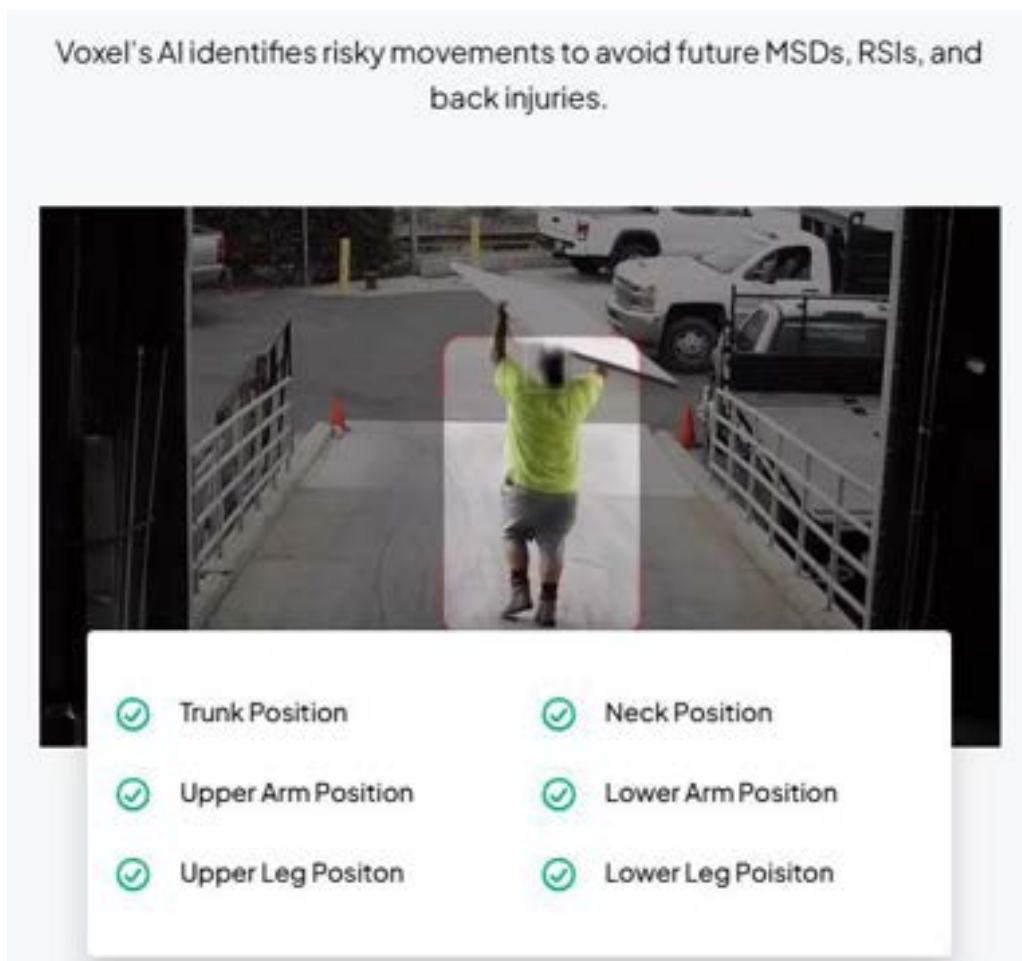
result

Voxel's clients have achieved remarkable and measurable safety improvements, aligning with our mission to protect the people who power our world. Across industries, Voxel has observed 5.1 billion protected work hours, showcasing the scale of impact our platform delivers.

For example, The Port of Virginia, America's Most Modern Gateway, saw a 50% reduction in truck speeding, a 15% reduction in PPE violations, and an 85% increase in safety team efficiency within just six months of implementing Voxel's platform. These improvements saved their safety managers 125 minutes daily, enabling them to focus on enhancing workplace safety culture rather than spending hours reviewing footage.

Other clients have also reported transformative results:

- 81% reduction in lost time incidents and 18% increase in employee retention at Vertical Cold Storage, showing that safety improvements foster workforce satisfaction.
- 65% reduction in workers' compensation claims and over \$3M in cost savings per site within one year, demonstrating Voxel's ability to deliver both direct and indirect financial benefits.
- Importantly, these results are achieved without compromising productivity, as evidenced by 0% change in productivity at Vertical Cold Storage.
- Voxel doesn't just reduce incidents; it fosters a culture of safety and efficiency, empowering teams to take ownership of their well-being while ensuring businesses maintain operational excellence.

