

# PORT TECHNOLOGY

INTERNATIONAL



Fifty-Fourth Edition

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## Introduction

There is no let-up in the financial difficulties faced by the world's major economies and thus, by extension, the logistics, shipping and cargo handling industries that underpin global trade.

No one seems to have any idea where this is all heading, so the safe thing to do is to re-examine cost structures and focus what investment there is on areas where the returns are likely to be, that is, if they invest at all.

In Britain and elsewhere, one of the most difficult obstacles created by the recession is the way in which companies have taken to hoarding cash. It is, of course, a natural psychological response to the commercial shocks that have battered the business world over the past few years. Those firms that didn't have enough capital to see them through the decline in demand have already gone to the wall; the remaining companies are wondering if their existing reserves will keep them operating until demand picks up again – but at no point in the sequence of recent events has there been any indication that growth has returned in any meaningful sense.

The Bank of England, among other central banks, printed a vast amount of money which was then given to the banks with the express purpose of it then being deployed back into the real economy to stimulate investment and demand. That hasn't happened; the banks have simply used it to repair balance sheets beaten up by their own mismanagement.

If it seemed that all the politicians' promises of rebuilding the economy were taking place in a parallel universe, the effects are now being felt in our world. Trade volumes are depressingly sluggish; freight rates, despite a recent rally, are still below break-even level on the mainline trades and those ports that have expansion plans underway or recently completed, will struggle to see a return on their investment in the foreseeable future.

Their main tool against this challenge is to cut costs, and a large number of the articles in this edition of PTI examine the various ways in which costs can be calculated and controlled.

Of course, ports are not the only sector belt-tightening – all other stages of the global supply chain are also examining cost structures. One of the surprising upshots of the recession is the way in which actors from the different parts of the supply chain have begun talking to each other. Shippers, previously reliant on shipping lines and forwarders to represent their interests, are now taking a direct interest in ports, and an interesting process of education has now begun for them because as they become more acquainted with our industry, new opportunities for efficiency and productivity will make themselves apparent.

### Gavin van Marle

Editor in Chief

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A large yellow VIGAN ship loader/unloader is shown in operation at a port. The machine is mounted on a ship's deck and has a long, horizontal conveyor arm extending towards the water. The background shows a body of water and a distant pier.

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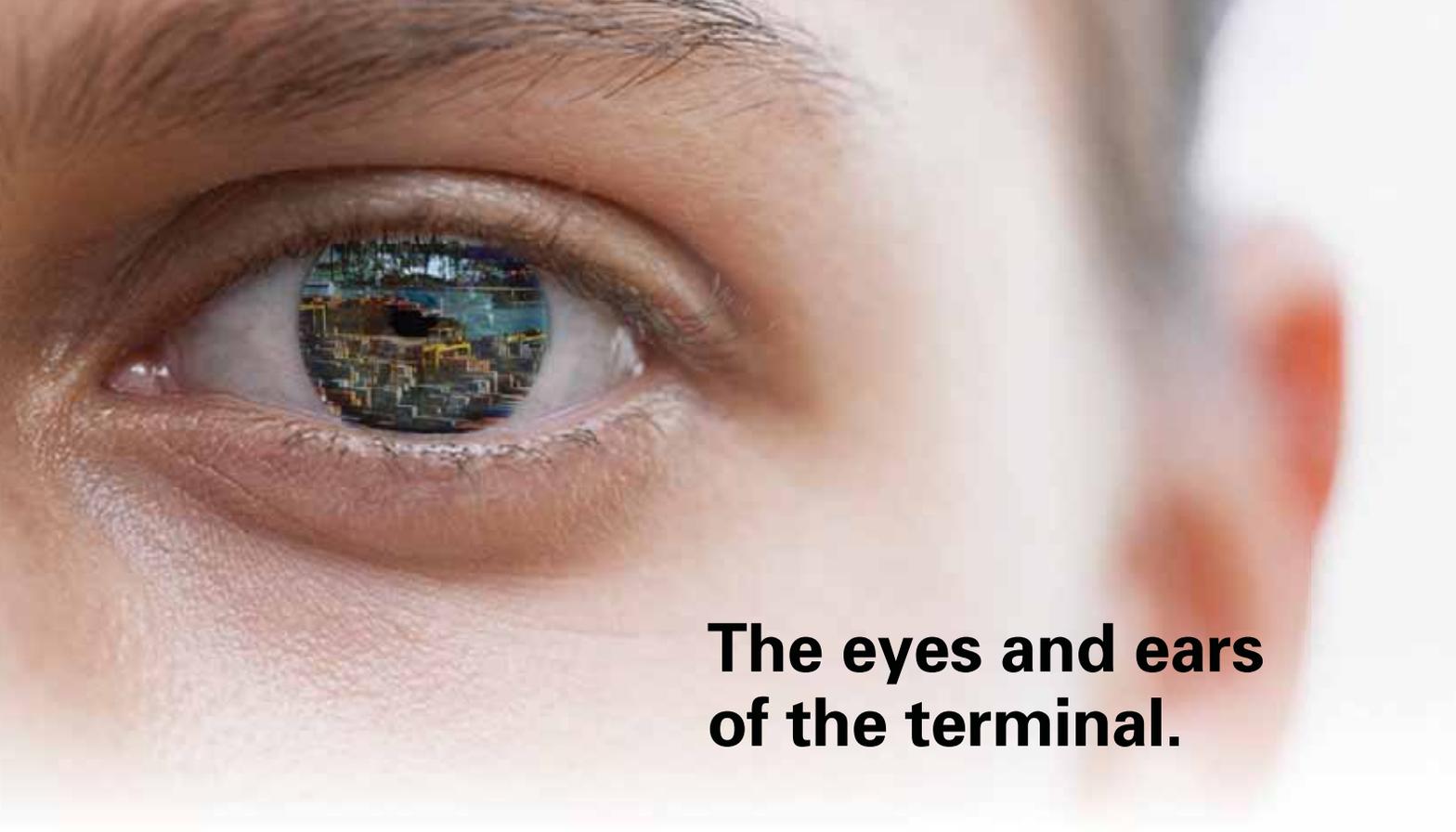
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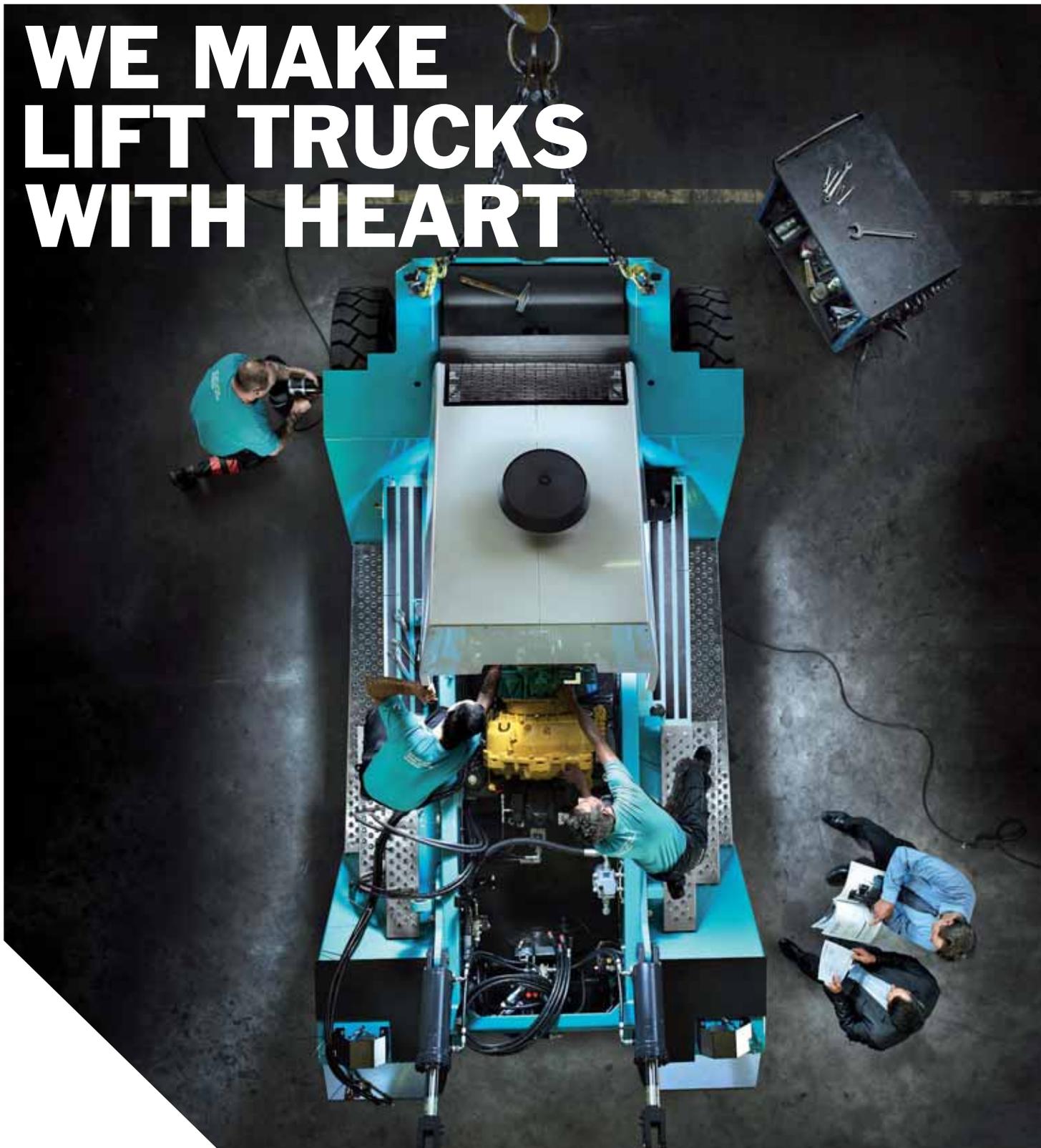
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# GLOBAL ISSUES



“If the key areas of the logistics supply chain are cost and speed, then the port plays an equally as important role in this process as any other factor.”

‘Port-able logistics solutions’, page 11.

# Port-able logistics solutions

Steve Shinji, head of global supply chain solutions and development, MOL Logistics, Middlesex, UK

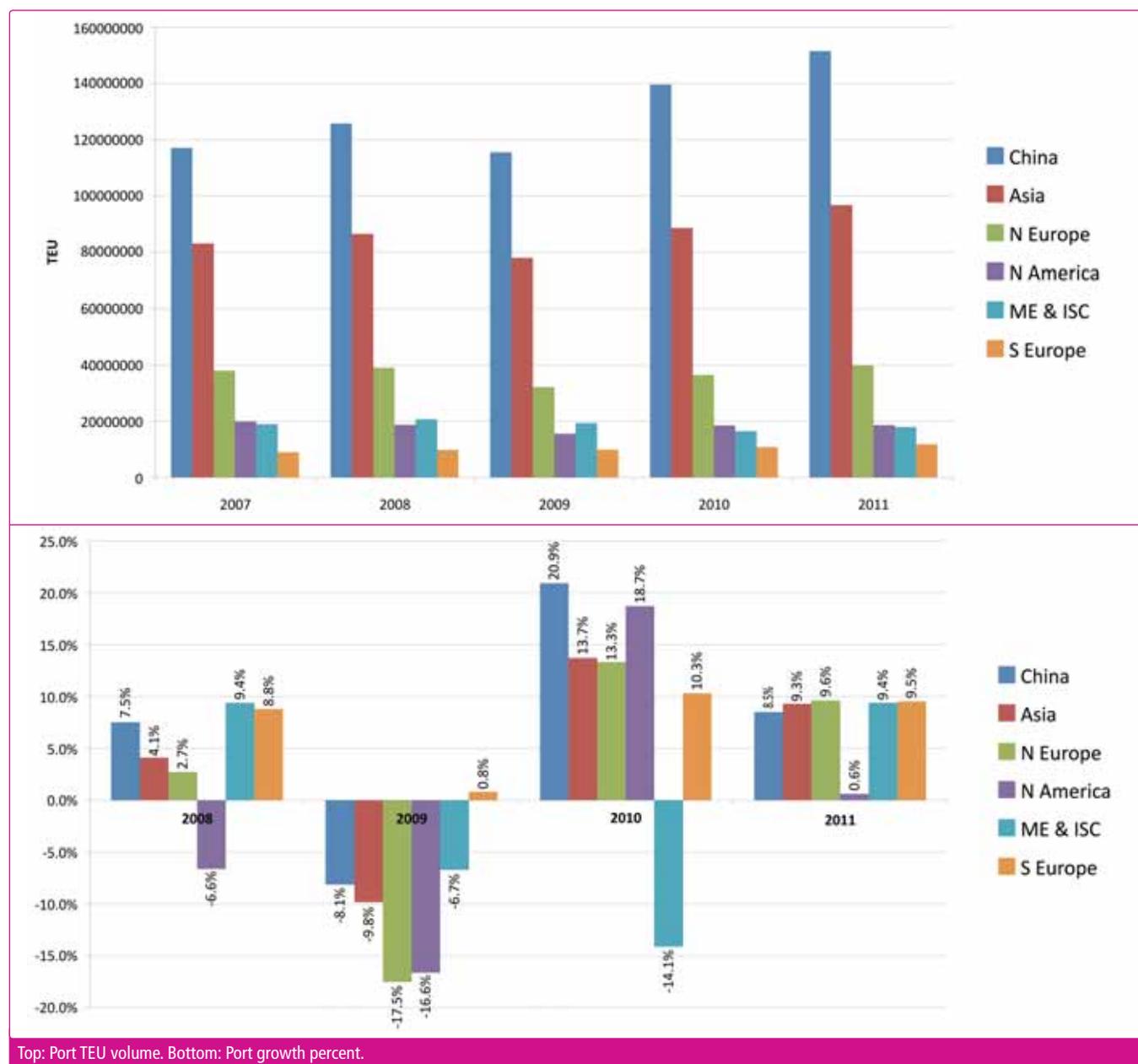
## Introduction

In an era where each process of the product supply chain is under constant evaluation, port terminals are now identified as a key stakeholder in the global supply chain process. Port selection is fast becoming a very important factor in the efficiency and speed for the market of shipped products. This article touches on the basic principles that support this new idea.

The logistics industry has changed and reinvented itself many times during my short yet progressive career in freight shipping. I remember when shipping was simply about moving cargo from A to B, with the key players in this process being a freight forwarder and the shipping line. The customer or 'end receiver' was exactly that; an end receiver.

## The logistic supply chain

End to end supply chain management has reshaped the industry almost entirely. No longer are freight forwarders only providing a logistic service to an end receiver, they are now an extension to their customer's business, and forwarders are now initiating innovative processes in the supply chain that are essential to the customer's business. Supply chain management is the integration of key processes that affect a product life cycle in terms of finance and quality. These key processes are commonly identified as: vendor or supplier management, origin cargo or CFS management, carrier selection or flexibility, delivery management or speed to market. Even this is now extended as far back as vendor or supplier sourcing and as far forward to warehouse stock or inventory management, onward distribution, and e-fulfilment.



Top: Port TEU volume. Bottom: Port growth percent.

However, with customers, logistics consultants, and freight forwarders constantly looking to improve supply chain efficiency, there is one essential part of the process that has been commonly overlooked: port selection. If the key areas of the logistics supply chain are cost and speed, then the port plays an equally as important role in this process as any other factor.

## Port reliability

Buyers source a vendor or manufacturer based on item price and production quality, with a large portion of suppliers for the UK and European market being sourced in the Far East and ISC countries. A basic cost analysis shows that combined production and freight costs are lower in the ISC region than that of the Far East, but the vendor spread supplying Europe is still equal amongst the two. In recent times, the pivotal decision maker here is port reliability.

After sourcing, evaluating and analyzing a product for manufacture and shipping costs, a buyer needs confidence in knowing that this product can be shipped without difficulty, to meet their required import delivery intake or product launch date. Therefore, equal importance must be given to the reliability of the exporting port operations as is to manufacture and shipping costs. The buyer does not want to be let down at the final hurdle due to the exporting port being incapable of coping with high TEU volume, congestion, poor weather conditions or technological failures.

Delays at port of export cause cargo delays on lead times or cause important portions of the cargo to be flown airfreight – both of which carry their own penalties to the supplier. So conducting a risk analysis on port of origin is worth it in the long run.

### Carrier selection

Freight rates plummeted in 2011, seeing many carriers fall in to the red. Long-term solutions see more vessel or loop sharing agreements by competing carriers, and more trade lanes served via transshipments.

With most carriers levelling out on freight rates, however, equal focus in supply chain economy is given to transportation costs. Where the logistic supply chain process traditionally revolved around carrier rates and agreements, we've found that other important elements in the process now decide what carrier is used for shipping, such as; transit times, arrival port location, transport links, and location of the importers warehouse or DC.

### Port facilities

Product speed to market depends on the turn around of cargo on arrival. When it comes to arrival turn around, specifically ports, we look at how quick it takes for a vessel to be offloaded, how reliable the port facilities are, how well the port can cope with weather conditions, how the port deals with traffic or congestion, and how close is it to a major rail head. All of these are areas

which should be taken in to deep consideration when selecting a port of arrival.

TEU volume into UK and Europe is set to grow by a further 15 percent during the period of 2012 to 2014, which means there is more pressure on these ports to deal with a higher capacity of vessels and inbound containers.

### Deliveries

The final logistical leg of the supply chain process is deliveries. The key factors here again are speed and cost. Carriers are primarily selected for cost and transit time, with both being pretty much on par across the big five carriers. However, with the rising fuel prices now driving up inland haulage costs, the logistical management process is reshaping, with forwarders and importers giving equal focus to the ocean freight and inland haulage cost. The location of the importer's warehouse or DC to the port of arrival is an important factor. For example, in the UK, an importer with a warehouse located in Suffolk, should request a sailing on a carrier that docks at Felixstowe for the short inland delivery after arrival. In the same theory, an importer with a warehouse in Hampshire should request an arrival in to Southampton Port. On reflection, a shorter inland haulage journey and paying a lower delivery seems like the obvious thing to do, but this is not practiced as often as it should be, as much of the focus is put on savings in ocean freight. The smaller percentage saving made on ocean freight, in many cases does not outweigh the larger percentage cost saving made on road haulage. A delivery analysis such as this has a direct impact on carrier selection.

## Focusing on the future port orientated solutions

The traditional logistics model focused almost entirely on carrier rates and agreements. This incorporated haulage, port of origin and of course, port of arrival. But rather than just serving as a gateway to a global market, the port is fast becoming a very important factor in the efficiency and speed to market of products.

By identifying the important role in which port operations play in the logistical supply chain, solutions are now being based around a port's capabilities. Decisions are now being made on which port is technologically capable of dealing with complexities, works best with high volumes, can cope with congestion and has good transportation links.

The key process in the modern supply chain solution is now the process which links the port of arrival and the point of delivery. When modelling a new logistical process for an importer, it is important to start with the location of the warehouse or DC in relation to the nearest port of arrival and then design the process in reverse. The traditional, and over analyzed carrier selection process and agreement, should follow on from this.

### ABOUT THE AUTHOR



**Steve Shinji** is the head of global supply chain solutions and development at MOL Logistics, specializing in transport flexibility, product speed to market, and logistic cost savings. Steve has spent 14 years working in Allport Supply Chain Management, Servisair Cargo and DHL Supply Chain. He now aims to provide MOL's European client base with transparent end to end supply chain solutions.

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# The cruise industry: itineraries, not destinations

**Dr. Jean-Paul Rodrigue**, Hofstra University, New York, USA, & **Dr. Theo Notteboom**, ITMMA, University of Antwerp, Antwerp, Belgium

## From liners to cruise ships

The global cruise industry carried about 19.1 million passengers in 2011, up from 7.2 million in 2000. Since 1990, over 154 million passengers have taken a cruise of more than two days. Of this number, over 68 percent of the total passengers have been generated in the past 10 years and nearly 40 percent in the past five years. The global growth rate of the cruise industry has been enduring and stable, at around 7 percent per year, in spite of economic cycles of growth and recession.

The emergence of the cruise industry can be traced to the demise of the ocean liner in the 1960s as it was replaced by fast jet services for which it could not compete. The last liners became the first cruise ships; the availability of a fleet of liners, whose utility was no longer commercially justifiable, incited their reconversion to form the first fleet of cruise ships. However, liners were not particularly suitable to the requirements of the emerging cruise industry. For instance, since many liners were designed to operate on the North Atlantic throughout the year for scheduled passenger services, their outdoor amenities such as boardwalks and swimming pools were limited. Additionally, they were built for speed (which was their trademark) with the related high levels of fuel consumption.

The first dedicated cruise ships began to appear in the 1970s and could carry about 1,000 passengers. By the 1980s, economies of scale were further expanded with cruise ships that could carry more than 2,000 passengers. The current largest cruise ships have a capacity of about 6,000 passengers.

## The cruise industry finds its business model

The modern cruise industry began in the late 1960s and early 1970s with the founding of Norwegian Cruise Line (1966), Royal Caribbean International (1968) and Carnival Cruise Lines (1972), which have remained the largest cruise lines. The early goal of the cruise industry was to develop a mass market, since cruising was until then an activity for the elite. In doing so, it developed a business model reflecting the mobility of its assets: the cruise industry sells itineraries, not destinations, implying a greater flexibility in the selection of ports of call and adaptability to changing market conditions.

Applying this business model in the past decades, the cruise industry developed into a mass market using large vessels and adding more revenue generating passenger services onboard. The Caribbean, with its winter peak season, remains the key market, but its dominance is being slowly eroded by the Mediterranean market, which offers a complementary summer peak season. Furthermore, strong niche markets have developed, focusing on, for instance, history (Hanseatic cities in northern Europe) or natural amenities (Alaska). Since the cruise industry is a relatively small segment of the global touristic sector, it has so far been very successful at finding customers to fill ever larger ships. The cruise product has become diversified to attract new customers and to respond to the preferences of a wide array of customer groups. In doing so, the cruise industry has innovated through the development of new destinations, new

ship designs, new and diverse onboard amenities, facilities and services, plus wide-ranging shore side activities.

## Capturing passengers and value

What is novel with cruising is that the ship represents in itself the destination, essentially acting as a floating hotel (or a theme park) with all the related facilities (bars, restaurants, shops, theaters, casinos and swimming pools). This permitted cruise lines to develop a captive market within their ships as well as for shore based activities (for example, excursions or facilities entirely owned by subsidiaries of the cruise line). Some cruise operators go very far in developing new entertainment concepts on board of their vessels, such as surf pools, water parks, ice skating rinks or rock climbing walls.

Onboard services typically account for between 20 and 30 percent of the total cruise line revenues. The average customer spends about \$1,700 for their cruise, including on ship and off ship expenses for goods and services. The majority of these expenses are captured within the cruise ship, as passengers spend on average \$100 per port of call.

## Selecting itineraries

Three main types of itineraries can be found:

- **Perennial** – The region covered by the itinerary is serviced throughout the year as the demand remains resilient, which is associated with stable (subtropical) weather conditions as well as stable itineraries. There may be significant seasonal variations in the number of ships deployed but the market remains serviced throughout the year. The Caribbean is the foremost perennial cruise market (summer low season), but the Mediterranean is also serviced year round, with a winter low season.
- **Seasonal** – Weather is the dominant factor explaining seasonality, implying that some regions have a market potential only during a specific period or season. This is particularly the case for Baltic, Norwegian, Alaskan and New England cruises that are serviced during summer months. Inversely, South American and Australian itineraries are serviced during the winter months.
- **Repositioning** – Because of the seasonality of the cruise industry the repositioning of ships between seasons is required. Cruise companies are increasingly using this opportunity to offer customers lower cost cruises for the inconvenience of having to book air travel arrangements for the return trip since the beginning and ending ports of call are not the same. This mainly takes place across the Atlantic as ships move from the winter Caribbean peak season to the summer Mediterranean peak season (and vice versa).

The number and order of port calls, the total sailing distance and the vessel speed are the main determinants of the total vessel roundtrip time. Schedule reliability is of utmost importance to cruise passengers, particularly when a tight synchronization exists between their arrival at the hub port and the departure of their international flights.

When delays along the route and in ports give rise to schedule reliability problems, cruise ship operators often decide to catch up lost time by increasing the sailing speed at night. Cruise ship operators can insert time buffers in the cruise liner service to reduce the risks of delays.

## Caribbean itineraries: the cradle of the cruise industry

The Caribbean is the world's largest cruise shipping market, representing over 40 percent of the annual cruise supply. It acts as an ideal cruising destination for the following reasons:

- The Caribbean is mostly a chain of islands in close proximity, implying short cruising distances between ports of call. The climate is subtropical with limited temperature fluctuations, albeit the hurricane season (August to October) can create some disruptions. There are a variety of landscapes ranging from rain forests to semi-arid conditions, as well as the presence of coral and volcanic islands.
- The region has a long history associated with European colonialism and accounts for the oldest settlements in the Americas. African, Hispanic, English, French and Dutch influences are prevalent, conferring a very diversified cultural landscape that often changes completely from one island to the other. Therefore, the cruise industry is able to offer to its customers a variety of cultural experiences in close proximity.
- Being adjacent to the US offers a large market of potential tourists able to afford cruise packages without having to travel far to start a cruising itinerary.

Most Caribbean cruises begin (and end) from the Miami or Fort Lauderdale cruise ports that act as the main hub ports. Both are major airports well connected to the rest of the US. New York is also a significant hub port, but its distance limits its Caribbean ports of call options; Kings Wharf (Bermuda) represents a common port call for New York bound Caribbean itineraries. Itineraries using San Juan, Puerto Rico as a hub port have the advantage of being able to effectively cover the eastern Caribbean, the furthest from the US and not serviced by cruises of seven days and less calling from southern Florida.

The typical itinerary is of about seven nights duration, which enables to cover a sub-region of the Caribbean comprising of three or four ports of call (see Figure 1). Cruise ships commonly arrive at the port of call early in the morning and leave in the evening, using the night to sail to the next port of call. To take advantage of a location that does not have sufficient infrastructure to accommodate cruise operations, several cruise shipping companies developed private cruise terminals, including related private touristic amenities, such as beaches, craft markets and restaurants. A salient example is Labadee in Haiti, which is privately owned by Royal Caribbean Cruises. The facility is an enclave protected by private security forces and acts as a port of call for most of the company's Western Caribbean itineraries.

## Mediterranean itineraries: an emerging complementarity

The Mediterranean is the world's second largest cruise shipping market, representing over 29 percent of the annual cruise capacity.



Figure 1. Selected cruise itineraries, Caribbean.

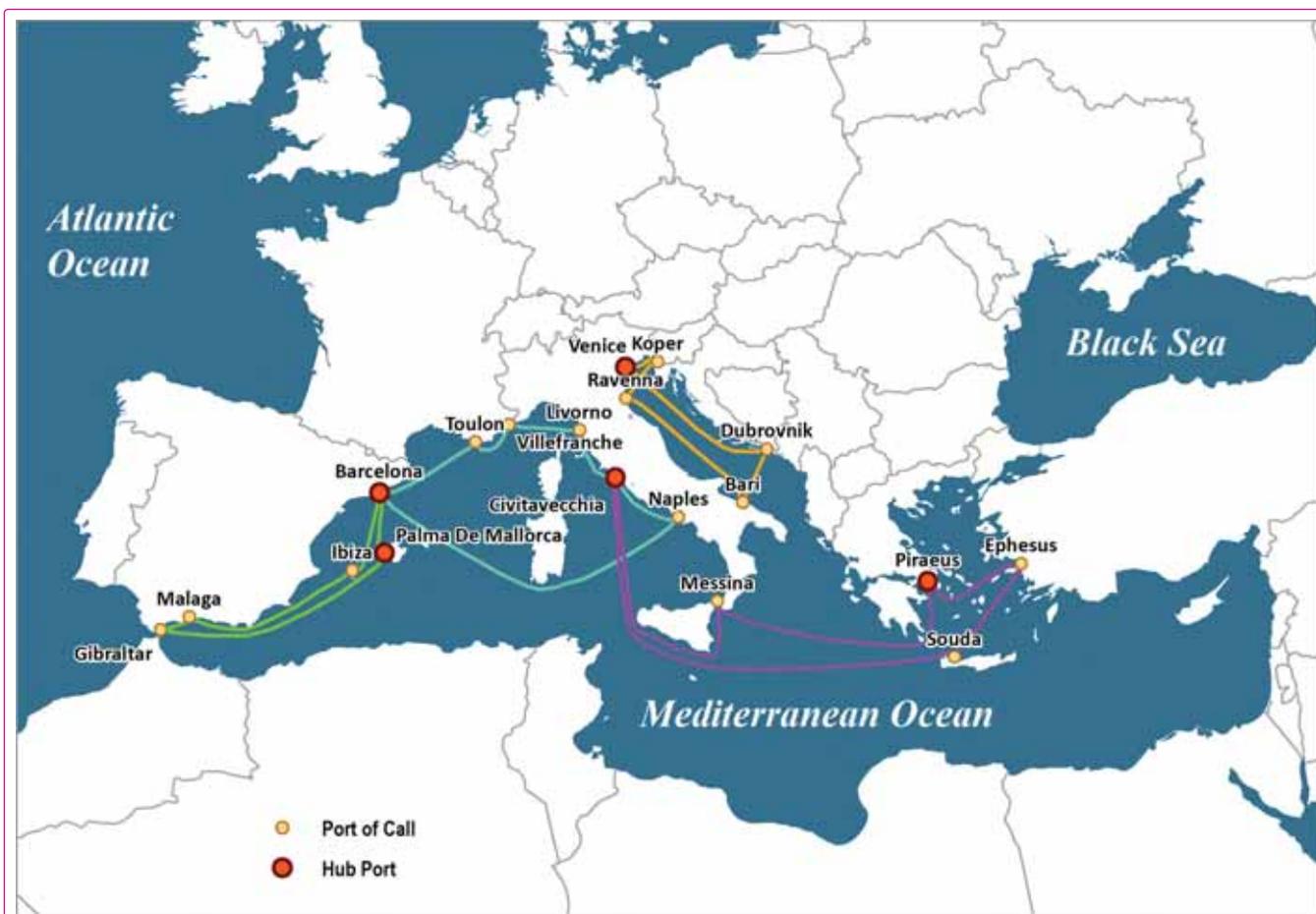


Figure 2. Selected cruise itineraries, Mediterranean.

Its adjacency to Europe provides the advantage of a large pool of customers. It is a perennial cruise market with a summer peak season (several itineraries are not serviced in the winter). The Mediterranean offers seaside resort destinations as well as world class cultural amenities, as several cities are museums by themselves (for example, Venice). Seven day itineraries are structured into small loops of four to five ports of call, each covering a specific sub-region, such as the Adriatic or the Spanish coast (see Figure 2). Since the distances between ports of call are relatively short, this leaves additional time for shore excursions as each port of call offers a wide array of cultural amenities. Itineraries of 14 days are also being offered, covering large parts of the European side of the Mediterranean.

Many of the itineraries are focused on historical sites and exceptional scenery. The most popular countries for cruise ports of call in Europe are Italy, Spain and Greece. Strong growth in Mediterranean cruises in the past years has meant that some ports are getting very crowded. This is particularly felt in top cruise tourist destinations such as Santorini in Greece, Venice in Italy and Dubrovnik in Croatia, but also hub ports, such as Civitavecchia and Barcelona, are challenged to cope with the strong growth of the past years.

### The importance of ports of call

Cruise ports come into three main categories depending of the role they serve within their regions:

- **Destination cruise port** – There are several reasons why the cruise port area can be the sole destination. In the case of cities such as Venice and Barcelona, the cultural amenities offered are world class to the point that tourists will have few incentives to see anything else in the vicinity. Alternatively, in some cases

there may be safety and security issues outside the port area, which can be common in developing countries.

- **Gateway cruise port** – Some cruise ports act as technical stops since they offer no significant cultural or physical amenities, but are used because they are servicing a major touristic destination. For instance, the port of Civitavecchia is the gateway to Rome, one of the most visited cities in the world.
- **Balanced cruise port** – These represent an array of cruise ports where the port can be a destination, but excursions are also available. The balance between the gateway and destination functions varies according to what each port and its region has to offer.

For most customers, a cruise involves two travel segments, the first being air travel to the hub port (with a return trip) and the second is the cruise itself. It is therefore important that the hub port is serviced by a well connected airport, with significant airlift capacity and which represents in itself a touristic destination. This is the case for Miami, Fort Lauderdale and San Juan; these are respectively well connected airports and act as hub ports for Caribbean itineraries. Barcelona and Civitavecchia (near Rome) are major hub ports for the Mediterranean and are well serviced by air transportation. Poorly connected airports are commonly associated with higher airfares, which impair the competitiveness of the city for mass tourism. There are a number of customer benefits linked to having more cruise embarkation points available, such as drive to convenience (particularly felt in North America) and fewer airport hassles. More 'close to home' ports also increase the likelihood of cruising; the reason why cruise lines will call at ports along the American Gulf Coast and Eastern Seaboard, such as Tampa, Galveston, Baltimore and New Orleans, is to capture customers wishing to avoid the hassles of flying to a hub port.



*MSC Splendida*, one of the largest in MSC's fleet with a capacity of 3,900 passengers (plus a crew of 1,300), pictured here in the Port of Barcelona, the second largest cruise port in the world after Miami.

## Live by the supply, perish by the supply?

The cruise industry has emerged to become a significant niche to the global tourism industry. The selection of ports of call and itineraries are carefully pondered to maximize the commercial potential and utilization of the ship assets. Since the cruise industry appears fundamentally to be driven by supply, it is likely that supply saturation, as opposed to demand saturation, will constrain future developments and impose a maturity on an industry that has until now continued to grow rapidly. While large hub ports have the capacity to accommodate additional port calls, it is the smaller 'exotic' or 'must see' ports that cruisers are seeking to visit;

this presents challenges for additional capacity. Berth availability and the capacity of small communities to accommodate large tourist influxes of short duration have become salient issues. This is likely to incite the additional involvement of the cruise industry in terminal operations, a trend that has already taken place with the setting of private port or resort areas. An emerging strategy involves the development of new cruise terminals co-located with service amenities, such as hotels, attractions, condominiums and shopping malls. While a further fragmentation of itineraries is likely to take place, a closer integration between the cruise port and cruise shipping industry is to be expected.

### ABOUT THE AUTHORS



**Dr. Jean-Paul Rodrigue** is professor at Hofstra University, New York. His research interests mainly cover the fields of economic and transport geography as they relate

to global freight distribution. Area of interests include North America and East and Southeast Asia, particularly China. Specific topics over which he has published extensively about cover maritime transport systems and logistics, global supply chains and production networks, gateways and transport corridors, international trade and regional development.



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Source: Wikimedia Commons | Maureen from Buffalo, USA

*“Recently, the Bayonne Bridge’s navigational clearance of 151 feet has raised concerns among maritime, shipping and industry representatives about the clearance limitation, future planning and introduction of larger vessels, due to the planned expansion of the Panama Canal.”*

*‘The Bayonne Bridge – plans to raise the roadway and lift the economy’, page 18.*

# The Bayonne Bridge – plans to raise the roadway and lift the economy

**Joann Papageorgis**, program director of the Bayonne Bridge Navigational Clearance Program, The Port Authority of New York & New Jersey, New Jersey, US

## Background

The Bayonne Bridge opened to traffic in 1931, and for more than 80 years has provided vehicular access between Bayonne, New Jersey and Staten Island, New York. Designed by Othmar Ammann, the 1,675 foot steel arch span was the longest in the world at the time and remained so for 46 years. In 1985, the American Society of Civil Engineers designated it a National Historic Civil Engineering Landmark. The Bayonne Bridge spans the Kill Van Kull, a critical shipping channel servicing Port Newark, Elizabeth Port Authority Marine Terminal and Howland Hook Marine Terminal. These terminals contribute to the Port of New York and New Jersey's designation as the busiest port on the eastern seaboard, with 40 percent of east coast container imports, serving the robust consumer market of the Northeast, as well as the industrial Midwest and eastern Canada. Annually, The Port of New York supports more than 280,000 jobs, \$11.2 billion in personal income and more than \$36 billion in business income in the region.

Recently, the Bayonne Bridge's navigational clearance of 151 feet has raised concerns among maritime, shipping and industry representatives about the clearance limitation, future planning and introduction of larger vessels, due to the planned expansion of the Panama Canal scheduled for completion in 2014. An additional increase in trade is also expected from South East Asia and the Indian subcontinent through the Suez Canal. The Panama Canal expansion will allow for larger ships to access the region, most of which currently cannot pass under the Bridge.

This clearance limitation is likely to cause a reduction of port competitiveness and diversion of cargo to other East Coast ports. The future use of larger, newer post-Panamax vessels is expected to reduce environmental impacts, lower shipping costs, provide economies of scale, and offer potential benefits in overall transportation costs to regional, and to national and international customers. Removal of the existing clearance restriction is crucial to maintaining the port's position as the third largest port in the country, and assuring continued regional economic growth and development.

## Finding solutions

To address these concerns, the Port Authority of New York and New Jersey authorized \$1 billion dollars and fast tracked the planning, regulatory review, preliminary and final engineering design, and ultimately construction of a solution to resolve the existing clearance restriction. In August 2009, the Port Authority initiated preliminary environmental alternatives analysis and conceptual engineering studies to evaluate a wide range of alternatives to address the clearance restriction. These alternatives included bridge modifications, such as raising the roadway, jacking the arch and conversion of the main span into a lift bridge operation, as well as a new bridge or tunnel replacement alternatives, and removal of the bridge in its entirety and replacement with either ferry service or alternate site expansion.

In December 2010, the Port Authority announced 'Raise the Roadway' as the best alternative to expedite the removal of the clearance restriction, control costs, and minimize environmental, neighborhood, and navigational impacts. Raise the Roadway will not necessitate any property acquisition or displacements, it will preserve the iconic, historic arch, maintain the navigational channel operations, and improve vehicular conditions by providing 12 foot lanes, a median safety divider, shoulders, widened walkway and bikeway, and the potential for a future transit corridor.

The Port Authority's innovative engineering design approach will also allow the higher suspended roadway to be constructed within the structure of the arch, while the lower, existing suspended roadway deck remains open to traffic, and will not necessitate a full bridge closure. This unique approach will expedite construction and minimize impacts to our customers, the community, and the traveling public. Rather than demolishing and replacing the Bayonne Bridge, we are expediting our efforts to rehabilitate, retrofit, and reuse the historic bridge arch structure and incorporate functional and design improvements for the future.

## Raising the bridge

The proposed construction staging is designed to fast track achievement of the navigational clearance, without negatively



Bayonne Bridge conceptual schematic – arch elevation.



Left: Existing clearance. Right: Proposed clearance.

impacting vehicular customers or operation of the Kill Van Kull shipping channel below. At the start of construction, the existing four lanes of vehicular traffic will be restricted to two lanes of traffic, one in each direction, on one side of the bridge. On the other side of the bridge, two lanes of traffic will be reconstructed at the higher 215 foot (mean high water) elevation.

When construction of the two travel lanes at the higher (215 foot) elevation are complete, traffic will be shifted to the new lanes. Instead of a traditional construction staging sequence that would complete the construction of the remaining two lanes at the newer higher 215 foot elevation, main span construction activities will be placed on hold, while the focus shifts to the expedited demolition of the existing 151 foot deck. When the deck over the channel is removed, the construction activities for the remaining two lanes of traffic will resume. The reprioritization of the construction staging will expedite the removal of the clearance restriction by as much as two years, without negatively impacting vehicular customers, or resulting in additional environmental, community, maritime, or navigational channel impacts [1].

The required regulatory review process is now the critical path and The National Environmental Policy Act (NEPA) Federal review process is well underway, with the US Coast Guard as the Lead Federal Agency. Conceptual engineering and alternatives analysis was completed in 2010, preliminary engineering in 2011, and the program remains on schedule for the completion of our final engineering design, environmental, and regulatory process in late 2012. The Port Authority anticipates the scheduled

completion of our federal environmental review process in late 2012, with state, local, and construction permits immediately thereafter, leading to the award of a Design – Bid – Build construction contract for Raise the Roadway anticipated in 2013.

### Importance of the project

The Bayonne Bridge program is a regional economic priority with continued strong support from New York governor Andrew Cuomo and New Jersey governor Chris Christie. The program also recently received the endorsement of the combined New York and New Jersey senate delegation and unanimous recommendation for inclusion in President Obama's March 2012 Executive Order to expedite infrastructure projects. During Bayonne Bridge construction, short-term economic activity is expected to result in more than 6,300 job years, \$380 million in wages, and \$1.6 billion in economic activity. In the long-term, the Raise the Roadway program will assure the Port of New and New Jersey maintains its position as an important economic engine for the region, and provides continued, sustainable regional economic growth and development for the foreseeable future.

#### ANIMATION LINK

[1] View a brief video animation of the proposed construction on the Port Authority of New York and New Jersey Bayonne Bridge program website: <http://www.panynj.gov/bayonnebridge>.

#### ABOUT THE AUTHOR



**Joann Papageorgis** joined the Port Authority of New York and New Jersey in 1985, and is program director of the Bayonne Bridge Navigational Clearance Program.

Ms. Papageorgis is responsible for expediting the planning, environmental review, and preliminary and final engineering design for the Raise the Roadway alternative as the best solution to address the existing 151 foot Bayonne Bridge navigational clearance restriction.

#### ABOUT THE ORGANIZATION

**The Port Authority of New York & New Jersey** conceives, builds, operates and maintains infrastructure critical to the New York and New Jersey region's trade and transportation network. These facilities include America's busiest airport system, marine terminals and ports, the PATH rail transit system, six tunnels and bridges between New York and New Jersey, the Port Authority Bus Terminal in Manhattan, and the World Trade Center.

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# Low carbon project leads the way on rail

**Lisa Brazier**, project manager, Haven Gateway, Essex, UK

## Introduction

Other ports should sit up and take note, said UK communities and local government minister Baroness Hanham as she launched the Haven Gateway's \$12 million Low Carbon Freight Dividend project.

This unique initiative is designed to shift containers from road to rail; aimed specifically at small and medium enterprises (SMEs), it offers them a grant of up to 30 percent for moving their freight from truck to train, where traditionally they would have used road transport.

"Innovation is the key to strengthening the economy and this project has enormous potential to be taken up elsewhere; it can give the lead to other container ports as to how they can manage and help small businesses as well," said Baroness Hanham.

"This innovative and practical project will bring greater awareness of how business growth can go hand in hand with carbon reduction, which is part of all of our lives today."

But it's not only the UK department of communities and local government which will be, as the minister promised, watching this project closely. The breakfast time launch at Felixstowe attracted a full house of SMEs, who are working through some pretty gloomy economic times. As Oliver Howard, office manager at Orchid Transport Services put it: "It's not very often that money from Europe goes into real business. In an industry that is struggling, anything that can give us an advantage or slightly increase our competitiveness is very welcome."

## The project

The rules of the game are that the maximum payment will be £75 (about \$120) per container switched from road to rail, for a minimum of 14 containers. The maximum number of containers eligible is currently set at 90. However, this limit will be reviewed and possibly increased as the project progresses, depending on participants' needs.

To qualify, an SME must have fewer than 250 employees and either an annual turnover of less than €50 million (around \$66 million) or a balance sheet of less than €43 million (around \$56 million); the SME must be based in the East of England; and eligibility also depends on any previous state aid funding received, and details of parent or subsidiary company ownership.

"This is definitely something we are looking to get involved in," said Oliver Howard at Orchid. "It is well documented that the haulage industry is struggling with fuel prices; any incentive to move traffic on to rail has to be welcomed."

Dennis Simmonds, managing director of WS Logistics, said: "With the roads as clogged up as they are, there must be alternatives, and we are open to look at anything that will enhance our business."

At the launch of the initiative, Haven Gateway projects director Richard Morton highlighted road congestion problems that existed whether you are in the freight industry or driving a car across the East of England and beyond. Add in the rising cost of fuel and the likelihood of carbon taxes sooner rather than later, and there was a clear need to find alternatives to the traditional routes for freight, he said.

"This is a pilot scheme; we want to prove that the concept works and that we have the ability to help change some of the culture and traditional methods of moving freight for SMEs. We



Baroness Hanham, Richard Morton and Tony Berkeley at the launch project.

know the [UK] government doesn't have a clear understanding of how it will achieve its European target on carbon emissions."

The project includes a series of 'Optimization of Freight Movements' workshops, which will provide advice, guidance and practical examples of how to reduce carbon emissions. Alongside these, the Haven Gateway is offering a Low Carbon Transport Marketing Package, enabling SMEs to market their services as carbon friendly and thus attract new customers.

Another crucial element is access to the Containerized Cargo Carbon Calculator, an online tool for comparing and contrasting cargo movement methods (road, rail and water) and the carbon emissions for each method.

In fact, the project has attracted the interest of feeder and coastal shipping operators as well – if the concept works for rail, why not water, said one.

Lord Berkeley, chairman of the Rail Freight Group, said: "What I like about this project is that it is going to bring the use of rail to small businesses, which don't have much time to investigate the complexities – and it is a very complex industry. I am also pleased that there is a follow up to this launch to educate people how to make it work. SMEs have the ability, generally, to be very innovative and I think the more innovative we get in this sector, the better."

Of course, the day to day reality for many SMEs is focusing on what they actually make or produce, not how they transport it. If their supply chain works, they won't fix it; many simply don't have the time or resources to do so anyway.

That's something the Haven Gateway has taken note of. The project has been organized to keep paperwork and bureaucracy to a minimum. Only two forms have to be signed and they can be returned together. From that point forward, everything else is electronic. Our focus is trying to make the process as easy as possible. The onus is on the project team, not the SME, to do the work – and that is the way it should be. We are there to support them every step of the way.

There was significant interest in the project even before the launch and so far over 20 SMEs have formally approached the Haven Gateway.

## Challenges

There are obstacles facing the project, however, and some of them once again reflect the reality of the SMEs' world.



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Richard Morton being interviewed by TV news team at the Felixstowe launch.

David Cross, commercial manager at rail freight operator DB Schenker, said: “We know there are people out there who want to use this opportunity, and we know the money is available for them; what we haven’t found is a long list of SMEs who organize their transport themselves.

“SMEs often don’t have the critical mass to have a member of staff organizing transport. So they tend to buy transport services off forwarding agents – and those forwarding agents, which would be booking the rail transport, exceed the size limits of the project.

“But subject to some paperwork being presented and verified, I think we can crack that, by demonstrating that the forwarders are acting on behalf of one of these SMEs.”

Apart from this frustration, he said: “Anything that helps offer people a ‘taste’ of rail, however you do it, is a good idea. We are talking about a substantial grant which would be especially welcome in the current climate. People are going to be interested and we believe we can introduce some quite small companies to the Haven Gateway and this project.”

## Conclusion

The Low Carbon Freight Dividend project has been supported with nearly \$4.7 million of funding from the European Regional Development Fund. Over a three year period, the aim is to move about 30,000 containers from road to rail; the project team says that would eliminate at least 11.7 million kilograms of carbon dioxide from the logistics supply chain, worth nearly \$5.5 million in associated environmental benefits, according to Defra calculations.

It’s also hoped that SMEs that do make the change will become ‘ambassadors’ for rail, encouraging others to make greener choices.

Baroness Hanham described the project as a ‘trail blazer’. “I think there are huge opportunities here to become the front runners in reducing carbon and getting freight off the road and on to rail,” she said. “We will really keep an eye on this and we hope other ports will be watching this too.”

Lord Berkeley concluded: “This is a really creative and fantastic scheme to encourage smaller firms to use rail freight for their container transport inland from the Haven ports. It will widen the interest in rail freight and demonstrate to them and their customers just how effective rail freight can be and the benefits in time, cost and carbon reduction that it can deliver.

### ABOUT THE AUTHOR



**Lisa Brazier** has worked for the Haven Gateway Partnership for over three years and was their office manager prior to becoming the project manager for the Low Carbon Freight Dividend. Lisa is studying part time for a BA in Business Management.

### ABOUT THE COMPANY

The **Haven Gateway** is a public private sector partnership that brings together the ports and logistics industry – including Felixstowe, Harwich, Ipswich and Mistley, and local authorities. The Partnership is committed to protecting the environment and quality of life in the Haven Gateway sub-region.

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# PORT PLANNING, DESIGN AND CONSTRUCTION

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*“In the recent years, the strategy of project developers has increasingly been governed by focus points in the negotiations over the business plan and over the conditions of the new facilities. The investigations of other seemingly minor technical issues tend to be postponed.”*

*‘Project phases and respective scope’, page 42.*

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# A low tech approach to dredged material management

**Dr Andrew Birchenough**, senior marine environmental advisor, Regulatory Assessment Team, Cefas, Suffolk, UK

## Background

The Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 (the London Convention) was one of the first global conventions to protect the marine environment from human activities. It has been in force since 1975 and is the most widely applicable international regulatory instrument.

The London Protocol was adopted in 1996 to modernize the London Convention and supersedes it for those countries which are Contracting Parties to both. The main objective of the Protocol is to protect and preserve the marine environment from all sources of pollution. Under the Protocol, all disposal at sea is prohibited, except for certain listed categories of waste that may be considered for disposal, provided that they meet certain criteria, and even then only under strict conditions. One of the categories is dredged material.

In recognizing the need for guidance in implementing Annex 2 of the Protocol and to assist national governments with the assessment of wastes or other material that may be considered for disposal, the Contracting Parties developed the Waste Assessment Guidelines (WAG). To make the WAG more accessible the Contracting Parties further developed a WAG Training Set (WAG TS), which comprised of a set of instruction materials intended for use by national authorities responsible for regulating the ocean disposal of wastes.

## Dredged material management

The London Convention and Protocol are the most widely applicable legislative instruments for the regulation of the disposal of dredged material at sea and are important in setting basic requirements for dredged material management. In addition to the WAG and WAG TS the London Convention and Protocol have developed Specific Guidelines for the Assessment of Dredged Material (previously known as the DMAF) which, as the title suggests, provides the context within which assessments of the suitability of dredged material for sea disposal should be carried out.

### The need for a low tech approach

The need to develop a low technology approach to dredged material management was identified at regional workshops that were conducted by the IMO, to increase awareness and understanding of the Protocol. The Central Dredging Association (CEDA), which represents the World Organisation of Dredging Associations (WODA) at the London Convention and Protocol, participated in these workshops running sessions on dredge material management. At these sessions participants raised the issue that some countries where regulations are currently absent or in development may lack the technical equipment and knowledge to enable them to implement the Protocol and effectively manage dredge material.

Therefore the IMO contracted CEDA to develop a low tech approach for assessing dredged material, in the form of a training set extension to the WAG based on the Specific Guidelines for Assessment of Dredged Material.

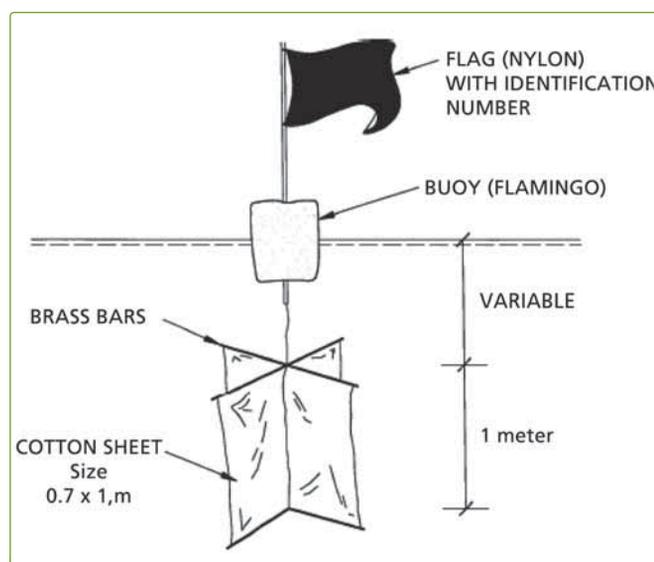


Figure 1. Sketch of a sub-surface drogue.

## The low tech WAG

The WAG training set extension for the application of low tech techniques for assessing dredged material (low tech WAG) has now been developed for CEDA by the Centre for Environment, Fisheries and Aquaculture Science (Cefas), a corporate member of CEDA.

The low tech WAG is intended to assist individuals or bodies who may be regulators, potential regulators or port operators in reviewing operations and provide the tools from a simple starting point to incrementally build an assessment, management and permitting system for dredged material to be considered for ocean disposal. The low tech approach is intended as a temporary measure to allow countries to adopt a precautionary approach to the management of dredged material, in the event that they have not yet developed sufficient capability to allow them to follow the full approach of the London Convention and Protocol Guidelines.

It is presented as a stand alone document but follows the same format and approach as the WAG TS, but it is more direct in the sense that low tech approaches are identified and explained to enable the user to make an informed choice. Where it was determined that low tech alternatives were not available, the WAG text was amended to make it more accessible for those operating in a low tech environment.

The low tech WAG provides information on low cost sampling, testing, information gathering and documenting, low cost monitoring and feedback surveys to help improve decision making in relation to dredged material. It also focuses on the alternative use of dredged material, referencing recent work undertaken by CEDA. It is important to highlight that CEDA, WODA and other organizations dealing with dredged material consider that it is a resource and therefore do not consider it as a waste, however the term waste is used in the low tech WAG in line with the WAG and WAG TS.

Some of the problems that the low tech WAG solves and the approaches it takes are highlighted next.

## Characterizing dredged material

To be able to make informed decisions about how to manage dredge material it is vital to know what type of material you are dealing with. The type of material can influence the potential for chemical contamination, what management options are available, if disposal is required and how it will behave in the marine environment. Evaluation of the physical characteristics of sediments for disposal is necessary to determine potential environmental impact.

Ways to characterize dredged material can include measuring and testing for specific characteristics to help determine the physical, chemical and biological properties of the material. A variety of assessment methods can be employed; however, some routinely used, such as chemical and biological testing, may not be accessible in a low tech environment.

The physical composition of the dredged material is one of the most obvious and easily collected pieces of information that can be used to reach conclusions about whether that material can pose a hazard to the environment. Most natural and anthropogenic contaminants (metals and organics) tend to be associated with the finer particles in sediments, mainly silts and clays that are less than 63 micrometers in diameter. Therefore, knowledge of whether the dredged material contains silt or clay is very helpful as it has greater potential to contain contaminants. The low tech WAG describes how the use of simple visual and textural assessments of the material to be dredged can be used in a low tech screening approach to help build a set of assumptions on the likelihood and distribution of any contamination in the sediment and determine the nature of material that is being dredged.

The document outlines how rudimentary tests can be employed to undertake a textural assessment, such as simple sieving techniques, to determine the sediment composition and amount of finer material (mud) in a sample. Simple tests involving smell, color and visual inspections are also described. For example, samples that are highly contaminated with hydrocarbons tend to have a petrogenic smell, may be black in color and give off an oily sheen when mixed with water and shaken.

## Selecting a disposal site

The results of the characterization will indicate whether the dredged material is suitable for disposal at sea. However, under the Protocol, the disposal of dredge material at sea should only be undertaken as a last option after consideration has been given to other management options in line with the waste hierarchy. In recognising the potential value of dredged material as a resource, this includes considering the availability of alternative uses such as engineering uses or environmental enhancement.

Where sea disposal is identified as an acceptable option, the selection of a site requires important consideration and, as far as possible, one should ensure that the disposal operation and the dredged material deposited on the seabed does not interfere with other uses of the sea and produce detrimental effects on the marine environment. Having defined disposal sites can also greatly simplify the development and enforcement of management measures for disposal activities.

The low tech WAG outlines the steps that should be followed in selecting a site. An important element is obtaining information on the nature of the water column and the seabed at proposed disposal sites. Where resources and equipment are available, this information is often obtained through, for example, bathymetric and sidescan surveys, current and flow meters and the even the use of video equipment. The low tech WAG describes some simple but effective techniques to gain such information on water movement (hydrodynamics), depth, the size and potential capacity of a site and biological resources.

A relatively simple but effective technique to measure sub-surface currents is to use a sub-surface drogue (see Figure 1).



Figure 2. Near bed flow and sediment transport patterns can be investigated by using seabed drifters which are released at the disposal site.

They can give more accurate information on currents and tides as drogues are not influenced by the wind, unlike floats or bottles on the surface. It can also determine if flows differ at varying depths in the water column and because they are easily visible the drogues can be tracked by a surveyor on land to determine flow direction and velocities. Near bed flow and sediment transport patterns can be investigated by using seabed drifters released at the disposal site (see Figure 2). Each drifter would have an individual number and a label requesting return information and promising a small reward. They are often recovered by, for example, beachcombers or in fishermen's nets. By plotting tracks of returned seabed drifters, an indication of near bed flow and residual drift can be gained from which assumptions of the fate of dredged sediment can be made.

## Assessing potential effects

Assessment of potential effects of a disposal operation should lead to a concise statement of the expected consequences, otherwise known as the 'Impact Hypothesis'. It provides a basis for deciding whether to approve or reject the proposed disposal option and for defining environmental monitoring requirements.

The low tech WAG describes how a conceptual model can be used to determine potential effects. Inevitably from a low tech perspective not all of the impacts can be easily assessed (for example, changes in the chemical environment) and not all will be relevant or easily assessed in all cases. However, from the information provided in the low tech WAG it should be within the capability of proponents to make an assessment, starting with the physical effects and as capability increases a more holistic assessment can be pursued.

Once potential adverse effects are identified advice is provided on how to formulate testable hypotheses about possible environmental effects and form the basis of post-disposal monitoring.

## Monitoring

Monitoring is used to verify that the permit conditions are met (compliance monitoring) and the assumptions made during assessment of the project are correct (field monitoring). The document provides examples of low tech monitoring methods that could easily be employed in a monitoring programme. These include simple observations that can take place from the shore or onboard vessels and can be used to ensure that, for example, disposal is taking place as stipulated in a permit and can confirm predictions made about the potential effects, such as the direction of plumes, which may be relevant if there are sensitive areas near the disposal site.

Finally a particularly novel low tech method employing a cola bottle is used to derive a relatively inexpensive general picture about turbidity. Turbidity is a measure of the light scattering properties of a volume of water and is related to the type and quantity of particles suspended in the water. The cola water sampler provides a way of collecting a sample of water to be



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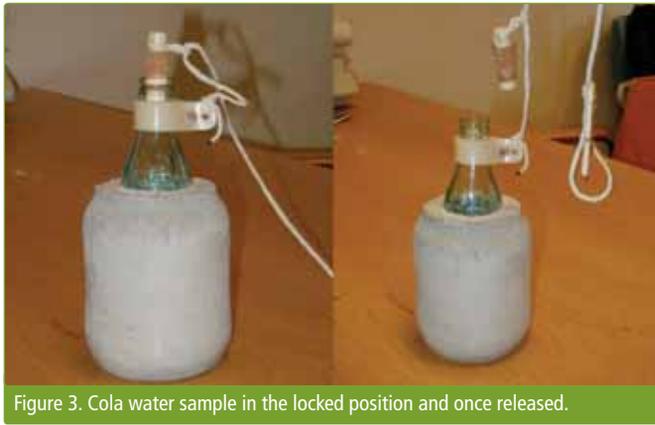


Figure 3. Cola water sample in the locked position and once released.

tested, particularly useful to collect samples from a particular depth within the plume. It consists of a cola bottle in concrete (see Figure 3). The concrete increases the weight of the sampler so

that it can descend into the water column quickly. The stopper is made of cork and fastens to the bottle with rope, the rope is held in the hand and the stopper is released by tugging the rope at whatever depth the water sample is required. Simple but effective!

### Next steps

The low tech WAG was adopted by the London Convention and Protocol governing bodies in October 2011. It has now been published by the IMO to be 'road tested' by its intended audience, such as ports and regulatory authorities operating in low tech environments. It is hoped that this process will enable identification of further low tech approaches that can be incorporated in the future to increase the low tech WAG's usability.

The low tech WAG was developed with financial support from the International Association of Ports and Harbours and the Government of the US. It was prepared by the Centre for Environment, Fisheries and Aquaculture Science (Cefas) and the World Organisation of Dredging Associations.

### ABOUT THE AUTHOR



**Dr Andrew Birchenough** is a senior marine environmental advisor in the Regulatory Assessment Team based at Cefas' Lowestoft laboratory. In his current position he is responsible for providing scientific advice to the Marine Management Organisation (MMO), Defra and other UK Government departments on the potential risks and impacts to the marine environment of a wide range of human activities, including; capital and maintenance dredge disposal, aggregate extraction and marine constructions. He represents the UK as at the Scientific Group meetings of London Convention and 1996 Protocol and has over 15 years experience of research and development into human impacts on the marine environment. Dr Birchenough also provides a UK national perspective

and leadership in relation to dredged material disposal to sea in that capacity is a member of the Central Dredging Association (CEDA) Environment Commission and British Section Committee.

### ENQUIRIES

Further information about the London Convention and Protocol is available at: [www.londonprotocol.imo.org](http://www.londonprotocol.imo.org)

Further information about WODA is available at: [www.woda.org](http://www.woda.org) and CEDA at: [www.dredging.org](http://www.dredging.org)

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# Manage your terminal intentionally: know the economic trade-offs

Allen Funston, consultant, & Dr. Harry King, manager – Simulation Modeling Group; Ausenco, Vancouver, Canada

Terminal equipment need not always be doing meaningful work. If equipment is idle, however, it should be deliberate and for the greater good of the business. To reach operating targets more easily, it is crucial to know the trade off costs of each decision.

## Consistency is king

Consistency is king, and it should come as no surprise. To quote Mark Horstman from Manager Tools LLC: “a well managed terminal may be repetitive and unsexy, but it’s profitable”. Ships and trains should not wait for long periods of time to be processed. Delays are generally very expensive; they increase shipping demurrage costs, increase the required size of train fleets, and decrease terminal throughput capacity.

Terminals can be made more consistent by first identifying the primary sources of delays using historical operating data. The most valuable documents to gather include:

- Train or truck activity logs
- Ship ‘Statements of Facts’
- Train, truck or ship cargoes by grade and tonnage
- Planned or unplanned maintenance events
- Inventory surveys

Categorized and quantified delays show where the terminal should focus its finite resources. Projects should be compared on the merits of their costs and benefits. A terminal manager may then ask: “How can I know the actual benefit of my planned improvements? My terminal has so many complex interactions.”

This is a valid concern; simple arithmetic can be dangerously inaccurate when many factors influence a terminal’s performance.

## Simulation helps

Ausenco have found dynamic simulation modeling to be a very powerful tool for terminals and supply chains of all sizes and complexities. The simulation models Ausenco develop for clients using proprietary software allow for accurate predictions of the benefits of operational improvements (see Figure 1). Testing operational improvements with a calibrated simulation model can be much more cost effective than experimenting with the real system.

All of a terminal’s major pieces of equipment are modeled individually with real life behavior that Ausenco confirm during site visits. Equipment interactions, operating restrictions, and realistic train movements are all captured.

Ausenco then calibrate the models to dozens of key performance indicators (KPIs) from at least one full year of detailed operating data. KPIs generally include all major elements of terminal performance, handling rates, and all components of ship and train times. Only after calibration do models become accurate predictors of future performance.

Once the benefits of planned operational improvements are known, terminal managers can select and implement new developments based on their value to their business.

It is important to continue to measure delays and compare them to operating targets. If delays are not kept in check, complacency can set in and inefficiencies can return. Dedication is necessary and a change in culture might be too. The prize, however, can be sustained performance improvements at little or no cost. Continuous improvement processes like Lean Six Sigma and Total Quality Management are not new, but they are effective in the right hands. Improving operations deserves serious

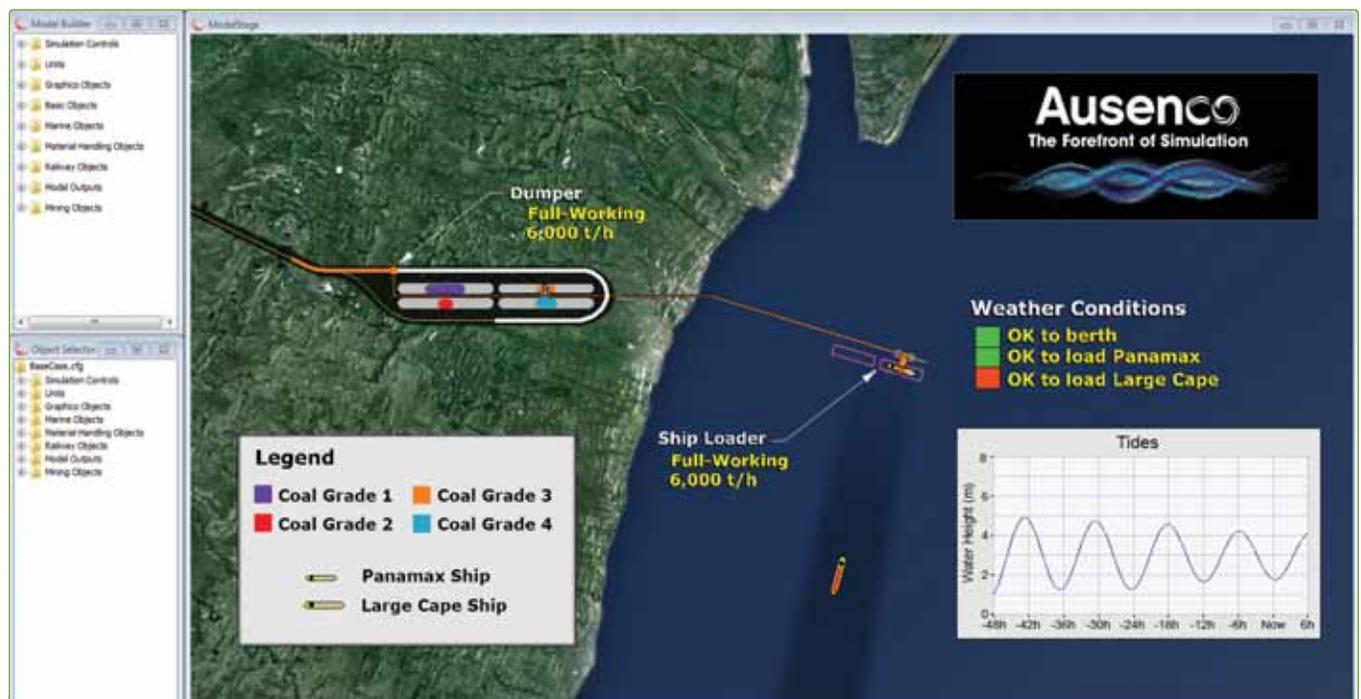


Figure 1. Screenshot of Ausenco’s proprietary simulation software.

consideration before spending inordinate amounts of money on new equipment and infrastructure.

Once existing operations have improved, new equipment may still be necessary to increase a terminal's throughput capacity and meet demand. Design and construction costs are generally significant, so it is important to test new equipment with a calibrated simulation model. This is vastly more cost effective than upgrading a terminal and crossing your fingers. With simulation, terminal managers can compare options easily and foresee future challenges.

Simulation modeling of new equipment and terminals is generally performed in parallel with the pre-feasibility and feasibility design phases. The two teams provide feedback to one another during project development and help optimize each other's results. Simulation often costs less than 5 percent of the design fees and can have greater than a 100-fold return on investment.

#### Efficiency breeds safety

Delays hindering the terminal frustrate operators and managers alike. Addressing these delays improves both morale and efficiency.

Efficiency makes operating targets easier to hit. As a result, operators will feel less rushed, will take fewer risks, and will have fewer accidents.

#### To guess is to risk

Competitors also make decisions with incomplete information. The key is to know more than them and invest more wisely.

The best investment is no investment at all; all terminals can do more with existing resources. If investment in new equipment is necessary, it is important to remember that projects that do not address a terminal's bottleneck will do little to improve throughput capacity or operating costs.

Data analysis and simulation help quantify benefits before projects are undertaken. They can offer a new perspective and identify the projects with the most value to the business.

To compete and succeed in today's economy, terminal managers must understand the economic trade-offs of their decisions and act accordingly.

#### ABOUT THE AUTHORS AND THE COMPANY

#### ENQUIRIES

**Allen Funston**, P.Eng., is a consultant with Ausenco Sandwell, specializing in industrial management and the optimization of bulk handling systems. He has studied major bulk handling terminals and supply chains worldwide, and has successfully managed a manufacturing plant in the Vancouver area.

**Dr. Harry King**, P.Eng., is the Manager of Ausenco Sandwell's Simulation Modeling Group and is an engineer and scientist with over 30 years of

experience in the planning and assessment of marine terminals and marine transportation systems.

**Ausenco** provides engineering and project management services in the resources and energy sectors. Ausenco Sandwell, part of Ausenco's Process Infrastructure business line, operates worldwide in the marine, bulk handling, mining infrastructure, energy and industrial sectors.

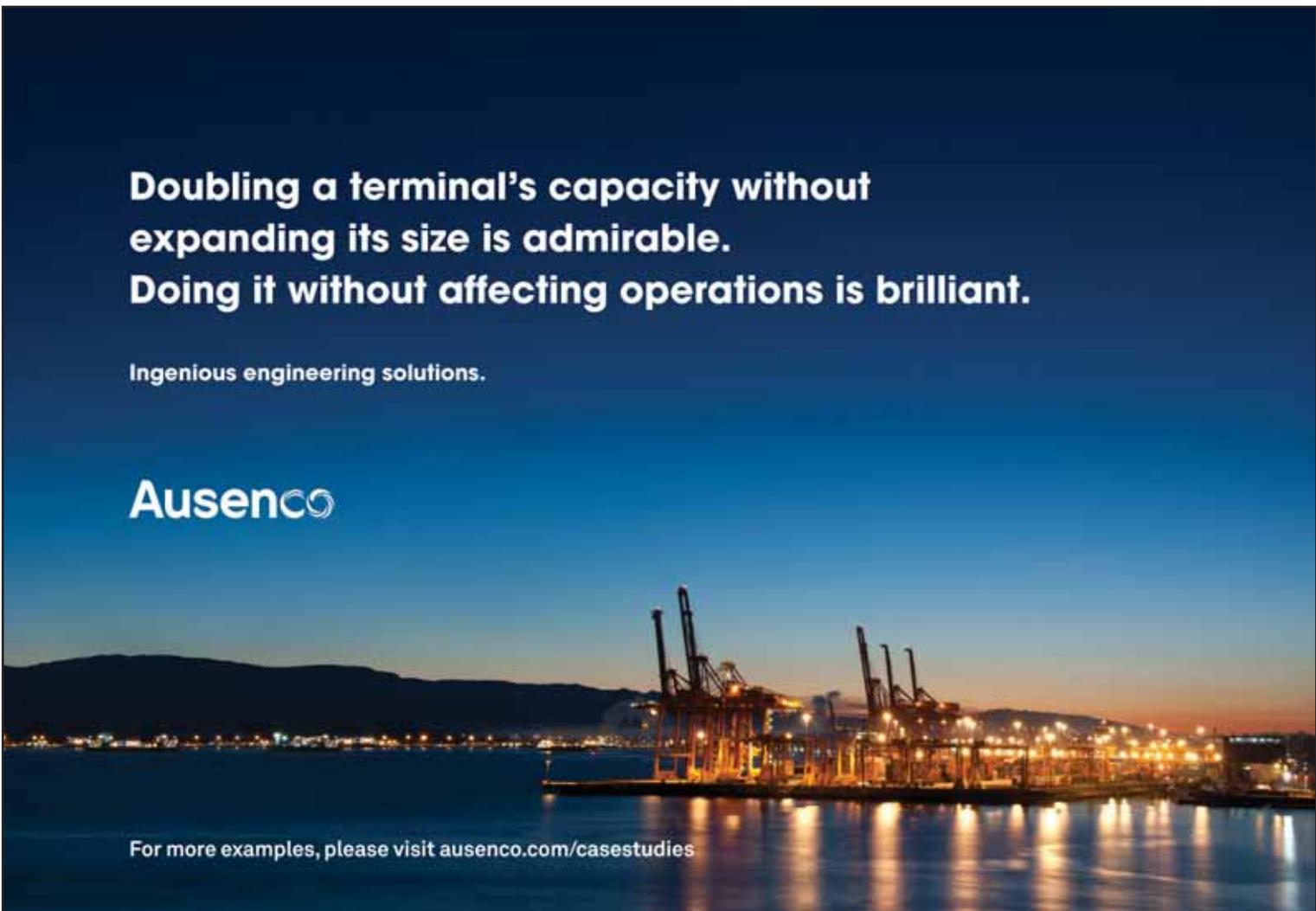
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# Finding the right balance between property based and minimum guaranteed throughput rents at ports

**Franc J Pigna** CRE FRICS CMC, managing director, Aegir, Florida, US

## Introduction

From a port authority's standpoint, 'port pricing' is an exercise in determining how to structure leases and how to establish the rent to charge for the use of a port's largest asset – property. Although operating concessions are also a form of rent for land and infrastructure usage, these types of leases are not the main focus of this article – it is the balance of a port's property portfolio.

This article explores, on a cursory basis, the issues, motivations, objectives, challenges and ramifications of two main revenue streams for ports, namely rent on land and facilities and rent charged on cargo throughput.

Unlike asset based rent (which typically is somewhat informally developed by ports and often used as incentives) throughput or toll charges on cargo transported to and from leased facilities and the port are more easily understood by port authorities.

## A port's true business

The business model for port authorities has dramatically changed over the last few decades, evolving from port operators charging for services rendered to now asset managers leasing out port assets. This evolution is far from over and will more than likely take port authorities into ever expanding roles as transport leaders and logistics nexuses. One thing is certain though, the role of asset manager will remain a cornerstone of a port authority's business model for a long time to come.

When ports privatized their operations and adopted the 'landlord' model, their revenue stream primarily came from charging rent for their fixed assets, specialized real estate facilities, infrastructure and land; all of which is charged directly in the form of rent or indirectly as in the case of wharfage, dockage and throughput charges.

## Throughput versus port property based rent

Throughput charges are also known as 'shared revenue' leases or minimum annual guaranteed rents (MAGR). MAGR is meant to mitigate a port's risks by generating an additional revenue stream to recapture infrastructure investment and other related costs, while the more traditional property based rent covers the financial return obligations of the fixed assets. MAGRs are also meant to balance a tenant's or operator's fixed overheads with a variable rent element and incentivize them to maximize the use of the leased asset in order to better pro-rate the lease costs.

Ports are capital intensive entities requiring long-term leases to parallel the typically long-term financing they use, along with the extended amortization periods required of infrastructure and specialized real estate facilities. Only in this fashion can ports obtain a reasonable return of and on capital values.

Leases for port properties should also be structured so that they are 'financeable' to facilitate releasing tied up equity in property. To accomplish this, leases should have a certain degree of standardization and the ability to generate a reasonably predictable cash flow. In many respects, the aforementioned could easily have

described the lease structuring needs of major, regional shopping centers, as their similarities with ports are both numerous and interesting.

Regional shopping centers also are capital intensive operations, requiring long amortization periods and are essentially distribution centers like ports. It is therefore no coincidence that certain similarities exist in the way rent is charged at both. For example, shopping centers have 'anchor' tenants while ports have terminal operators; shopping centers have a 'base' rent equivalent to ports, charging rent for land and facilities; and shopping centers have 'percentage' rents, which are the equivalent of MAGRs.

Also, like regional shopping centers, there is a question as to whether percentage rents or MAGR at ports benefit the landlord, tenant or both. Some believe that MAGR only benefits the port while others argue that, if properly structured, they can 'motivate' ports to not act short-sighted or opportunistic. How so? By motivating them to strive to establish the optimal tenant mix, rather than taking on just any tenant regardless of vacancies. In this fashion the greatest amount of externalities between tenants will result, along with tenants making the maximum use of their leased facilities to better amortize their rent costs. If this optimal tenant mix is accomplished, the port should also generate the maximum possible rent from its property assets and enhance the overall economic value of the port in the process.

Which raises the question, should MAGRs be the 'carrots' and the asset based rent the 'stick'?

## Issues

Stated another way if the MAGR is too high, tenants will seek alternative facilities if available; if the MAGR is too low then the port will in effect be subsidizing the tenant's operations. Therefore, a key strategy for ports should be to carefully balance MAGR with property based rent, as this will result in the right balance of fixed and variable costs for tenants and achieve the various aforementioned objectives.

Another issue regarding MAGR, especially in the US, is how ratings agencies view them. One of the main sources of financing the expansion and modernization of ports in the US is through bond financing. Rating agencies look very favourably on ports with relatively high levels of MAGR. Typical statements found in port reviews might be: 'Financial operations at the port are stable and are supported by long-term leases' and 'strong minimum annual guarantees (MAGs)' or 'it is important to note that all of the port's tenants are currently operating above MAG levels.'

Clearly these agencies see MAGR as a revenue floor mitigating cargo throughput and revenue swings caused by economic shifts. From this perspective, many agencies use MAGR to debt service and to capital plan ratios to indicate how the port's MAGR level bolsters their financial position and an argument can well be made for this. However, this might also be influencing ports to raise MAGR to inordinately high levels, resulting in port tenants (especially at bulk and commodity ports) not achieving the

requisite MAGR cargo thresholds during their lease terms and possibly resulting in some unintended consequences.

This type of situation might create the perception on behalf of tenants that there is little difference between MAGRs and property based rent, resulting in two potentially detrimental situations for ports.

Firstly, tenants might wrongly perceive that MAGRs are just another form of rent for the facilities they lease, leading them to mentally bundle MAGR and property based rent. If this occurs then port located facilities will certainly seem expensive when compared with industrial land and facilities near ports. This line of thought can and has undermined many a port's ability to charge proper MAGR and properly recapture its extensive investment in infrastructure, security and other elements, which is what differentiates port facilities from industrial estates and parks besides the sea – land interface (and presumably is the reason tenants pay a premium to be located there).

Secondly, in instances when MAGR levels (or throughput commitments) are too low, this can result in the failure of major port infrastructure projects or in them not being built. A case in point was the US \$150 million LAXT super coal terminal at the Port of Los Angeles, which was built to service the Japanese coal market and was commissioned in 1997. It was the only West Coast coal terminal capable of handling a 275,000 deadweight tonnage vessel. The Japanese refused to commit to a high enough throughput tonnage to make it financially viable and it eventually was shut down in 2003.

Notwithstanding the fact that China and India were not major buyers of coal then, the shutting down of LAXT shows the negative impact of not having proper levels of either MAGR or minimum throughput commitment. This especially comes across when taking into account that, in just nine years from LAXT being shut down, China and India have become major coal importers, there are now major concerns surrounding nuclear facilities in Japan and coal exports to Asia from North America are exponentially expanding. One example of this is Cloud Peak Energy's Wyoming Powder River Basin coal (high British thermal unit/low sulphur 'clean' coal) exports to Asia increasing to three million metric tonnes in 2010, from one million in 2008.

## Challenges

'Rent' is a charge levied for the use of a resource or asset provided by the port authority in a manner and amount which will recoup costs (for example, for capital, operations, repairs and maintenance and management) and produce adequate returns of and on capital invested (preferably valued at market, but sometimes at replacement costs). The goal then should be to properly structure rents to result in the efficient use of the asset or resource and attain the port authority's financial and socio-political goals and objectives as well. This brings up the issue as to how rents should be established at ports for land and facilities.

Typically rents at ports are based on a 'historical' land value basis, having little to do with current 'market' values or are equally misguided by being based on so called 'comparables' for seemingly related industrial properties not located within a port's perimeter.

From an economic concept standpoint, the value of an asset is the opportunity cost of not using that asset or alternatively the capitalized value or the present value of the future stream of net benefits. By its very nature then, asset valuation is forward looking.

Therefore, the focus on a port's asset valuation should be on current market values rather than historic ones. These asset valuations should be undertaken at appropriate frequencies for the asset class in question to ensure values are current and rents based on these values will produce real economic rates of return. Only in this fashion will lease rates equal or exceed the opportunity cost of capital and ensure that appropriate investment levels are

maintained at the port (based on a competitive market basis rather than a government subsidy).

Furthermore determining asset values should be done by using appropriate comparable sale benchmarks of true 'like kind' assets (which probably are not located anywhere near the port) and appropriate financial assumptions in the income approach. For this, the valuer or appraiser needs to have an innate understanding of the unique business dynamics found at ports, which is rare to find in the industry.

By not having proper market rents and lease structures for land and facilities, ports can significantly diminish the economic value of these important assets, lose revenue (not to mention control) and potentially subsidize a tenant's operations.

## The balance

Just because ports operate under a 'landlord' model does not necessarily mean that there is or can be a common set of goals and objectives for most ports or a suggested balance between asset and throughput based rents.

The degree of emphasis each port places on 'economic development' (a catchall phrase for subsidized government engineering for job growth), asset management goals and objectives (for example, revenue, profit, returns from fixed and capital assets) and generating the highest possible cargo throughput and corresponding revenues, varies greatly from one 'like kind' port to the other. Therefore, until there is an alignment of port authority operating structures (maybe when 'corporatization' of port authorities becomes more prevalent?) the 'perfect' balance between asset and throughput based rents will vary greatly and need to be tailored to each facility.

## Conclusions

The balance between asset and throughput based rent is a subject requiring more careful scrutiny by ports today, as the marketplace is increasingly demanding a higher degree of financial sophistication from ports and ports need to release the substantial amounts of tied up equity in their real estate and property. This makes it imperative that a port authority not short change itself by asking too low a base rent on land and facilities or by making itself less competitive through inordinately elevated MAGR.

In the end, the objective of shared rent leases or MAGR from a port's perspective is to strike a balance so that tenants will use their leased facilities at ports to the maximum possible potential, ports will not subsidize a tenant's operations and port assets will reach appropriate target rates of returns over specified periods of time.

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#### ABOUT THE AUTHOR



**Franc J Pigna**, CRE, FRICS, CMC, is the managing director of Aegir Port Property Advisers. Mr Pigna has been meeting property challenges worldwide on behalf of clients in the port, shipping and related maritime logistics sector as well as the financial, investment and corporate real estate industries for over twenty-five years worldwide. He is a member of the Counselors of Real Estate in the US and is a Chartered management consultant and Fellow of the Royal Institution of Chartered Surveyors in the UK.

#### ABOUT THE COMPANY

**Aegir** is a pioneer port property consultancy, specializing in meeting the unique property challenges faced by ports and the maritime industry. This is accomplished through unorthodox yet practical, market driven port property strategies designed to support ports' core business mission, increase revenues and enhance port values.

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# A megaport for Kuwait – confirming the layout

**John Baugh**, principal scientist, HR Wallingford, Wallingford, UK

## Background

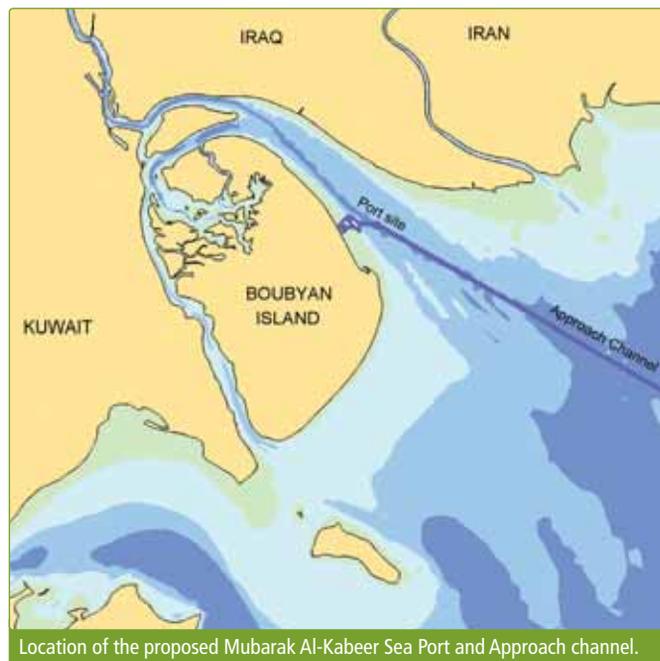
The State of Kuwait has had a long-term plan to construct a regional scale hub port for the northern Gulf in Kuwait. During the 1990s, a port masterplan study examined several possible locations for the proposed port, including two to three sites around Boubyan Island. During the period from 2003 to 2005, a masterplan for Boubyan Island was undertaken, with reference to development options and environmental conditions. This work was informed by extensive surveys and site investigations.

Further masterplanning, concept design and economic and technical feasibility studies of a container port located on Boubyan Island were completed in the period from 2004 to 2009. These included an expansion of the plans from 9 berths (2006) to 24 berths, with a potential to extend to 60 berths. These studies led to the layout as defined in the tender for detailed design, Environmental Impact Assessment (EIA) and construction of Phase One of the port, which was awarded to Hyundai Engineering and Construction Co Ltd (HDEC) in 2010.

Within the HDEC team, Haskoning Nederland B.V. undertook the confirmation of layout and detailed design studies and HR Wallingford provided a programme of modelling and assessment services, both for the port design and for the environmental studies.

## The site

Boubyan Island is the largest of Kuwait's islands, with an area of approximately 850 square kilometers. The island is very low lying, is regularly inundated and consists almost entirely of soft mud (Sabkha). Surrounding the island is a set of khawrs (channels). The port site and channel were in the Khawr Abd Allah, to the north east, which lies between the island and the coastline of Iraq. Depths in the Khawr Abd Allah are typically 10 meters below Chart Datum.



Location of the proposed Mubarak Al-Kabeer Sea Port and Approach channel.

The seas surrounding Boubyan Island have been identified as having high biological productivity and ecological diversity. The environmental sensitivity of the island is such that the masterplanning exercise included approximately half of Boubyan Island as a nature reserve.

## The scheme

Phase One of the proposed port, now referred to as the Mubarak Al-Kabeer Sea Port, consists of a quay wall approximately 1,600 meters long, a reclaimed area of 176 hectare acres and a small vessel harbor. In addition to the scope of studies for Phase One, studies were required to provide detailed design for Phase Two and for the confirmation of the overall layout for all development phases up to and including Phase Four-b, which is to include 10,800 meters of quay and requires a reclaimed area of 864 hectares. The port requires a dredged manoeuvring area and up to 50 kilometers of approach channel to link the port site with the Gulf. Dredged depths for Phase One are advised to be an average of 6 meters below the present bed level in the proposed port manoeuvring area.

## Scope of studies

The contract to confirm the port layout (all four phases) and to undertake the detailed design and construction of Phase One included a very tight programme. To meet this objective it was therefore necessary to undertake many aspects of the study in parallel, including studies to confirm the layout and support the detailed design. The programme also required the design studies to be undertaken in parallel with an important data collection exercise.

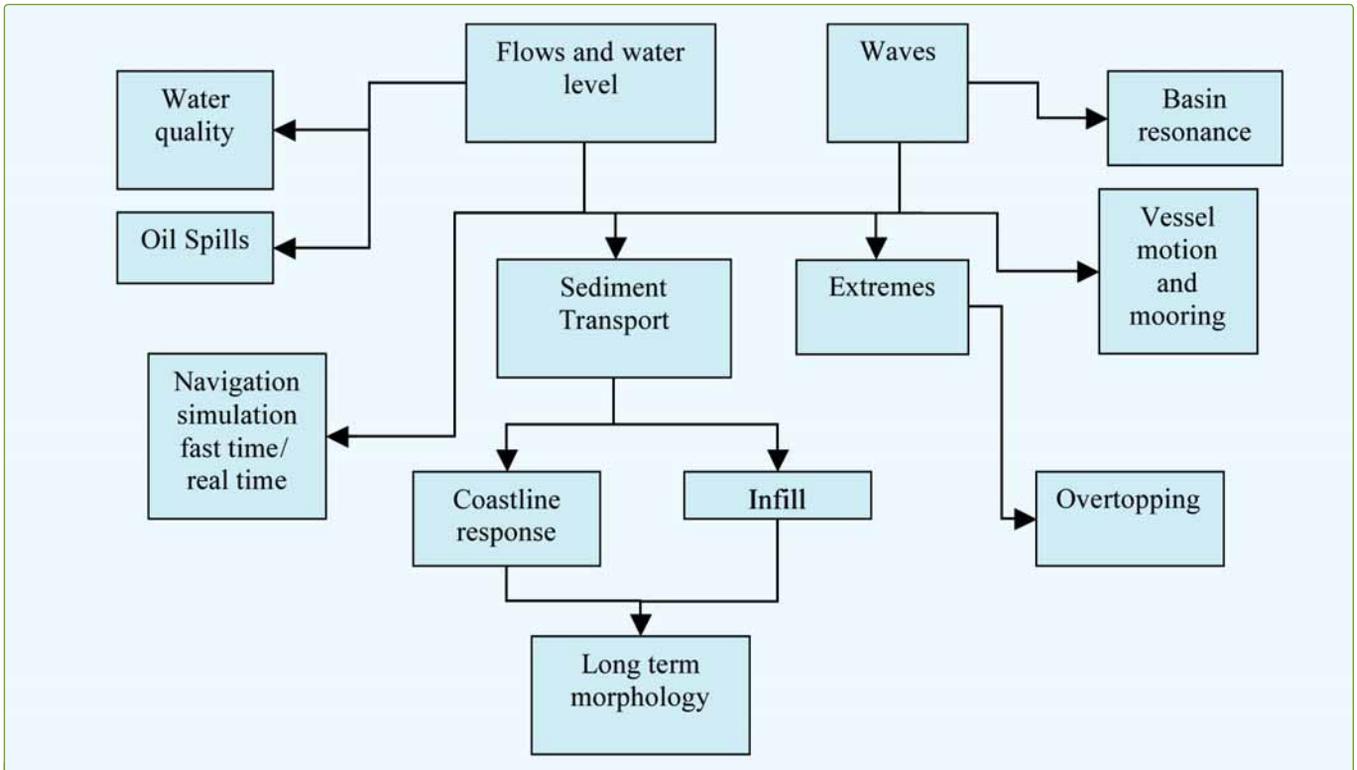
Therefore, the studies required to support the design had to do so based on existing data, primarily from the 2003 to 2005 surveys. As further data collection was to be completed during the design studies, an additional validation stage for the findings of the study was included in the latter stage of the work. This approach allowed all the aspects of the port design and potential environmental impacts to be addressed quickly, giving maximum time to deal with any particular difficulties which may emerge.