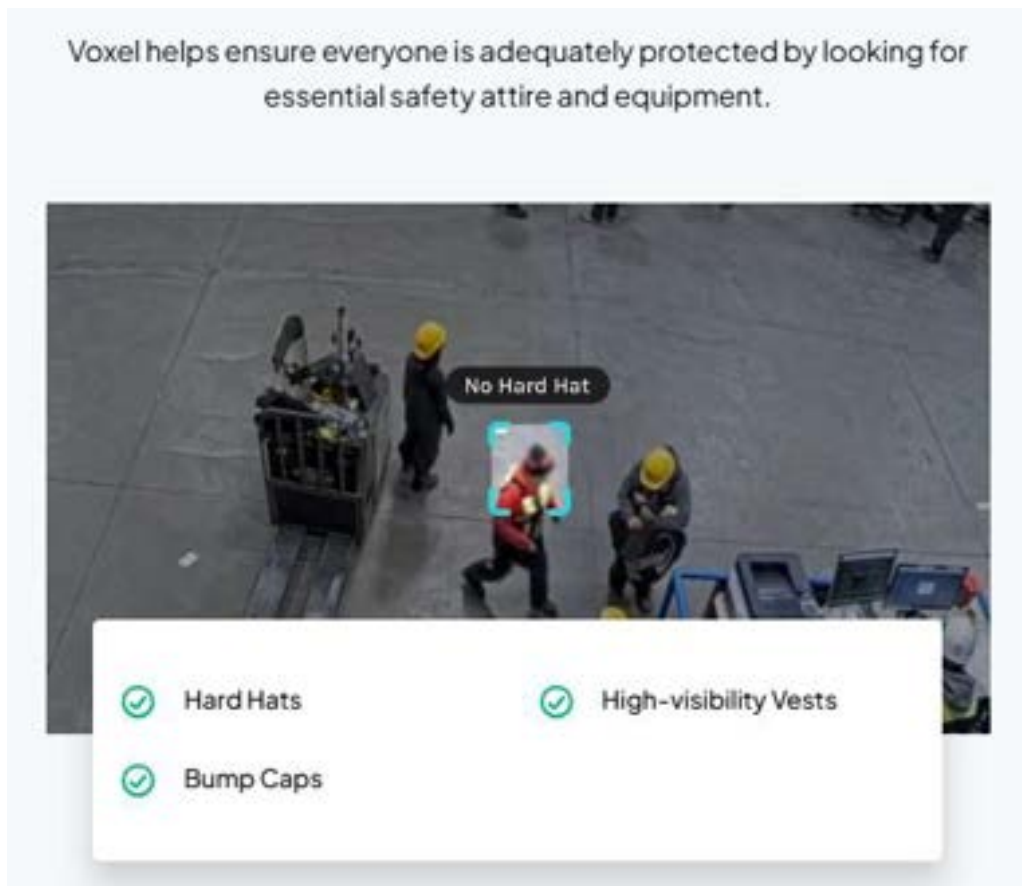


conclusion

Voxel is more than a safety solution—it's a strategic tool for organizational transformation that aligns with our mission to protect the people who power our world. By combining cutting-edge AI with a deep understanding of workplace dynamics, Voxel addresses safety at its core, both improving and saving lives while driving operational excellence.

Voxel empowers safety leaders with a powerful tool to identify risks before incidents happen, fostering proactive safety cultures and positive work environments. Innovation should not just solve today's problems but anticipate tomorrow's challenges.

Voxel is committed to continuous improvement, ensuring our platform evolves alongside the industries it serves. We are proud to share our journey and inspire others to reimagine workplace safety through AI-driven solutions.



Voxel is redefining workplace safety with its AI-powered site visibility platform, enabling businesses to proactively identify and mitigate risks in industrial environments. By seamlessly integrating with existing camera systems, Voxel transforms video footage into real-time, actionable insights—helping organizations prevent incidents before they happen. Built with privacy and security at its core, Voxel enhances workplace safety without compromising employee trust. By reducing risk, enhancing operational efficiency, and fostering a proactive safety culture, Voxel empowers businesses to protect their workforce while maintaining the highest security and compliance standards—driving both safety and productivity forward.

LINK: <http://voxelai.com/>



About TT Club

TT Club is the established market-leading independent provider of mutual insurance and related risk management services to the international transport and logistics industry. TT Club's primary objective is to help make the industry safer and more secure. Founded in 1968, the Club has more than 1100 Members, spanning container owners and operators, ports and terminals, and logistics companies, working across maritime, road, rail, and air. TT Club is renowned for its high-quality service, in-depth industry knowledge and enduring Member loyalty. It retains more than 93% of its Members with a third of its entire membership having chosen to insure with the Club for 20 years or more.

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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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Further Advice and Information

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