The scale of the proposed development meant that regional scale investigations were required to understand the primary environmental forces (flows, waves) that would act on the port, and the potential for the port to change these forces with consequential effects on sediment transport, water quality and long-term morphological change. Furthermore, detailed modelling studies were required to address a series of issues key to the design of the port, including vessel movement at berth, overtopping of the structures and flushing of the small vessel harbor.

The proposed port design confirmation studies required a rapid supply of information for a number of phased layouts in a site that was complex, dynamic and sensitive. Studies were multi-dimensional and covering a wide range of spatial scales.

## Hydrodynamics

The large-scale port development required a similarly large-scale modelling effort. To allow modification of the tides and waves by the channel to be simulated accurately, a model domain,



Schematic of studies to support the design and EIA of the Mubarak Al-Kabeer Sea Port.

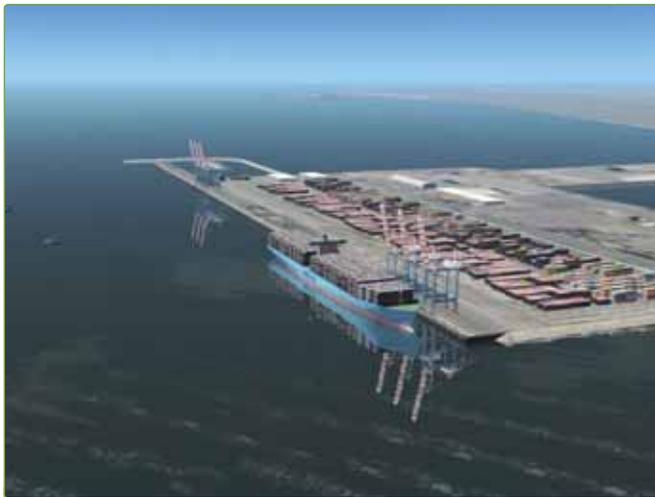
extending more than 120 kilometers from the port site, was used. This large area allowed the imposed boundary conditions to be kept well away from any area of influence of the works.

The flow modelling was undertaken using the finite element based TELEMAC system. The flow model mesh varied from a maximum size of 6 kilometers at the open sea boundary to around 100 meters in the area of interest. A total area of approximately 18,500 square kilometers was included in the flow model.

Regional scale wave modelling was undertaken in SWAN, a third generation spectral wave model which simulates the transformation of random directional waves. The SWAN model is ideally suited to the transformation of wave energy spectra in a large coastal area, as it could include the effects of offshore banks and reefs, which result in depth induced wave breaking and wave to wave interactions. The model also included wave generation caused by wind within the model area.



Physical modelling of vessel motion at berth undertaken for the port study.



Phase One of the proposed Mubarak Al-Kabeer Sea Port as included in the HR Wallingford Navigation Simulator

The hydrodynamic modelling was initially set up against the 2003 to 2005 dataset to provide the design team with early sight of the conditions anticipated at the port. Later on in the modelling study stage, further site data was collected to fill data gaps revealed by the initial study. A validation exercise was undertaken to confirm the acceptable performance of the models.

The modelling confirmed the hydrodynamics at the port site as having what are relatively high currents for the area, with peak values of 1 to 1.5 meters per second. Most of the wave energy found within the wave climate at the site was short period, confirming the lack of need for additional wave protection, as proposed in the masterplan layout.

#### Sedimentation

Regional scale sediment transport modelling was undertaken to demonstrate the potential for infill in the dredged areas. As the development is of a sufficient scale, the longer-term morphological response of the Khawr Abd Allah and the port operation could influence each other. Thus it was apparent that simulating infill on the 'as designed' port layout did not tell the whole story. Therefore it was necessary to examine the interrelation of the two factors in detail. This involved assessing

the morphological changes that could occur in response to the port and how these would, in turn, change siltation in the channel and manoeuvring areas. The results were used to refine the port layout and to reduce expected siltation levels both in the short and longer-terms.

#### Vessel motion and mooring

One particular area for investigation, with significance for confirmation of the layout, was to confirm acceptance of the design to the operational constraints (limiting environmental criteria) at the port operations. These were linked to a defined threshold of vessel motions either for cargo handling or staying on berth.

These studies were performed by a combination of numerical and physical vessel motion studies. The physical modelling undertaken was for the Phase One and was completed at a scale of 1:100. The model was constructed in a wave basin, having a model area of about 1,080 square meters (40 meters by 27 meters). The generally acceptable nature of vessel motions at the berths was confirmed by the physical modelling. Comparison of the physical and numerical modelling provided confidence in use of the numerical modelling for further investigation.

#### Navigation

In parallel to the design studies, it was required that a training facility be set up for the port. Therefore the real time Navigation Simulation Facility at HR Wallingford was set up to simulate Phase One of the port. The facility allowed a training plan to be established for the port users, even before the port was built.

#### Summary

- A fast track methodology has been successfully adopted in a complex region by use of a parallel studies approach, including adequate sensitivity testing with subsequent validation of the findings against bespoke data collection.
- A suite of modelling tools have been used to refine aspects of the layout to reduce predicted siltation and maintenance dredging requirements.
- Feedback between a port development and the morphology of the surrounding seabed have been taken into account for a longer-term prediction of environmental conditions (currents, waves, sedimentation) at the site.

#### ABOUT THE AUTHOR



**John Baugh** is a principal scientist working within the Coasts and Estuaries Group at HR Wallingford. He has been applying numerical modelling techniques

to hydrodynamic, sediment transport and water quality problems at port developments for more than 20 years.

**HR Wallingford** is an independent engineering and environmental hydraulics organisation. Based in Wallingford, UK, the company delivers practical solutions to the complex water related challenges, using a unique mix of know how, assets and facilities, including state of the art physical modelling laboratories, a full range of numerical modelling tools and staff with world renowned skills and expertise, underpinned by a dynamic research programme.

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# ‘Ports of money?’ – a reflection

**Martin Blaiklock**, project finance consultant, Independent Port Consultants (IPC) Ltd, Surrey, UK

## Introduction

It is now almost 30 years since Associated British Ports was privatized and a number of ports in the UK were sold into the private sector. Since then, there have been investments by the private sector in ports and port operations in many countries. Well, has this transformation been a success? Has it improved customer satisfaction? Have such initiatives proved ‘value for money’?

From an operational point of view, one could probably argue that private sector intervention has had a significant impact on the commercial effectiveness and efficiency of such ports; as a banker, however, I am unqualified to comment further, except to provide a subjective opinion. Against financial criteria, the answer has been mixed, some successes and some under-performances! One positive outcome, nevertheless, has been the development of new port facilities to support the increasing volumes of international seaborne trade.

The past 30 years have seen many developments in financial technology, in general, with a plethora of risk mitigation, hedge funds, and capital market derivatives offered to customers. Unfortunately, many such financial instruments have had marginal value, particularly in the current economic downturn, possibly to the extent of resulting in disaster for some incautious investors!

## Financing projects

The underlying technology to finance port projects has not changed significantly over this period. The options open to port developers are to raise debt, – the cheaper form of funding in comparison to equity, – either against:

- (a) corporate or government guarantees as security, or
- (b) the underlying project’s cash flow projections, generically described as ‘project financing’.

In some regimes, the latter mechanism has been extended into public service concessions known as Public Private Partnerships (PPPs). In essence, however, such PPPs are tantamount to having the same structure as ‘project financing’, except there is a terminal date (pardon the pun!) to the commercial service contract or concession.

Two conclusions can be immediately drawn from these 30 years’ experience:

- ‘project financing’ techniques are inherently complex, so it takes twice as long to seek and secure a suitable package to fund the project, which in turn results in commensurately higher up front costs. (Note: this negative feature can often be offset by the greater certainty with respect to construction costs and the implementation timetable); and
- port facilities comprise two distinct types of asset: (a) jetties, breakwaters and storage areas. This infrastructure is primarily steel and concrete, which have a useful life of 50 to 100 years, and (b) cranes, equipment and warehouses, whose useful life is shorter, – albeit not short, – of around 10 to 20 years.

It is one of the tenets of financing projects, – and indeed for financing generally, – that long-term assets should be funded by long-term finance. (Note: this was what Northern Rock, a UK housing finance bank, got disastrously wrong in 2008!). Hence, for funding equipment, the market, meaning commercial banks, can usually satisfy demand, not so for infrastructure.



Rizhao Sea Port, Shandong Province, China.

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Given that 70 percent or more of the costs of a new port may be spent on infrastructure, this creates a significant funding problem for new green field ports. 50 to 100 year debt is just not available.

## Evaluating PPPs

It comes as no surprise, therefore, that experience has shown that the ‘landlord model’, where the state or government provides the infrastructure, either funded out of budget or by loans secured by government guarantees, with the private sector responsible for financing the equipment, has been found to be an optimal structure worldwide. Successful examples of this can be found in Tangier, Sokhna and Rotterdam, Amsterdam, amongst many others throughout the world.

Two questions arise, nevertheless:

- can the landlord model be applied for private intervention across the sector? Yes, if the private operator can control the technical, commercial, and financial risks. This works for a container, minerals or oil and gas terminal, but not so for a general purpose cargo port, where guarantees of traffic are difficult to quantify; and
- has the port developer made allowance for the additional costs for ‘access infrastructure’ – meaning the road or rail connections on land, or port access from the sea? I am amazed at the number of times that my colleagues in IPC inform me that developers have planned new ports when continuous dredging is required for access, which is a costly operating burden, or when the plans ignore the costs for new and necessary investment in road and rail connections to transport goods into and out of the port! Further, the cost of access infrastructure may often represent a significant proportion of the costs of the port itself. Lenders are, by nature, risk averse and will shy away from such opportunities if this aspect is not addressed in the plans.

## Available funds

Whereas the basic technology of project financing has not changed over 30 years, the terms and conditions of funds available have, dramatically! Since the financial crisis of 2007 to 2008:

- the number of commercial banks in the project finance business is 50 percent of what it was;



© Flickr/Rennett Stowe

Container ship unloads its contents at the Port of Los Angeles.

- the interest rates (margins over base rate) for commercial bank loans have doubled;
- the term, or maturity, of such loans from commercial banks is half what it was before, meaning a loan with longer than 10 years maturity is an exception rather than a given (as it might have been before the crisis).

The only funding institutions which may come to the rescue for long-term funding are the development banks (IFIs), bilateral funds (such as KfW, Germany and OPIC US) and Export Credit Agencies (ECAs), the latter only available for capital goods and services which have been exported from their manufacturing country – not cement and concrete, which make up a large proportion of the infrastructure costs. Further, such funding institutions are more active in emerging markets than the developed world.

The use of IFI funds, however, drags many projects into the public and political arenas with a consequential loss of commercial assurance of a successful outcome, a move which may be unattractive to many terminal developers. Hence, many of the larger and financially stronger investors or operators currently fund their projects by raising debt by using their corporate balance sheets as security.

Two additional reflections:

- the natural investors for ports are, in many ways, the life insurance and pensions funds. Over the last 25 years such funds have become more involved with the sector, but not as principals; they have invested in ports through (private equity)

funds. Unfortunately, on occasion, some fund managers have oversold the opportunities. For example, the EBITDA multiples that such fund managers have used to recommend such investments to their clients have been far too optimistic. It is to be hoped, however, that with time such investors will recognise the sector is a sound investment; and

- such life insurance and pension funds are risk averse, like lenders. They prefer to finance existing operations and are averse to construction risk. Hence, they are more useful as a refinancing source once project completion is achieved, not at the outset of such a venture. In regard to the port's sector, these investors appreciate the benefit of being a participant in a project, which has economically valuable assets and a long-term revenue stream.

## Conclusions

Finally, two conclusions:

- Good banking is simple banking – one lends a dollar in the expectation it will be paid back. Good project financing is also best approached in a like manner! Clear and simple financing structure, supported by strong risk free implementation; successful projects follow such a formula.
- Since and during the financial crisis, I am not aware of any port project anywhere which has been project financed and which has later gone into administration or bankruptcy as a result of poor financial structuring, lack of due diligence or execution. As an asset class, infrastructure (ports) has weathered the storm well!

### ABOUT THE AUTHOR

**Martin Blaiklock** has worked for 30 years as an infrastructure project financier for (a) an investment bank (Kleinwort Benson), (b) a commercial bank (HSBC), and (c) a development bank (EBRD,) on projects throughout the world. He also regularly presents seminars and training courses internationally to governments, banks and companies on project finance and PPPs.

### ABOUT THE COMPANY

**Independent Port Consultants (IPC)** is a group of ten independent port consultants with wide international experience of port developments and operations. IPC operates out of the UK and its consultants work on assignments either individually or collectively.

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# Port Kembla outer harbor development

**Ray Smith**, business development manager, Port Kembla Port Corporation, New South Wales, Australia

Expanding port facilities within the confines of two breakwaters and limited port land is a challenge faced by Port Kembla Port Corporation. Port Kembla is located on the east coast of Australia, just 60 kilometers south of Sydney, and is confronted by increasing international trade demand which can only be met by construction of new port infrastructure. The challenge facing the port is how to design and build these facilities within the existing boundaries of the port. The solution, notwithstanding the many technical challenges, is the development of seven new berths and approximately 45 hectares of reclaimed land.

## Background

Port Kembla is a major Australian industrial port, which traditionally serviced the local steel, coal and grain export trades. All of these existing facilities are located in the main hub of the inner harbor. Construction began in the 1950s, when BHP Steel expanded their steel plant located on the south side of the port. Over the years a coal export facility (17 megatonnes per year capacity), a bulk grain terminal (up to 5 megatonnes per year) were constructed.

Construction of three new berths and 45 hectares of terminal area for motor vehicle imports, containers and heavy project cargoes was completed in 2007. There were approximately 380 RoRo and other small liner trade vessels calls in the year 2011 to this terminal.

With this most recent expansion, future development in the inner harbor is effectively limited by lack of foreshore land and future growth will focus on the outer harbor.

## Drivers for expansion

The major container terminal for New South Wales is Sydney's Port Botany with historical growth of 7 percent per annum. At some point in the next 10 to 15 years this facility will reach capacity at which time Port Kembla is ideally placed to provide the additional capacity to service both the major consumer markets of Sydney and southern New South Wales. Long-term, a four berth facility of 1,200 meter berth line will be constructed in the outer harbor area with a minimum of 1.2 million TEU per year and the capability to handle up to 8,000 TEU vessels.

The increasing international demand for Australian minerals has resulted in proposals for development of new mines along the eastern seaboard including iron ore, bauxite and coal. Port Kembla is gearing up to meet this demand by the construction of three berths with at least one berth capable of handling capesize vessels.

## Design Parameters

The challenge facing the port was to maximize the number of berths and supporting land area within the confines of the outer harbor port boundaries which consists of 140 hectares of water and 25 hectares of port owned foreshore land. The shipping channel to access to the inner harbor area must also be maintained to enable safe passage for capsize vessels up to 300 meters in length. A navigational channel, sufficiently wide enough to complete the 100 degree starboard turn after clearing the northern breakwater on entering the port, is a necessity.

This section of the port, despite the protection of the two breakwaters can be affected by some short and long period wave effects, particularly when offshore weather depressions sweep in from the north east.



The three inner harbor berths primarily used for car import break bulk and project cargo. The land side terminal contains 25 hectares for first point of rest for 7,000 motor vehicles, containers and break bulk with 18,000 square meters of storage sheds. Four processing facilities for motor vehicles, each on 5 hectares of land, are also in the port area. To the right is the export grain terminal, with capacity to load capsize vessels and has an annual capacity 4 to 5 megatonnes per annum.



Aerial photograph of Port Kembla Port, showing inner and outer harbor areas. The outer harbor reclaimed land areas shown as the dotted section. The existing timber jetties on the western perimeter identified berths 202-205 and the eastern berth 204 will ultimately be subsumed into the new infrastructure.





# Project phases and respective scope

**Daniel Achero**, LNG technical director – product manager LNG, Tractebel Engineering, Brussels, Belgium

## Introduction

When a project starts the investor is always facing a lot of questions. Is it feasible? Is it economically viable? Where to install the facilities? How to get the permits? When could I start the operation? Which financing model?

The answers to these questions require time and effort. However, the market opportunity to develop a business might not remain on after for long. The investor cannot wait for the answers; the cumulative times for all these answers could mean missing the opportunity. The investor should thus organize its activities in order to optimize the efforts and expenses. One needs to also organize activities into a sequence, and eventually overlap the said activities in a natural and dynamic progression.

## The sequence of the activities

The sequence of the activities will depend upon the nature of the investment and the capability of the investor to find solutions.

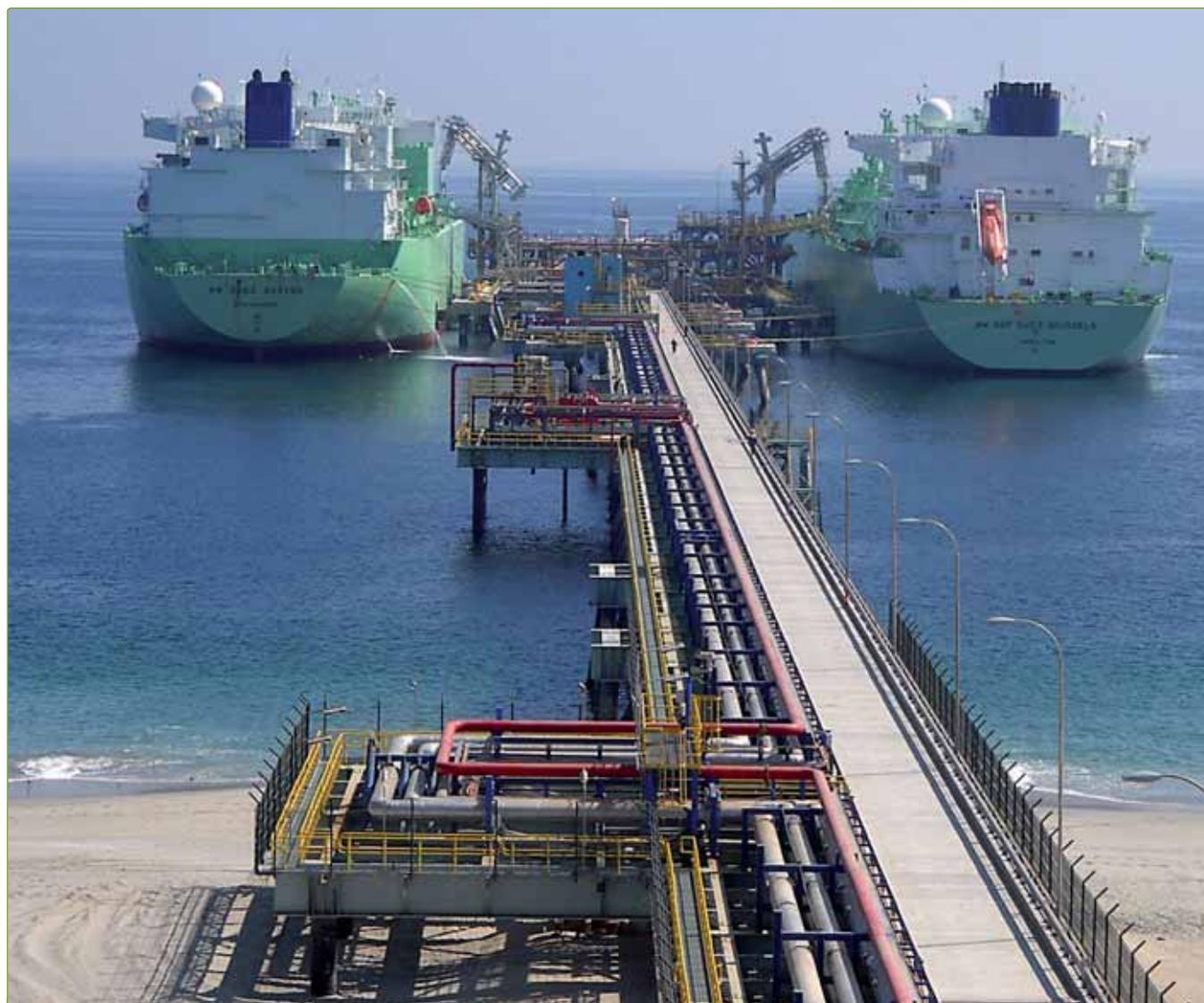
The main challenges faced by the investor are related to the best site selection with regards to the market, to the investment and operating costs, to the technical feasibility and economical viability of the proposed project, the permitting, the financing, the best strategy for the project execution and for minimizing the project risks.

The activities that are required to address all these elements are carried out by the investor's in-house resources or are outsourced to consultant and engineering contractors.

The industry has established a tradition of project phasing through different steps, to sequentially bring the information and data to the various actors in the project development; the investor, consultants and engineering contractors. This progressively secures the project development whilst managing the project risks and preventing useless expenses until the final investment decision (FID).

The traditional phasing can be summarized as follows:

1. Market appraisal and project performance definition
2. Project feasibility study, including site selection



Mejillones LNG terminal in Chile.

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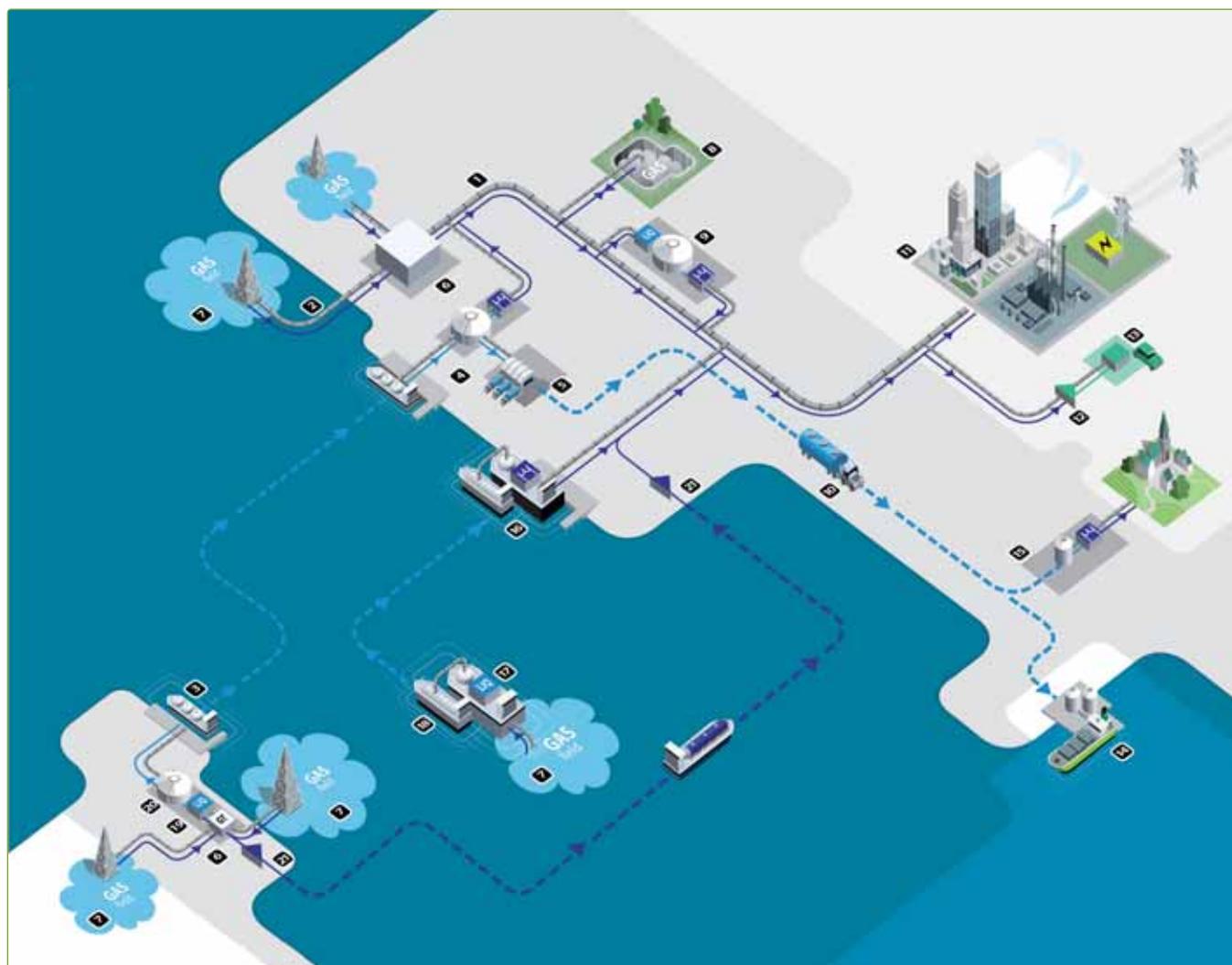
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- |                              |   |  |
|------------------------------|---|--|
| <b>1</b> Pipeline            | <b>8</b> Underground Gas Storage              | <b>15</b> LNG Satellite Station            |
| <b>2</b> Subsea Pipeline     | <b>9</b> LNG Peakshaving                      | <b>16</b> Floating Storage / Regasificatio |
| <b>3</b> LNG Carrier         | <b>10</b> LNG Trucking                        | <b>17</b> Floating Production/Storage/Of   |
| <b>4</b> LNG Import Terminal | <b>11</b> Gas City Distribution / Power Plant | <b>18</b> Shuttle Regasification Vessel (S |
| <b>5</b> Truck Loading       | <b>12</b> Compressed NG Export Plant          | <b>19</b> Liquefaction Plant               |
| <b>6</b> Gas Treatment       | <b>13</b> Compressed NG Station               | <b>20</b> Storage & Loading                |
| <b>7</b> Gas Pre-Treatment   | <b>14</b> Ship LNG Fueling Station            | <b>21</b> Compressed NG Import Stator      |

The gas value chain.

© GDF SUEZ

3. Basic design, including environmental assessment
4. Permitting
5. Project financing
6. Project implementation (detail engineering, procurement, construction and commissioning)
7. The start of commercial operation

The listed steps are sequential but could overlap with regard to the project, its milestones and/or particular issues.

This phasing, to be efficient, shall comply with rules and each step has to cover a specific scope. The results of each step will then be used to implement the following step. It is therefore important to correctly define the phasing.

In the typical phasing there are three phases basically involving technical studies which are needed to enable progress and to feed inputs to the financial and the legal phases. These three technical

steps are the feasibility study, the basic design and the project execution. The scope of each technical step will be set up to give the expected answer without exposure to extra expenses or schedule issues.

### Feasibility study

The feasibility study should bring to the investor the information and data on the site selection versus the market. It should also provide data on the technical feasibility with regard to expected performances and the economical viability of the project. At this level of the project, information should be sufficiently complete to validate the site selection. Particular attention should be paid to seismic and soil data.

The scope of the study should therefore include:

- A market study
- A site selection

- The project definition
- The process description
- The description of the most important systems
- The plot plan
- The schematic diagrams
- A preliminary HAZID and environmental assessment
- The CAPEX and OPEX estimation with an accuracy of around 20 or 30 percent
- A project development schedule
- The financial analysis
- The proposal for next step execution
- The specification for the site studies (soil survey, seismo-tectonic investigations, and bathymetry)

## Basic design

When the project feasibility is acceptable and when the various site studies have confirmed the validity of assumptions made at earliest stage, the investor will launch the following step: the basic design. An option for the basic design is the Front End Engineering Design (FEED), which has a scope more oriented to functionalities and basic work specifications.

The basic design studies will be used for the permitting, for the project financing and as a technical basis for the project implementation. The required information is thus more detailed and the proposed solutions should be optimized.

The scope of the basic design will therefore cover all the studies required to achieve these three goals. It will include:

- The interpretation of the site data
- The studies required for a correct definition of the works
- The optimization studies for the best investment or operation cost results
- The safety assessment
- The environmental impact assessment
- The equipment and systems specifications
- The drawings required for a correct understanding of the specified solutions
- The project execution schedule
- The scope description and specification for the project execution
- The CAPEX and OPEX estimation with an accuracy of around 10 percent

- The contracting strategy for an optimum project execution, price and schedule

## Project execution

After FID the investor can launch the last project development step: the project implementation phase. After this project implementation the plant will start its commercial operation.

The scope of the project implementation is quite easy to define: all activities required and ready for operation. The scope covers the detail engineering, the procurement, the construction, the certification, the commissioning and the assistance to investor operation team for the plant start up.

It includes the material and equipment specifications, the calculation notes, the construction drawings, the material take off and the working procedures. It also includes the preparation of the operation manuals.

## Conclusion

The above explained phasing and respective steps are typical and are to be used as guidelines. Each project is governed by different parameters that will lead to a specific phasing that is optimized for the purpose of the project.

It is, however, to be understood that the various steps involve expenses before the FID. These early expenses are often seen by some investors as excessive and sometimes they try to escape them and to shortcut the sequence. Shortcuts, of course, are possible but not automatically beneficial for the project overall. An unfounded assumption in one step will need to be managed during the following step when higher expenses are involved. This will affect the progress and be a source of delay and additional expenses.

The project development is a complex program. This program could extend from five through to ten years depending upon the circumstances.

In the recent years, the strategy of project developers has increasingly been governed by focus points in the negotiations over the business plan and over the conditions of the new facilities. The investigations of other seemingly minor technical issues tend to be postponed.

The art of project management also involves the capacity of adjusting smoothly during the implementation phase of the project and addressing some of the issues left unresolved, to fit the various commitments made by the owner.

### ABOUT THE AUTHOR



**Daniel Acheroy** has worked for Tractebel Engineering since 1974 and has developed LNG experiences since 1976, first as mechanical and piping engineer, then as project manager and later on as LNG technical director. The LNG experience was built up in worldwide projects, as project manager for engineering contract or as EPC contractor or as technical sponsor: Turkey, Korea, Thailand, Portugal, Spain, Brazil, Chile, Croatia, France, USA and Canada, amongst others.

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A leading international engineering consultancy company, **Tractebel Engineering** is part of GDF SUEZ, an industrial group with the financial strength to address the challenges of the future. With approximately 3,300 people in some 20 countries, they offer life-cycle engineering solutions for power, nuclear, gas, industry and infrastructure clients. Services include a full range of engineering assignments: architect engineer, owner's engineer and consulting engineer. Their customers are private and public companies, as well as national and international institutions.

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# Sustainability reporting

## A trigger towards sustainable development of a port

**Dr. Eric de Deckere, CEng. Greet Bernaers & Tine Vandendriessche**, Antwerp Port Authority; **Peter Van de Putte**, Scheldt Left Bank Corporation; & **Dr. Stephan Vanfraechem**, Alfaport Antwerp

### Introduction

The Port of Antwerp is the second largest port in Europe, with a large cargo generating capacity, and is able to call on a wide ranging synergy between maritime, logistics and industrial activities. It is also home to the largest integrated chemical cluster in Europe. This multi-functional capability generates significant added value for the surrounding communities, the region and the entire country. The companies in the port provide employment, directly and indirectly, for more than 145,000 people, with a pool of highly trained personnel.

In the Twentieth Century, the main emphasis of port policy was on economic development. The core tasks of the port community were to organize the varied and constantly expanding flow of goods as efficiently as possible, while assuring a high level of stable, skilled employment. This core task did not change, but social and environmental concerns started to become more important during the last decade. Competitive advantage is no longer limited to the economic sphere; increasingly it is sought in a wider social and international context. The Antwerp port community is convinced of this. Therefore further economic development of the port needs to be accompanied with a clear sustainable policy, maintaining a balance between economy, people and environment (people, profit and planet). This balance can be enhanced by a port authority, but this balance can only be reached when all stakeholders in and around the port area are actively involved.

The public sector, the Antwerp Port Authority and the Scheldt Left Bank Corporation, and the private sector, represented by Alfaport Antwerp, decided to encourage the Antwerp port community to get actively involved in improving the overall sustainable performance of the port. However, the baseline had to be described both in a quantitative and qualitative way, based on a list of indicators. This resulted in the first sustainability report for the Port of Antwerp, which was also the first sustainability report for a port area, worked out jointly by private and public sectors.

### Stakeholder involvement

The stakeholders were involved in the process at an early stage. Representatives of companies and the industry, trade unions, local governments, NGOs, agricultural organizations, transport sectors and institutes involved in educational programs all participated actively in the process. First, the expectations of the stakeholders regarding the sustainability of the port were identified. Next, possible indicators that could be used to measure social, economical and environmental performance of the port were identified. Subsequently, it was discussed in small working groups which data could be used to quantify these indicators and also who could provide the data. The data of the initiating public and private sectors were used, as well as the data of the Flemish Environment Agency, the Public Waste Agency of Flanders, the Research Institute for Nature and Forest, local governments and the National Bank of Belgium.



Figure 1. Import and export between the Port of Antwerp and the different continents in 2009 (in tonnes).

TABLE 1: NON-GRI LISTED INDICATORS QUANTIFIED IN THE SUSTAINABILITY REPORT OF THE PORT OF ANTWERP, REFLECTING THE SUSTAINABLE PERFORMANCE OF A PORT AND/OR COMMUNITY

Port specific indicators	Community specific indicators
<b>Economical performance</b>	
<ul style="list-style-type: none"> <li>market shares per cargo type</li> </ul>	<ul style="list-style-type: none"> <li>investments in research and development</li> <li>labor productivity</li> <li>modal split or sustainable transport</li> <li>economical use of the area</li> <li>logistic activity</li> </ul>
<b>Environmental performance</b>	
<ul style="list-style-type: none"> <li>environmental shipping index</li> <li>sediment quality</li> <li>oil spills</li> <li>waste disposal by vessels</li> </ul>	<ul style="list-style-type: none"> <li>air quality</li> <li>soil quality</li> <li>water quality</li> <li>environmental nuisance</li> </ul>
<b>Social performance</b>	
<ul style="list-style-type: none"> <li>security practices, such as International Ship and Port Facility Security Code (ISPS); Authorised Economic Operator (AEO); Alfapass</li> <li>unwanted passengers</li> <li>educational programs for schools</li> </ul>	<ul style="list-style-type: none"> <li>sustainable mobility for employees</li> </ul>

After the data analysis, a first draft text was produced. This text was discussed during a second stakeholder process. Stakeholders were forced to analyze a part of the text which was not related to their background. For example, stakeholders with a background in economics were asked to analyze text on environmental and social indicators. Comments and suggestions were worked out in the final text proposal, which was sent around for a final consultation with the stakeholders. So the final product is based on an intensive stakeholder involvement, which had been maintained during the whole process.

### Selection of indicators

It was decided to draw up the sustainability report in accordance with the international Global Reporting Initiative (GRI) guidelines as much as possible. The GRI method is not only widely recognized, it is also one of the most widespread, most standardized and most used method for companies that want to report on sustainability. GRI developed a standard list of indicators, focusing on economical, environmental and social performance. In addition, sector supplements were worked out,

as it was recognized that expectations of sustainable performance of sectors, such as NGOs, mining and metals, might differ. Therefore tailor made sector specific indicators have been worked out. So far, however, this is not done for ports in which multiple sectors perform. Neither guidelines have been worked out for an approach which reports on the sustainable performance of an area, such as an industrial area, a city or a port.

With the help of the stakeholders, two additional lists of indicators were worked out for the sustainability report of the Antwerp port community (see Table 1). The first list of indicators is linked to specific aspects of ports, while the second list tries to reflect the sustainable performance of a community. The latter can also be used for industrial areas or cities. On the other hand reporting on human rights and product responsibility, two categories listed in the GRI guidelines under the social performance, is less relevant for an European port community.

### A journey through the Port of Antwerp

The outcome of the stakeholder process and the selection of indicators resulted in an integration of sustainability indicators for

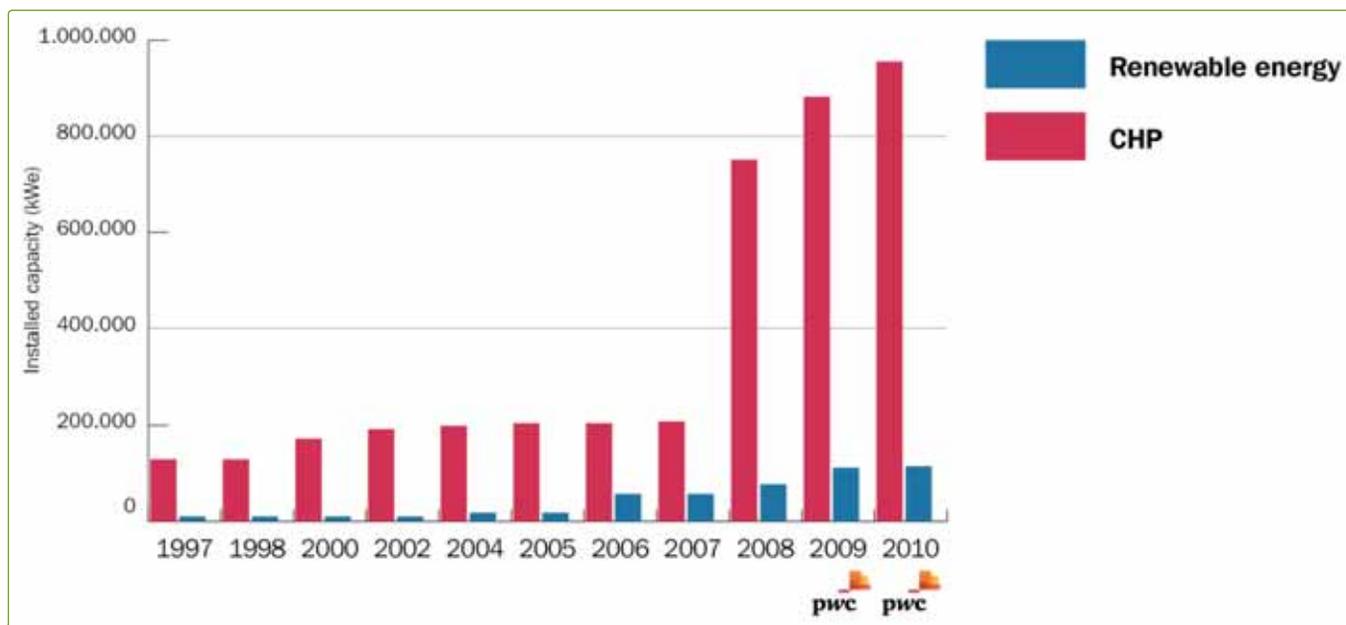


Figure 2. Installed cogeneration capacity (CHP) and installed renewable energy capacity (kilowatt energy).

people, planet and profit, more or less linked to the route followed by goods that enter the Port of Antwerp. An impression of this route and aspects reflected in the indicators are described here:

- In 2010, about 180 million tons of goods entered Europe by the Port of Antwerp (see Figure 1). The selection of Antwerp is based on a careful and efficient cargo handling, but other aspects are also considered, such as safety and services provided for the vessels, for example waste disposal facilities, and their crew, for which the port received the International Seafarers' Welfare Award in 2011.
- The combination of maritime, logistical and industrial activities generates important added value. An added value of €8.5 billion (about \$11.2 billion) was generated by the joint effort of about 900 companies in 2009. In this way, the Port of Antwerp plays an important role for the economy of Flanders and Belgium. This is also reflected in the number of well trained but dominantly male employees (about 150,000 people).
- Trained employees and modern handling techniques are also crucial. This combination guarantees the high productivity and excellent services for which the Port of Antwerp is known and appreciated around the world. Training and innovation also have a positive impact on health and work safety.
- To guarantee sustainable economic development both the private and the public sector invest significantly in profit (for

example, through infrastructure and energy efficiency) and people (through training programs to guarantee that there will be qualified people for the increasing number of jobs) and planet (for example, to reduce emissions to water and air, and increase sustainable energy and nature development, see Figure 2).

- From the port, goods are distributed to the hinterland. The port, the region and the hinterland are interconnected by a complex network of economic, logistical, social and societal relationships. Sustainable transport modes to and from the port, reflected in the modal split, are important to limit the nuisance to this network.
- Like any global port, the Port of Antwerp exists in relation to the area's residents, who are often also its employees. The Port of Antwerp has developed many initiatives to reinforce and maintain these bonds. After all, one of the main themes of the sustainability strategy rightly determines that the port has to be a well behaved port, on both the right and left bank.

The final sustainability report ([www.sustainableportofantwerp.com](http://www.sustainableportofantwerp.com)) reflects the current status of people, planet and profit in the Port of Antwerp, based on a list of 42 indicators. The report however is only a status report and is now used as a trigger to work out actions in which different stakeholders focus on a sustainable economic development, keeping the balance between economy, people and the environment.

#### ABOUT THE AUTHOR



**Dr. Eric de Deckere** is technical manager environment at the Department of Spatial Planning and Environment of Antwerp Port Authority. His interests cover integrated water and sediment management and sustainable development. He coordinated the first sustainability report of the Antwerp port community.

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# It's time to go green

**Sara Sköld**, director and environmental specialist at the Clean Shipping Project, Lund, Sweden

## Introduction

It goes without saying that the shipping industry has undergone some significant changes over the years. Technological developments have helped terminal operators and carriers transport cargo more efficiently than ever before, but now is the time to begin really enhancing the industry's 'green' image.

As people around the world become more aware of the global environmental problems, they are demanding more sustainable products and services. As a result, to satisfy their customers' needs, cargo owners are beginning to look closer than ever before at the performance of the entire supply chain of products – from the manufacturing line to the ships used to transport the goods.

## Greening the logistics industry

Everyone involved in the logistics industry knows that shipping is one of the most energy efficient ways of transporting goods. However, shipping is also still associated with a number of unwanted side effects. Ships produce many harmful emissions, with greenhouse gases, sulphur oxides and nitrogen oxides ending

up in the air, whilst waste, heavy chemicals from antifouling, cleaning agents and lubricants end up in our oceans.

It is not just shipping companies that hold the key for a future of sustainable shipping. Terminal operators can facilitate efficient and clean shipping by acting as green service hubs. This should help make them a preferred location for cargo owners with a green agenda.

Due to slow rule making in the past, the shipping industry's reputation is somewhat damaged. With the new, more stringent regulations from both the IMO and the EU regarding the fuel sulphur content on short sea routes in northern European waters, this might begin to change. The difficulty for shipping lines is how they implement these changes, with so many different laws affecting them in different areas of the world. As ships become 'greener', terminal operators will be looking to improve their own carbon footprint by attracting the most environmentally friendly vessels. One example of this can be seen at the Port of Gothenburg, which announced last year that it would repay up to 60,000 SEK (about US\$8,800) of the port charge to the first twenty vessels meeting the new targets set by the Clean Shipping Index.



The Port of Gothenburg is planning to become one of the 'greenest' ports in the world.

## Technological innovation

Since its development, the internet has helped a wide variety of industries revolutionize the way they do business and the shipping industry is no different. Twenty years ago, it would be a mere dream for cargo owners to be able to look up a price or a schedule online, get an instant overview of availability, receive an instant booking confirmation and track incoming cargo. This is now becoming the norm.

Today, we can go even further than that and cargo owners can now use online databases to choose which carrier to use, based on their 'green' credentials, whilst terminal operators can use the same tools to measure the environmental performance of the ships that use their services.

## The Clean Shipping Project

We founded the Clean Shipping Project in 2007 to increase the focus on the environmental issues of shipping. Leading cargo owners, such as Philips, Volvo, H&M and Tetra Laval, together with major ports such as Gothenburg and Antwerp, are currently signed up to use our services, which highlights how seriously these companies are taking 'green' logistics. Freight forwarders such as Geodis Wilson, Schenker and Kuehne Nagel have also joined up to work together for a greener supply chain.

Our main focus and our biggest success has been the launch of the Clean Shipping Index, which is run by the not for profit association, the Clean Shipping Network. Since it was founded, the industry's response has been positive, with many organizations embracing its holistic approach regarding the environmental issues of shipping.

The Clean Shipping Index was created as an online tool for cargo owners, to allow them to make informed, sustainable choices when selecting providers of sea transport. Now freight forwarders and terminal operators can access environmental data

on ships and shipping companies free of charge, after they have agreed to not disclose any of the information to a third party.

The Index goes well beyond the environmental regulations of today. Carriers are required to fill in a list of 20 questions about the different ships in their fleet. Cargo owners and terminal operators can then, with a few mouse clicks, compare the environmental performance of the shipping companies. Information can be viewed not only for an entire fleet, or a single ship, but also for just a specific issue of choice, like carbon dioxide for example.

Today, there are about 1,700 vessels in the index, owned by 45 large shipping companies or operators. New vessels are entered on a daily basis and it is free for any line to enter data into the index. For many ship operators it is not only a sales tool but a benchmarking tool, as it highlights how they rank among their competitors and also how their overall environmental performance is.

## Encouraging progress

In May, I have been invited to speak at the RORO event in Gothenburg. I'm delighted to take part in the conference sessions devoted to the environment. The fact that such a well respected event is focussing on the environmental impact of shipping shows that the industry recognizes the need for change.

Last year, Maersk unveiled its manifesto for change, which set out a plan to make shipping easier. This year, we need to set out a vision for improving the environmental performance of every part of the logistics industry. The new environmental regulations are an important step, but it goes without saying that more can be done in other areas. The Port of Gothenburg's current initiatives are a fantastic move and I have no doubt that more terminals will follow suit over the coming years. However, the biggest development on the horizon is the fact that the Port of Gothenburg is also planning to base a new port around the Clean Shipping Index shows a real step change.

### ABOUT THE AUTHOR



**Sara Sköld** is a director and environmental specialist at the Clean Shipping Project. She has worked in the transport sector for the last seven years with focus on environmental issues. She has a masters degree in Environmental Science and a masters degree in Physical Geography with focus on Climate Change.

### ABOUT THE EVENT

**RORO** is the only event dedicated to the RoRo industry in Europe. This year's event is hosted in Gothenburg from 22 to 24 May and will feature presentations from a wide variety of industry experts, including Sara. Visitors can register for free at [www.roroex.com](http://www.roroex.com) which entitles them to entry to all conference sessions, as well as the exhibition.

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# It's getting loud in the North Sea

A specialist company from Lübeck is reducing offshore underwater noise and protecting marine life with the Big Bubble Curtain

**Werners Evers**, communication and PR consultant, Hydrotechnik Lübeck, Lübeck, Germany

## Introduction

There's a lot happening in the North Sea. Floating platforms with gigantic cranes are being pulled out to sea; workboats and helicopters are shuttling back and forth. Eemshaven has become a massive materials storage location and is a base for opportunities. The industrial harbor's location on the Dutch side of the Ems River estuary is strategically beneficial for projects in Eemshaven.

The German government wants to stop using nuclear energy. By 2030, 5,000 wind turbines will be on stream in the North and Baltic Seas. Sixty new nuclear power plants will no longer be necessary when these turbines are producing 25,000 megawatts of electricity. This is a unique project for the German energy sector and an ambitious challenge for the country's industry.

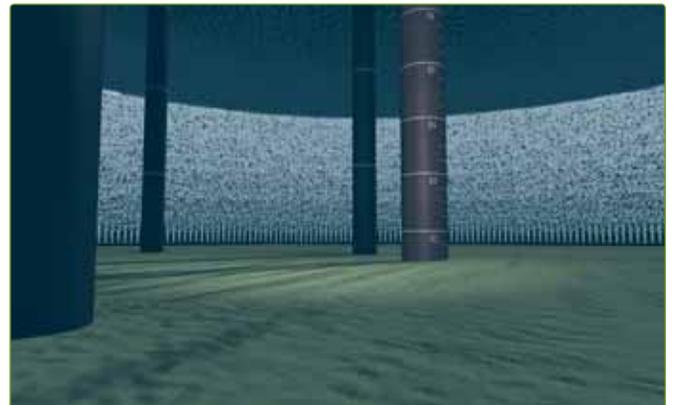
The wind over the North Sea blows strong and steady. The sea is perfectly suited to the task of generating power from wind, and large areas in the middle of it have been designated for major construction sites – far enough away from land that they don't interfere with the view of the water. However, the sea is a sensitive ecosystem containing many creatures worth protecting. So when wind turbines of gigantic dimensions are installed there, nature can't be allowed to suffer.

Early on, scientists and conservation groups warned, above all, of the extreme underwater noise emissions. With this level of underwater noise, harbor porpoises would die over time. For the foundations of just one turbine, up to four piles are driven into the seabed. Every pile is 55 meters long and weighs approximately

200 tonnes. A pile driver hammers them through mud and rock hard sand until they are 40 meters deep in the ground. Roughly 3,000 blows are required – for every pillar. Underwater noise insulation is an absolute necessity.

## The Big Bubble Curtain

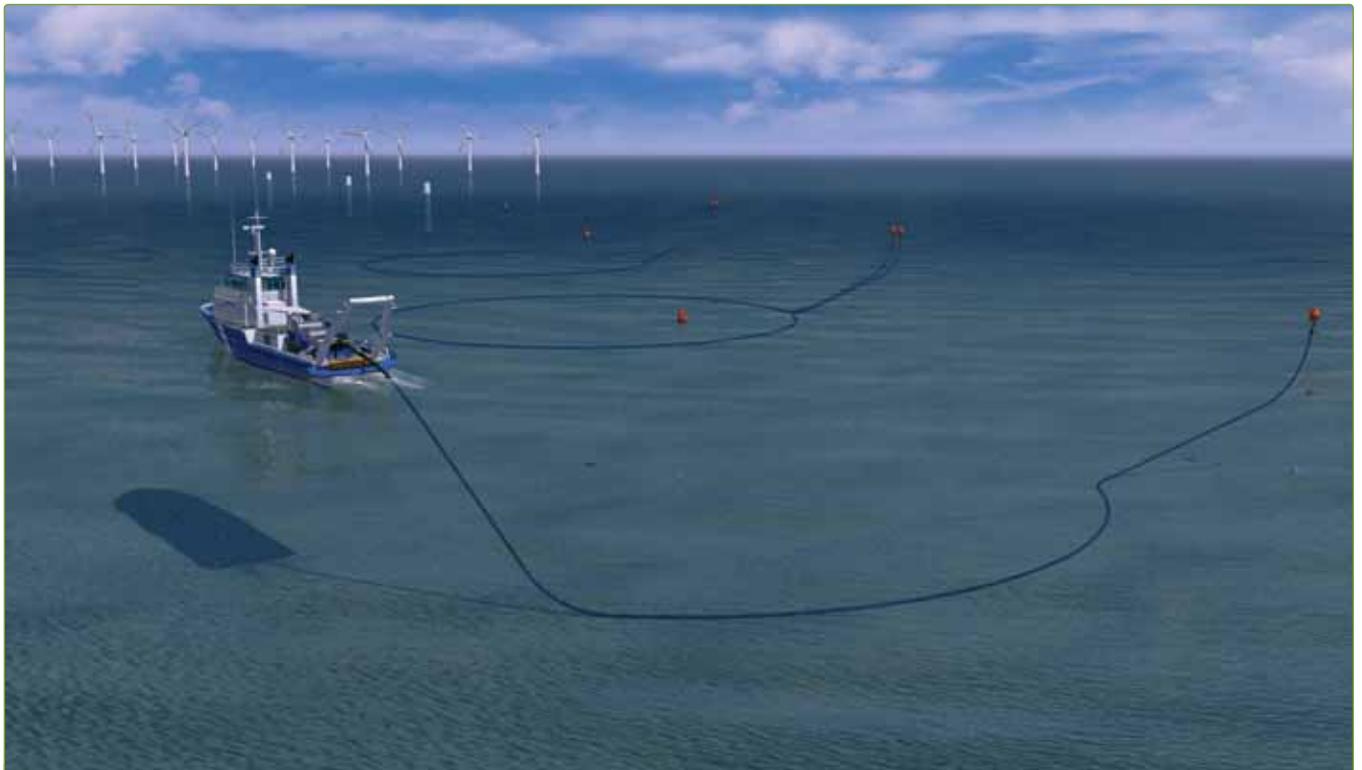
The engineers from Hydrotechnik Lübeck have taken on this challenge. After two years of research and development, a system is now ready for operation: the Big Bubble Curtain HY75. The initial idea was, in itself, very simple: air bubbles alter the density of the water, and the sound waves are interrupted and



The noise reducing screen made of air bubbles is formed around the building site.



The bubbles change the density of the water. Sound and pressure waves are interrupted and prevented from travelling any further.



The Noortruck lowered the third hose in a perfect circle around the building site.

prevented from travelling any further. The requirements for this new technology, however, were high. Crucial guidelines had to be met, and the rapid pace of building could not be hindered. €5 million (about \$6.5 million) were invested for research and development. These funds came primarily from the Federal Ministry for the Environment. Expert support came from the University of Hannover and the competence of the BioConsult and ITAP companies.

The way the curtain functions is easy to explain. A special ship, the Noortruck, is equipped with three large hose reels and a cluster of powerful compressors. Before the pile driver platform is brought into position, the Noortruck has already lowered the first ring shaped hose into the North Sea; a perfect circle around the building site with a diameter of approximately 160 meters. The ends of the hose are fixed at the water's surface using buoys. Now the platform can be moved into place, as the Noortruck is already lowering the next hose at the next location. The advantage: the platform can prepare for the pile driving work without delay. Shortly before the pile driver starts, the Noortruck returns to the ends of the hose. The compressors are started and a noise reducing screen made of air bubbles forms around the building site. When all the piles are deep in the ocean floor, the dismantling of the platform begins. The Noortruck uses this time to sink a further hose at another location. While the platform moves to its new position, the first hose is retrieved from the seabed and the work cycle begins again.

### The Noortruck

The Noortruck is big enough to transport the equipment for three bubble curtains. It also has enough space for the necessary compressors. As a second feature – which is no less important – the ship's manoeuvrability has to be pointed out. This is very important in the placement of the hose rings. Finally, the Noortruck is a ship on which the crew can feel comfortable and safe.



This way of working allows all the trades and crafts involved to work independently of each other.



The Noortruck is equipped with 3 large hose reels and a cluster of powerful compressors.



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Source: Trianel

Thanks to the Big Bubble Curtain, noise levels remain below even the German government's recommended limits.

Cay Grunau, an engineer and the director of Hydrotechnik Lübeck, says: "The air bubble curtain used during the Borkum West II project has more than met our expectations. The placement, the operation, and the retrieval function smoothly. Of course, we expected a reduction in noise emissions, but the initial measurements are between 152 and 158 decibels, which constitutes a 15 decibel decrease in the noise level. This has surprised us all. It means we even remain below the limits set by the government agencies. Now we're working on optimizing this value itself. By changing how the hoses are laid out and put into place, it should be possible to double the level of noise reduction."

### The origins of the bubble

For more than 30 years Hydrotechnik has focused on the use of compressed air in maritime construction. They have installed so called pneumatic oil barriers in many of the world's tanker harbors to protect against oil pollution. When put into use, the Big Bubble Curtain usually blocks the harbor entry within minutes. The oil is contained by the stream of rising bubbles. The biggest installations built to date are in Italy, Croatia and the United Arab Emirates. In Germany hose lengths from 1,000 to 1,500 meters were used. These were sunk to a depth of 60 meters.

The initial spark for the development of a bubble curtain for offshore underwater noise protection came from the FINO 3 project.



One important feature is the excellent manoeuvrability of the Noortruck.

Within the framework of this project, a noise barrier for the driving of a monopile in 24 meter deep water needed to be developed, built and operated within six weeks. As a specialized company, Hydrotechnik Lübeck were the only ones to come under consideration for this job. They had already gained very good experience working on noise protection for the detonation of munitions in the Baltic Sea.

#### ABOUT THE AUTHOR



**Werner Evers** is a communication and PR consultant. His years of experience in the media world have made him a specialist in the visual realization of journalistic content. He oversees the

new position of marketing for Hydrotechnik Lübeck.

#### ABOUT THE COMPANY

Based on more than 30 years experience in environmental protection and special marine construction, **Hydrotechnik Lübeck** combines expertise in planning, manufacturing and installation under one roof.

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# Clean commerce

## How fuel cells help keep port emissions at bay

**Ryan Skukowski**, policy analyst, Fuel Cells 2000, Washington D.C., US

### Environmental regulation of port activity

Large, commercial ports around the world number in the hundreds, and all of them move goods as an essential part of the global economy. Ports bring vital economic activity to a region, but they also contribute a great deal of pollution to the surrounding area. From hauling ships to lifting containers, port activity is extremely energy intensive, causing heavy emissions as well as noise and light pollution. Ocean going ships, tug boats, yard vehicles, and container movers are some of the major culprits of these emissions, which include particulate matter, nitrogen oxides, and volatile organic compounds.

In the US, ports continue to expand, but now face a variety of regulations designed to limit their environmental impact. In 2004, the US Environmental Protection Agency (EPA) began to regulate the nitrogen oxide emissions from large Category 3 marine engines and four years later did the same for small marine engines. The cumulative effect of these regulations was an 80 percent reduction in emissions from marine diesel engines. Since then, the EPA has tightened its standards on off road diesel engines, rail engines, fuel quality, and more, prompting several US states to do the same.

### A technological shift

The shift toward stricter regulation is quickly changing the technological landscape at a number of these ports. At the Port of Long Beach, California, new environmental incentives include a program to encourage ships to plug in to shore power when docked. On the east coast, the Ports of New York and New Jersey incentivize operators of trucks and ocean going vessels to switch to cleaner fuels and EPA emissions compliant engines. At the Port of Miami, Florida, electrification of gantry cranes is taking place on a large-scale, replacing diesel engine power systems and reducing noise and emissions at the same time. International ports are taking similar measures to improve their environmental profile. From Gothenburg Port in Sweden, where a system of rail shuttles has replaced a number of short distance drayage trucks, to Dubai's Jebel Ali port, where eight diesel powered gantry cranes are undergoing electrification, regulatory pressures and a growing acceptance among the shipping industry for sustainable practices is driving technology upgrades designed to cut emissions to zero at ports around the world.



Vuosaari Harbor, Finland.

© MSC S/AMSC Finland Oy

### The potential for fuel cells

One technology that holds great potential to clean up port activity is fuel cells. Part of a family of technologies, fuel cells generate energy through an electrochemical reaction between hydrogen and oxygen, a process that is inherently clean and efficient. The only emissions from fuel cells are water and heat, both of which can be recovered and put to use. Fuel cells already meet or exceed environmental standards set by the EPA for emissions, efficiency, and noise. At ports, they could become an attractive alternative to diesel generators to meet a variety of applications and power needs.

#### Current activity in Finland

Vuosaari Harbor at the Port of Helsinki, Finland, is one location where the potential of fuel cells is being demonstrated today through the Demo2013 project. A joint effort among leading Finnish companies and research institutions, Demo2013 will demonstrate fuel cells in a variety of applications aiding electricity delivery, cargo handling, communications, and logistics, and allow the companies involved to test and market their products in a working environment. The project began in August 2011 and will continue through the second half of 2013.

Playing a major role at the port will be a 50 kilowatt, solid oxide fuel cell system from Finnish manufacturer Wärtsilä. The system will feed electricity to the electrical grid, redirect waste heat to the harbor area and district heating system, and demonstrate the overall potential of Wärtsilä's fuel cell – which boasts efficiencies up to 53 percent, low noise, and zero emissions of sulphur dioxide, nitrogen oxide and particulates – throughout the port. Aside from stationary power, Wärtsilä will feature its fuel cell auxiliary power unit (APU) on board ships docked at the harbor. At ports where speed restrictions are in place for approaching vessels, a fuel cell APU could provide clean power to bring the ship to harbor, thereby greatly reducing emissions.

Fuel cells will also be demonstrated in forklifts that assist cargo movement around the yard, and a modular fuel cell system from Finnish company T Control Oy will guarantee reliable back-up power (more than 160 hours, according to the company) to a telecom base station in harbor and security applications on site.



Eidesvik Viking Lady.

© Oddgeir Refvik/Mercator Media

such as gates and security control systems. The hydrogen needed to fuel these installations will be supplied by Woikoski Oy via a mobile refueling unit at the harbor.

### Current activity in California

Fuel cells are also becoming integrated into daily operations at the ports of Los Angeles and Long Beach, California, the first and second largest ports in the US, respectively. These two ports are mammoths of economic activity, moving more than \$350 billion in goods and materials each year, and although they compete for business, the ports now collaborate on environmental programs and infrastructure projects to help 'green' their operations.



Vision Motors Tyrano rig.

© AZGreen Magazine

In particular, the ports of Los Angeles and Long Beach have identified drayage trucks as an area where new technology could vastly improve their overall environmental performance. In July 2011, Vision Motor Corp., a zero emissions vehicle manufacturer based in El Segundo, California, delivered a heavy duty hauling truck to Total Transportation Services Inc., one of the port's largest cargo haulers. The vehicle is a fuel cell battery hybrid Tyrano Class-8 rig, capable of 200 miles between hydrogen fills, thanks to the onboard fuel cell, which recharges the battery during use, eliminating the need to plug in to recharge. The truck gets the same mileage out of a kilogram of hydrogen as a gallon of diesel, but for half the price.

The ports committed \$425,000 from a joint Technology Assistance Program to demonstrate the Tyrano Class-8 rig, and its trial will last 18 months. Total Transportation Services has signed a letter to purchase 100 heavy duty trucks from Vision upon successful demonstration, with the option to purchase an additional 300.

The Port of Los Angeles has been greatly encouraged by the demonstration so far, and recently awarded Vision Motor Corp. up to \$1.4 million to retrofit more than a dozen of their electric short haul drayage terminal tractors with hydrogen fuel cells. The retrofit is expected to greatly extend the driving range of these vehicles, while also improving operational efficiency. For the Port of Los Angeles, this type of retrofit is particularly crucial – cargo handling equipment generated almost one third of all carbon monoxide emissions, 6 percent of carbon dioxide equivalent emissions, and nearly 10 percent of nitrogen oxide emissions in 2010.

### Future potential

While these three ports are currently world leaders in making fuel cells a regular fixture, they have only scratched the surface in terms of how the technology can be integrated. For vehicle applications, fuel cells provide the same amount of power as diesel engines, but without the harmful emissions, noise and headache inducing fumes. In addition to the forklifts, drayage trucks, and short hauling vehicles being tested at the ports above, fuel cells can power passenger vehicles used around the yard, and can even provide prime power to ships and rail locomotives.

Fuel cells are ideally suited for stationary applications, as well. Grid independent power is crucial for port security systems that include closed circuit surveillance cameras, logistics centers, warehouses, guard gates, and other critical security functions. Container cranes that offload cargo from ships could replace their diesel generator with a fuel cell, as could containers that require refrigeration.

### Toward a cleaner tomorrow

As ports around the world continue to expand, the environmental issues facing surrounding communities will only grow in severity. Fuel cells can help resolve many of these issues, and have the potential to reduce a port's emissions while raising its efficiency. Fuel cell systems are scalable, and lend themselves well to stationary, motive and auxiliary power applications around the yard. They are also flexible, meaning they can be used in hybrid systems or as onboard battery chargers. The early adopters at the ports of Helsinki, Los Angeles, and Long Beach provide just a glimpse of the benefits fuel cells can provide, and their progress will hopefully inspire other ports to strive for a cleaner flow of commerce in the near future.

#### ABOUT THE AUTHOR

**Ryan Skukowski** is a contributing researcher and policy analyst for Fuel Cells 2000, a program of the Breakthrough Technologies Institute in Washington, D.C. Since joining the organization last year, Ryan has co-authored reports, written articles, and presented on the topic of fuel cell power generation and other emerging applications.

**Fuel Cells 2000** is an activity of the Breakthrough Technologies Institute (BTI), a non profit [501(c)(3)] independent, educational organization that identifies and promotes environmental and energy technologies that can improve the human condition. Fuel Cells 2000's mission is to promote the commercialization of fuel cells and hydrogen by supplying accurate, unbiased information, and developing and disseminating summary materials free of charge through their website.

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# CONTAINER HANDLING

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# Defying wind and weather

**Wolfgang Jarausch**, senior marketing manager, Baumer Group Product Segment Motion Control and **Kai-Hans Otto**, head of design engineering, Baumer Hübner GmbH, Berlin, Germany

Peru is one of the fastest growing countries in Latin America. Callao, as major seaport, plays a prerequisite role in ever growing cargo handling. Heavy duty encoders are crucial when it comes to smooth loading and unloading of cargo from giant vessels.

## Important transshipment point

Callao is the main seaport of Peru and a significant transit point for the fast growing cargo traffic between Asia and South America. In 2010, it handled more than 1.3 million TEU. The main share is held by the terminal DP World Callao, Muelle Sur, which has a capacity of 850,000 TEU. A water depth of 16 meters allows for landing and embarking of ships of the post-Panamax class, with a maximum cargo capacity of 8,000 TEU.

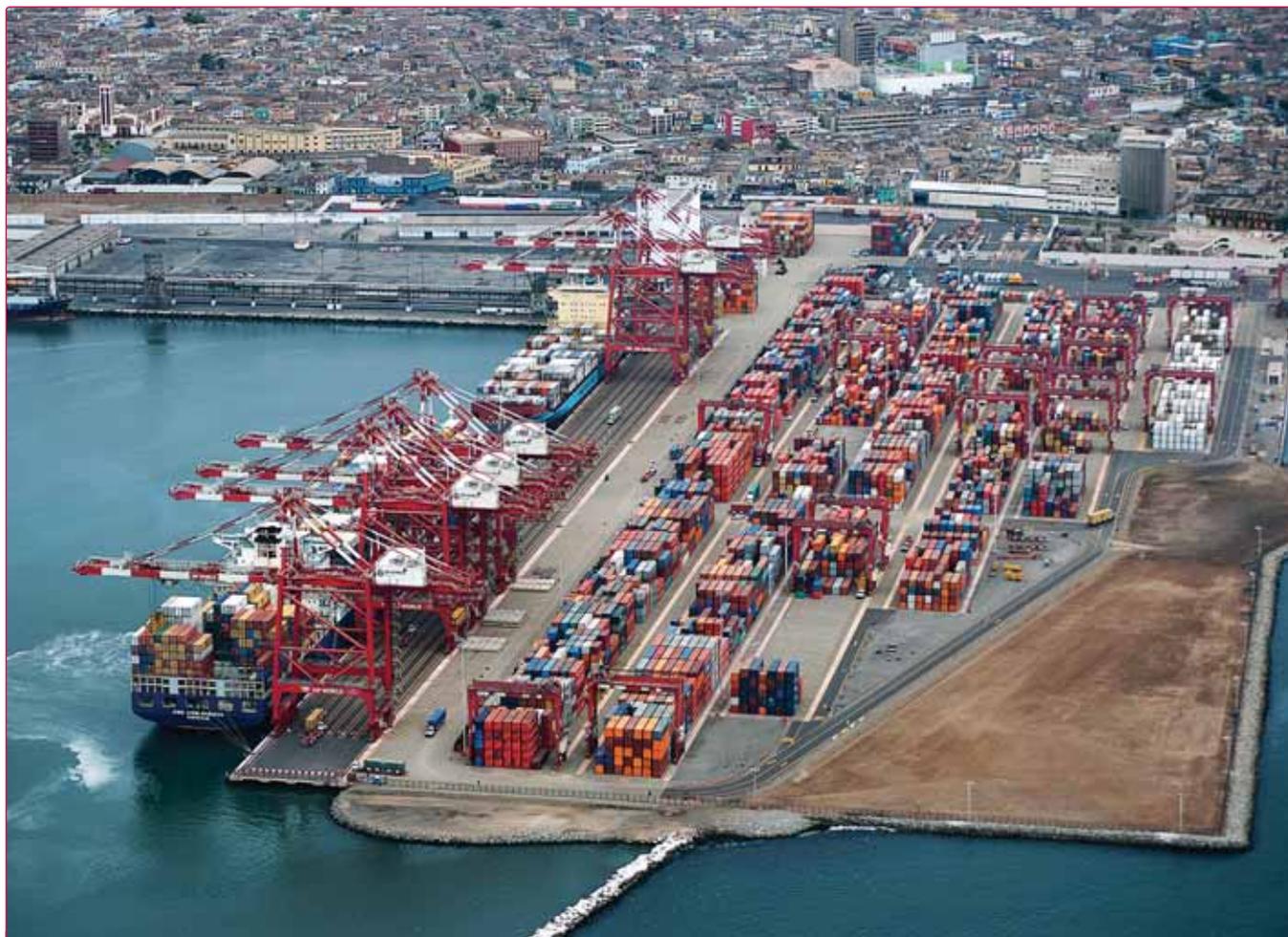
The starting point for terminal upgrade was in May 2010. Today, there are six STS cranes, with a maximum capacity of 28 TEU every hour, and 18 RTG, all equipped with the Baumer Hübner HeavyDuty encoders from the Baumer Group competence center for HeavyDuty applications. Deployed at spreaders, crane trolleys and chassis, they ensure reliable and trouble free operation.

## Maritime climate poses a challenge to all components

Harbor cranes are in action 24 hours a day and permanently exposed to corrosion by saltwater and salty air. These conditions call for outstanding products, so heavy duty encoders, specially conceived for continuous operation, strong mechanical impacts and a corrosive ambience, are the products to choose when it comes to long-term proven reliability in cranes and port installations.

The cable pull used for lifting and lowering the spreader is exposed to maximum stress and strain. The cable of a twin spreader is expected to handle loads of 65 tons, and have lifting speeds of 100 meters per second and lowering speeds of 180 meters per second.

For DP World Callao, Muelle Sur, each crane requires two hoisting drives of 620 kilowatt, each manufactured by the company Franz Wölfer Elektromaschinenfabrik. Shaft diameter is 95 millimeters. One drive is intended as an emergency drive. Most demanding requirements are on continuous performance. Planned maintenance is only twice a year, and the system is expected to run without any unexpected breakdown.



Aerial photo of the container terminal DP World Callao, Muelle Sur.

Photo: DP World Callao

Consequently, the encoders deployed must be ultra reliable to meet the application requirements.

## High precision

Precision is another decisive criterion, since the encoder has to provide dependable feedback on the spreader's lifting and lowering speed.

The incremental HeavyDuty encoder HOG 220, with through hollow shaft, will cope with all these challenges and fits any shaft diameter between 80 and 115 millimeters. The robust, thick walled housing, with special surface finish, provides electric insulation, saltwater resistant primary coating and a second top coat sealing. This way, the housing is compliant to category C4 of ISO 12944. Further, the anti-corrosion protection does not only include the housing, but comprises the other components as well. Cable glands, connector outlets and screws also have to give proof of their saltwater resistance.

## Bearing blocks

Thanks to its robustness, the encoder will also endure very high axial and radial loads. 450 Newtons axial and 700 Newtons radial are effortlessly mastered by the bearing blocks. Insulated against inductive shaft currents up to 0.7 kilovolts, they are reliably protected from damage. Another design benefit is eased electrical connection by the proven terminal box rotatable through 180 degrees. A protective lid and encapsulation will prevent the electronics from any damage by dust or condensation while the cover is opened for installation.

## New product platform

The latest development in the HeavyDuty portfolio is the HOG 86 platform. The compact design and flexible installation capabilities make the encoder perfect for speed and position feedback at cranes, or for drive control tasks at lifting platforms.

The resilient aluminum housing with saltwater resistant top coat compliant to category C4 and ISO 12944 ensures long-term IP 66 protection – even at the shaft. Dual bearings provide a load capacity reserve up to 300 Newton radial and 200 Newton axial. There is no need to outline again that other components, such as cable glands, outlets and screws, are also saltwater proof.

The blind hollow shaft design is conceived for



HOG 86: convenient e-connection by terminal box rotatable through 180 degrees.

Photo: Baumer

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More information on Baumer solutions for cranes and lifting equipment is available under [www.baumer.com/cranes](http://www.baumer.com/cranes)



Spreader drive. The HeavyDuty encoder is directly attached to the 95 millimeter shaft.

Photo: Baumer

12 or 16 millimeter shafts, as well as cone shafts 1:10, with 17 millimeter diameter. The insulation will prevent the ball bearings from damage by inductive shaft currents up to 2.5 kilovolts and provides particular dimensional stability capabilities when exposed to strong shocks and vibrations. The encoder is also available with optional long life hybrid bearings.

### Integrated functionality monitoring

Condition monitoring for immediate error tracking, to prevent damages, is a prerequisite requirement of plant operators. The optionally integrated functionality monitoring feature, the enhanced monitoring system (EMS), will continuously supervise the encoder functionality to ensure reliable operation. Any error identified is signaled to the control via the alarm output. The multicolor LED integrated in the housing creates visuals of encoder supply, output driver operation and signal integrity. EMS is a valuable tool for error tracking, to eliminate expensive system downtime.



The encoder HOG 86 is available with several connection types and also with redundant sensing.

Photo: Baumer

#### ABOUT THE COMPANY

The **Baumer Group** is an international leading manufacturer and developer of sensors, encoders, measuring instruments and components for automated image processing. Baumer combines innovative technology and customer oriented service into intelligent solutions for factory and process automation and offers a uniquely wide range of related products and technologies.

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# enTIRE asset software – a business case

Reviewing the type of benefits that a container terminal can achieve through the deployment of the advanced entire asset tracking software solution.

**Richard Butcher**, group marketing and sales director, IMS Ltd, Southampton, UK

## Objective

The objective is to save between 10 and 30 percent on marine terminal tyre management costs by introducing an effective and highly efficient asset tracking software solution. The enTIRE software has been designed by industry experts with the sole purpose of achieving savings for operators of any type of wheeled vehicle.

## Tyre issues

Container terminals around the world that operate any form of wheeled handling equipment will acquire multiple types and sizes of tyres every year. The average terminal will spend in excess of \$2.5 million to \$5 million per annum on tyres.

The price of world rubber has significantly increased and operators are looking at the best possible options when replacing their tyre fleets.

Terminal operating equipment needs to be in optimal condition at all times, and at peak times the machines will run 24/7, with most operating 365 days. Of course, scheduled

The following is based on an actual container terminal that looked at the performance and costs associated with their tyres over an 18 month period:

Facts and figures:

- \$2.5 million dollars spent every 18 months on tyres
- Tyres achieving 4,000 hours against manufacturers claims of 9,000 to 10,000 hours
- 40 percent of tyres failing prematurely – (against manufacturers claims)
- Average tyre price \$2,200 (at the time of the review)

This type of data can be tracked and analyzed by enTIRE software.

maintenance is a key factor in keeping the machines operational and to maintain the required safety aspects that are paramount on container terminals.

Tyres endure tremendous stress, they have to operate on various surfaces, from smooth tarmac to concrete block pavements. Excessive weight and speeds will cause wear and tear and having

**Your safety is our goal.**



incorrect air pressures can cause significant structural stresses to the machine frame, it can also lead to increased tyre wear and higher fuel consumptions.

A review of terminals has indicated that operators find lack of tyre maintenance, such as regular inspections, checking the air pressures and rotation of tyres, has caused excessive wear and tear to the framework of the vehicles. It has led to tyre failures and more accidents, which lead to greater vehicle downtime and an overall impact on hourly TEU productivity.

Being able to select the right type of tyre for the machinery, terminal quayside surfaces and incumbent climates is essential. Terminal maintenance teams are faced with a trying time when selecting the right type of tyres for their machines. Getting the right tyres does not always mean buying the cheapest or, for that matter, the most expensive, and so by checking and continually monitoring the tyres' performance over a period of time, effective decisions can be made. This is where the enTIRE asset tracking software from the Australian VMC group can be a solution.

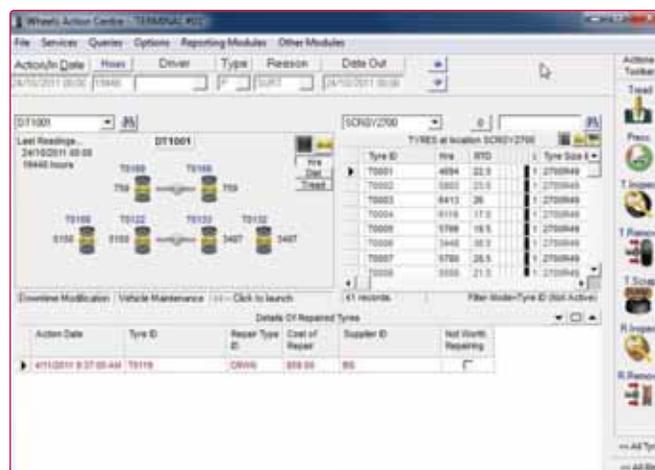


Tyre Prices are increasing and with an average tyre for a straddle carrier costing between \$2,500 to \$5,000 you are looking at between US\$20,000 to US\$40,000 per straddle carrier in operation.

## enTIRE asset tracking software

Tyre management needs to capture key data to allow for effective management of tyres purchased and operated. This data must include:

- Total hours, distance and tonnes that tyres and rims are achieving
- Wear rates by tyre brand, size, type, vehicle and position
- Cost per hour, distance or tonne
- Location and status of all tyres and rims (including those away for repair or recapping)
- Deliveries of tyres and rims
- Status of rim tests and inspections
- Failure reasons, lost tread value
- Expected tyre usage
- Warranty claims
- Complete detailed history of tyres and rims.



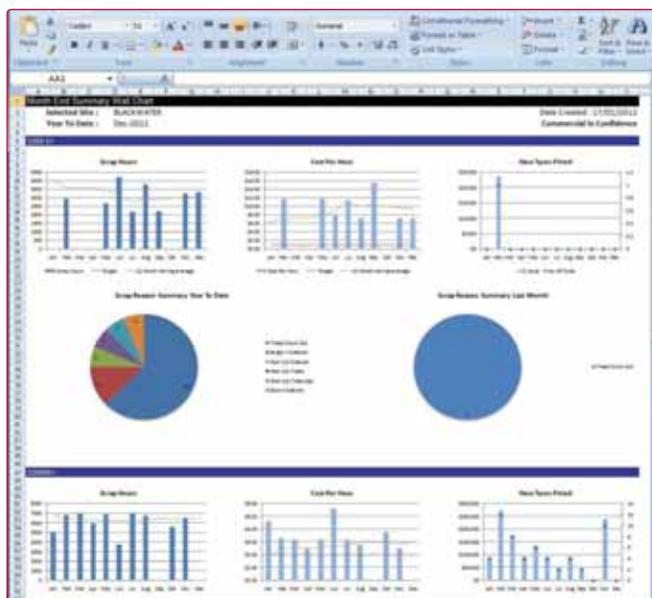
enTIRE allows the user to 'drag and drop' to move wheels and tyres with all the current and historical data transferred.

## Effect on tyre costs

The result of managing tyres effectively is the reduction of tyre costs, increased tyre life, improved safety and minimized downtime. Below are the potential savings that can be achieved with robust tyre management procedures. Of course, each operation will be different. The greatest savings for terminals is the reduced equipment downtime.

- Increased competitiveness between suppliers – 5 percent saving
- Purchasing based on tyre performance not cost or other factors – 5 percent saving
- Determining the best casing for multiple recapping – 4 percent saving
- Identifying and addressing operational issues that decrease tyre life – 6 percent saving
- Improved recap selection – 5 percent saving
- Improved tyre life due to correct tyre pressure maintenance – 4 percent saving
- Reducing in stock loss – 1 percent saving.

**This results in a 30 percent estimated reduction over three years (10 percent per year).**



With all the data collected, the operational and maintenance managers can analyze lots of data and KPIs to ascertain the best performing value tyres for the terminal to operate. A wide range of 'canned data reports' are available but additional reports can be produced and all can be exported to excel spread sheets if required.



Tyre size	Pattern	Rim Sizes	Diameter (mm)	Width (mm)	Weight (kg)	Steering Wheels (kg)	Load Wheels (kg)	Load capacity		
								6 km/h	10 km/h	25 km/h
1000-20	C2 & Y5	(7") 7.5" (8") x 20	1014	237	149	6000	7200	7200	6480	6000
1000-20	Smooth	(7") 7.5" (8") x 20	1000	242	156	6200	7440	7440	6696	6200
1100-20	S/C8	7.50-20 & 8.00-20	1040	250	163	6200	7440	7440	6695	6200
1100-20	S2C2	7.50-20 & 8.00-20	1102	273	202	6200	7440	7440	6695	6200
1200-20	C2	7.50-20 & 8.00-20	1151	300	262	7500	9000	9000	8100	7500
1200-20	S2C2	7.50-20 & 8.00-20	1102	273	202	7600	9120	9120	8208	7600
1200-24	C2	8.50-24 & 9.00-24	1249	310	297	7800	9350	9350	8424	7800
1200-24	SC2	8.50-24 & 9.00-24	1180	288	258	7500	9000	9000	8100	7500
1500-25	C3	11.25-25	1525	440	620	18500	22200	22200	19950	18500
1800-25	C1	13.00-25	1600	500	890	22000	26400	26400	23760	22000

Operational and maintenance departments can run comparisons on different tyre brands in order to identify the most effective make for the incumbent conditions.



# The zero emissions container ship

**Mark Sisson**, senior port planner and analyst, and **Krystle McBride**, transportation analyst, AECOM, Oakland, CA, US

## Background

Air emissions from port activity have received a great deal of scrutiny in the past decade, especially in the Ports of Los Angeles and Long Beach which are the largest two container ports in North America by far. Sources of emissions tend to be grouped into three broad categories: terminal handling equipment, trucks, and ships.

Electrification of terminal equipment coupled with the relatively quick turnover of equipment and sophisticated exhaust controls has greatly reduced emissions from this source. As part of their clean truck program, the Ports of Los Angeles and Long Beach, along with the trucking industry, have spent hundreds of millions of dollars in the past few years to modernize the drayage truck fleet serving the port and reduce emissions. Research into further emissions reductions from switches to natural gas or electrification of drayage trucks has the potential to yield even larger reductions in the near future.

Ships have proven more difficult to modify in order to reduce emissions. At berth, they can be plugged into shore power to allow zero emission hotelling operations, but as soon as a ship sets sail, giant engines burning low grade bunker fuel spew out a great deal of emissions while the ship is still in port and near shore.

According to 2009 emission data from the *Roadmap for Moving Forward with Zero Emission Technologies at the Ports of Long Beach and Los Angeles* issued in August 2011, ocean going vessels now account for 43 percent of all nitrogen oxides and 60 percent of all diesel particulate matter from port operations. This report states that: 'outside of at-berth operations (i.e. shorepower), it is not practical at this time to pursue zero emission operation of OGVs ... due to technical and operational constraints.'

This paper examines the possibility of overcoming these constraints with the example of adding a large amount of lead acid batteries to a large containership. The fact that berths in Los Angeles and Long Beach are (or soon will be) equipped with shore power allows ships to not only turn off engines while at berth, but to potentially use the high voltage connection and one to two days of berth time to recharge a large volume of batteries while at berth.

## Meeting the energy demands of ships

The calculations in this paper assume a hypothetical large containership of approximately 10,000 TEU capacity. The main engine on such a ship will likely be approximately 60,000 kilowatts in size. If we are concerned about emissions within a 40 nautical mile radius of the port (this range has been used in air emissions studies at the Ports of Los Angeles and Long Beach in the past), it will take approximately five hours of vessel run time to maneuver away from berth and outside of this range. This calculation is based on a mean speed of 12 nautical miles per hour from a vessel with a maximum speed of 24 nautical miles per hour, plus an hour of time to maneuver at very low speed from the berth to the edge of the breakwater.

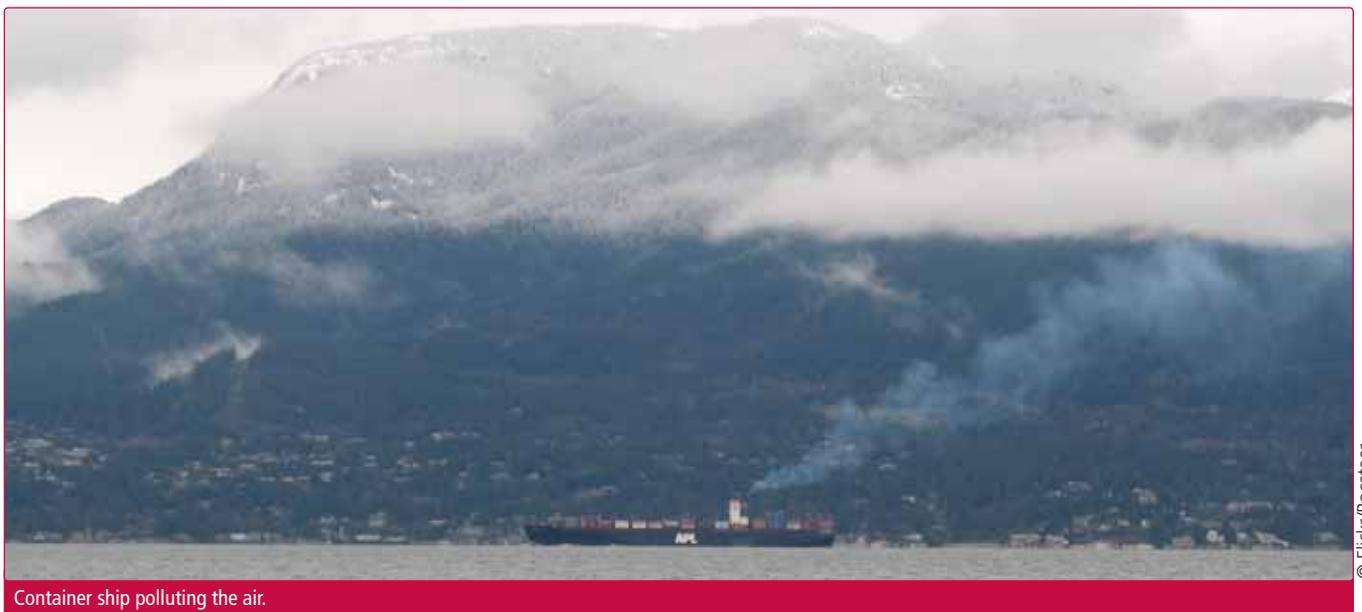
According to calculations presented in the *Port of Los Angeles Inventory of Air Emissions-2010*, during these five hours, the main engines will be running at approximately 11 percent of power, which means, for our above example, a total energy use of 33 megawatt hours.

According to allaboutbatteries.com, lead acid batteries have an energy density of 0.041 megawatt hours per metric ton. Approximately 800 metric tons of batteries would therefore be required to travel 40 nautical miles away from port in electric mode.

Although 800 metric tons may sound like a tremendous amount of weight, a 10,000 TEU container vessel will have a gross weight of approximately 100,000 metric tons, and will be able to carry 10,000 metric tons of bunker fuel and 30,000 metric tons of ballast water. Since the batteries will act as ballast, it may be possible to simply reduce the ballast water tank capacity by 800 metric tons and have little to no impact on the overall operating weight of the vessel under most circumstances. As a point of comparison, a single layer of car batteries (approximately 20 centimeters in height) arrayed at the bottom of a 10,000 TEU container ship will weigh approximately 2,500 metric tons.

## The solution

In the November 21, 2011 issue of Maritime Executive magazine, Harry Valentine proposes the use of batteries in ships using the St



Container ship polluting the air.

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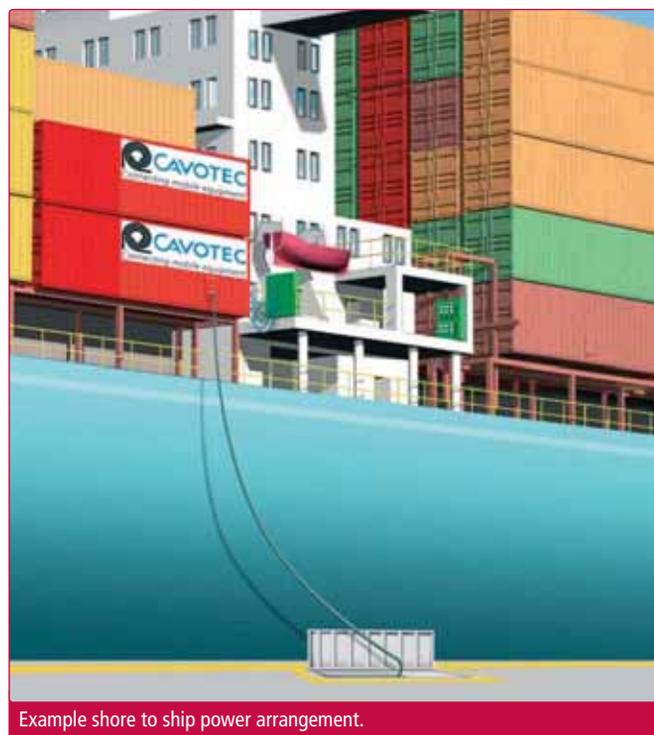


Connection details for high voltage shore to ship power.

Courtesy of Cavotec

Lawrence Seaway. Mr. Valentine states that: ‘advances in grid-scale electrical battery storage technology can allow for the installation of such batteries over a wide area and limited height, in the lower levels of a ship.’

Although lead acid batteries were used in this hypothetical example due to their low cost, the costs of higher performance battery types, such as lithium ion, are rapidly declining and may approach the cost per unit weight of lead acid batteries within a few years, whilst offering three times the energy density or more. Depending on the relative cost of batteries set against bunker fuel,



Example shore to ship power arrangement.

Courtesy of Cavotec

there may be compelling reasons for ship owners to maximize battery capacity in order to save on overall energy cost of vessel operations since this is by far the largest cost element of container ship operations.

In order for the battery bunker fuel hybrid ship concept to move from a hypothetical study to reality, both ports and shipping lines must plan for change. Ports must ensure that sufficient high voltage power is available not only to run the ship while at berth, but to also charge batteries. Large ships such as the one used in our example may require 2 megawatts or more for battery charging in order to reach a full charge in less time than is required for stevedoring activity. Even higher rates of charge may be desirable in the long-term if battery technology evolves to allow a ship to cover a significant fraction of its journey across the open ocean on electric power.

## Summary

Upgrading a ship to carry 800 metric tons or more of batteries is not a trivial exercise, but the resulting fuel savings may eventually become so compelling that vessel operators adapt this as the new standard. If ports or nearby communities who are currently suffering from ship emissions wish to accelerate this evolution to electric power, they have the same tools available as they do for encouraging vessel operators to equip ships to accept shore power. These range from the ‘carrots’ of financial discounts at berth and subsidized rates of electric power to the ‘sticks’ of mandates written into the terms of new leases, or financial penalties for calling in ships not equipped with battery systems.

### ABOUT THE AUTHORS

**Mark Sisson** leads AECOM’s marine analysis group. He is responsible for business development, project execution, and oversight of research and development of our simulation models. He has 17 years of experience managing and executing a wide range of marine terminal planning, simulation, and analysis projects.

**Krystle McBride** is a transportation analyst who has worked on a variety of analysis, simulation, and market research projects related to marine terminals. She has experience in analyzing operations of container terminals and bulk facilities. She has also conducted significant research into green port-related subjects, including performing emissions estimates.

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# Port radio data networks – back to the future

## Can middleware designed for terminal operations provide a wider technology choice?

**Richard Lambert**, founder and director, International Terminal Solutions Limited, Loughborough, UK

Container terminals and port facilities are generally busy areas with the movement of cargo on and off the facility, and using heavy plant and equipment to handle the cargo. It is therefore not really a surprise that the use of radio frequency (RF) communications in this environment is quite widespread in order to aid the efficient management and monitoring of the cargo movements and status of the equipment and plant.

In ports and terminals, systems integrators utilize many types of RF communication for the transfer of operational and engineering data. This can vary from very short range systems to site wide networks.

Most short range applications are point to point devices or RFID type systems, such as container truck identification or security card access systems. These types of systems are used for driver authorization to permit use of the equipment. Short range systems are also implemented to reduce costs involved in cabling where this would be difficult to do.

However, when referring to port installations, inevitably one tends to think of the site wide wireless data networks, and most people will immediately think of a WiFi network; however this is not the only option, with several others being available, including Narrowband and GPRS (GSM).

### WiFi

Mention a site wide radio data network and you immediately think of an IEEE 802.11 network, or to give it its more common name, a WiFi network. These are very common in ports and terminals these days because they are very flexible and most applications can use them to connect through to mobile equipment. In fact we commonly use WiFi networks to connect management and monitoring software to mobile equipment for functions, such as position determinations systems (GPS enabled equipment and tracking systems), and automated asset management, telemetry, and equipment status condition monitoring.

WiFi networks, however, are not always practical, can be expensive on larger sites, and rarely operate reliably straight out of the box. Most WiFi networks operate in the 2.4 gigahertz frequency band and the maximum radiated power allowed limits the range to approximately 100 meters to 140 meters. This effectively means on all but the smallest of sites multiple access points will be required to cover the site with a cohesive network. This, in my opinion, is the weakness of this type of technology, as the access points need to be in line with the site of the mobiles and will also need to be connected to the site Local Area Network (LAN). This can lead to gaps in the coverage and, to compensate for this, ITS write our mobile applications allowing for potential patchy WiFi coverage by building in local processing and data buffering.

There are however some instances where the installation of a WiFi network is not possible or practical due to the lack of suitable access point locations or other reasons. An interesting recent example of this is the Messina Lines terminal at Genoa, Italy.

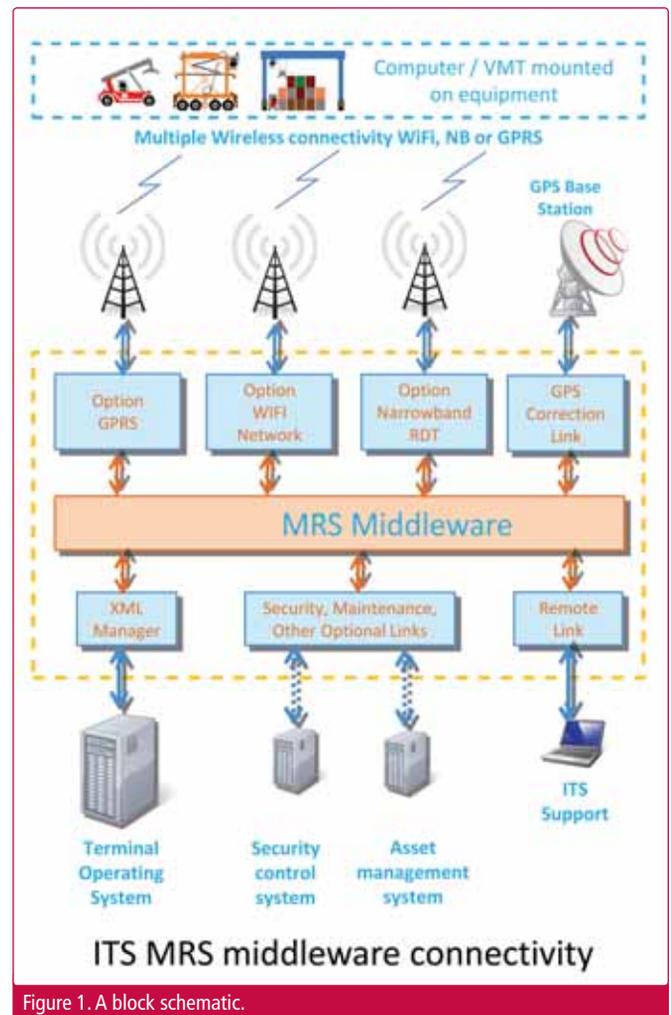


Figure 1. A block schematic.

### Narrowband

As part of a site wide upgrade project, Messina Lines had decided to replace its existing internally developed Terminal Operating System (TOS). The system selected offered mobile connectivity using a thin client over a WiFi network. However this became an issue at the Genoa terminal, as, in common with many terminals, the site is leased and construction of suitable additional structures to mount access points was not possible. A number of vendors were approached but a workable, reliable, proven solution could not be found using WiFi.

Traditionally, Narrowband technology was used with a direct connection to the TOS (running a computer screen emulation at a lower data rate bandwidth). However, when WiFi came along, with its much wider bandwidth and higher levels of data exchanges, most TOS systems developed their interfaces solely



Figure 2. A picture of a RDT terminal connected to the MRS middleware.

for this medium in mind. So, at Messina, the new TOS was only able to connect to a WiFi network, which of course the terminal wasn't able to implement.

ITS have a long history using Narrowband technology in ports and terminals and have several Narrowband networks deployed. The feedback we get is that the users are happy with the Narrowband systems as the reliability is very high and has a range of several kilometers. This effectively allows a whole yard to be covered from a single transmitter with excellent coverage, even down between the containers in the stack.

Several years ago it became clear that TOS connectivity could become an issue for existing Narrowband users, so ITS started to develop the MRS middleware application. In its early days this was purely a translation programme to convert the bulky XML messages from the TOS in to a more streamline format that could transmit over the Narrowband network with its lower band width. The translation software was then connected to the existing radio frequency network management software (radio network server) and this then allowed all current TOS systems to connect to the Narrowband network and retain all the functions and features that modern terminals expect, making the Narrowband network completely transparent to the Terminal Operating System and the users alike.

Following on from this the logical step was to expand the connectivity of the software applications to create the MRS middleware. This has been in operation for a few years and the MRS application is designed to accept connections from multiple servers and clients such as TOS systems, access control systems, asset management and ERP systems, and many others. The main function this connectivity provides is the ability for the mobile to access and be accessed by various management systems. Two good examples of this are for security and engineering purposes, where security database applications can authorize remote

mobile equipment operators using their access cards or log on PIN numbers and for engineering. Asset management systems can communicate directly with the equipment or operators to report faults and update equipment status.

ITS have many clients who utilize this MRS middleware technology, some using the WiFi connection but many using the Narrowband option. A prime example of this is one of Europe's largest transshipment hubs managing several million TEUs per year. This terminal runs all its GPS enabled PDS, mobile operator terminals, drivers' security card log on and remote asset management across a Narrowband network using the ITS MRS middleware application.

## GPRS (GSM)

In the last five years many new technologies have matured and the focus has been on multiple radio frequency connectivity. This first started with dual connectivity to either a Narrowband or WiFi network, to ensure that software and systems could connect seamlessly. As mentioned above, this has been successfully implemented on a number of terminals, some using WiFi and some Narrowband. More recently, however, we have added GPRS or GSM connectivity to the middleware. GPRS or GSM technology is the transmission method used by mobile phones to send and receive data, and industrial rated mobile modules can be integrated into mobile systems for data only applications.

We first started this development when one of our existing UK customers wanted to also add a remote connection to roving equipment that could go off site, the key requirement for GPRS or GSM being to add network coverage to remote or extended sites where it was not commercially viable to add infrastructure. We finished our beta phase testing of this earlier this year and have now fully integrated this alongside the Narrowband and WiFi connectivity. The first implementation connects mobile harbor cranes and tugs to an asset management system. Interestingly one of the mobile harbor cranes is actually on a sister terminal some 30 kilometers from the main port area. Now the asset management system receives reports via WiFi for on site equipment and GPRS for off site equipment, all routed through the MRS middleware software.

Initially we were concerned that with GPRS or GSM there might be a notable lag in the data transmission, rendering it unsuitable for some purposes. However with messages being sent to the asset management system and acknowledgments being received back in only a second or so we are very pleased with the results, and more importantly so is the port with the purchase of additional mobile systems as their roll out progresses.

When asked what is the best radio data network for a container terminal, the answer almost certainly should be it depends on the sites' particular circumstances and requirements. WiFi networks, without doubt, offer good levels of connectivity but can be costly



Figure 3. A shot of asset management tracking.

to implement, especially if there is not existing infrastructure to support and connect the multiple access points required to the main site wired network.

Coverage can also be an issue and this needs to be considered when writing any software for the remote mobile units, as connections can drop without warning. Narrowband networks have strong propagation and are relatively low cost to implement but also have some restrictions in their connectivity through lower band width, unless you also implement a well designed middleware application to handle this. GPRS or GSM technology can work well, and in fact is the only practical solution if you want a connection to your mobile equipment when it is outside the range of any site wireless network. But consideration also needs to be given to the running cost associated with the mobile phone operator's network charges, and occasional delays in data transmissions. However, whatever technology is adopted by the terminal it is quite clear that well designed middleware provides that optimal solution for flexibility to connect to any type of RF media both now and in the future, when additional functions and systems are implemented.

#### ABOUT THE AUTHOR

**Richard Lambert** studied Production Engineering at Nottingham Trent University, England. He has worked in the petrochemical and steel production industries, with projects aimed at optimizing production with the introduction of real time control and automation. Richard has over 20 years experience in implementing system solutions to port and terminal operations. Initially joining Morris Automation as a project manager, then leading the Ports and Terminal division of Savoye Logistics as the solutions director.

#### ABOUT THE COMPANY

In 2002 Richard lead a group of Port automation specialist to set up **International Terminal Solutions Limited**. The company specializes in turnkey automation projects for container terminals, concentrating specifically on the development and implementation of systems aimed in streamlining and increasing container terminals operational efficiency.

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# Port community systems: a vital role to play

**Richard Morton**, secretary general, European Port Community Systems Association, Brussels, Belgium

## The EU Directive

The EU Directive 2010/65 on reporting formalities for ships sets a clear deadline: by 1 June 2015, all EU member states must accept electronic reports via a Single Window.

To clarify, these new requirements apply to the reporting formalities applicable to maritime transport for ships arriving in and ships departing from ports in EU countries. The aim is to provide the business community with a streamlined process for submitting export and import information to customs and other government agencies.

“Every EU country must ensure that the reporting formalities at their ports are requested in a harmonized and coordinated manner,” states the Directive summary.

It adds: “EU countries shall accept electronic reports via a Single Window as soon as possible and, at the latest, by 1 June 2015. The Single Window will be the place where all information is reported once and made available to various competent authorities and the EU countries.”

As members of the European Port Community Systems Association point out, there are obvious and important parallels with existing port community systems and the operators of these systems are already well placed to take up the Single Window challenge.

“Port community systems can, and will, play a major role as Europe moves towards the Single Window concept,” says EPCSA chairman Pascal Ollivier, who is director of corporate development at the French PCS operator SOGET. “The implementation of 2010/65 is a major project for EPCSA’s business applications committee. Port community systems can act as clearing centers; we emphasize that 2010/65 implementation should harmonize on a European level.”

## EPCSA and port community systems

When EPCSA was first set up at the end of 2010, its founding members made clear their intention to provide an important source of expert opinion with regard to any new Directive being considered, says Ollivier. “And we will continue to offer clear and concise direction and give support in the practical implementation of European Commission policy. We can save the European Commission time, money and effort by creating a picture of what is already possible.”

In many cases, the first priority was to explain exactly what a port community system does.

They are, of course, all about simplifying the complexities of day to day trade across Europe. Customs, forwarders, shippers, shipping lines, terminal operators, inspection agencies, hauliers and railway operators – all of these, and more, need access to smart, real time information.

The electronic platform provided by a port community system is at the heart of the ‘spider’s web’ of the logistics intelligence required for smooth trading, relaying messages and enabling the re-use of data wherever possible, so that the many stakeholders involved need enter their data only once. The alternative can be a sea of paper, allied with inefficiencies, inaccuracies and far too much duplication of work.



Gareth Lewis, senior technical manager, World Customs Organization, speaking at the EPCSA conference held last summer, in Brussels.

“In the business processes of port logistics, the port community systems are well established, which means that they already have active interfaces with most of the carriers, terminals and local authorities,” says Mr Ollivier. “After a first analysis of the reporting formalities listed in the Directive 2010/65, it should be noted that today a significant part of the messages is already communicated via the port community system. The remaining messages could be created from existing reports, possibly by adapting the set of data.”

EPCSA is recommending that the port community system should take over the function of a clearing center – including receiving messages, processing the data in accordance with the requirements, and forwarding these messages to the stakeholders and authorities, or to a Single Window.

“The advantages of the port community system acting as clearing center are obvious,” says Alan Long, managing director of Felixstowe based Maritime Cargo Processing, another founding member of EPCSA.

“Port community systems act as a trusted third party, guaranteeing the confidentiality of all players involved. Double input or notifications by the stakeholders can be avoided. The existing infrastructure in the ports can be used further – that means no additional investments in new infrastructure, and also that it will enable faster implementation of the Directive.”

## The UN and port community systems

The important role that port community systems are playing in the move towards the Single Window concept has already been highlighted at UN level. The conclusions of the UN’s Global Trade Facilitation Conference held in Geneva at the end of 2011 recognized the importance of port community systems.

“The Single Window models vary greatly from one country to another, depending on a country’s readiness and priorities,” said the conference report. “Models include paperless customs, port community systems and Single Window systems that link government agencies on the national and regional level.”

Most advanced trading countries have not implemented the national Single Window concept, said the report: “Instead, other forms of Single Window networks, in particular port community systems and Customs Single Windows, are being successfully used to support a high performing logistics sector.”

EPCSA, then less than a year old, played an active part in the conference, which was organized by five UN regional commissions as part of the new ‘Joint UN Regional Commissions’ Approach on Trade Facilitation’ initiative.

It was an ideal platform for EPCSA to explain how and why port community systems act as the vital cog in millions of supply chains across Europe – and how port stakeholders can work together to create such a system where there is none.

## Europe’s future

Europe is home to some of the most efficient port community systems in the world. Port communities already ‘signed up’ to a comprehensive port community system probably wonder how on earth they managed before it existed – yet, still, there are many ports within and beyond Europe that lack an integrated port community system. As a result, users often have to input the same data several times into several different systems, duplicating work and creating obvious inefficiencies.

EPCSA’s stated mission is to influence public policy at the EU level in order to achieve e-logistics throughout all European ports, operating as a key element of the EU maritime, shipping and logistics industry.

So far, its activities have included the publication of a unique guide entitled ‘How to Develop a Port Community System’, which sets out 12 ‘actions’, or basic steps, to developing a system that suits the specific environment it will serve and provides the solution to bottlenecks or delays that can create inefficiencies.

“There has been a great deal of interest in this guide,” says Pascal Ollivier. “It does not lay down a definitive way in which a port

community system should be created, but rather gives an outline to show organizations how this issue relates to their local circumstances.”

An essential message, he says, is that community involvement and communication are the most vital parts of setting up a system – in other words, everyone must be ‘on the same side’.

“Organizations may feel challenged by the technology side of the process, but in fact it is bringing the port community together with a common purpose and understanding, and agreeing the way forward, that proves to be the most time consuming part.”

## EPCSA White Paper

EPCSA has also produced a comprehensive White Paper examining the role of the port community system in the development of the national Single Window concept, and here it makes clear that some things should remain firmly private sector led and organized. The message is: “Competitiveness remains an essential element for motivation and differentiation. This principle applies to Single Window systems regardless of the standardization and harmonization achieved between port community systems, cargo community systems or other national or international Single Windows.”

The association believes that Europe’s world leading position in terms of its port community systems could only have been achieved under competitive conditions. “Business to business areas should not be placed under state control. This safeguard will ensure that new technologies enter the logistics sector as quickly as possible, and that Europe remains the market leader in global logistics knowhow and the development of Single Window.”

EPCSA was set up towards the end of 2010 and has six founding members: SOGET (France), dbh (Germany), Maritime Cargo Processing (UK), Portbase (Netherlands), PORTIC (Spain) and DAKOSY (Germany).

It provides port community systems with a common lobbying position at the EU. Port community system operators now

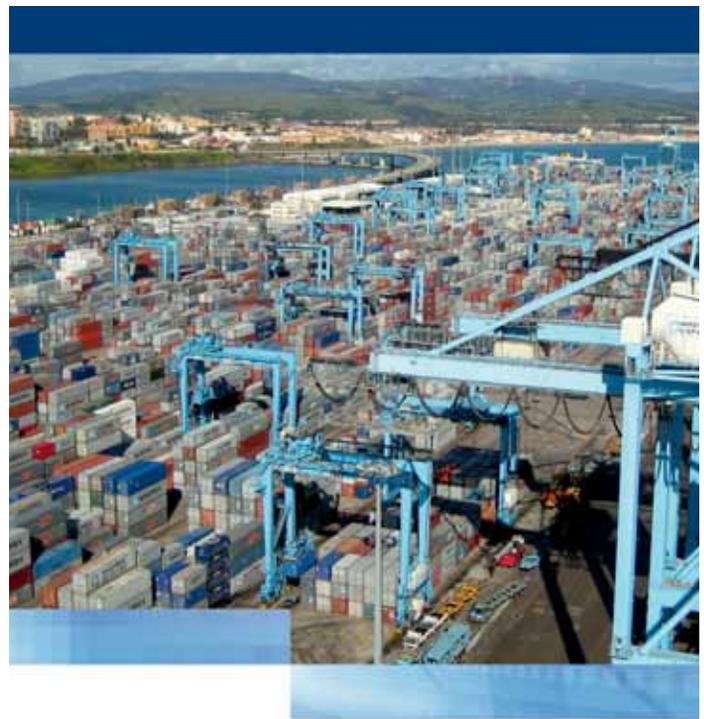


Courtesy: Port of Felixstowe

Maritime Cargo Processing (MCP), one of the founder members of EPCSA, has its roots at the Port of Felixstowe but now serves the needs of ports all around the UK.



How to develop a Port Community System – the twelve actions.



have a voice – and, clearly, they are already being heard. New members and associate members are signing up, and EPCSA’s influence is growing.

## Conclusion

Mr Ollivier emphasizes that this is a dynamic sector. Nothing stands still. “The port community system environment is going through a total rethinking process due to the evolution of global trade and EU regulations,” he says. “Most of our systems have been designed years ago to address local needs and have been upgraded over months and years according to user needs and EU regulations.

“But, in the meantime, the world has changed; globalization of shipping lines, freight forwarders, terminal operators. Those stakeholders are thinking global before thinking local. When those stakeholders address the EU market, they think global as well.”

Parallel to this, EU regulations are becoming more and more part of daily life, he says.

“Port community system operators need to ‘think different’ and match the needs of public and private stakeholders from a European perspective, no longer from a local perspective. That is why EPCSA is so important to SOGET and to the whole port community system sector.”

### ABOUT THE AUTHOR



**Richard Morton** is a well respected independent ports and maritime consultant, working with port and logistics organizations and a number of EU driven projects across Europe. As secretary general of EPCSA, he works closely with the association’s members to lobby at a European level, ensuring a regular dialogue between port community system operators and the European Commission and maintaining regular contacts with DG MOVE and the TEN-T Executive Agency.

### ABOUT THE ORGANISATION

The establishment of the **European Port Community Systems Association** (EPCSA) has given port community systems a voice and common lobbying position at the EU. EPCSA is committed to working closely with the European Commission as the Commission develops a number of initiatives and directives such as e-customs, e-freight and e-maritime.

### ENQUIRIES

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# Terminal operators can rely on LED lighting

**Kristie Anderson**, vice president of marketing, Phoenix Products Company, Inc., Milwaukee, Wisconsin, US

## Introduction

The advantages of LED lighting are becoming increasingly well known. The solid state technology requires nearly no maintenance, regularly consumes only one third of the energy of the traditional HID light sources, and offers instant on, white light. By populating a total cost of ownership (TCO) calculation with their own data and costs, operators can readily estimate their expected energy and maintenance savings.

Yet even when their own calculations tell a favorable payback story, some operators still hesitate to invest in LED lighting, mainly because the cost of acquisition for LED fixtures typically exceeds that of fixtures with traditional light sources. A miscalculation, a bad installation, any unforeseen cost or quality problem can be an expensive proposition and eliminate anticipated savings. Having little experience with LED technology, some operators have opted to forego the benefits because they consider adopting the technology too high a risk.

## Mitigating risks and managing concerns

Scott Fredrick, chief executive of Phoenix Products Company, Inc., manufacturer of LED lights for port applications, understands. "As a manufacturer, we had the same concerns when we developed our ModCom™ LED floodlight," he says. "It was a major investment, and we had to be sure the technology was ready for these applications."

For Phoenix, it was a matter of managing risk through education, in house testing, third party verification, and beta testing. With LED experience in other industries and decades of experience in general floodlighting at ports, Phoenix knew the keys to a successful application of LED technology on port cranes would be:

- maintaining sufficient and uniform light levels
- managing vibration to maximize the fixture life
- ensuring the longevity of the light engine in a marine environment
- managing thermal properties to maximize light engine life



To perform reliably for years, the Phoenix ModCom™ LED floodlights installed on this mining shovel incorporate many features designed to manage the effects of vibration.

First and foremost, the fixture should provide ample illumination evenly in the application. Phoenix determined that an output of over 20,000 lumens was required from its LED floodlight to replace a 1,000 watt high pressure sodium fixture. Operators should be able to get a firm idea of how a fixture will perform by requesting a lighting study from their LED lighting manufacturer. Sample specifications from similar applications may also be available to help clarify goals.

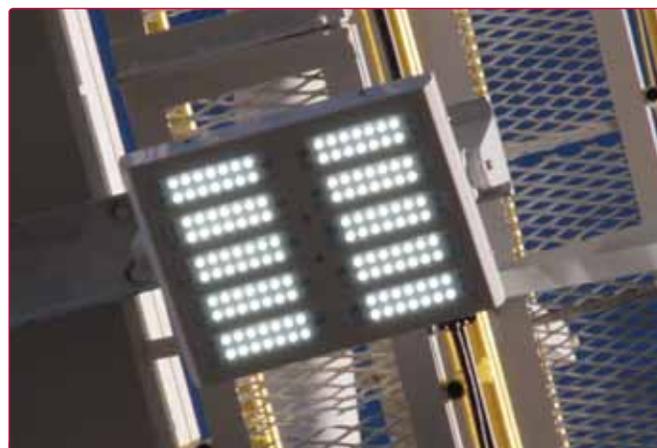
Generally speaking, operators are looking for 200 lux minimum at any point 10 meters from the centerline of a crane. A common evenness goal would be 3:1 uniformity within a 3 meter radius; in that area, the maximum light level would be no greater than three times the minimum level in the space. A common performance goal specified for LED fixtures is an L70 of 50,000 hours. This figure indicates that, at 50,000 hours, the fixture would provide 70 percent of its initial lumen output.

Operators may also want to specify the color temperature of the light according to their preference. With crane operator comfort in mind, several specifications have been written with 5,500 degrees Kelvin at a maximum, which would be similar to daylight, as opposed to being 'warm' or 'cool' in color.

Lighting fixtures on port cranes are subject to constant vibration and the corrosive elements of a marine environment. Standard for any fixture in this environment are corrosion resistant materials and finishes, such as low copper content aluminum, marine grade paint, and stainless steel hardware.

In addition to contributing to corrosion, residue left by saltwater condensation and evaporation can degrade optical performance. Terminal operators should ask LED fixture manufacturers to discuss how the fixture, light engine and optics are protected from the effects of saltwater and vibration. In its ModCom floodlight, Phoenix uses circuit boards conformally coated with silicone approved by the LED manufacturer.

The ModCom also incorporates fully potted drivers, sealed optics (IP67), and stranded wires with protective sleeves at wear points. Phoenix tests its fixtures against the extreme vibration standards of



This LED floodlight incorporates conformal coated circuit boards, sealed optics, and potted drivers to ensure years of reliable service in marine environments.

the makers of the world's largest earthmoving equipment, mining draglines and shovels. Phoenix fixtures have successfully performed in these mining applications for nearly two years.

Especially critical in LED applications is a design and construction that direct heat away from LEDs and circuit boards, as excessive concentrations of heat will dramatically shorten the useful life of the fixture. Evidence of sound thermal management in fixture design includes heat sinks and metal frames to draw heat away from the light engine. Good air circulation also helps to dissipate heat.

Leveraging the fact that heat rises, vertical fins encourage air flow from the bottom of a fixture to its top. Proper fin orientation in heat sinks can enhance heat dissipation by as much as 30 percent. In modular LED fixtures, a strategic design will employ the space between modules to further enhance air flow. In addition to specifics on operating temperatures, lighting fixture manufacturers may be able to provide thermal images of the fixtures in operation to illustrate how heat is dissipated.

## Objective measures and tests

Operators considering LED options will want to review objective test results and third party verifications: safety certifications,

such as UL or ETL, LM79 reports for third party verification of lighting performance, and lighting layouts. IP ratings and a marine certification, such as UL 1598A Marine Outdoor, will provide further proof of a fixture's suitability. Here again, real world experience will trump laboratory testing and operators will want to consider the industry track record of the manufacturer and ask about similar installations.

Despite a fixture manufacturer's best efforts to eliminate the possibility of fixture failure, operators will want to know they have options if a failure does occur. In the case of a modular fixture, LED modules can be swapped out. The final protection, of course, is the fixture warranty. A five year warranty can be considered the industry standard for a performance floodlight.

Whether motivated by a desire to reduce energy costs, to minimize maintenance and downtime, or to operate in a more environmentally conscious manner, most operators will reach a point of considering LED lighting. By informing themselves, requesting proof of performance, and asking fixture manufacturers to help address their concerns, operators who have been waiting for the technology to evolve can be assured of its reliability and begin to enjoy the benefits of LED lighting now.

### ABOUT THE AUTHOR

**Kristie Anderson** joined Phoenix Products Company in 2005 as an industrial product manager. She now serves as the vice president of marketing with responsibility for product management. She is a graduate from the University of Wisconsin School of Business and has eight years of experience in the lighting industry.

### ABOUT THE COMPANY

**Phoenix Products** is a global provider of specialty, durable lighting products that are designed to perform in extreme environments and rough service conditions. Its products are known for meeting exact specifications, improving equipment performance and reducing equipment maintenance costs in multiple markets. Founded in Wisconsin in 1892, the company maintains its headquarters in Milwaukee.

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# Scratching below the surface – container crane purchase

Liebherr Container Cranes, County Kerry, Ireland

## Introduction

Purchasing a container crane can appear to be a simple process. Requirements are specified and, after tender evaluation, a crane manufacturer is chosen based on the specifications and cost. However, it is often what is not obvious from the proposal that will determine if the purchase will ultimately prove to be a sound investment. When buying a container crane, the initial cost of the crane may seem very attractive and often serves as a lure, but scratch beneath the surface and there is substantially more to be considered than initially meets the eye.

The real costs of crane ownership are to be found in the 25 years plus of service and maintenance required during a crane's lifetime. Understanding these costs and the factors that contribute to them is critical when making an informed decision on purchasing a new crane.

Variables such as maintenance, repair, spare parts availability, crane reliability, energy and fuel costs, productivity rates, crane inspection services and the like can quickly add up and can be substantial. But when differentials are considered between

manufacturers over the lifetime of a crane, the difference can be in the millions. As is often the case, when there are a number of cranes to consider, the figures involved can be in the tens of millions of dollars. A perceived saving of several hundred thousand dollars on the purchase price of a crane quickly pales into insignificance.

## Spares and maintenance

The design and quality of the components used in a crane is a major factor for the cost of spare parts and associated repair costs. These costs can quickly increase if the design or quality of components is in any way compromised. For example, are the drives and motors for the crane engineered using safety factors based on the max torque or average torque design requirements?

When the equipment is designed to the minimum limits, frequency of breakdowns and repair will be increased. The crane may be under guarantee for the first number of years and these costs are hidden, but choice of manufacturer can have a huge bearing on spare parts costs. In some instances, the annual



Assembly on site can eliminate any possibility of structural damage due to shipping the crane erect.

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spare parts bill can be up to four times more expensive than the spare parts for a similar crane from a different manufacturer. Availability of spares and ease of access to service engineers when local maintenance personnel are unavailable or unable to fix the breakdown is essential for the smooth running of a crane and in reducing mean time between failures and the costs associated with an out of service crane. Some manufacturers offer 24 hours a day, seven days a week access to engineers in their service department and are able to respond and get the spare parts delivered promptly. With others, service and spare parts delivery may take weeks. It is essential that the crane manufacturer acts as a central point of contact in the event of a fault with the crane and not pass the queries onto a sub contractor or supplier. Dealing with a range of sub suppliers would not be an ideal situation, especially when there is a vessel waiting to be unloaded. It is also necessary to evaluate the manufacturers' training courses. Do they offer training for engineers to allow them to carry out repairs quickly and economically? Is the equipment used in the crane standard and modular, facilitating ease of access and uncomplicated repair or replacement? Does the manufacturer keep spares in stock? What about sub suppliers, are they reputable firms? Will spares be available in 10 or 15 years? Is the crane manufacturer transparent and willing to supply a list of sub suppliers and parts, to allow direct purchase of spare parts locally if the need arises? What about key components like the drive systems, are they specifically designed for container cranes, or have they been purchased from sub suppliers, in which case they could become obsolete in a number of years and require replacing? What will the cost of this be? All these questions need to be

addressed prior to signing on the dotted line. Liebherr Container Cranes have supplied container cranes over thirty years ago which still operate and are still being supplied with spares.

## Crane productivity and the bottom line

With optimization and the tight margins that are the norm in today's port operations, increasing productivity and minimizing cycle times is the goal for container crane operators. Crane productivity rates can have a real impact on the bottom line. A difference of a couple of percent in productivity in ship to shore cranes can lead to substantial amounts of money over the course of a year. The quicker a crane can load, or unload a vessel the more money that can be earned from a crane in any given hour. Put another way; if a more productive crane, as opposed to a cheaper crane is selected, then it may be possible to actually purchase fewer cranes. Likewise with secondary handling equipment, such as RTG's, RMG's and straddle carriers, an increase in productivity will ultimately lead to a much lower handling cost per TEU and a lower capital equipment requirement and initial investment. A point to bear in mind, is that a highly productive STS crane will not reach its full potential unless it is supported by a fleet of productive secondary handling equipment that are not limiting factors on the overall container handling operation.

Simultaneous motion of all main drives on a crane, ease of positioning of spreaders, drivers comfort and the elimination of sway or motion of the container are some of the key factors in increasing a cranes' productivity and improving the earning potential of a crane.



The Port of Khorfakkan is one of the most productive ports in the world. Productivity rates have reached 245 moves per hour with four STS Cranes. That's a crane productivity rate of over 61 moves per hour.

## Crane availability

A crane should be available when needed. A difference of a percentage point or two in the availability rate of a crane can translate to a substantial difference when it comes to the bottom line. When a crane is out of service it is costing money. Over the course of an hour, loss of earnings can reach into the thousands. There are also increased costs aside from maintenance in terms of idle operators and checkers who still have to be paid. A port may also be liable for demurrage charges. If a crane is operating for 12 to 14 hours a day, then a difference of a percentage point in availability per year can cost hundreds of thousands of dollars. This is before you take into account loss of customer goodwill, damage to the ports' reputation and increased lifetime costs associated with unreliable cranes.

## Energy and fuel costs

Cranes should be optimized for maximum efficiency in terms of power consumption. It is essential that a crane allows for the use of kinetic energy from the lowering of the hoist to generate electricity that can be fed back to the grid and used by other cranes which are hoisting, or stored and used to reduce power consumption demands. When buying an RTG, RMG or straddle carrier, it is easy to become distracted by the often repeated mantra of low fuel or energy consumption per hour. However, the real comparisons between cranes should be based on the cost in terms of fuel or energy per TEU moved.

## Structural damage

Structural damage may not be immediately evident as a factor that will impact on the cost of a newly purchased crane. A crane should be delivered while ensuring minimal structural damage to the steel. If it has been transported to site fully erected, it may have been subjected to stresses and strains during sea transport, leading to micro fractures in the steel. These problems won't be apparent straight away but will show up over time and will require expensive and time consuming remedial action to repair. In addition, the structural steel should be of the best possible quality, purchased from reputable steel mills with certification and full traceability. Every crane should be designed to perform with

minimum sway in wind speeds close to the operational limits. Features, such as a lattice boom and beam, will increase structural rigidity and will lead to increased stability and productivity in these conditions.

## Crane inspection services

Depending on the choice of manufacturer, crane inspection services can become a significant cost. Full time inspection services on site, overseeing manufacture, construction and commissioning can be costly over the manufacturing period. Some crane manufacturers will require more supervision (cost) from crane inspectors, while for other established quality manufacturers these costs will be minimal.

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Crane productivity and availability are two of the key factors when it comes to assessing the lifetime cost of container cranes.

## Conclusion

In conclusion, before a crane is purchased, a thorough understanding of the lifetime cost of container crane ownership needs to be analyzed. An assessment based on productivity and availability rates, costs of spares, maintenance and servicing, training of employees and lifetime support costs needs to be undertaken. Local costs like labor and cost of fuel or energy and crane inspection services also need to be factored in.

The lifetime cost is balanced by the earning potential of cranes, which as explained earlier is calculated from the cranes

productivity and availability figures. Variations in productivity can lead to substantial discrepancies in earnings from different cranes. Significant differences in earnings can arise from initial variables as small as 1 or 2 percent. Armed with all the data outlined above, it is now possible to make an informed decision on which crane will best meet with the purchaser's requirements, taking into consideration the lifetime cost of crane ownership and the benefits and pitfalls of choosing one manufacturer over another.

### ABOUT THE COMPANY

**Liebherr Container Cranes Ltd.** have been designing and manufacturing cranes in their Irish facility since 1958. Delivering productive, reliable cranes with exceptional longevity has become Liebherr's hallmark. Today Liebherr continue this tradition and incorporate the latest technology in their products to create container cranes that deliver outstanding productivity with exceptional lifetime costs.

### ENQUIRIES

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# Trends in marine terminal automation

**John Scott**, vice president, Container Terminal Solutions, Navis, Oakland, CA, US

An unpredictable economy and fluctuating container volumes are two key challenges marine terminal operators continue to navigate, creating new demands for efficiencies. These uncertainties have caused a renewed interest in process and equipment automation technologies as a path to increased efficiency. When deployed and integrated with the terminal operating system, these automation technologies can support and increase terminal capacity, optimize equipment utilization, and improve overall container handling performance in the terminal.

Process automation involves the integration of the TOS with third party hardware solutions that are utilized at the gate, in the yard and at the quay. Various forms of hardware including real time locating systems (RTLS), radio frequency identification (RFID), global positioning satellite (GPS), and ocular character recognition (OCR) can automate the tracking of vehicles and the movement of containers to and from the ships, within the yard, and in and out of the gate, providing real time data streams on asset identity, location and performance. When integrated with the terminal operating system, process automation technologies can improve the visibility of container and truck movements, to optimize asset allocation, automate the delivery of 'next move' information to the equipment driver, and ultimately increase the productivity of the terminal.

## The evolution of automation

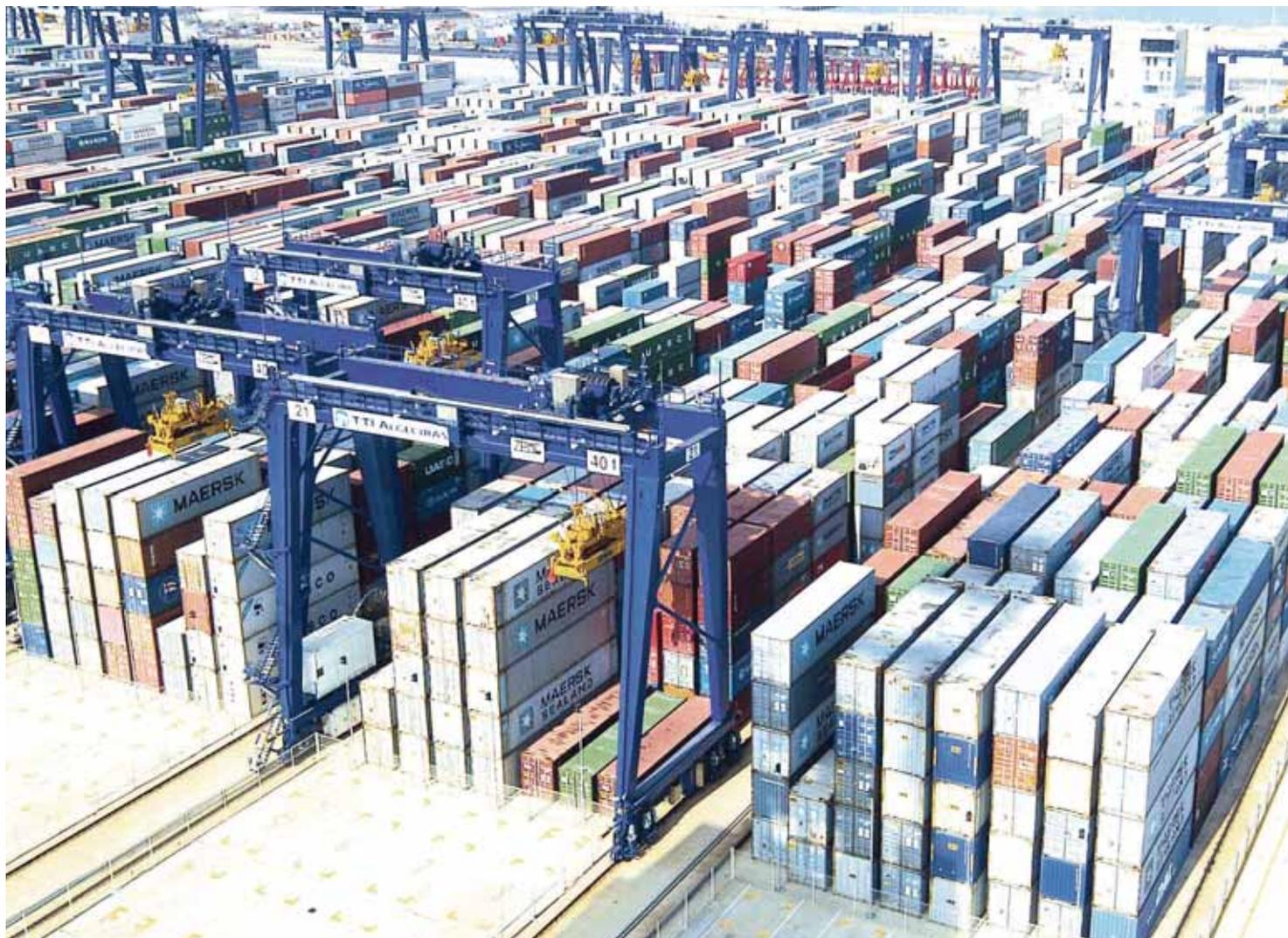
Since the late 1980s, the marine terminal industry has been supported by a growing range of expert information systems to coordinate and more recently automate the planning and management of container and equipment moves in a complex and demanding business environment.

TOS was originally used for ship and yard planning, but as container throughput, yard and vessel sizes and the number of shipping routes served increased, systems were expected to also optimize gate planning, equipment control, ground stowage strategies and human resource management.

Prior to the launch of the world's first terminal operating systems, many operators used paper and wall charts to manage container movements. The skyrocketing increase in global container throughput – nearly 700 percent from the end of the 1980s to 2008 – has led to the development of programs, systems, equipment and devices to enhance operating efficiencies, improve management controls and business intelligence and connect marine terminals with the wider supply chain. Terminals and systems once expected to cope with just 50 moves an hour now have to manage 100 or more moves in larger container yards with exponentially higher container stacking positions.



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## Current trends in automation

In this equipment intensive business, the ability to make terminal fleets more productive will be a major differentiator. Looking forward, process automation technologies will help extract better utilization and extend the lifespan of these expensive assets. The ability to maintain real time asset visibility gives the industry a key to handling more business with existing assets. Remote monitoring technologies will also support the industry by improving the environmental and energy performance of its equipment, with real time tracking of operational parameters, such as fuel consumption, oil usage and running temperature.

The terminals that are doing it right leverage both process automation and equipment automation to address the optimization of business intelligence. Having visibility into the data, created from process and equipment automation, provides marine terminals with real time operations and business intelligence. The results are real, in some cases delivering 10 to 20 percent or more in productivity improvements. Terminal operators can use the data from process and equipment automation, optimization tools and real time location to ultimately make better business decisions.

## Looking for ROI

This year, Sociedad Portuaria de Cartagena (SPRC) in Cartagena, Columbia will implement a terminal process automation solution

that integrates Navis Marine Telematics Software (MTS) with RTLS technology provided by Zebra Technologies, to track the location of street trucks, utility tractor rigs (UTR) and general assets in real time. The tracking system will provide location information to the Navis SPARCS TOS, offering real time asset visibility, increased domain awareness and improved operational efficiency for SPRC.

As the first terminal in South America to deploy RTLS technology to track truck movements, SPRC will be able to identify queue order in the rubber tire gantry (RTG) stack. The increased visibility into street truck location allows SPRC to optimize RTG job assignments and correctly prioritize competing gate and vessel jobs for peak efficiency and cost savings.

SPRC utilizes Navis PrimeRoute to automatically dispatch tractors to the optimal point of work in the yard, increasing utilization and lowering the number of vehicles required to move cargo. To increase efficiency, the RTLS Technology will provide real time location information to PrimeRoute to automate the manual data entry that equipment operators are required to key in, removing the dependency on manual data entry and allowing the equipment operators to focus on their primary objective – moving containers. This greatly improves the effectiveness and accuracy of Navis PrimeRoute, as well as the overall safety of the operation. Once the RTLS infrastructure is in place, SPRC also plans to track additional assets, such as people, personal vehicles and baggage carts.

## The future of automation

“As we look to double our container traffic in the next five years, it is imperative for us to increase operational efficiency and productivity to manage that anticipated growth.”

**Eduardo Bustamante**, IT director at SPRC

Since 1993, when ECT launched the world’s first automated terminal, the industry has been both fascinated and skeptical about the prospects for robotized container handling. Until recently, automated container handling was the province of the pioneering few with deep pockets to fund big in-house development and implementation teams. But, like IT before it, the robotics industry



is maturing. Growing experience and competition within the commercial sector is driving down costs and the terminal industry is now able to draw a growing skills base within its third party suppliers, driving the trend toward automated equipment.

In a marine terminal, the advent of equipment automation is focused on the shift to unmanned vehicles. Equipment such as automated stacking cranes (ASC), horizontal transport vehicles (HTV) and automated guided vehicles (AGV) are in development and once deployed will eliminate the need for manual operations, thus reducing operating costs, increasing equipment utilization and allowing workers to be redirected to other tasks.

As terminal operators continue to navigate an uncertain economy and import and export volumes fluctuate, the future of automation will focus on optimizing the entire terminal rather than just specific parts, such as the yard or gate. Automation will need to go beyond the TOS and container operations to include the total set of needs at the terminal, from equipment

maintenance to labor rostering as well as other critical terminal functions. Operators will take advantage of the greater visibility and integration provided by new technologies to define and implement best practices for the business as a whole.

Further, a single, open, standardized platform that runs across terminals will allow terminal customers and shipping lines unprecedented visibility into their operations across multiple sites. Automation solutions of the future will provide terminal operators the ability to interact in real time to optimize operations across an entire network, with the potential to be intuitive enough to slow down certain operations while accelerating others. There will be a greater shift in focus on technological solutions that provide greater quality, reliability and scalability. From gate to yard to vessel, terminal operators who invest in systems that govern the movement of all container logistics and operations will ultimately differentiate themselves from competitors now and in the future.

#### ABOUT THE AUTHOR AND THE COMPANY

#### ENQUIRIES

**John Scott** joined WhereNet, now Navis, in April, 2000. Navis acquired WhereNet's Marine Telematics Software (MTS) in March of 2011. As vice president of Container Terminal Solutions, John is responsible for Navis' existing MTS customers and sales of new container tracking solutions. Multi-site MTS customers include SSA Marine, Ports America, APL, APM Terminals, Yusen Terminals, and K-Line.

**Navis**, a part of Cargotec Corporation, is the global technology standard for managing the movement of

cargo through terminals, standing the test of time. Navis combines industry best practices with innovative technology and world class services to enable customers to maximize performance and reduce risk. Whether tracking cargo through a port, automating equipment operations, or managing multiple terminals through an integrated, centralized solution, Navis provides a holistic approach to operational optimization, providing customers with improved visibility, velocity and measurable business results.

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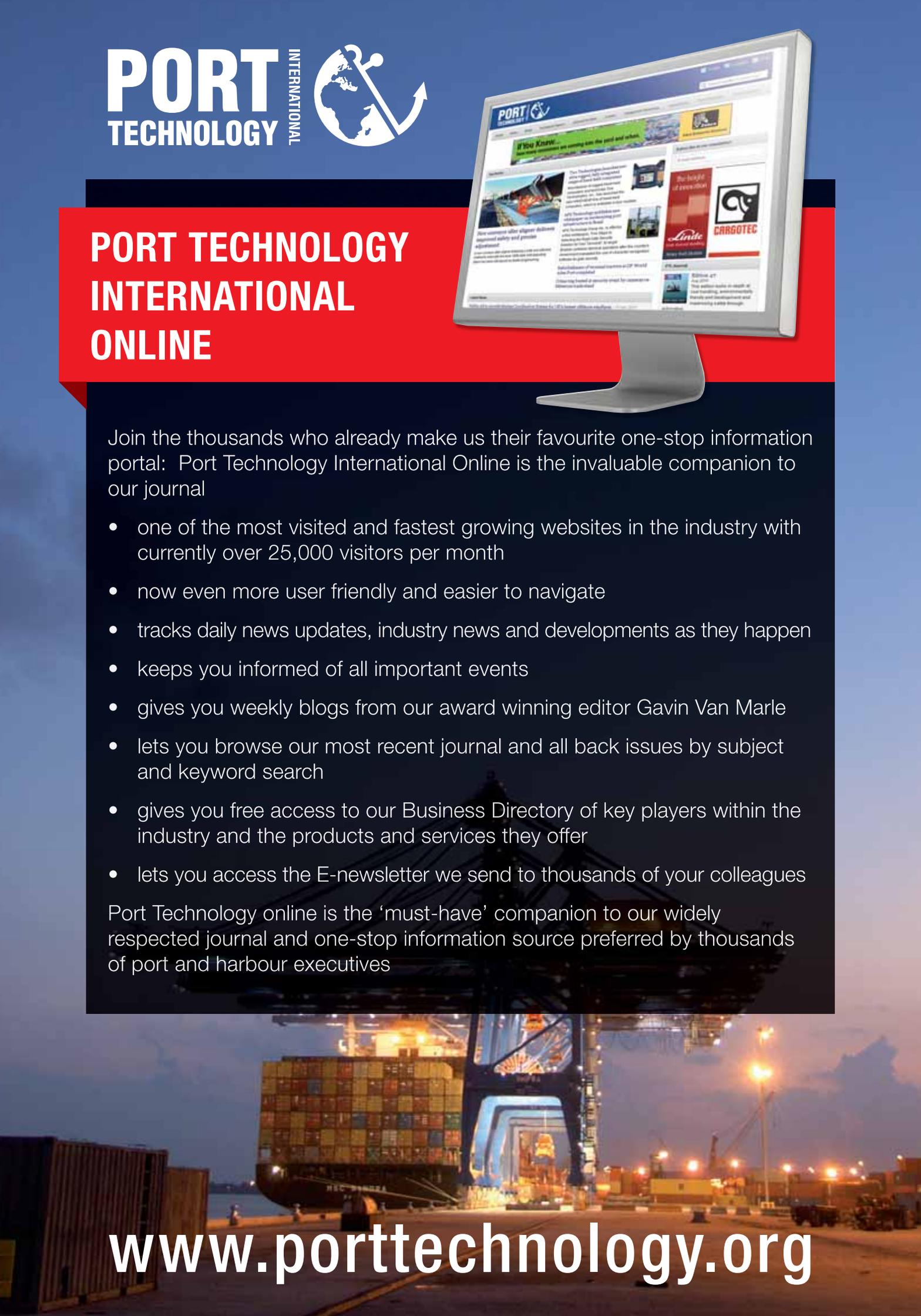


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# Seismic protection of quay cranes

**Michael Jordan**, chief executive, **Yoshi Oritatsu**, engineer and **Erik Soderberg**, structural engineer, Liftech, Oakland, CA, US

## What's the problem?

Container handling quay cranes have existed for 54 years and the only collapse due to an earthquake occurred in 1995 at Kobe, Japan. Liquefaction caused that collapse. Quay cranes have a history of successfully resisting earthquake damage. However, this is only because cranes were light and one or two legs could lift a few inches off the rails with only minor crane damage. This is no longer the case; large heavy cranes are different. The forces required to lift a heavily loaded leg are so great that the crane cannot resist them without damage, perhaps even collapse, and the crane lateral load on the wharf may be large enough to damage the wharf.

The Japanese were first to recognize this problem. Since the Kobe earthquake, all new quay cranes in Japan are designed to resist major earthquakes. Only recently has the danger of crane collapse been recognized outside of Japan. The Ports of Los Angeles (POLA) and Long Beach (POLB) recognize that seismic forces from cranes can damage wharves. The ports' recent codes have requirements that limit the crane's impact on the wharf. However, though the codes limit the effects of the cranes on the wharf, they do not address a crane's seismic performance.

## Protecting the crane and the wharf

To protect the crane and the wharf, the usual practice in Japan

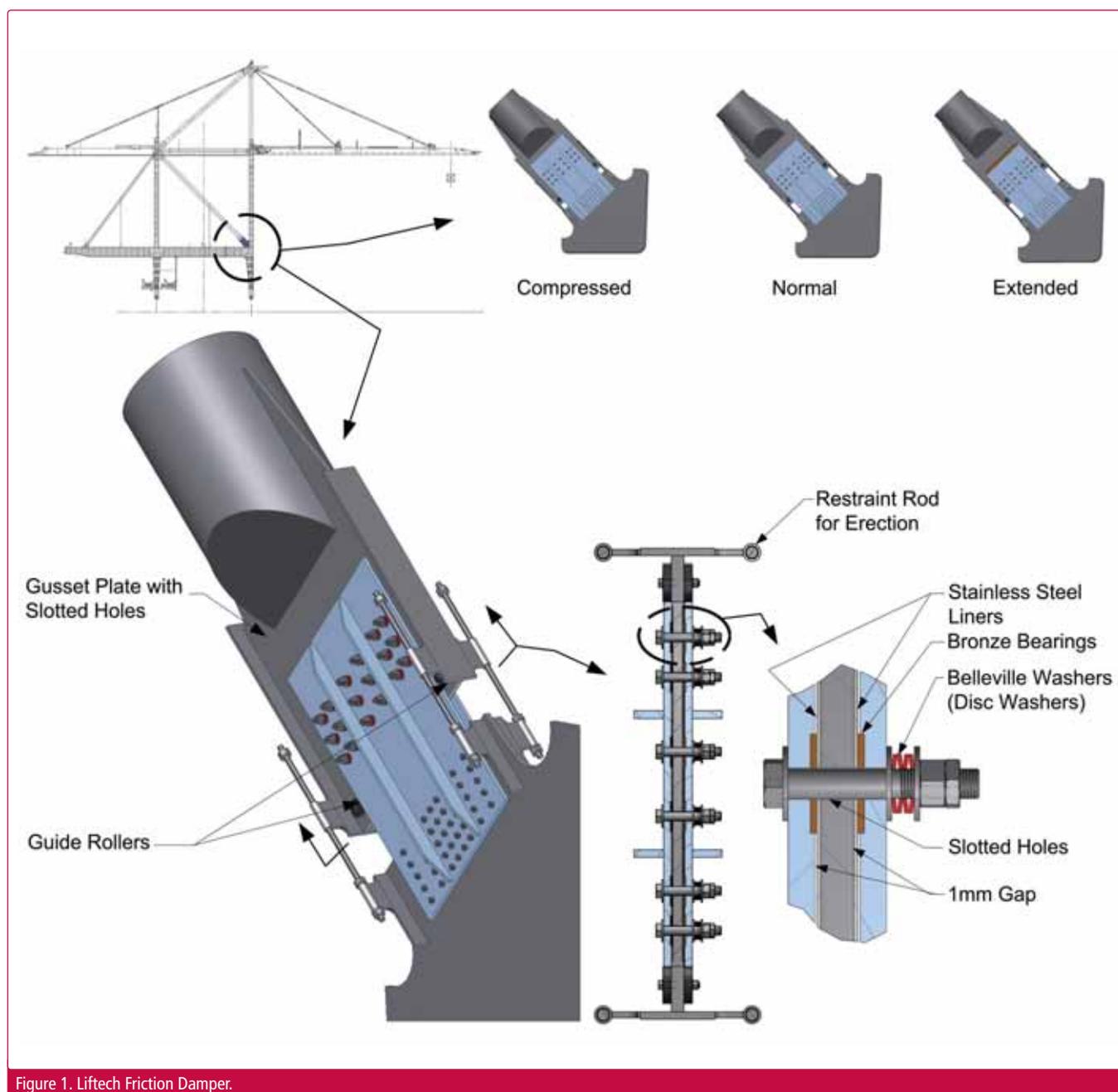


Figure 1. Liftech Friction Damper.

is to add base isolation systems to the cranes at the wharf level. The isolation systems include a trigger, a hydraulic damper, and a reset device. The system is complex and expensive. Fortunately, quay cranes have a structural element that can be easily converted to a device that will protect the crane. A friction damper can be inserted in the diagonal to portal tie connection (see Figure 1). The friction damper works by allowing the connection plates to slide as the crane structure deforms in an earthquake. The damper provides a large clamping force on the sliding plates to dissipate significant energy during the earthquake. The phenomenon is similar to braking a moving wheel on a car.

For new cranes, the cost of the friction damper is relatively small. For existing cranes, friction dampers are an economical retrofit. The friction damper needs little maintenance and can be easily reset after an earthquake.

## Friction dampers on container cranes

The idea and use of a friction damper is not new. A number of researchers have studied friction dampers. Egor Popov and Carl Grigorian published *Energy Dissipation with Slotted Bolted Connection* in 1995, reporting their study of bolted friction dampers. Friction dampers have already been used in a number of building structures.

Four new container cranes with friction dampers are being delivered to APL terminals at the Port of Los Angeles in the summer of 2012. The cranes will have resettable friction dampers and are the first of their kind for quay cranes. The dampers will protect the cranes and the wharf.

The POLA and POLB wharf design criteria require that the wharf be functional after the 'Operational Level Earthquake' (OLE), with a 50 percent probability of exceedance in 50 years, and with no collapse after a 'Design Earthquake' (DE), a major earthquake level used for designing structures for life safety. However, most quay cranes were not designed to these criteria. The APL cranes are designed to remain operational after the OLE and to not collapse in the DE. Most likely, the cranes will be operational even after the DE, after the damper is reset and the crane frame is realigned by adjusting the restraint rods.

## The POLA and the POLB codes

The codes contain requirements for both new container cranes and modifications to existing cranes to protect the wharves from overload during earthquakes.

The design of four APL terminal cranes presented many challenges. The project schedule was tight. Fabrication needed to start before the design of the wharf was complete. Consequently, many wharf design parameters were unknown during the crane design process. The new wharf was expected to be more flexible than a typical wharf. A reasonably stiff crane was needed to meet operational requirements. Making the crane structure unusually flexible to limit its impact on wharf response was not an option, some type of seismic isolation mechanism was required. Studies of several seismic isolation concepts indicated that friction dampers are the most practical and economical solution.

## The Liftech friction damper

The friction dampers are located at the bottom of lower diagonal braces as shown in Figure 1. The dampers have bolted shear connections with the bolts located in long slots. The damper includes a center gusset plate with long slotted holes, lap plates (shown in blue), conical washers, and tensioned bolts. The sliding surfaces are bronze bearings and stainless steel liners. Restraint rods provide added safety, hold the diagonal brace during erection, and can be used to restore the joint to its original geometry after sliding occurs.

Friction developed from the bolt clamping forces restrains the joint until a predetermined threshold force occurs. Once the threshold is exceeded, the joint slips, resulting in an increase in the crane's effective period and dissipation of seismic energy as heat. Both phenomena reduce or 'damp' the seismic response and reduce the seismic forces. Since container cranes need to be reasonably stiff to operate properly, the friction joints do not slide during normal operation. The joints also will not slide in storm wind conditions.

## Performance

Nonlinear time history analyses were performed to quantify the crane and wharf seismic response. Figure 2 shows a time history plot of wharf displacements. As the plot indicates, the crane with dampers reduces the maximum wharf response. Figure 3 is a comparison of crane response, with and without the damper. As the time history plots indicate, in addition to reducing the forces on the wharf, the friction dampers reduce the lower portal frame movement, which reduces the strain in the lower legs. The upper frame's drift, however, increases when the friction dampers slide. The strains in the upper frame remain at acceptable levels.

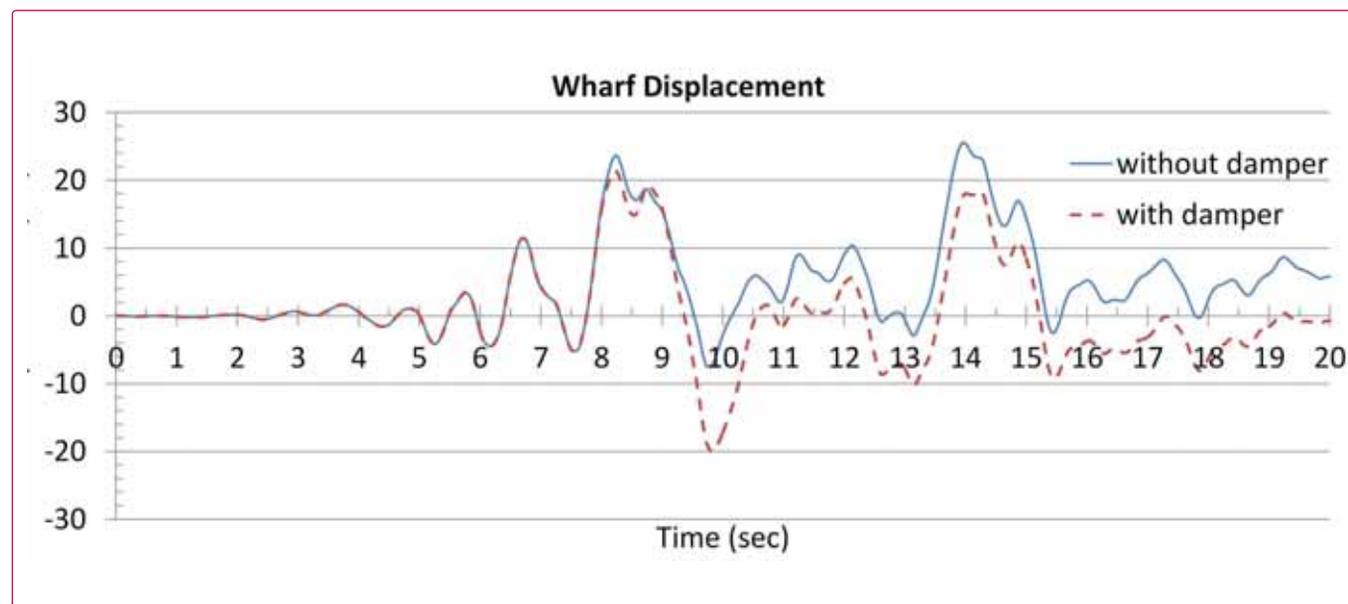


Figure 2. Wharf response.

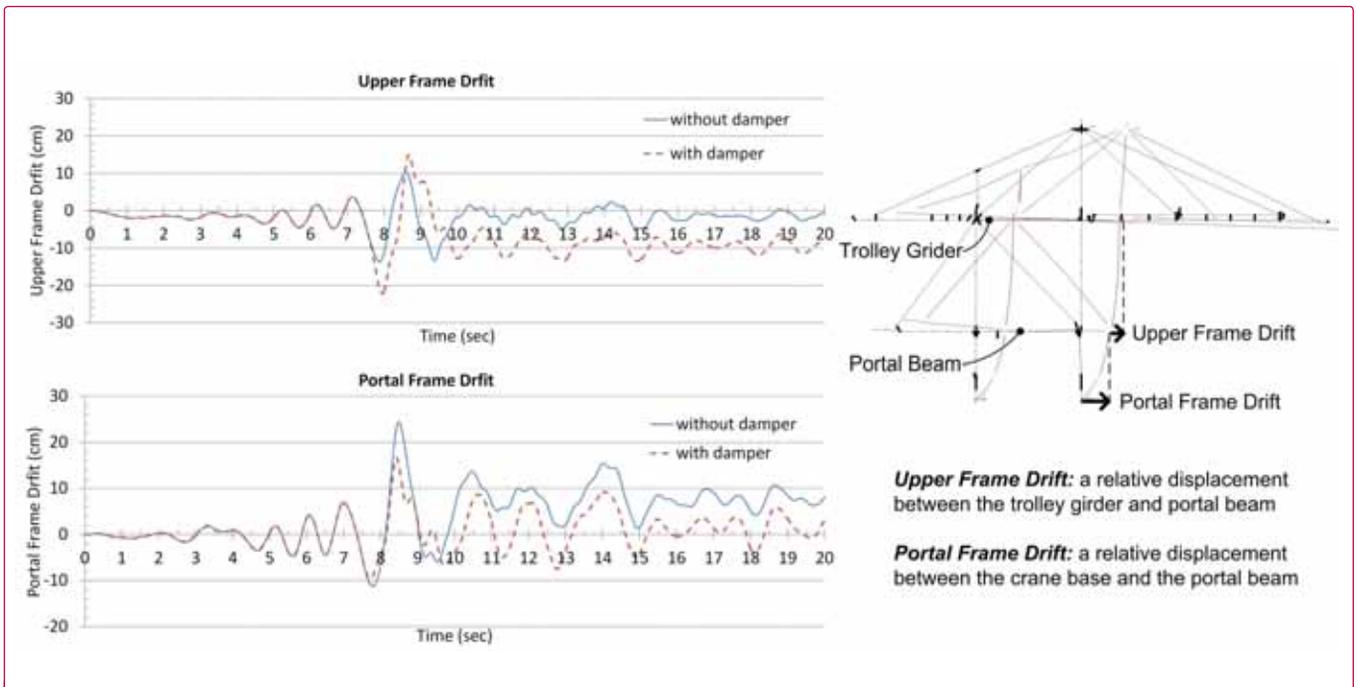


Figure 3. Crane response.

## Recommendations

Seismic forces on quay cranes in seismically active regions should be carefully considered. The occurrence of a major earthquake is unlikely. However, the consequences can be catastrophic.

In some situations, the loss of a crane may be acceptable. In other situations, it may be unacceptable. Engineers can offer

advice about what to expect and the consequences of selected criteria, but the stakeholders should decide how much risk is acceptable. The questions to answer are how much does protection cost and what is it worth?

If some seismic protection of quay cranes, wharves, or of both is desirable, friction dampers provide an economical and practical solution for new and existing cranes.

### ABOUT THE AUTHORS AND THE COMPANY

**Michael Jordan** is a Liftech structural engineer and chief executive with over 50 years of experience. He is an internationally recognized expert in the container crane industry. He has been involved in the container industry evolution since participating in the structural design of the first container crane for Matson in 1958. Since then, he has designed the structures of hundreds of duty cycle cranes, prepared numerous specifications for the design of duty cycle cranes, and investigated fatigue damage problems and major failures caused by fatigue crack growth and brittle fracture.

**Yoshi Oritatsu** is a Liftech structural designer and registered professional engineer with five years of experience in the design, analysis, and modification of container cranes, large derrick cranes, bulk loaders, and wharf structures. His work includes the analysis of crane and wharf seismic response, including the effect of isolation and energy dissipation systems.

**Erik Soderberg** is a Liftech structural engineer and vice president with 17 years of experience in the design, review, and modification of a variety of structures including container cranes, wharves, buildings, heavy lift equipment, and various rigging structures. He has consulted on hundreds of cranes, participated in the design of several wharf structures,

and has designed many crane transfer systems ranging from curved rails to shuttle systems. He has engineered repairs for dozens of container crane structures and for several bulk loaders. His field skills include an understanding of heat straightening techniques and the ability to develop repair procedures on site.

**Liftech Consultants Inc.** is a consulting engineering firm, founded in 1964, with special expertise in the design of dockside container handling cranes and other complex structures. Their experience includes structural design for wharves and wharf structures, heavy lift structures, buildings, container yard structures, and container handling equipment. Their national and international clients include owners, engineers, operators, manufacturers, and riggers.

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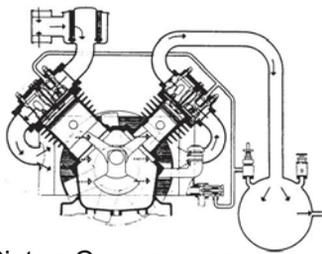


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“The system for multi-cargo berths operates grabs, hoppers and trucks to the specific stockyards. The main issue with the latter system, is how to efficiently stack the material in a safe and environmentally friendly manner.”

‘Ship loading and unloading: maximum flexibility and mobility’, page 102.



Piston Compressor (<1800)



Roots Blower (1900)



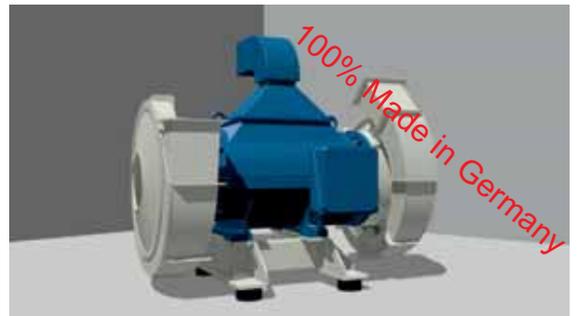
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# High tech solutions underway at Gladstone Ports Corporation

Lee McIvor, media advisor, Gladstone Ports Corporation, Queensland, Australia

## Introduction

As the world continues to look towards Australia to meet its growing energy needs, the Gladstone Ports Corporation (GPC), as the fourth largest coal terminal in the world, will be expected to meet this growth. To that end, GPC is focussing on maximizing the supply chain interfaces and working closely with mines, Queensland Rail and Pacific National to optimize existing assets while expanding and developing new ones.

During the 2011 to 2012 period, the Port of Gladstone is forecast to have handled 93.8 million tonne of cargo. Trade growth is expected to come primarily from the coal industry as coal mines recover from the flooding events of 2010 and 2011. Coal exports are forecast at 60 million tonnes.

GPC continues to work closely with its coal customers and rail operators through our Continuous Improvement Programme and Capricorn Coal Chain Maximization project, with a specific focus on coal throughput growth, dozer efficiency and cost control. These two initiatives are vital to reviewing and improving our operational practices, level of service, efficiencies, cost structures and coal loading facilities.

Consultation with our customers during the year helped to achieve an 80 percent reduction in the number of very dry coal trains. These trains need water added during unloading to eliminate dust, which slows down the unloading time.

Mine or terminal cooperation around this issue, involving our unloading supervisors and our Quality Assurance team, were successful in reducing the number of very dry coal trains.

We also continue to improve our ship vetting process during the year to reduce delays caused by seaworthiness inspections. GPC uses Right Ships to check each vessel against more than 100 criteria such as age, crew competence, incidents and structural integrity.

We are working with other coal ports around Australia to align the criteria to create a national bulk loading standard. Optimizing performance and pursuing operating excellence continues to be a focal point for the port.

## Key initiatives

Some of our key initiatives include:

### E-train development

Hardware installed in 2009 and 2010 has been further developed and now covers all unloading facilities providing us with live information for every train and wagon unloaded at GPC facilities. This effectively increases the efficiency of our operation and eliminates errors associated with the manual transfer and handling of information.

### Remnant coal collection

Ensuring all coal is extracted during the unloading process has both environmental and operational benefits. Traditionally this



Aerial photo of the RG Tanna Coal Terminal.

has been a manual process. During 2011, trials were successfully completed in one unloading system using laser scanners to detect coal remaining in the wagons and preventing carry back of coal along the rail system.

The primary deliverable was a carry back system that could measure and report on the volume of remnant coal found in a wagon after dumping was completed. The system was initially designed to acquire raw data from laser devices that scanned the train wagons as they passed out of the dump station.

These scanners are the primary enabling technology for the detection of remnant coal. They function by measuring distances (across a scanning field of view of up to 270 degrees) using the time of flight of a laser pulse. The conjunction of individual measurements across the complete field of view results, in a single completed scan, a two dimensional line corresponding to the surface adjacent to the laser scanner face.

The scanners used are capable of operating at up to 50 hertz, which is 50 scans per second. If the surface adjacent to the laser scanner is in motion along the main axis of the laser scanner (transverse to the scan) then a three dimensional surface profile can be created by 'stacking' multiple two dimensional scans.

To correctly position these two dimensional scan lines in cases where the surface movement is not uniform, it is necessary to also measure the speed of the surface by means of an additional scanner that has its scan line oriented along the axis of motion of the surface (in this case, along the direction of travel of the coal train). These two laser scanners (transverse and longitudinal) are mounted over the entry to the final pair of pits, allowing sufficient time to stop the train and dislodge any hang ups before exiting the pit area.

Finally, in order to provide for a possible future requirement to check the outgoing wagons for residual coal (to ensure that detected hang ups have been dislodged) a second transverse scanner is installed at the exit of the dump station.



Dozers working on a stockpile.

This visual reference system is located with the two laser scanners to provide a visual confirmation of any hang ups detected. It is currently used primarily to gather data for system commissioning, as the operators use the existing fixed camera system for their visual monitoring.

### Ongoing work

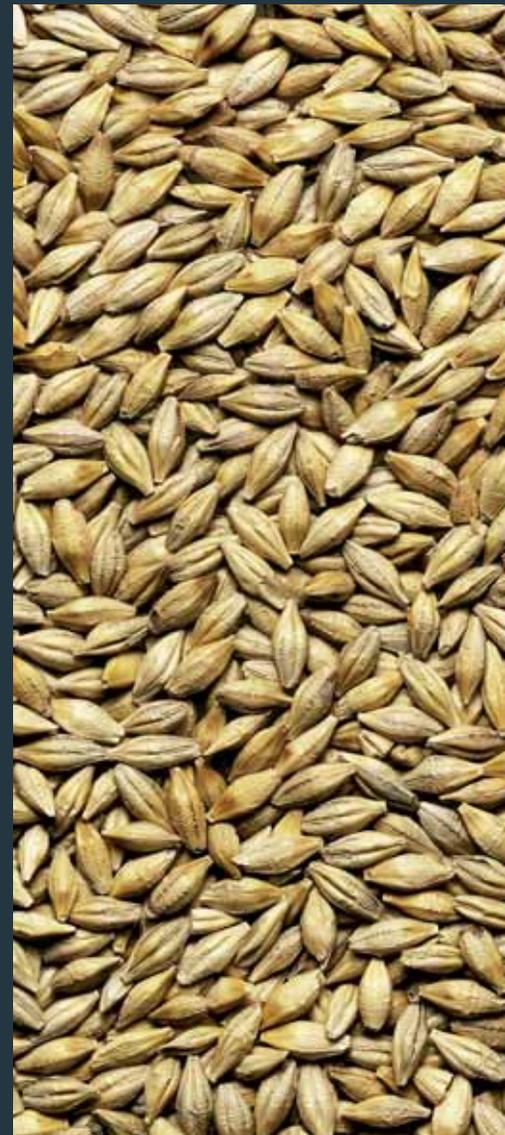
Work has begun on a stockpile automation programme that will involve three dimensional mapping and visualization aligned with an automated coal stockpile tonnage assessment as part of an online operational system. The aim of the system is to estimate the volume and hence tonnage of coal on the stockpile. Video imagery will provide up to 60 real time images around the site, which are compiled into a three dimensional mosaic, capturing the state of the stockpile at any given time.



The wharf at RG Tanna Coal Terminal.

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Alongside this project is an online programme for allocating drivers and dozers to stockpiles according to the latest trainlist and shipping schedules. To assist dozer operators an in cab guidance programme is being planned to help manual dozer operators until such time that semi-autonomous and fully autonomous dozer systems are introduced on the site. As with all new systems a key issue is safety and systems are currently being developed to manage safety where autonomous dozers are operating.

Semi-autonomous dozer system capabilities will be developed by an Tele-Operator Assist project. This will allow a semi-autonomous dozer to be supervised from the operations control room.

This year will see the completion of Stockpile 22, increasing our stockpile capacity to close to 7 million tonne. Work has also begun on an EIS for the Outer Harbor Channel Duplication to be developed in stages, depending on industry demand. The combination of growth in the coal trade with the development of Wiggins Island Coal Export Terminal, and the commencement of LNG industries together with the growth of other future industries, has identified the need to undertake the duplication of the shipping channels in the outer harbor.

The existing configuration with a single channel has limitations on the capacity to handle multiple deep draft vessels simultaneously. Through the provision of a second channel, it will be possible to separate inbound and outbound vessels with the resultant increase in capacity at the same time as maintaining safety.

A major development for the GPC is the construction of the new Wiggins Island Coal Export Terminal (WICET). Owned and developed by existing coal exporters located in Queensland, the terminal will be located at Golding Point to the west of the existing RG Tanna and Barney Point Terminals. The multi billion industry funded terminal is expected to provide about 80 million tonnes per annum in additional export capacity through the Port of Gladstone once fully commissioned.

The WICET consortium includes 16 coal companies, eight of which are stage one owners. They include Aquila Resources, Bandanna Energy, Caledon Resources, Cockatoo Coal, Northern Energy Corporation, Wesfarmers Curragh, Yancoal and XStrata Coal. The first coal shipments through Stage One are planned for late 2014.

#### ABOUT THE COMPANY

**Gladstone Ports Corporation** (GPC) was first constituted in 1914 as the Gladstone Harbour Board. Almost 100 years on, GPC has become the world's fourth largest coal export terminal and the largest multi-commodity port in the state of Queensland, Australia. With a workforce of close on 700, GPC is set for rapid expansion in the next decade. The introduction of the LNG industry into the port precincts has ensured the Port continues to develop the prosperity of the state of Queensland and the nation.

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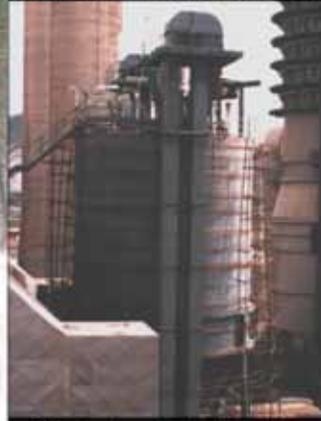
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# Boosting offshore transshipment worldwide

**Captain Giordano Scotto d'Aniello**, head of commercial department, Coeclerici Logistics, Milan, Italy

In 2012, Coeclerici Logistics is delivering the second twin vessel Bulk Limpopo for Vale Mozambique, the FTS Bulk Borneo for PT Berau Coal and is revamping the Floating Transfer Station Bulk Kremi I, operating in the Black Sea.

The events are in line with the company strategy, which started developing offshore logistic projects more than 30 years ago by implementing maritime solutions to overcome the various bottlenecks existing in the Mediterranean Sea and creating a chain of raw material distribution, allowing end users, such as power plants or steel mills, to take advantage of the economies of scale and be more competitive in the market.

Long time elapsed since the Cavalletto system, costal barges and floating cranes were ideated. The systems were used to help the Italian local coal fired power stations to optimize the coal supply by implementing a door to door distribution. After this beginning in the domestic market, over the years, Coeclerici Logistics has gone international with current projects in South America, India, Indonesia, Africa and Italy. The Logistics division handles 15 million tons per year of raw material off shore and this figure is foreseen to increase in the near future to over 35 million tons per year, with the delivery of other transshipment units in 2013, with long-term contracts already allocated.

## Bulk Zambesi and Bulk Limpopo- Mozambique cargo cycle

Bulk Zambesi and Bulk Limpopo have been designed by Coeclerici Logistics to improve the operational logistic chain of the raw material in the Moatize area, where Vale has a huge coal mine concession located 17 kilometers northwest of Tete city, along the left bank of the Zambesi River.

The units' construction took place in China, under the supervision of Coeclerici technicians, who were constantly on site during the building phase; the construction used Italian and European technology. Both units are provided with equipment that allow modern and effective environmental control. Such equipment include dust isolators and a system for the selective management of waste to avoid any type of contamination occurring at sea or on board. Each unit is equipped with five heavy duty cranes, a belt conveyor system capable to guarantee a peak loading rate of 5,500 tons per hour and an average of 3,000 tons per hour within a weather margin of 2 meters significant wave height and 25 knots of wind.



Bulk Limpopo.



Bulk Borneo at shipyard.

## Cycle operations

The coal will be loaded at Beira loading berth and transported to a suitable anchorage 20 miles off the coast, where there are no draught constraints and where the coal will be transferred by means of the system installed on board into ocean going vessels (OGVs) up to 180,000 deadweight tonnage. The transshipment operations will make it possible not only to complete the loading of those ships that cannot be fully loaded at quay, but also of larger ships of Panamax and Capesize segment, that cannot dock in Beira because of the channel or port restrictions. Bulk Zambesi and Bulk Limpopo will allow Vale to export from the Port of Beira a quantity of about 11 million metric tons per year and to distribute the cargo worldwide in the most cost effective manner.

## Bulk Java and Bulk Borneo – Indonesia

Coeclerici Logistics took delivery of the floating transfer station (FTS) Bulk Borneo, where operations will commence in mid 2012 at Muara Pantai anchorage in Indonesia. The FTS will support the already operating FTS Bulk Java, consequently boosting the client coal output.

### About the project

Coeclerici Logistics proposed to PT Berau Coal, one of the top five coal producers in Indonesia, the use of FTS, duly designed to load an average of about 40,000 tons per day from standard Indonesian barges into ocean going vessels up to Capesize.

The offshore transshipments operations will be carried out using a system equipped with two heavy duty cranes with grabs, two hoppers and a belt conveyor system with two swiveling shiploaders capable a tilt angle of 25 degrees. The FTSs are environmentally friendly and designed to meet the requirements

TABLE 1: FTS BULK BORNEO TECHNICAL SPECIFICATIONS

Criteria	Value (meters)
LOA	97.000
Breadth	32,25
Depth	7.50
Draft	5.80
DWT	(about) 11,800

of international classification societies and the requirements of IMO, MARPOL (SOPEP), IOPP, ISPP and IAPP, as well as meeting local regulations and Coeclerici standards.

Bulk Borneo, in conjunction with the existing Bulk Java, will allow an annual throughput of about 10 million of metric tons per year.

## Black Sea — FTS Bulk Kremi I

Coeclerici Logistics and Transship Ltd, one of the largest Ukrainian shipping companies, set up a joint venture to operate in the Gulf of Kerch to overcome the existing logistics bottleneck in the area. Since 2010 the sulphur transshipment operations, which are performed by Bulk Kremi I in conjunction with the floating crane Atlas I, offer an integrated logistics chain solution to their users.

Bulk Kremi I was converted in the year 2000 into a self loading and self discharging vessel to perform transshipment operations of dry bulk material in the Black Sea. In order to further improve the services rendered by the JV, Bulk Kremi I has undertaken modernization works to enhance the loading performance rate.

The unit has been equipped with environmentally friendly systems composed by two hoppers, a telescopic shiploader comprising of a particular retractable chute which will be used only with sulphur cargo operations (the chute will be uninstalled when handling coal and iron ore) and a longitudinal cross belt conveyor system. Bulk Kremi I is able to load the cargo directly into the OGVs from river barges, avoiding the double handling of the cargo, but with the option to use the existing buffer storage on board to optimize the barge cycles.

### System description

The system allows the unit to grab the material with the 25 ton cranes from the barges. It can then either load its own hold (buffer of about 13,000 tons) or transfer the material into OGV up to Panamax, since the air draft is about 18 meters, with a full load draught of about



Bulk Kremi shiploader chute.

6 meters. The system has a transshipment capacity of 750 tons per hour and has been designed to mainly handle sulphur, but is capable of handling coal and iron ore by using inverters on the extractors and is designed to avoid any dust emissions during operations.

The shiploader can be simultaneously rotated and raised up to 50 degrees from the horizontal, to overcome deck obstructions, such as cranes, on the vessels. The operation is guaranteed for the whole range of movement of the retractable part, which is between 20 meters and 30 meters with intermediate positions.

The loading system is particularly significant as it is the first in Europe suitable for offshore transshipment of pelletized sulphur – a material that gives off highly flammable dust. For this reason the design had to be developed within the European ATEX Directive (94/9/EC) for products indented to be used in potentially explosive atmospheres.

### Future projects

Coeclerici Group is nowadays an international reality with a multi-divisional structure of logistics, trading, mining and shipping that has strengthened during the past few years, expanding its presence worldwide.

Recently the Group has opened a new office in Miami, Florida to set up a presence in the US for trading of North and South American coal and related raw materials and looking for new opportunities in logistics throughout the American continent.

Coeclerici Group is confident that, as the US is one the biggest coal producing countries in the world, the activities in this market will allow the various company divisions to expand even further on international activities and to be able to follow the market evolution.

### Bulk Kremi – main characteristics

Length:	121.92 meters
Beam:	30.48 meters
Loaded draught (within 12 miles from shore):	6.658 meters
Deadweight:	about 13.000 tons
Gross tonnage:	7.061 tons
Net tonnage:	2.118 tons
Hold (flat top):	1
Crane:	2 by 25 tons
Cranes outreach from barge side:	26 meters
Shiploader outreach from OGV side:	18 meters to 28 meters

TABLE 2: HANDLING MATERIAL & MAIN CHARACTERISTICS

Material	Sulphur UN1350	Coal	Iron ore
Specific weight (t/m <sup>3</sup> )	1.21	0.8 – 0.85	2.2
Maximum size (mm)	0 – 100	0 – 75	0 – 75
Middle moisture (%)	0.5 – 2.5	10 – 30	10 – 30
Angle of repose (°)	43	37	35
Capacity of SHP1 (t/hr)	750	500	750

#### ABOUT THE AUTHOR

**Giordano Scotto d’Aniello** is a master mariner and has been employed on dry bulk vessel for more than 10 years. Since 1998 he is working for the Coeclerici Group, at first in the Shipping department and then, since 2004 in the Logistic department. He is presently working in the ‘new projects’ department and is head of the commercial division of Coeclerici Logistics, where he is involved in the conceptualization of offshore transshipment solutions for clients worldwide.

#### ABOUT THE COMPANY

Since 1895, **Coeclerici** has been sourcing, marketing and transporting raw materials (primarily coal) from mines to final end users, serving the power and steel industries internationally. The Logistics division has promoted and patented the use of floating terminals and transfer stations throughout the world with far smaller investments, lower management and environmental impact for port terminals.

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# The Port of Maputo: charting a course for a successful development

**Gerhard Botha**, chief operations officer, at Maputo Port Development Company (MPDC), Maputo, Mozambique

## Background

To understand where the Port of Maputo is heading in the future, one has to know its past. In 1972, the Port of Maputo was a busy hub, handling near 17 million tonnes per year. Durban's port, a little further south, was handling only 3 million tonnes more than that and Richard's Bay Port didn't even exist.

Then the long civil war came. In 1988, the Port of Maputo barely reached 1 million tonnes; infrastructure deteriorated, shipping companies moved their business elsewhere and ports like Richard's Bay were born and prospered. It was only in 2003, when the Port of Maputo was transformed into a Private Public Partnership and concessioned to Maputo Port Development Company (MPDC), that things started changing. In only nine years, the Mozambique's capital port grew from 4.5 million tonnes to 14 million tonnes (this expected year's throughput).

This growth is the result of a massive investment – \$291 million by the port's concessionaires – in the rehabilitation of roads, rail, quays, general infrastructure and acquisition of equipment. However, the most beneficial change was the channel dredging to -11 meters, with a sailing draft above 11 meters. This allowed the port to receive bigger ships and, after the dredging, the Port of Maputo had an impressive growth of 35 percent.

## Port of Maputo Masterplan

The dredging of the access channel to the port was the first of the many actions included in the Port of Maputo's Masterplan; an ambitious and dynamic tool, which charts the port's successful development. According to the updated Masterplan, the Port of Maputo foresees that, by 2020, it will be handling almost 50 million tonnes, with an investment of US \$1.7 billion in the coal, container and bulk terminals. The port will also receive channel dredging to -14 meters, berths rehabilitation and also rail, road and warehousing improvements. The coal terminal, for example, is planned to grow from the current 6 million tonnes capacity to 30 million tonnes (20 million of coal and 10 million of Magnetite), and the container terminal will increase from the present 150,000 containers to 400,000 containers (phase one).



Much of the grand design to secure a vibrant future is presently visible only as images, which reflect the foresight of those who have launched this mammoth 20 year project. But to turn all this into reality, the Port is now working in what the eye can't see.

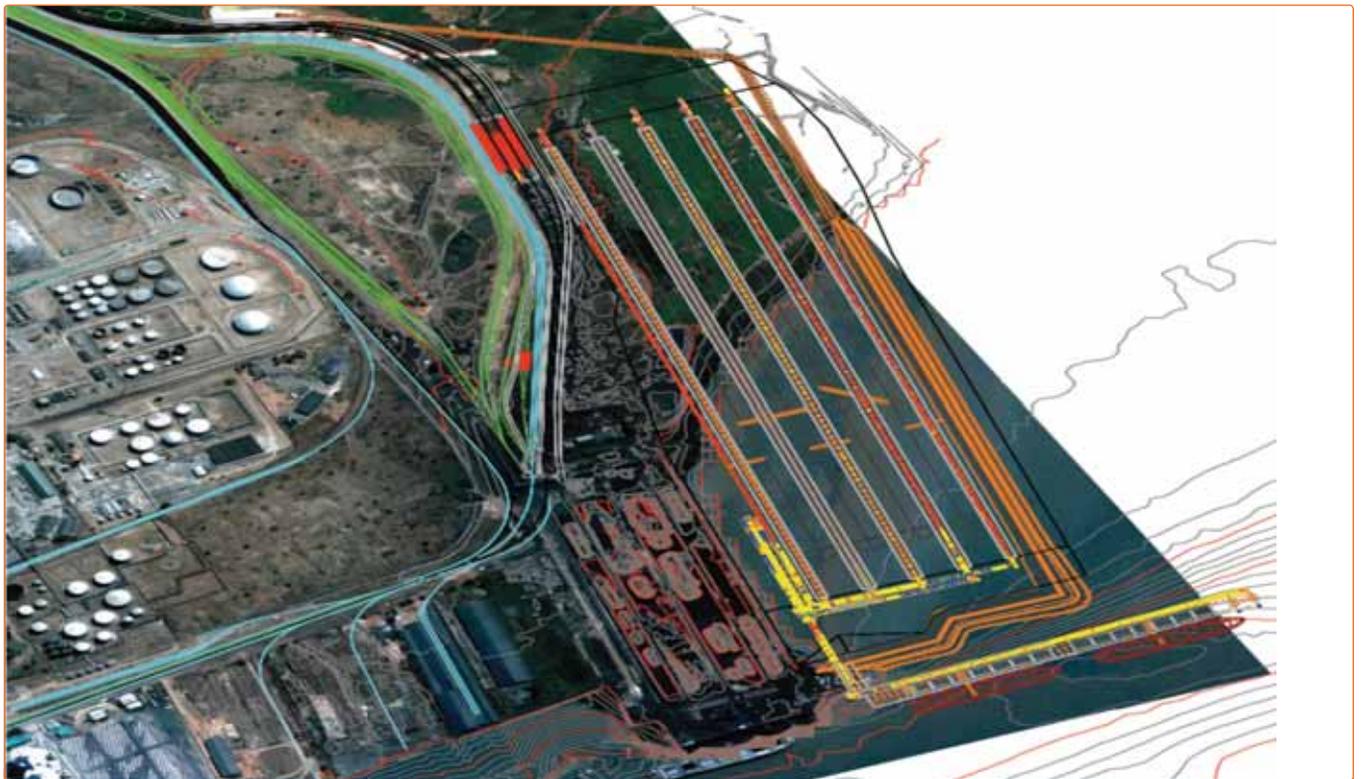
## Building foundations, facing challenges

In order to make a sustainable investment, the Port of Maputo has been taking time to build its foundations. 2011 and 2012 have seen an unprecedented alignment between all stakeholders, including the Mozambican Ports and Rails Company, Caminhos-de-Ferro de Moçambique (CFM), the National Customs Authority and the National Institute of Hydrography and Navigation (INAHINA). These stakeholders, amongst many other tasks, control all navigational aids in the access channel to the Port of Maputo. All play a fundamental role in the achievement of the Masterplan's strategic objectives.

The Port of Maputo has a geostrategic location, relative to key markets – the main mining regions of South Africa, Swaziland and part of Zimbabwe. This gives the port a strategic, competitive



The Port of Maputo, Mozambique.



Overview of Matola Coal Terminal.

advantage in comparison to neighboring ports, who are struggling with congestion. Most of the mineral cargos are transported to the port by road, even though they are more rail oriented. This poses numerous issues, such as road congestion, road maintenance and environmental problems. Today, there are about 1,200 trucks moving in and out the port every day. Very soon, with raising demand, this number will double, if cargo is not moved by rail.

Efforts are now being developed by CFM and MPDC to evaluate the requirements and needs of infrastructure, rolling stock and market demand to move some of the cargo from road to rail. The main focus is given to minerals that represent a considerable percentage of the cargo handled at the port.

Other developments taking place at the port are related to customs, namely, improvements on the transit regulation and the introduction of a Single Window system (electronic clearance of goods). These improvements are aimed at simplifying the import and export process and the documentary process so that, in time, the customs process goes paperless.

Human capital is also one of the port's major concerns. High skilled employees are scarce in the market and there is no

specialized education available – although in the past there was a port school ran by CFM. Efforts are being made to create a port activities school and all options are being carefully analyzed, including training future employees in available schools in South Africa. Regional cooperation is being developed in order to address this issue. The investment in human capital, will not only benefit the port of Maputo but all ports in the country, including the growing northern ports of Beira, Nacala and, potentially, other ports to be developed in line with the advent of huge coal reserves.

Safety and environmental areas receive dedicated attention and benefit from continuous investment. Clean and safe operations are Port Maputo's major aim, and port users are already praising the port's initiatives. Training in safety procedures is done on the job and in special training sessions in South Africa. On top of this, safety internal campaigns are a must all year round.

All this is based on a positive corporate culture and a strong belief that the port is operating for the development of the region. Mozambique is one of the world's fastest growing economies and the Port of Maputo is making, and will continue to make, its own distinctive contribution to the country's impressive progress.

#### ABOUT THE AUTHOR AND COMPANY

Born and raised in Durban, **Gerhard Botha** worked for SA Port Operations for more than 26 years. In 2006, DP World invited him to go to Djibouti as the container terminal manager and later also as project manager of the Doraleh Container Terminal development (a greenfield project). When his mission was concluded, he was invited to go to DP World Dakar where he then again assumed functions as container terminal manager and worked closely with the project team on the expansion of the terminal. Mr. Botha started in December 2011 as chief operations officer at MPDC.

**Maputo Port Development Company (MPDC)** is a national private company, which results from the

partnership between the Mozambican Railway Company (Caminhos de Ferro de Moçambique), Grindrod and DP World. In 2003 Port Maputo was given the concession of Maputo's Port for a period of 15 years. In 2010, the concession period was extended for another 15 years, with an option of an additional ten years of operations after 2033. Port Maputo holds the rights to finance, rehabilitate, construct, operate, manage, maintain, develop and optimize the entire concession area. The company also holds the powers of a port authority, being responsible for maritime operations, piloting towing (tugboats), terminal and warehouse operations, as well as port planning development.

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# Ship loading and unloading: maximum flexibility and mobility

**Telestack Limited**, Co Tyrone, Northern Ireland

## Introduction

Traditional ship unloading in ports and terminals varies. There is the fully integrated ship to stockyard systems, incorporating grab cranes, hoppers, conveyors and stackers or reclaimers for fully dedicated berths. Alternatively, the system for multi-cargo berths operates grabs, hoppers, trucks to the specific stockyards. The main issue with the latter system, is how to efficiently stack the material in a safe and environmentally friendly manner. Telestack mobile stacking and truck unloading solutions are particularly effective when stockpiling multi-cargo in a remote stockyard, which allows the customer to stockpile differing types and grades of materials in various locations.

For ports which operate multi-cargo berths or stockyards, Telestack's mobile equipment can offer the flexibility to stockpile up to heights of 17 meters at a rate up to 2,500 tonnes per hour, using a range of truck unloaders and mobile radial telescopic conveyors. This automatic stockpiling system eliminates the segregation, degradation and compaction of the material within the stockpile, which ensures the material characteristics are maintained. Also, it can be used as a back-up stacking system in the event of failure or during statutory maintenance of a dedicated stacker or reclaiming system (see Figure 1).

This stockpiling unit can be installed with a crawler tracked dolly unit or wheeled dolly unit for full site mobility in harsh ground conditions. This site mobility ensures the operator can use this equipment anywhere within the stockyard when required. In many instances, these units are multifunctional, utilized for both stockpiling and ship loading applications up to Panamax



Figure 1 (a). Radial telescopic stockpiling coal directly from trucks in stockyard.



Figure 1 (b). Mobile radial telescopic shiploader loading pet coke to vessel with telescopic cascade chute directly from trucks.



Figure 2. Typical ship unloading application complete with grab crane discharging into hoppers which feed directly to trucks, which unload in the stockyard.

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- Cement
- Grains
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Figures 4 and 5. Mobile truck unloader stockpiling aggregates directly from trucks in stockyard.

size vessels, with the radial telescopic features offering maximum maneuverability and flexibility during both processes.

In many applications, a fully automated integrated system would not be feasible to the particular port and inland terminal with lower capacities, which could not justify the high capital expenditure of the overland conveyor and stacker or reclaimers systems. As shown in Figure 2, the popular method for multi-cargo berths would include grabs, hoppers and trucks to the specific stockyards. These trucks would transfer the bulk material directly to the stockyard. Primarily, these trucks would dump the material within the stockyard, then loading shovels or excavators would be used to stockpile the material, either with a loading shovel driving up and down stockpiles or a number of excavators used to achieve the required stockpile height and capacity, as shown in Figure 3.

This is not an effective stacking method, with extensive contamination and double handling of the material, which leads to increased operational and production costs. The Telestack mobile solutions offer a range of mobile truck unloaders and stackers which can eliminate these common problems.

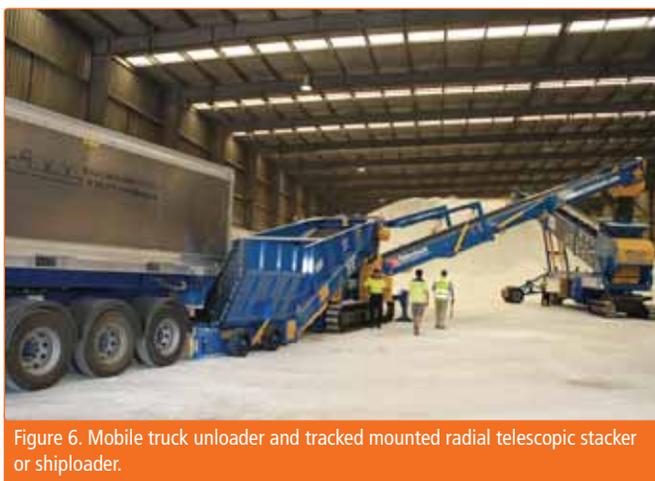


Figure 6. Mobile truck unloader and tracked mounted radial telescopic stacker or shiploader.

In specific stockpiling applications directly from trucks, Telestack offer a range of mobile truck unloaders which can transfer the load directly from the trucks to a stockpile. This unit can include a radial facility, which again allows maximum flexibility to stockpile up to 10 meters. This efficient stockpiling method eliminates the double handling of the material and allows the operator to stockpile directly from this single unit. Also, the mobility of this unit means it can be easily moved around the stockyard, according to the requirements of the operator.

This range of truck unloaders can be used in conjunction with the radial telescopic stacker to achieve the greater stockpile height and capacity if required. The combination of these two mobile units, for both stockpiling and ship loading, offer the customer complete flexibility, safety and efficiency, taking into consideration required stockpile heights, capacities and types or grades of materials within typical multi-cargo berths.

The overall benefits of this range of equipment includes:

1. Dual functionality, both for ship loading and ship unloading operations, which eliminates overhead costs for secondary equipment
2. Ease of transport from stockyard to quayside
3. Range of truck unloaders utilized as a stacker or shiploader or feeding the radial telescopic stackers
4. Wide range of dust suppression or containment and trimming facilities
5. Operational movements range from in line, radial, parallel and many more
6. Hatch changes normally only require parallel movement – no need to reverse out if the vessel is geared
7. Cost effective solutions
8. Customized solutions to meet the needs of any application

These mobile systems highlight Telestack's aim to provide for the specific needs of each application to ensure the equipment is efficient and reliable during these types of operations.

## ABOUT THE COMPANY

**Telestack Limited** specialize in the design, manufacture and installation of a complete range mobile coal handling systems for operation in ports, power stations, steel mills and cement kilns. The range of equipment takes into consideration the 'day to day' operational capabilities of coal handling, consisting of shiploading or unloading, stockpiling, reclaiming, truck unloading and linking conveyors. The Telestack equipment offers the operator cost efficient solutions with unrivalled mobility and flexibility. Telestack currently have installations globally with some of the worlds largest coal producers and processors including, BHP Biliton, Mechel, SUEK, Rio Tinto and many more.

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# OIL, GAS AND CHEMICAL HANDLING



“Ship to shore connections made by hoses offers better flexibility, but compared to loading arms they are prone to tear and wear; they have a limited lifetime and require relatively inconvenient operation.”

‘Towards zero operational costs of loading facilities for bulk fluids’, page 108.

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# Towards zero operational costs of loading facilities for bulk fluids

**Robin Boot**, sales and marketing manager, Kanon Loading Equipment B.V, Zeewolde, The Netherlands

## Introduction

The ultimate goal is to achieve a zero cost of ownership for any installation. But is that a reasonable goal? The logical answer would be no. However, when it comes to loading facilities, a well thought out concept would allow one to come a long way towards this target.

The transfer of fluids is the backbone of companies who produce or trade these fluids or provide storage capacity. At the end of the day, it is the fluid flow that keeps the meters counting and that generates the cash flow. This article will discuss the last part of the liquid transfer line: the loading facility; the most critical part of the transfer of fluids between a storage tank and a tanker.

The Loading facility is a flexible part in the liquid transfer line as it needs to follow the horizontal and vertical movements. This flexibility requires the use of loading hoses or loading arms; this is particularly vulnerable to risks, due to emergency situations, faulty operation and wear and tear.

## Loading and unloading process at the jetty

Loading and unloading of ship tankers is a challenging event which includes several risks. Considering the dynamics inherently associated with a transport vessel while connecting and transferring to and from a liquid cargo transfer system, such as a hose loader or loading arm, accidents can easily happen during any of the operational phases.

Marine loading hoses and marine loading arms are two available alternatives to transfer liquids between a storage tank and a tanker, as they offer the required flexibility. Ship to shore connections made by hoses offers better flexibility, but compared to loading arms they are prone to tear and wear; they have a limited lifetime and require relatively inconvenient operation. Hoses are often subject to periodical tests and inspections, once or twice a year, thus they inherently include a certain yearly cost of ownership. From a safety point of view, automatic emergency release provisions with 'zero' spillage are hardly available for hoses and neither are actuated quick couplers that make life easier for operators.



Figure 1. A marine loading arm in operation.



Figure 2. A typical jetty layout for loading arms with a control system.

Connections made by marine loading arms achieve a fully rigid connection, still with the possibility to follow all the ship's movements by the use of swivel joints in between the steel pipes, and so solve the disadvantages of loading hoses. They can also be executed with automatic 'no spillage' emergency release couplers

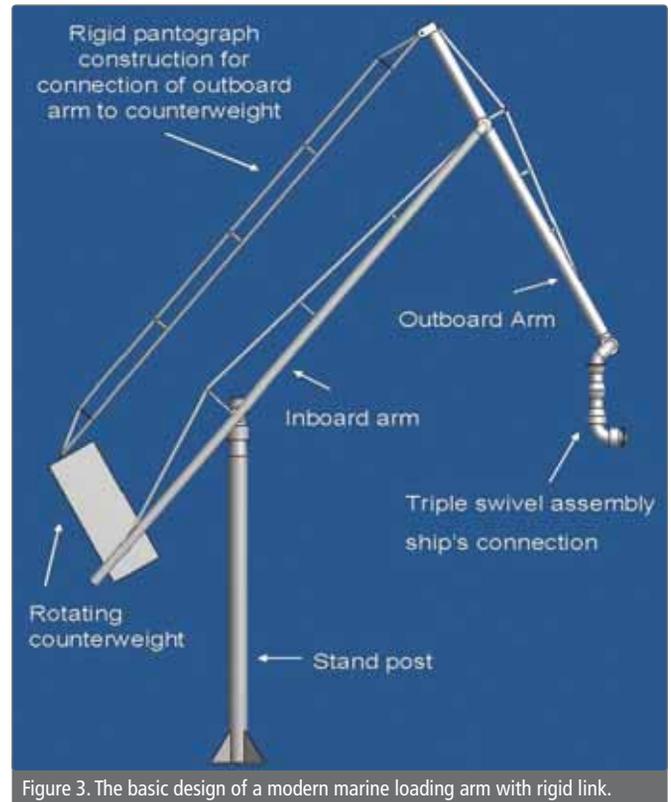


Figure 3. The basic design of a modern marine loading arm with rigid link.

and equipped with powered quick couplers to increase personal safety and to protect the environment. The structural design of the marine loading arms is an extremely important factor when it comes to required maintenance.

The human factor contributing to the cost of ownership is not always visible, but it has a close relation to the convenience of operation and the maintainability of the loading arms. Any difficulties in the everyday operation and in the maintenance procedures will have a decided impact on the operators.



Figure 4. The difference between a rigid link system and cable link.

To increase job satisfaction and job performance, the facility and the operation of loading arms and maintenance should be designed through the eyes of operators and maintenance crew and suited for one man operation. For example, flexible wires with pendants for regular loading arm control should be avoided, as they can cause accidents and are prone to getting damaged, thus causing unexpected movements of the arms.

## Design of the loading arms

It is worthwhile having a detailed view of the design of the loading arms, since it is a crucial factor when it comes to required maintenance. Simplicity of design of marine loading arms combined with an optimal structural configuration will allow a close to zero cost of ownership.

### Counterweight balancing: rigid link versus cable link

The moveable parts, called inboard arm and outboard arm, are counterweight balanced (see Figure 3). Marine loading arms can have two separate counterweights, one for the inboard arm and one for the outboard arm, or a single rotating counterweight that is a combination of both. The linkage between the moveable loading arm pipes and the counterweight can be made by either a cable and wheel assembly or a rigid steel bar (see Figure 4). A cable system needs regular inspection, greasing and re-tensioning, whereas with a rigid connection the balancing is set one time in the factory and never again.

### Self-supporting structure versus separate support frame

The liquid carrying piping can be supported by a frame that bears all the weight of the liquid line. This configuration is a complex one and should be avoided for all applications other than cryogenic or extremely corrosive fluids. Improvements in swivel joint design have eliminated the need for a separate support frame, even for extreme large dimensions. This means that self-supporting loading arms can be applied as a standard, which is a significant improvement towards the goal of simplicity.

### Swivel joints

The performance of marine loading arms depends on the swivel joints. Modern, high performance swivel joints allow leak free operation for years, without the need for periodical greasing or any other maintenance. A multi-year warranty, which includes all the swivel joint parts, is essential to achieving zero cost of ownership.

### Marine loading arms configuration

Marine loading arms with symmetric design beside the recommended self-supporting structure and rigid linkage have a proven record of reliability thanks to the equal division of forces within the entire structure (See Figure 5). With the basic maintenance limited to a few grease points only, the uptime is practically 100 percent and the cost of ownership is practically zero.



Figure 5. Symmetric Marine loading arm.

## Conclusion

Modern, symmetric marine loading arms with rigid link and self-supporting structure and executed with high performance swiveling joints provide a close to zero cost of ownership for the loading equipment. Extra attention to a simple and intuitive way of operation will further minimize the operational costs.

### ABOUT THE AUTHOR

**Robin Boot** is sales and marketing manager of Kanon Loading Equipment B.V. He joined the company in 1999, and has since been involved in many marine loading arm projects worldwide.

### ABOUT THE COMPANY

**Kanon Loading Equipment B.V.** is a first class supplier of marine loading arms with innovative symmetric design. They also provide top and bottom arms for truck and rail- folding stairs, loading platforms and swivel joints. Ease of handling, safety for operator and environment, reliable performance for many years, are basics for the design of KANON equipment.

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# Optimizing financial performance of aboveground storage tanks

**Jeff Eickhoff**, general manager of sales and marketing, HMT, The Woodlands, TX, US

In today's economy, tank operators are seeking means of improving the financial and operational performance of their tank assets. Terminal operators and their customers are concerned more than ever with increasing working capacity, reducing heel, extending service life and reducing emissions and evaporative product loss. This article takes a closer look at these key concerns and considers some potential strategies to improve performance, increase tank working capacity and reduce heel.

Tank working capacity is driven by the distance the floating roof can travel when the tank is cycled. This distance is, in turn, driven by the constraints at the top and bottom of the tank and the depth of the floating roof system. Increasing working capacity can result in operational efficiencies and drive increased revenue.

Heel reduction is a related, but separate issue. Heel refers to the inventory that is stranded at the bottom of the tank between the tank bottom and the floating roof when the roof is at its lowest operating position. For the owner of the stored product, this inventory acts, financially, just like a fixed asset, in essence tying up working capital indefinitely.

Reducing this heel has a direct positive impact on cash flow. For example, replacing a traditional steel pontoon IFR with a low profile, suspended IFR system can allow for up to an additional 2 feet in roof travel. On a 150 foot crude storage tank, this equates to over 6,200 barrels, or more than \$620,000 of immediate positive cash flow. Design details, such as the use of drain dry sumps or low profile nozzles, can aid in achieving these results.

The use of a mesa or plateau style bottom (a raised bottom which displaces a portion of the liquid) can also achieve significant heel reduction; however, this method does not result in the working capacity increases that can be achieved by lowering the IFR.

Many factors influence working capacity and heel:

- Depth of the floating roof and seal systems
- Floating roof support method and design details
- Equipment located under the floating roof (for example, mixers, diffusers, piping and hoses)
- Safety buffers above and below the floating roof
- Inlet type and position
- Bottom treatments such as drain dry sumps or mesa bottoms

## Best practice #1 – Do the math

Begin with a thorough operational analysis to assess the current working capacity constraints and partner with a provider that can offer options. Options vary and can include flush mounted dome roofs; suspended, low profile IFRs and seals; pontoon modifications, and alternative bottom fill systems. These details can have a big impact on financial performance.

## Extending service life

Increasing out of service intervals and reducing unplanned outages can add hundreds of thousands of dollars, even millions to the bottom line. In an effort to make tank operations more efficient and increase profitability, many operators are specifying materials with longer life spans and fewer maintenance requirements.



Aluminum domes offer several advantages, including superior corrosion resistance and positive impacts to both tank capacity and emissions mitigation.

Storage terminals near ports typically have high cycle frequencies and flow rates, increasing repetitive stresses on floating roof and seal systems. Thoughtful selection and design of these systems can mean the difference between 10 and 20 year service intervals. In addition, most unplanned maintenance can be avoided by specifying systems and materials that are built to last and designed to perform under the types of dynamic loading situations the system can be expected to encounter.

Years ago, when the first aluminum IFRs were brought to market, these technologies were underdeveloped and unproven. Fast forward 40 years and multiple aluminum roof manufacturers have evolved and offer extremely high quality, well engineered and cost effective systems that offer significant benefits over traditional steel options.

Some of these benefits include:

- Aluminum does not require painting or coating
- Aluminum domes do not require the periodic structural repairs commonly required with cone roofs



Tank bottom treatments such as drain dry sumps or mesa bottoms can have significant impacts on heel reduction.

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- The well designed systems on the market are durable and able to handle high flow rates and heavy cycles
- Aluminum can be suspended (reduced heel, increased working capacity, reduced emissions and improved tank safety)

#### Best practice #2 – Research materials and partner with a provider that can offer proven technologies

The right materials coupled with proven designs can improve tank efficiencies, extend service life, and result in savings in several key areas.

### Reducing emissions and evaporative product loss

In addition to environmental concerns, product loss is an important consideration in assessing tank financial performance. Many factors influence tank emissions, including those which can be controlled through proactive design decisions:

- Type of fixed roof (clear span or column supported)

- Floating roof seal design and details (pressure application system, material durability and ability to conform to shell deviations)
- Floating roof penetrations and seams
- Gauge pole or guide pole well treatments

#### Best practice #3 – Engage an emissions or environmental expert and research options to reduce emissions and product loss

Multiple options, such as best in class seals; suspended, zero deck seam full contact IFRs; clear span dome roofs and guide pole or gauge pole well treatments can make the difference of thousands of pounds of product loss yearly. In areas where emissions are tightly regulated, this can help avoid costly penalties.

### Proactive assessment and collaboration

Over the years, tank equipment has evolved considerably. Materials are lighter weight, have higher life expectancy and require less maintenance. Design practices have also evolved to solve many operating problems and constraints. A good tank equipment provider can help operators assess their current tankage and provide customized solutions to meet key financial and operational objectives.

Each tank is unique and solutions are never one size fits all. Proactive collaboration between tank operators and equipment suppliers can deliver a major boost to the bottom line.

#### ABOUT THE AUTHOR

**Jeff Eickhoff** is the general manager of sales and marketing for HMT and also manages the company's Latin America and Canada businesses. In addition, Mr. Eickhoff has co-developed HMT's current program of technical seminars created to increase awareness of design innovations and fundamental best practices for aboveground storage tanks. The most recent of these seminars was presented at the NISTM conference in Orlando in March. Mr. Eickhoff joined HMT in 2010 and holds BA and BS degrees in Architecture from Washington State University.

#### ABOUT THE COMPANY

**HMT** is the global leader in aboveground storage tank solutions. HMT brings a distinct level of innovation and service to the tank industry through a unique approach of partnering with customers to optimize tank operations. Knowing that every customer's need is different, they use their decades of experience to customize solutions that help tank operations become more efficient, more productive and more profitable.

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# Safety, quality and environment driving improvements at ports

**Earl J Crochet**, general manager Gulf Liquids, Kinder Morgan, Houston, Texas, US

## Implementing a new culture

Kinder Morgan terminals embarked on a voyage to establish a corporate culture built around safety, quality, and environmental compliance. This ongoing process began several years ago and, though great strides have been made, the simple fact is Kinder Morgan will never be completely satisfied until zero incidents can be claimed.

## Improving safety at ports

Years ago, mariners used a sextant and the stars to help guide them safely from one port to another. Now they rely on guidance systems, radar, thermal imagery and other modern technologies. With these developments must come safety. Every company says they want to work safely and create a culture of safe practices. But how many actually take the necessary steps to ensure the workplace is as safe as possible?

It begins with providing training for each employee for each and every task, ensuring all employees wear and use the correct personal protective equipment (PPE) at all times, and taking responsibility for the surrounding work environment.

At Kinder Morgan we spend hundreds of millions of dollars each year on integrity management programs and maintenance to comply with and, in some instances, exceed federal safety laws and regulations. We also post statistics detailing our operational performance on our website to increase transparency. This detail shows that Kinder Morgan continues to outperform the industry averages in virtually all safety and release categories over a 12 month rolling average.

If an incident occurs, costly repairs may be needed, along with a cleanup and possible litigation and fines. When assets are not operating, ports cannot meet customers' needs and revenues are not produced. All of these can take a toll on the company's reputation and make it more difficult to conduct business in the future. Consequently, it behooves all of us in the industry to operate safely. The bottom line is that it costs much more to repair assets than it does to properly maintain them.

## Become a responsible, ethical operator

Being in compliance with operating permits and protecting the environment is not only the right thing to do, it is good business. For a terminal operator, there are tremendous incentives to operate facilities responsibly. Therefore, first and foremost, there must be a commitment to protecting the public, employees, contractors and the environment.

Upholding a company's reputation is paramount. Businesses are judged by how they act. Ethics and integrity can be interpreted many ways, but for Kinder Morgan we sum it up with the rule: treat others how you wish to be treated. This means acting with honesty and integrity in all dealings and doing what is believed to be right at all times within the legitimate role of business.

Another crucial area of ethical operation is the correct management of people. Treating your employees and customers the right way is the only way to do business. No one wants to do business with someone they don't trust. This means keeping your

### Kinder Morgan core principles

These principles are not listed in order of priority, but rather all of them share equally in our current and future success. Following these core principles not only benefits Kinder Morgan terminals and all of our employees, but also ultimately benefits our customers.

1. Do not compromise safety
2. Be an environmentally compliant and responsible operator
3. Have ethics and integrity
4. Show commitment to employees and resources
5. Provide customer service and fiscal responsibility
6. Have a quality focus



Pasadena facility.



Pasadena control room.

word, operating safely and being open and honest in all aspects of your operations.

Providing the resources employees need to do the job correctly the first time leads to less rework, which ultimately leads to lower cost of service. This also means taking care of all the assets necessary to operate efficiently and safely.

### Best value, not cheapest option

Customers want to be treated well and be provided a service in the most cost effective manner. Providing a good service at a fair price benefits employees, customers and shareholders. This does not mean the cheapest option is best for your customer, but it should be the best value. There is no room for short cuts in safety, environmental compliance or ethics in order to win or keep a customer's business.

Our terminals handle many types of customer products in many forms, and our customers expect us to return the products in the same form, same quality and same amount. When a customer's product is damaged, lost or contaminated, it impacts both the customer's business and ours. If our commitment to safety and customer satisfaction suffers enough, customers will find someone else to handle their products.

Not only does quality affect our customers, contaminations can have devastating effects. Depending on the products handled and when the contamination is discovered, a single contamination can become a multi-million dollar mistake. We train employees and provide them with the necessary resources to keep a quality focus at all times.

#### ABOUT THE COMPANY

**Earl J. Crochet**, P. E., is general manager for the Gulf Region of Kinder Morgan Terminals. Mr. Crochet is responsible for the daily operations, maintenance, safety, quality and environmental compliance for three terminals with over 26 million barrels of storage. He joined the company in 1988 as an engineer and has held various positions of increasing responsibility including operations manager, director of field operations for Plantation Pipe Line, and director of operations and EH&S for terminals.

**Kinder Morgan Energy Partners**, L.P. (NYSE: KMP) is a leading pipeline transportation and energy storage company in North America. Kinder Morgan owns an interest in or operates more than 38,000 miles of pipelines that transport primarily natural gas, refined petroleum products, carbon dioxide and crude oil; and approximately 180 terminals that store, transfer and handle such products as gasoline, ethanol, coal, petroleum coke and steel. Kinder Morgan, Inc. owns the general partner interest of

Kinder Morgan Energy Partners. Kinder Morgan Management is a limited liability company and its only significant assets are the partnership units it owns in KMP. Combined, Kinder Morgan has an enterprise value of approximately \$65 billion.

### Another tool – You Can Stop

Another tool our employees can use to implement all six of our core principles is our 'You Can Stop' campaign. This sounds simple, but it is an extremely powerful work culture adjustment. We have empowered all employees – from the newest operator to the most senior executive – to stop any process, activity or person (coworker or contractor) whenever they think something is not safe, out of compliance or has the possibility to become so.



This takes a tremendous amount of faith in our employees. Even when it turns out that the situation is not a problem, just the fact that we are willing to take the time to discuss it sends a powerful message to our employees.

### Results to date

For three years in a row, the number of recordable injuries at Kinder Morgan has dropped because our six core principles and the 'You Can Stop' campaign are part of our culture. Kinder Morgan has also reduced reportable spill volume, and the quantity and severity of significant incidents. We continue to strive to drive all three of these categories to zero and we will not relent until we do.

#### ENQUIRIES

Web: [www.kindermorgan.com](http://www.kindermorgan.com)

# Efficiency from loading to reporting

**Melanie Graf**, PR consultant, CharakterPR, Hamburg, Germany

## Introduction

Mergers are a challenge for any company. If the newly formed company is to act as a coordinated entity, it must integrate all of its processes, systems and databases as quickly as possible. TanQuid GmbH & Co. KG, currently Germany's biggest independent tank terminal operator, was faced with this particular challenge in 2008. At that time, TanQuid was a business created from three newly merged companies with completely different system structures. It was clear what had to be done. The new company urgently needed a standard terminal management system that could draw upon the same data at all of its sites to enable centralized terminal control. A challenging project had begun. TanQuid selected the OpenTAS terminal management and automation system from Implico, a consulting and software company with many years of expertise in this field.

TanQuid was spun off from the VTG-Lehnkering Group as an independent tank storage company. It subsequently expanded with the acquisition of the Petroplus and IVG tank terminals sites. The company now owns 14 tank terminals with storage capacities of between 24,500 cubic meters and 878,000 cubic meters. It operates two further tank terminals on behalf of other companies.

On January 1, 2012, the Transtank joint venture with BP Europa SE was added to the portfolio. Because OpenTAS had been used successfully for many years at the five sites of the former VTG-Tanklager (one of Implico's first customers), it did not take long for TanQuid senior management to decide that OpenTAS was the right solution for their new company too. The way forward was now clear: In the future all of the company's sites would use the same latest release of OpenTAS.

## A uniform data language

Thomas Knutzen, head of IT for TanQuid, remembers the start of the projects well: "We had in fact undertaken to complete three projects in one. We had to consolidate our data, import the new database into a new technical environment and then implement a new release of OpenTAS."

Everyone involved was aware that the different data systems were unable to communicate with each other because they were based on different programming keys. Bernd Marschalk, Implico project manager, adds, "The most important thing was consolidating the data, because without doing that, we would not be able to carry out the system migration."



One tank of the TanQuid GmbH & Co. KG

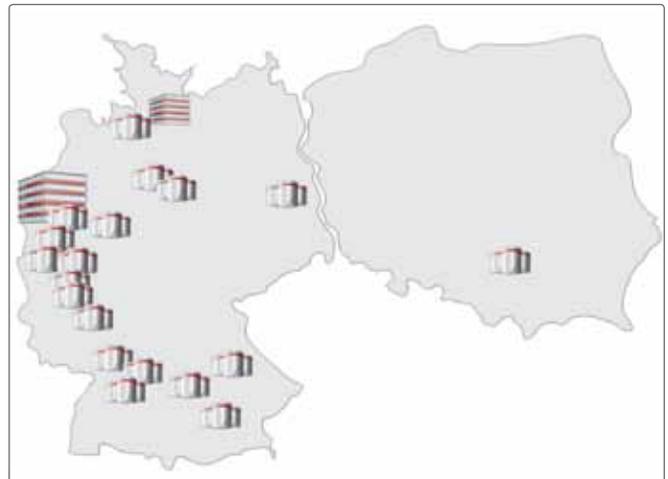
© TanQuid

In the three original companies, all the products, model types, transaction numbers and transaction codes were different. The first step towards building a common database was therefore to extract the data from the three different databases. This data extraction, analyzed in depth, the data in common. The analysis gave an overview of several thousand records. Out of this could be deduced which products were the best sellers and which product numbers had failed to generate any activity for some time. The project team then decided which records they wanted to keep. Specialists at Implico redefined the data keys in order to transfer them to the new system. "This paved the way for importing the master data from its various locations into OpenTAS at each migration date," says Marschalk.

The whole project now focused on bringing all of the processes together and controlling them from a central point. We needed to make sure that the data systems at each site understood the same language. When they look back at this, Knutzen and Marschalk agree that they had set themselves a very ambitious goal. The more the project progressed, the more they began to appreciate its magnitude and complexity. The size of the team grew in size as a result. The team always had to bear in mind that, during the migration project, every change to the system would have consequences that could extend as far as the tank truck driver. It was more than simply a matter of integrating new software. Numerous processes – the logistics chain and working processes, for example – had to be aligned. The customer expected the coherent deployment of OpenTAS to make its processes more efficient and identical at all sites in the future.

## Roll-out in record time

Following the data consolidation, OpenTAS 4.3 needed to be rolled out nationwide, initially at nine TanQuid tank farms. The Salzgitter



TanQuid owns 14 tank terminals and operates two further terminals on behalf of other companies.

site was the first in line. In April 2009, it was the first site to go live with the new OpenTAS release. The other eight terminals followed in close succession. Each terminal had local issues to contend with and therefore faced its own, unique challenges.

"The changeover dates brought their own problems. Migrating data in the middle of the month required particular care to ensure that the data was transferred accurately because we had to keep specific German regulations concerning taxation of energy in mind," says TanQuid's head of IT, Thomas Knutzen. The obstacles were all dealt with, and in April 2010, the harmonization project successfully concluded with the migration of the Berlin terminal. In under a year, the project team had succeeded in converting the nine sites to automatic loading with OpenTAS 4.3 for all modes



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of transport – truck, train, ship and pipeline. At the same time, Implico created a new central database and renovated its entire technical infrastructure.

In separate subsequent projects, oil and gas specialists from Implico converted the Hünxe tank terminal to OpenTAS in November 2010 and more recently, in August 2011, the Neuss 1 depot. As a result, eleven TanQuid sites are now operating with the new release of OpenTAS. They are all integrated in the central database and can therefore be controlled centrally. Three more tank farms transfer their data from a non-OpenTAS system. “A special interface converts this data, allowing entries to be made via OpenTAS and enabling the other system to send the loading data back to OpenTAS,” says Marschalk. This ensures that reporting from this tank terminal to the control center is standardized and comparable.

## Efficient, fast and cost saving

TanQuid gains a number of benefits from the standardized OpenTAS Terminal Management and Automation System. Thomas Knutzen says: “The key benefit is that we manage several sites using a standardized software solution based on a single database. The technical environment is therefore easily scalable to include new sites. Every tank farm submits the same type of data, allowing our headquarters to operate a standard reporting system.”

The tank farm processes and the automated IT background processes are virtually identical at each site. TanQuid customers can use the same customer number at all sites. Individual customer requirements, such as data communication interfaces, can therefore be provided quickly and efficiently at multiple locations at the same time. In addition, TanQuid staff at different sites can collaborate in solving new challenges. Similarly, the period of familiarization needed when moving from one TanQuid site to another is greatly reduced. Using OpenTAS as a standard also means that finding a solution to an error message at one site automatically provides a solution to potential problems at all the other sites.

## Rapid integration of new transport legislation

The first test for the new centralized administration came early in 2011. At around this time, new customs regulations came into force requiring an electronic customs clearance for excisable goods being transported across EU borders. Implico has made provision for these mandatory Excise Movement and Control Systems (EMCS) processes. The electronic customs procedure – from login to validation to logout – is integrated in the loading and shipping process and runs completely automatically in the background.

Thanks to its extensive use of OpenTAS, TanQuid was able to introduce the EMCS functions centrally in a single step. There were only a few exceptions where separate integration was necessary due to local conditions. “We are very pleased with the quick and painless integration of EMCS. The previous TanQuid environment would have required solutions for three different systems,” says Thomas Knutzen.

Since the beginning of 2012, the transportation of excisable goods within Germany has been subject to the EMCS regulations. Implico has also integrated the necessary EMCS processes in OpenTAS for the TanQuid tank terminals.

## A partnership for the future

The next migration will take place outside Germany. The Radzionkow tank farm in Poland is a TanQuid subsidiary that still works with a separate database and an older version of OpenTAS. The project for switching to Release 5.0 of OpenTAS, which has been the available since January 2012, has already started and is expected to be completed by April 2012. In Germany, Speyer is the only terminal not yet linked to OpenTAS and it is expected to make the switch in 2012/13. The new release will be integrated over the medium to long-term into the three tank terminals with interface functions in Koblenz, Plochingen and Neuss 2.

## Summary

Together, Implico and TanQuid have achieved their goal and turned three companies with different systems into a single group with a coherent terminal management and automation system. The successful changeover has brought two key benefits: the data at the different storage terminals is comparable and can be managed centrally, and each individual site has gained from having the fully automated OpenTAS solution. One of the key reasons for this success was the way the team members from two different companies were able to build a capable project team. Project and IT manager Thomas Knutzen from TanQuid summed up his three years working on the project: “I must admit that we were surprised by the complexity of the project at first. But we grew into a great team, learning something new each time we tackled a different site. The final migrations went like clockwork.”

## ACKNOWLEDGEMENT

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### ABOUT THE AUTHOR

**Melanie Graf** works as PR consultant. Her agency CharakterPR is focused on port industries, logistics, IT and finance. She studied economics and worked for several years as a PR manager at a bank and at an international port operator.

### ABOUT THE COMPANY

As an international consulting and software company, **Implico** supports oil and gas companies worldwide in optimizing their business processes. The company was founded in 1983. Headquartered in Hamburg, Germany, the Implico Group has subsidiaries in the UK, Malaysia, Romania, Switzerland and the US. Five of the world's ten largest oil companies now rely on Implico's industry experience, consultancy expertise and high performance solutions – including OpenTAS, SAP OGSD (SAP Oil & Gas Secondary Distribution) and IDM (Integrated Dispatch Management). The fast growing Implico Group currently employs around 250 staff.

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# Fire protection of ethanol storage facilities

Henry Persson and Francine Amon, SP Technical Research Institute of Sweden, Fire Technology Department, Borås, Sweden

The use of ethanol has increased significantly in many countries as a means to fulfil climate goals by replacing fossil fuels with renewable fuels. However, the introduction of ethanol fuels creates new risks and challenges from a fire protection point of view. SP Fire Technology, together with the Swedish Petroleum and Biofuel Institute (SPBI), has taken the initiative to develop a proposal for a research project on ethanol tank fire fighting – ETANKFIRE. The goal of the project is to develop and validate a methodology for fire protection and suppression of storage tank fires containing ethanol fuels and to determine the large-scale burning behaviour of ethanol fuels to ensure proper investment in the fire protection of ethanol storage facilities.

## Background

The EU has a goal of replacing 20 percent of vehicle fuels with renewable fuels by the year 2020. Similarly, in the US, the use of ethanol fuels has increased dramatically during the last decade and this trend is expected to continue. The obvious consequence of increasing the volume of low blended ethanol is that the volume of bulk ethanol transported, handled and stored will increase dramatically in coming years. The volume of the storage tanks is also increasing, setting fire fighting operations a significant challenge. On top of this, experience with fighting storage tank fires involving ethanol or other water miscible fuels is very

limited. There are a few known ethanol tank fires but these fires have resulted in burn out rather than extinguishment.

## Differences between ethanol and gasoline

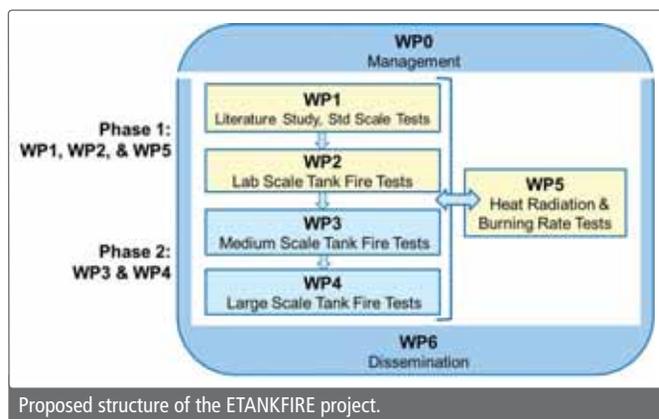
The burning behavior of a large-scale ethanol fire might be significantly different from a petroleum fire and this difference is further complicated by the fact that the size of the fire has an impact. Experience from small-scale fires shows that radiation from an ethanol fire is lower than that from a gasoline related fire. However, there are indications that the opposite may be true in a large-scale fire. Such observations were made during the Port Kembla ethanol tank fire. One consequence of this phenomenon could be an increased risk for escalation and an increased complexity in fire fighting operations due to higher heat exposure of personnel and equipment.

The most important difference from a fire extinguishing perspective is that ethanol is a water miscible fuel. The potentially large fuel depth in a storage tank fire means that the dilution effect from the foam or water solution may not contribute to extinguishing the fire, as it might be during a spill fire situation. Some test data concerning foam fire fighting of ethanol fuels and other water miscible products are available, even for reasonably large-scale scenarios, but they all represent spill fire conditions.



Photo: NSW Fire Brigades

Ethanol tank fire in Port Kembla, Australia, 2004. The tank was about 32 meters in diameter and contained about 4000 cubic meters of ethanol. Extinguishing attempts were started after 30 minutes using AFFF-AR foam but extinguishment was not attained for about 20 hours, at which point the ethanol was diluted to about 10 percent.



Knowledge is lacking concerning how to extinguish tank fires containing water miscible fuels. Storage tank fires are usually extinguished using large capacity foam monitors. In practice this means that gentle application is not possible and extinguishment cannot therefore be expected. In most situations, the pre-burn time will also be longer than that expected in a spill fire, thereby increasing the temperature of the fuel and creating hot steel surfaces, making extinguishment even more difficult. Based on this, existing test data from large-scale tests and standardized test results cannot be easily extrapolated to ethanol tank fire scenarios.

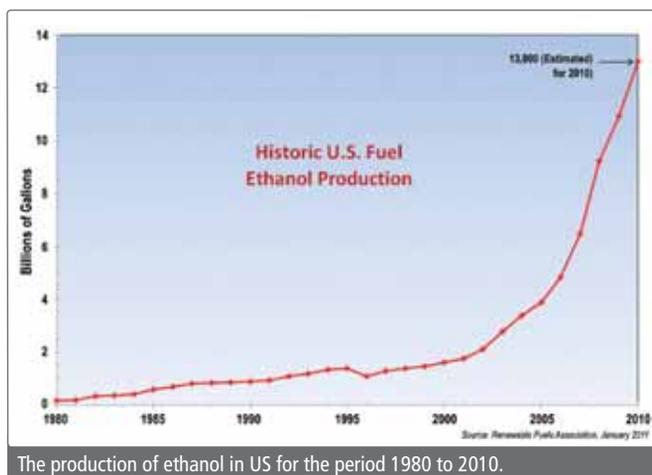
## Evaluating both conventional and non-conventional extinguishing techniques

The main goal of the ETANKFIRE project is to provide a platform of knowledge ensuring proper investment in the fire protection of ethanol storage plants. This work will involve acquiring science based information regarding the large-scale burning behavior of ethanol fuels and the development and validation of a methodology for fire fighting of tank fires containing ethanol fuels. In order to achieve this goal, it will be important to understand the differences between conventional suppression of spill fires versus tank fires involving water miscible fuels.

The project plans described below form the basis for discussions and detailed planning which will be made by a steering committee comprised of the funding stakeholders when the project is launched. The technical work will be divided into five work packages, WP1-WP5, which in turn will be divided into two phases. Phase 1 will include WP1, WP2 and WP5 while WP3 and WP 4 will be conducted during Phase 2 of the project.

The first part of WP1 will focus on a literature review in order to identify existing test data and experience from real tank fire incidents. The second part of WP1 will provide a connection to existing knowledge and standard performance requirements for fire fighting foams by conducting extinguishing tests in 'standard-scale'. The tests will provide information about the influence of fuel depth, pre-burn time, and various ethanol fuel mixtures.

WP2 will involve extinguishing tests simulating a small-scale tank fire using input from WP1 to specify the test conditions. The test configuration will allow a significant fuel depth and prolonged pre-burn time. The purpose is to examine various conventional extinguishing techniques based on the use of fire



fighting foam (low, medium, high expansion foam, CAFS and various application methods) and non-conventional extinguishing media or methods, such as liquid nitrogen or the use of 'solid foams' (granulates or spheres made of foam glass or other spherical, non-combustible materials).

The intention of WP5 is to determine the burning behavior (heat radiation and burning rate) of ethanol fuels under large-scale conditions. These tests will provide valuable data to validate various commercial computer programs for the calculation of heat exposure from pool fires and tank fires, as such experimental data is lacking. The fire area will be about 250 square meters and the amount of fuel sufficient to ensure a full intensity fire for 10 to 15 minutes.

The detailed planning of Phase 2 (WP3 and WP 4) will be conducted when the results from Phase 1 has been evaluated. The tentative plan is that the tests in WP3 will be performed in a medium-scale tank fire setup, with a preliminary fire area of 30 to 40 square meters. The aim is to verify the results for the most promising extinguishing techniques used in WP2 and to demonstrate that the selected extinguishing media, application technique and application rates are providing the expected results in a scaled up situation. WP4 involves a tank fire test in large or full-scale. Whether WP4 can or should be realized will depend heavily on the evaluation of the results and experience from WP1-WP3. The main goal of the test in WP4 is to verify the most promising extinguishing technique from the tests in WP3 under real-scale conditions.

## Phase 1 of the project

At the present time, funding for Phase 1 is secured from three partners; a number of other stakeholders have indicated a clear interest in participation. The project will be launched when we have four partners. Based on a preliminary budget, ten full partners contributing €50, 000 (around \$67,000) each would be required to complete Phase 1 of the project. The aim is to start the experimental work during summer 2012. Those that join the ETANKFIRE project, can take an active role in the detailed planning of the test program, witness some of the tests and get information of test results first hand.

### ABOUT THE AUTHORS

**Henry Persson** and **Francine Amon** work at SP Technical Research Institute of Sweden at the Fire Technology Department.

Mr Persson has over 30 years of experience, mainly with testing and research in fire extinguishing media, systems and industrial fire fighting.

Dr Amon has degrees in environmental and chemical engineering and has 14 years of research experience in fire suppression and fire fighting technology. She also has served on NFPA technical committees related to fire fighting equipment.

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# VTS, NAVIGATION, MOORING AND BERTHING



“Unscheduled downtime is costly, not only in terms of reduced throughput and revenue, but also in terms of managing relationships with shipping lines. There is a need within the market to develop innovative solutions to combat this issue of unscheduled downtime in ports.”

‘Innovation to reduce downtime’, page 123.

# Innovation to reduce downtime

**Richard Hepworth**, managing director, Trelleborg Marine Systems, Singapore, Malaysia

Industry survey, the Barometer Report 2 from Trelleborg Marine Systems, has revealed that eight out of ten ports suffer from unscheduled downtime and, of these ports, almost half are down for approximately 10 percent of the time.

The findings reflect a similar position to that of the previous year, when the report was introduced. The fact that the industry is not getting to grips with these surprisingly high levels of downtime is a concern. Unscheduled downtime is costly, not only in terms of reduced throughput and revenue, but also in terms of managing relationships with shipping lines. There is a need within the market to develop innovative solutions to combat this issue of unscheduled downtime in ports.

## Fender load monitoring

Trelleborg are always working to develop new and innovative systems that will help ports to operate more efficiently and are pleased to have recently received patent pending status on a system for monitoring the load on marine fenders, which can be used to measure both the impact on fenders when a vessel berths, and the ongoing force applied as the vessel continues to bear against them whilst docked.

The data collected by this system could prove to be invaluable to ports and harbors all over the world in terms of avoiding disputes and the costly downtime associated with insurance claims. One key advantage of the system is that it can be adapted to suit the needs of the environment it is located in – the market needs bespoke solutions to improve efficiencies and minimize downtime.

Trelleborg have designed the system to be flexible and to align with the needs of the port: data can be processed, communicated and transmitted through either wire (for example, copper wire or optical fiber) or through wireless means, whichever is more suitable for the environment that the device is to be located in.

Additionally, the data collection device itself may be located either directly within the fender, on the structure (jetty), or at a remote location, depending on the needs of the customer. If more than one fender is providing load sensing data, this can be transmitted to a central data collection and processing system. The system is also apt to be retrofitted into existing fenders.

Once the central system receives and processes the data, it is configured to automatically transmit real time data. Alternatively, data can be stored on a dedicated memory, and periodic transmissions made to the central system.



A marine fender load monitoring system can be used to measure impact when a vessel berths and the ongoing force applied as the vessel bears against the fenders whilst docked.



The data obtained has the potential to be used in a number of ways, such as developing a deeper understanding of berthing dynamics.

This central system can also be configured to receive other relevant data which may affect the load sensor data, for example, environmental or visibility information. There are a number of existing products that can be used to compliment the marine fender load monitoring system and gather this additional data.

When analyzed, the data obtained has the potential to be used in a number of ways, such as developing a deeper understanding of berthing dynamics, which in turn could assist with future fender and wharf design, and further, feed into the revision of safe and acceptable berthing operations and procedures.

Additionally, load data may be used to determine when maintenance is needed, or indeed, a replacement fender is required. In the event of an accident, or a fender failing, the data can be used to provide information as to why – providing valuable data for insurance claims, and helping ports and shipping lines to avoid the costly downtime associated with disputes.

## Fender maintenance

90 percent of Barometer Report respondents also believed that maintenance is an important or critical consideration when upgrading port operations, so we are working to reduce downtime in ports and harbors during scheduled maintenance, by developing systems aimed at improving ease of maintenance.

Increasingly, Trelleborg have been providing turn key solutions for fender systems and, as such, tend to get more involved in the design of accessory products, including fabricated steel maintenance platforms, which are complimentary to the core fender system.

For ports, unplanned maintenance equals unscheduled downtime and a significant hit to the bottom line. So, it's important to work with suppliers that have the perfect blend of expertise in the areas of design, testing, manufacturing and aftercare service. Low maintenance solutions can come at an additional upfront cost, but there is no room for cutting corners when dealing with mission critical equipment – in the long run it will prove to be a false economy.

### ABOUT THE AUTHOR

**Richard Hepworth** is a qualified mechanical engineer (University of Manchester, UK) and the current managing director at Trelleborg Marine Systems. Richard is a veteran of the engineering sector having worked in a number of roles both within Trelleborg Group and externally, including sales, business development, marketing, strategy and senior management.

### ABOUT THE COMPANY

For over 30 years, **Trelleborg Marine Systems** has designed, manufactured and installed tailor made berthing, docking and mooring products for ports all over the world. The company employs over 250 people in 14 locations around the globe.

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## Shipping never stops and neither can you if you want to keep your clients happy.

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For the very best solutions in Fender Systems, Offshore Integrated Mooring, Docking and Mooring and Marine Protection make certain with Trelleborg Marine Systems.

# Ever larger ships need pilots more than ever

**Nick Cutmore**, secretary general, International Maritime Pilots' Association, London, UK

## Introduction

Maritime pilots provide an essential and unique service to the shipping industry. Their principle role is to:

- provide critical independent local knowledge and navigational information to vessels;
- bring the highest level of ship handling skills to maneuver vessels within their port.

The prime obligation of pilots is to provide a critical public safety service by ensuring the careful management and free flow of all traffic within their pilotage area, thus protecting the environment. Pilots need to be able to exercise their professional judgment undeterred by commercial or economic pressure. Pilotage is an essential part of a port's safety management system, and compulsory pilotage is considered to be the most effective and important form of navigation safety regulation.

Pilots come aboard vessels by small boat or helicopter at the most critical phase of a vessel's voyage to assist with the conduct of navigation in waters with limited draught, widths, variable currents and other traffic competing for space. Ship's masters cannot be expected to be fully conversant with the special navigational and regulatory requirements of an area.

Pilots also bring highly developed ship handling skills which are necessary with ever larger ships and they bring the local communications knowledge necessary to work with local services, such as tugs and linesmen. A pilot's training is of necessity long and thorough, given the value of ships and their cargoes.

## The International Maritime Pilots' Association

The International Maritime Pilots' Association (IMPA) is the voice of professional maritime pilots worldwide. From its inception in 1970, it has striven relentlessly to promote the best practicable standards of pilotage, in the interests of safety and protection of the environment, through the safe conduct of navigation.

Maritime pilots provide an indispensable service to the shipping industry. IMPA seeks to support them in this challenging task, by acting as a focal point for discussion among peers wishing to share their specialist knowledge and experience.

In addition, by representing the professional interests of its membership, the association provides important links with different interest groups, both at industry and government level, advising other maritime practitioners and regulators on specific matters of shipping safety from the operational perspective of maritime pilots.

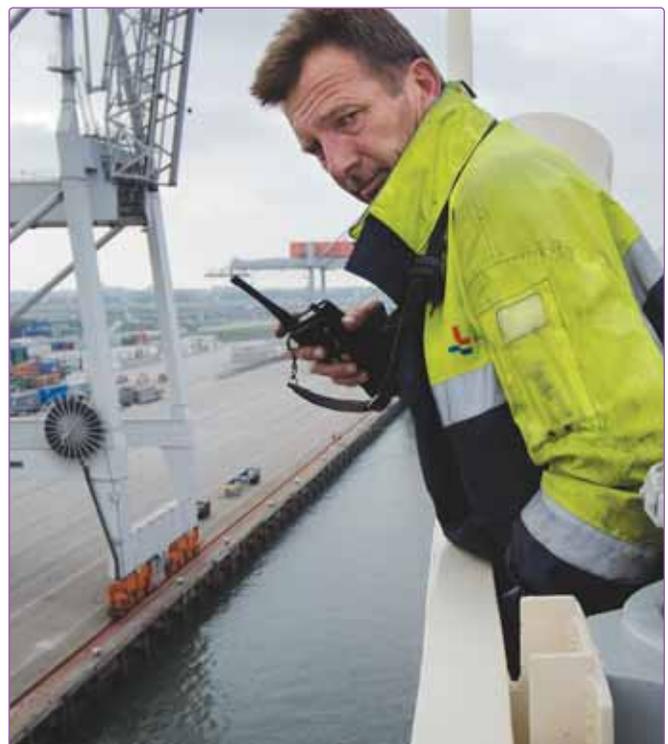
In this role IMPA is not only able to contribute to critical debates and to influence outcomes. It is also well placed to endure that maritime pilots are valued for their unique role in aiding the efficient movement of vessels as this pertains to local areas and impacts on their unique conditions.



Pilot boarding in Brazil.

Pilots normally enter the profession after a career at sea and learn their new trade mostly by mentoring from a qualified and experienced pilot. This is typically supplemented by simulator training and model training. Thereafter, training continues on a constant basis to maintain skills to the very highest degree.

The master and pilot relationship is an intriguing balance of mutual trust and respect, largely unwritten, which provides an unrivalled level of safety in a society that expects, and receives, the



Berthing in Rotterdam.

Photo: Theo v. Pelt



A long way up!

highest of standards from the shipping industry. Marine pilots are handling ever larger vessels, often in harbors, rivers and canals that have hardly changed over the years.

Professional pilots provide a unique service indeed, thanks to their local knowledge and technical expertise in handling different types of ship under the prevailing circumstances in a given area. Whether this service is performed in coastal waters, estuaries, rivers, ports, harbors, lakes, enclosed dock waters or any combination of these areas that may come within the jurisdiction of a port or other competent authority, it requires energetic and resourceful people with well developed skills and sound judgment. Their ability to respond quickly and effectively to unique conditions is absolutely essential to ship masters, who cannot be expected to be fully conversant with the special navigational and regulatory requirements in the pilotage area.

## ECDIS

IMPA has two issues concerning ECDIS. Firstly, with mandatory carriage due in 2018 for most of the world's tonnage, pilots as a profession have to be well advanced in thinking about training. There is an IMO model course, 1.27. This document is helpful but does deal with the topic in a generic way. We have to remember the wide range of equipment manufacturers (over 30) that are available. Pilots cannot be trained on every ECDIS type any more than they can with radar sets. 1.27 also deals a lot with ECDIS data entry which is not a pilot's responsibility.

Our second concern is the accuracy of data on ECDIS. Like a laptop, ECDIS relies on software. Old software, which has not been updated by the manufacturers, can be dangerous. Some manufacturers do not create ENCs as good as they could be, owing to the way the data is processed. Therefore we ask pilots to treat ECDIS data like everything else they use, be it a buoy, GPS, radar, AIS or indeed a paper chart.



Another typical day for a Dutch Pilot.



Master and pilot consulting with the ECDIS.

There are operating ‘anomalies’ with ECDIS. Yes it’s type approved and data is tested, but it must be constantly updated. It has to comply with regulations (IMO performance standards, amongst others) when initially installed, but, if a ship changes hands, you could have an ENC display that is maybe six years old. Port State Control currently have no methodology to assess ECDIS software for compliance with SOLAS.

IMO do recognize these problems and they have issued to all administrations, MSC Circular 13/91. These anomalies can include:

- Inadequate depiction of shoal water
- Incorrect display of obstructions
- Incorrect display of wrecks
- Incorrect display of light sector arcs

Now IHO in Monaco has cautioned about ECDIS equipment, especially about early model ECDIS made by a specific named manufacturer. IMPA has issued a circular about training and operation of ECDIS; this is on the IMPA website. Its purpose is to give guidance about both training and operational issues from a pilotage perspective.

Pilot’s uneasiness about ECDIS has resulted in the use, by many pilots, of portable pilot units (PPU) which carry aboard laptops loaded with port specific entry data, including the very latest hydrographic data.

## Pilot safety

IMPA has been working at IMO since 2006 to improve the current SOLAS arrangements in Regulation 23 regarding boarding arrangements. IMO’s Assembly in November 2011 adopted new boarding arrangements which will become mandatory in July 2012.

### ABOUT THE AUTHOR



**Nick Cutmore** was appointed secretary general of IMPA in July 1999, following 24 years at Trinity House, the Lighthouse and Pilotage Authority in London. At IMPA he has overseen a growth in membership and activity in the past 12 years including the adoption by IMO of Resolution A960 (Standards for Training and Certification and Operational Procedures for Maritime Pilots other than Deep-Sea Pilots) and the introduction this year of improved SOLAS standards for pilot boarding.



Pilot boarding off the French coast.

In our opinion, the most significant issue is not to do with hardware but is actually the acknowledgement that the pilot ladder is a part of the ship’s safety equipment. The impact of this is that there is now no ambiguity. Defective ladders will be reported to PSC and non-compliance will lead to detention. IMPA has revised the wheelhouse poster and this will be approved by IMO’s Maritime Safety Committee in May 2012.

## Bridge standards

For many years pilots have been the subject of criticism from a small body of detractors. We are constantly confronted, at IMO and in other places, with figures dressed up as facts. The executive of IMPA have always been concerned about the deteriorating standards on board ships that pilots are called upon to conduct. IMPA wanted to measure the standards on those bridges and to this end conducted a campaign in 2011 asking just 11 yes or no questions of its members, such as: “Did the captain stay on the bridge during the passage?” and “was a competent helmsman provided?” The response was overwhelming. We had 14,000 replies, covering just eight weeks, which is statistically a very good basis for getting a good picture of what conditions on ships’ bridges are like. The results will soon be used to inform debate at IMO.

## Competition

On the wider political stage, IMPA continues to monitor further attempts by the EC to mandate for competition in pilotage services, despite all the evidence presented that competition bizarrely drives up costs (as recently demonstrated in Denmark) and leads to increasing levels of accidents (as demonstrated in Argentina and one part of Australia).

### ENQUIRIES

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# FLNG – huge growth planned through to 2018

Lucy Miller, analyst, Douglas-Westwood, Canterbury, UK

## Introduction

Douglas-Westwood has been tracking the FLNG sector, its vessel designs and concepts for three years and presents forecast capital expenditure for the next seven years in the latest edition of its *The World FLNG Market Report*. Douglas-Westwood forecasts capital expenditure over the period of 2012 to 2018 will total \$29 billion.

There are two main sectors that form the floating LNG industry:

- **Floating liquefaction** – a specialized floating production, storage and offloading vessel with LNG liquefaction topsides (LNG FPSO). Other hull types, such as semi-submersibles and spars, have been suggested
- **Floating regasification** – this can take place on a vessel located either offshore or alongside. There are two main types of floating regasification vessels – floating storage and regasification units (FSRU), which remain stationary on location, or regasification vessels (RV), which can also act as LNG carriers

It is important to note that at present there is no industry standard definition of FLNG. Many sources that refer to FLNG simply mean LNG FPSOs, while others consider FSRU as an umbrella term to include all types of floating regasification vessels.

Parties looking to progress FLNG developments include both the vertically integrated majors such as Shell and smaller independent service providers, including Flex LNG, Høegh LNG, and SBM Offshore.

## Floating liquefaction

The key drivers of the floating liquefaction sector are the desire to monetize stranded offshore gas fields and the relative costs of an onshore liquefaction terminal. A modular design allows the FLNG vessel to be built in lower cost environments then towed to location. Positioning the liquefaction facility on field reduces the requirements for costly upstream facilities and long pipelines to shore which would be required for an onshore development.

While principally aimed at offshore gas reserves, floating liquefaction has also been considered for onshore fields, with projects in Papua New Guinea and Western Canada in development.

### Design challenges

The vast majority of systems on a floating liquefaction vessel will be the same or similar to those used on conventional oil producing FPSOs. There are, however, various equipment designed or adapted specifically for these vessels:

- Insulated storage tanks, which need to utilize a specialized LNG containment system that is sloshing resistant.
- Topsides modules that include gas pre-treatment and liquefaction processing equipment.
- Offloading cryogenic liquid offshore in difficult sea conditions is a potentially hazardous task. Much research has been put into the development of safe and efficient offloading systems for LNG FPSOs.

### Prelude development

Shell is currently developing two floating liquefaction design concepts: a large-scale generic facility which is expected to be able to produce around 3.6 million tonnes per annum of LNG and a smaller facility of around 2 million tonnes per annum.

In July 2009 it was announced that Samsung Heavy and Technip had won the contract to design and construct up to ten of Shell's 3.6 million tonnes per annum units, the first of which will be used Australia from 2017 on the Prelude development. Other possible locations for both sized vessels include Egypt, West or East Africa, Indonesia, Iraq and Venezuela.

### Containment system

Shell will utilize an adapted version of GTT's membrane design which is used on a large number of LNG carriers and regasification vessels. In this membrane system, prismatic shaped LNG tanks are fully integrated into the hull and effectively form an inner hull, within which the containment system fits.

By introducing two rows of tanks, the liquid motions in the tanks are significantly reduced and resonance between the liquid motion and ship motion avoided. This reduces the risk of sloshing related damage to an absolute minimum.

### Liquefaction processing technology

The Prelude vessel, measuring 488 by 74 meters, is the world's largest offshore floating structure. Prelude's liquefaction process trains will use Shell's dual mixed refrigerant (DMR) technology. The design makes use of two compressor strings, which ensures that if one compressor fails, the whole train does not stop – it can continue running at a reduced capacity. The first application of this technology in a baseload LNG terminal was the Sakhalin II project in Russia.

### Leasing

Under Prelude's business model, the feedstock owner, Shell, will operate the floating liquefaction vessel and be responsible for obligating any contractual arrangements with offtakers. While this is likely to form the business model for large integrated companies such as Shell, other operators are looking to leasing in order to spread risk.

Under the leasing model, the owner of the LNG FPSO does not own any rights to the feed gas or the LNG as it is processed, liquefied, and stored. Instead, the leasing contractor receives a fee for providing the services.

TABLE 1: PRELUDE STATISTICS

Size:	488 by 74 meters
Displacement:	600,000 tonnes
LNG capacity:	3.6 million tonnes per annum
Condensate capacity:	1.3 million tonnes per annum
LPG capacity:	0.4 million tonnes per annum
Storage:	220,000 cubic meters
Field (s):	Prelude, Concerto, Cruz
Water depth:	250 meters

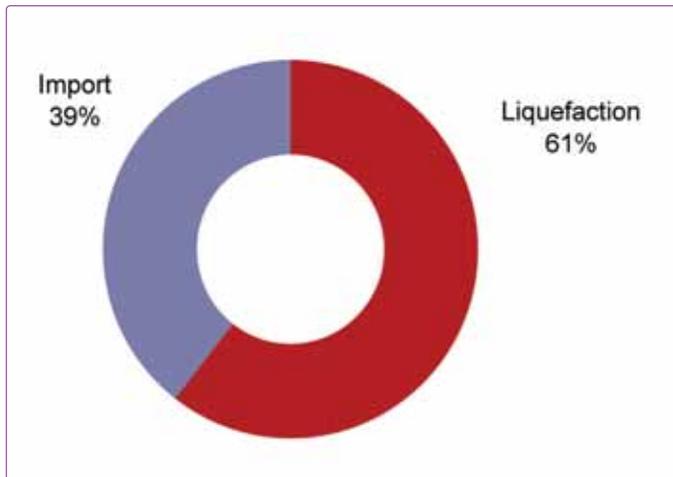


Figure 1. FLNG Capital expenditure by type.

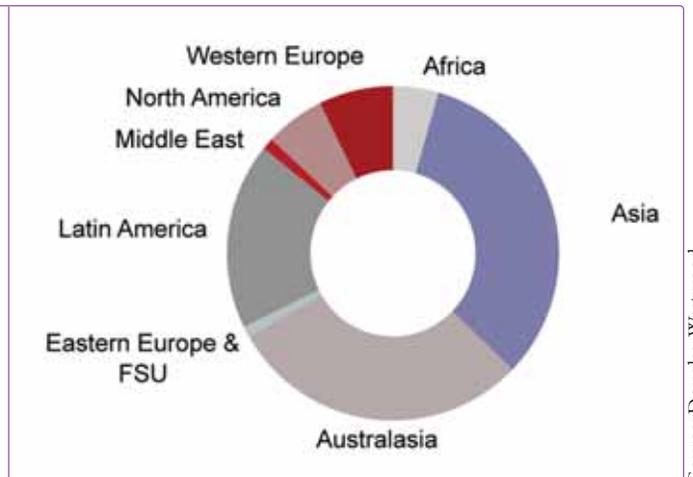


Figure 2. FLNG Capital expenditure by region.

Source: Douglas-Westwood

Leasing is extremely common in the conventional FPSO sector and there is considerable scope for crossover within the FPSO and floating liquefaction leasing sectors. Companies involved in both sectors include SBM Offshore and Teekay.

Leased LNG FPSO designs differ from Prelude in the following ways:

- Smaller physical size
- Smaller liquefaction capacity – most of the designs range between 2 and 3 million tonnes per annum. This compares to Prelude’s 3.6 million tonnes per annum of LNG, plus condensate and LPG
- Simpler liquefaction technology – nitrogen expander or single mixed refrigerant compared to Shell’s double mixed refrigerant

Correspondingly these vessels are expected to have lower capital cost than Prelude, which has been estimated at around \$3 billion.

## Floating regasification

Floating regasification vessels are the most developed form of floating LNG system and there are currently nine such facilities in operation worldwide. These are located in Argentina, Brazil, Dubai, Kuwait, the UK and the USA.

Floating regasification is proving popular with LNG developers for the following reasons:

- **Shorter lead times** – the construction times for floating regasification vessels are considerably shorter than for onshore terminals
- **Temporary fixtures** – floating regasification vessels can be used as temporary terminals, either as an initial phase before the start up of an onshore terminal or for periods of peak demand. These vessels can easily be moved from location to location
- **Cost** – for small to medium sized volumes, floating terminals are often cheaper than the equivalent onshore development

The floating regasification market is set to increase rapidly over the next decade as more countries utilize the technology. The cost and construction time advantages are proving alluring, even in countries such as India and China, which have traditionally favoured onshore development solutions. Indonesia, with its stranded gas fields and rapidly growing cities, is a focus for both floating liquefaction and regasification terminals.

## Market forecast

Historically, the global FLNG market has only consisted of import terminals; however, this is expected to change over the next seven years. As capital expenditure associated with floating liquefaction vessels is more than triple that associated with typical floating import terminals, liquefaction vessels are expected to dominate global capital expenditure over the 2012 to 2018 period, with \$29 billion expenditure forecasted (see Figure 1).

Asia, which is a focus area for both floating liquefaction and regasification, is expected to account for a third of the forecast capital expenditure (see Figure 2). There are two key floating liquefaction projects in this region – Petronas FLNG and Inpex’s Abadi development, the former of which has recently been sanctioned.

Australasia was the first region in the world with an approved FLNG liquefaction project – Shell’s Prelude floater. Offshore gas fields and deep subsea trenches such as the Timor Sea Trench make this region a key focus area for floating liquefaction project developers.

Many Asian countries are considering floating regasification vessels in order to import gas to rapidly growing cities. Even China, which has traditionally advocated onshore terminals, is considering positioning a series of vessels along its coastline. Future floating regasification capital expenditure from this region is likely to come from countries such as Bangladesh, China, India, Indonesia, Pakistan and Vietnam.

### ABOUT THE AUTHOR

**Lucy Miller** has conducted market analysis on a variety of Douglas-Westwood’s commissioned research projects for clients in the oil and gas sector, as part of commercial due-diligence and published market studies. As the lead author of Douglas-Westwood’s published market studies, ‘The World FLNG Market Report’ and ‘The LNG Market Report’, Lucy has considerable knowledge on the sector. Lucy has also completed a number of LNG related research projects for clients including equipment manufacturers and suppliers and major contractors.

### ABOUT THE COMPANY

Established in 1990, **Douglas-Westwood** is an independent employee owned company and the leading provider of business research and analysis, strategy and commercial due diligence on the global energy services sectors. They have offices in London and Canterbury (England), Aberdeen (Scotland), Singapore and New York (USA) and to date have completed more than 750 projects to clients in 70 countries.

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# Training and certification of VTS personnel

**Sergey Rostopshin**, head of VTS center, Port of Saint-Petersburg, Saint-Petersburg, Russia and **Dmitry Rostopshin**, senior project manager, development department, Transas Marine International, Askim, Sweden

The intensity and responsibility of the job of VTS operator in large seaports could be easily compared with a job of air traffic controller. VTS operators perform their duties 24 hours a day, controlling traffic in the port or on approach, preventing dangerous situations, collisions, grounding of vessels and oil spill accidents. Decisions are made within a short period of time and require full information.

Despite of the importance of VTS operators' work, if we surveyed the general public, asking: "Do you know this profession?" – thousands of people would answer yes for air traffic controllers and only few people will know who VTS operators are. There was not that much attention paid by maritime government organizations to this occupation. Fortunately, in recent years the situation has changed, with the support coming from international organizations.

VTS at the Port of Saint-Petersburg has a long history of VTS operations. At the moment, the VTMIS of the Port of Saint-Petersburg consists of a coastal VTS center, two port VTS centers and a VTS center in the new passenger port. There are 60 VTS operators working in the port, providing services like information, traffic management and navigational assistant services, according to IALA classifications.

## VTS efficiency

In mid 1990s, statistics of VTS usage in world's largest seaports showed that despite significant expenses for the establishment and running of VTS, costs were far outweighed by VTS's contribution to the safety of navigation and environmental protection. VTS efficiency can be estimated through a comprehensive approach, which stipulates not only a comparison of VTS operation expenses, with profit from navigational charges and taxes, but also takes into account the potential loss, which may occur in the case of an absence of VTS in the port. In practice, VTS is considered to be profitable if it decreases the number of accidents in the VTS responsibility area by 50 percent. In fact, VTS operated by professional and properly educated staff could provide much more advantages.

## VTS training regulations

The VTS institution itself is quite young. This explains the fact that training of VTS personnel for a long time hasn't been subject to any international standard. Some competent authorities have defined some local standards, according to their national



Control of vessel movements in the port.



Port of Saint-Petersburg VTS Control Centre.

regulations. However, this practice has raised inconsistencies in determining when VTS operators are considered competent enough for unassisted duties.

Taking this into account, in 1997 IMO issued resolution A.857(20) containing general principles of the recruitment, training and qualification of VTS operators. At the same time, standards for training and certification were developed by IALA, according to decision taken at the 8th International VTS symposium (Rotterdam, 1996). These standards were issued in 1998 and approved by IALA council as IALA Recommendation V-103.

The main principal declared by the Recommendation V-103 is a necessity for VTS staff to get necessary qualifications, proved by certificate, before they can be appointed as VTS operator or VTS supervisor.

## VTS training

The recruitment process should include tests, medical inspections and should demand professional qualifications from applicants. According to resolution A.857(20), candidates are not required to have nautical education. In this case it is recommended to provide additional lectures to let trainees acquire minimal nautical knowledge (such as navigation, vessel construction and control and port operations). Together with professional knowledge, it is very important to take into account personal skills and the psychological portrait of the person.

The general training program is defined in the IALA document V-103/1 VTS Operator Basic Training. The certificate is issued by a competent authority or institution. However, certificates don't guarantee that a VTS operator is ready to take over unassisted duties, due to the fact that various VTS centers have different areas of responsibility, different regulations and their own peculiarities, which are not covered by basic training. This is the reason why before getting access to the system, the operator has to undertake additional training at the workplace. This training is carried out by a qualified instructor of a VTS center. Such training is described in the V-103/3 VTS On-the-Job Training.

IALA Recommendations suggest five levels of competence for the on the job training (level one being the lowest and five the highest). A VTS operator is required to be at level one to four, and VTS Supervisor – at level three to five. Duration of the on the job training is not defined by standards and is based on the instructor's experience, depending on the VTS complexity and trainee's skills. VTS management is authorized to define duration of training,

define training plans according to each particular VTS and organize tests or interviews after the completion of the training. Training records are registered in a certification book, proving access to unassisted duties. The certification book is an additional document to the VTS operator certificate. It contains the name of operator, certificate details, records about on the job training or additional and advanced courses, regular assessments (recommended by IALA) and breaks of the VTS operator duties for more than three months.

On the job training in the Port of Saint-Petersburg usually starts right after employment, in parallel with basic training. Upon successful test completion, a VTS operator is allowed to work as an unassisted duty operator. Reattestation is carried out every five years. Every VTS operator should pass additional annual assessments under the control of VTS Supervisor.

The term VTS Supervisor was also suggested by IALA V-103 recommendations. Besides supervision itself, this person is also in charge of activities coordination between other VTS systems, authorities and services. A VTS Supervisor is a certified VTS operator, who has passed extended VTS supervision training,

including on the job training with corresponding records in the certification book. Extended VTS supervisor training is provided by accredited training centers. The training program is advised in IALA Model Course V-103/2 VTS Supervisor Advancement Training.

On the job VTS supervisor training has to be provided by a VTS instructor qualified as a VTS supervisor. On the job VTS operator training could be provided by an instructor qualified as a VTS operator or VTS supervisor with good training skills, high level of knowledge and expertise in VTS center operation (minimal required experience is defined by the competent authority). The VTS instructor is responsible for staff training and further evaluation of competence. IALA V-103/4 VTS On-The-Job Training Instructor recommendations define specific goals of such training.

## Conclusion

Summarizing all above, it is important to underline that the proper qualified training of VTS personnel is the fundamental step in creating efficient, safe and reliable vessel traffic services in the port.

### ABOUT THE AUTHORS



**Sergey Rostopshin** graduated from navigational department of the Saint-Petersburg State University of Water Communication. After sea going service in Russian and Dutch shipping companies, he continued working ashore in the Port of Saint-Petersburg VTS as operator. After few years Sergey was promoted to position of the VTS supervisor. Today, Sergey is the head of the VTS Center.



**Dmitry Rostopshin** works in Shore Based Systems department of Transas Marine, since 2000. He is in charge of development and installation of VTS systems around the world. He holds the position of the senior product manager in the development department. He is also a PhD student in Novorossiysk Maritime Academy.

### ABOUT THE COMPANY

**Transas** is a global player on worldwide VTS market, well known for its high end professional solutions in vessel traffic management, coastal surveillance and security provision. Over 160 vessel traffic management systems have been successfully installed in 55 countries.

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### Search & Rescue

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# Fewer books on the bridge, more information

**Ben van Scherpenzeel**, initiator and project leader, IHMA Nautical Port Information Project

## Nautical port information

For many reasons, nautical port information is of great importance to masters, shipping lines, trading floors, agents and publishers of such information. Why is this information important and what is it used for?

### Rules and regulations

- Masters must comply with IMO requirements for berth to berth passage planning. IMO resolution A.893 requires voyage or passage planning, which is essential for all ships engaged on international voyages. The aim of passage planning is the preparation of a ship's navigation plan so that the intended passage can be executed from the departure port to the arrival port ('berth to berth') in a safe and efficient way, in respect of both the vessel and the environment. The significance of this activity is highlighted by the fact that most accidents happen between the pilot station and the berth. Additionally, ships will grow even bigger in size. As a result safety margins are getting smaller, increasing the need for more detailed nautical port information.
- Information used in this process may differ from source to source and the master is then faced with the difficult task of selecting the right information.
- The vessel also has to comply with provisions and stipulations laid down by insurance companies that port information should come from a reliable source (the harbor master). P&I clubs have reiterated the advice on the exchange of information ahead of pilotage.

### Environment

Next to the rules and regulations, there are also environmental reasons for having correct port information.

- **Reducing emissions at sea** – With proper tidal window and berth availability information one could sail to the pilot station at optimal speed, saving bunker fuel and hence reducing emissions. The reduction of greenhouse gas emissions at sea has become an important driver. By sailing to the pilot station at economic speed with proper tidal window information, one can save up to 50 percent of bunker consumption.
- **Reducing emissions in port** – With proper terminal information one could prepare the ship properly for mooring and loading or discharging operations, saving time in port and hence reducing emissions. The reduction of greenhouse gas emissions in port has become more and more important. By preparing the ship properly for port, not only is operational safety improved, but one can decrease the need for tugs, auxiliary and main engines, and the amount of hours in port can be reduced.

### Commercial

There is a commercial reason as well; trading floors, where a ship's destination and amount of cargo is decided, also need nautical port information. If trading floors are not certain about the exact depth, they apply an additional safety margin, resulting in less cargo for the port and a tremendous inefficiency in the logistics



### Background on The International Harbour Masters' Association (IHMA)

Alan Coghlan, president, IHMA

The IHMA is a professional association for harbor masters. Founded in the 1990s, it is a non profit organisation, with 200 members throughout the world. Our beginnings lay in the European Harbour Masters' Association (EHMA), which was founded at Cork in Ireland in 1985. Following that occasion there were constant contacts from outside Europe asking if they could become involved. It soon became clear there was a demand for such an association to cater for harbor masters throughout the world and a little more than a decade after the founding of the EHMA it was decided to cater for those outside Europe and the IHMA was formed. The association is governed through an executive committee of seven full members and a permanent secretary. To cater for the individuality of regions, a European Harbour Masters' Committee (EHMC) exists with IHMA and as numbers grow in other regions it is intended to follow that regional committee model. We also maintain very close official links with 'sister organizations' such as the International Maritime Pilots' Association (IMPA), the International Association of Lighthouse Authorities (IALA) and the Nautical Institute (NI).

Our principal aim and objective is the promotion of safe, secure, efficient and environmentally sustainable operations within ports. To date this has mainly been spread through our Congress, which is held every two years. Another important vehicle for the promotion of our aims is attendance at IMO as an NGO.

As an observer at IMO, the ability to positively contribute or influence is limited. However, in our opinion, attendance is important, as it is the one place where all international maritime interests meet. We have become aware that in order to further contribute to worldwide safety of operations within ports we must develop and publish credible position papers and initiate meaningful projects which will be of benefit to both ports and their customers.

chain. One centimeter difference in draught can mean a loss of up to 180 tonnes of cargo for a VLCC.

## Electronic charts and publications

The increasing number of digital publications and Port ENCs contribute to an efficient voyage. Ships have been fitted more and more with satellite communication systems, enabling them to log on to port and terminal websites and plan a port visit whilst at sea. These digital publications raise the frequency of updating dramatically and enlarge the users' expectations on the correctness of data. Having correct digital data available becomes an absolute necessity.

One would think that this information is sufficiently available. However, IHMA found that this is not the case, at least not in a worldwide uniform standard; the information many times is incomplete for many ports, and it is not always accurate and certainly not easily accessible.

IHMA investigated the root cause of this lack of information and found three main causes:

- Harbor masters receive many different questionnaires from all sorts of publishers of nautical information. Completing these questionnaires is administratively cumbersome, resource intensive and leads to different information about the same port as not every questionnaire is completed by the same person.
- On top of this, many cross links between parties will always result in miscommunication.
- Apart from many questionnaires and cross links, a lot of people in the nautical chain are not always aware of the importance of this information.

In an ideal situation, nautical port information will originate from an authorized source, will be reliable, up to date and available online. However, to date most of this information is gathered from ship's agents and distributed by private parties. To keep this information accurate and up to date is a challenge. The various, sometimes inconsistent sources of nautical information required for port entry and berth or terminal usage may lead to confusion as to the user bearing directly on ship and port safety and efficiency of port operations. The lack of uniformity and availability of reliable port and terminal information originates from the fact that this information is generally published in printed documents which generally do not contain the most recent information. Publishers gather this information by sending questionnaires (in different formats) to port authorities, ship's agents and terminals. In general ports do not have a central source for this information.

Ships have been overwhelmed with Safety Management Systems in the last decade in a rather hasty way. As a result the maritime industry has now the impression that a ship, laden with documents and procedures, sails into a port or terminal, and finds itself in an environment with not even the basic information available, nor transparent procedures or certification. There is a strong call that ports should catch up with the ships. The first step in this approach is providing nautical information of the port, together with source and date of submission.

## The Nautical Port Information Project

The IHMA came to the conclusion that action was needed to address this issue. What we need is a web-based solution, publishing port and terminal information in a standardized form, freely available to all users, including producers of nautical publications, to ensure identical information in charts, books and company instructions.

To start with, the organization determined – in close consultation with ports, customers and the UKHO – one single

IHMA format for port information. This information is limited to nautical, safety and operational issues. Commercial issues remain beyond the scope of the IHMA. The IHMA also seeks to ensure that harbor masters and terminal operators accept their role as the principle source for authorized port and terminal information, which not only encompasses general information about reporting, position pilot stations and VTS channels, but also covers port specific berth and terminal information and admission policy.

Listening carefully to customers, publishers of nautical port information and harbor masters, IHMA has taken at heart that:

- Port information should be available online and should be as up to date as possible.
- Port information should be presented in a uniform format, regardless of the port. Ports start developing their own systems and websites independent from other ports. Our customers prefer a standardized way of providing information. If we do not provide a system soon, to publish information in a standardized way, this development will continue.
- One single document should be introduced to answer all customers' queries. This can also be made available to publishers, so that they can make corrections to their own products themselves. Having correct digital data available in a standardized format makes the port a 'next generation' port.
- One single document for new personnel, nautical service providers and terminal operators should be introduced. This will lead to uniform procedures within a port.
- A single document is needed that can be used for certification, for instance in safety management systems.

### The information in question

The required nautical port information consists of two parts. The first part is general port information for the port as a whole, giving general nautical port information such as:

- contact information and port regulations
- notifications, arrival and departure checklists
- port description and navigation
- port safety
- port security
- environmental information
- nautical services and communication
- port operations and services

The second part of nautical port information is port information for each berth or fairway section, giving specific nautical port information per section of the port – approaches, anchorages, entrances, fairways, berths and covers information, such as:

- position
- UKC policy
- wind, tidal, visibility restrictions

There is an important difference between the information in sailing directions, navigation warnings and notices to mariners. All those have a focus on seas. The IHMA information on the other hand has a focus on ports, providing information between pilotstation and fenderline.

## Knock-on benefits

Nautical knowledge that is explicitly available will not only serve ship masters and maritime industry. Also the port organizations benefit, because, as Alan Coghlan, president IHMA, points out: "Looking into the future it is likely that the numbers of qualified mariners in the port industry will decrease. Therefore we believe

it to be very important to create a standard of nautical knowledge that will serve ports, ship masters and all other stakeholders of the chain well into the future. Through the chain we are creating awareness of our world, therefore it is now time to share our world and our knowledge in an accredited standard. This is what is expected of us.”

Benefits for the port organization are as follows:

- Specifying explicitly all nautical knowledge in one document can improve processes in harbor masters’ organizations.
- An explicit inventory of all the knowledge that a whole generation in the port authority may have is made before this knowledge gets lost.
- New people entering harbor masters’ organization have a solid instrument to get acquainted with all admission policies.

- Admission policies will be communicated to agents and vessels in a uniform and unquestionable way, also when port officers change watch.
- Knowledge on admission policy will no longer be kept to the port authority alone, but will be transparent and shared with the outside world for better planning and more safety.

Good nautical port information is the foundation of safe, efficient port use in the most environmentally sensitive and collaborative manner. Good quality information and data means that all information is consistent, accurate, up to date, complete and most importantly, is based on a port industry standard. By improving the information within the supply chain, trading partners will improve safety, reduce costs, improve productivity and accelerate product access to the market.

**ABOUT THE AUTHOR**



**Captain Ben van Scherpenzeel**, director nautical developments, Policy and Plans, Harbour Master’s Division Port of Rotterdam, has spent 15 years at sea; three years on tankers and reefer vessels as a deck officer and 12 years on cruise vessels as a deck officer, staff captain, and project manager of new build programs. He joined the Port of Rotterdam in 2004. His responsibilities are projects related to shipping.

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# Unique marine growth control technology

**Christopher Do**, inventor of Marine Growth Control Technology, president and chief executive officer, IEV Group, Selangor, Malaysia

Until now, controlling marine growth has just been an area of concern for marine structures and often is a problem that is overlooked by port and harbor operators due to its expensive and time consuming nature. Traditionally, divers use a high pressured water jet cleaning system to remove marine growth, a process which is costly and time consuming, especially at busy ports and terminals, where diving work is constantly interrupted by vessel operations. IEV's revolutionary marine growth control solution offers port and harbor operators a cost effective and permanent marine growth prevention solution to reduce loadings as well as microbial corrosion attack by sulfate reducing bacteria (SRB).

Marine growth build ups in the splash zone of marine facilities, especially steel structures, adds static weight to the foundation and increases the diameter and the surface roughness of the piles, thereby increasing the drag coefficient associated with wave and tidal actions on the structure. At marine ports and harbors, structures are prone to accelerated low water corrosion, particularly microbiologically induced corrosion formed from SRB underneath marine organisms, which is mostly the corrosion inducing mechanism at the splash zone area. An accelerated corrosion rate could rapidly reduce the expected life

of structures. For example, a structure constructed for a life of 90 years may essentially be reduced to as much as 45 years [1].

IEV's Marine Growth Control Technology (MGCT), a series of specially designed and patented apparatus, is powered by natural ocean forces and their own buoyancy. The continuous sweeping motion contacts made by the rubber rollers against the structure breaks down the marine colonization process of microbial slime or micro-fouling, every minute of every day, thus permanently preventing the marine growth affixing to the members. This eliminates the formation of SRB that promotes corrosion in structures and the need for periodic cleaning and thus, substantially reducing cleaning costs. Cleaner structures also make for speedier inspections. Technology and nature work effectively together to strengthen and protect port and harbor structures such as piers and jetties.

## REFERENCE

- [1] *ALWC on steel structures in marine environments*, by Dr. Ashok Kumar & Larry D. Stephenson, U.S. Army Corps of Engineers, Engineer Research and Development Center, Construction Engineering Research Laboratory and NACE International. Published in Port Technology International Edition 32, 2006.



MGP being installed on an offshore oil platform.



MGP installed on an offshore oil platform.



MGP-W SC on a jetty pile.



Marine growth on oil and gas platform.



MGP installed and cleaning marine growth.



MGP reconfigured and protecting structures.

## ABOUT THE AUTHOR

**Christopher Do** is the inventor of the Marine Growth Control Technology and the founder, president and chief executive officer of IEV Group. He established the business in 1986 to commercialize his invention, the 'ocean-powered' Marine Growth Control (MGC) technology. Over the last 25 years, more than 27,000 Marine Growth Control apparatus have been installed on approximately 400 offshore structures worldwide.

## ENQUIRIES

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- Facilitates the underwater inspection of submerged structures to monitor corrosion and integrity of jetty piles.
- Eliminates Sulphate Reducing Bacteria (SRB) - induced and other forms of corrosion attack caused by marine organisms
- Improves aesthetic feature of the facility.



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# Port management – back to basics: knowing what vessels are really doing in your space

**Dr Rafal Goralski**, technical director, GeoVS, Cardiff, UK

## Technological progress

Compared with the current state of human machine interface science and technology, VTS systems lag years behind. This results in a significant limitation of VTS operators' efficiency and operational comfort, preventing VTS from fully performing its role in improving the safety of navigation in port waters. Luckily, there are solutions.

The last two decades have seen unprecedented technological progress in electronics, computers and software. With that progress an important trend, that marks the Twenty-First Century, becomes evident. As technology becomes ubiquitous it stops being perceived as something strange and different. Increasingly it becomes mainstream, blends with the environment, as an indispensable part of our lives.

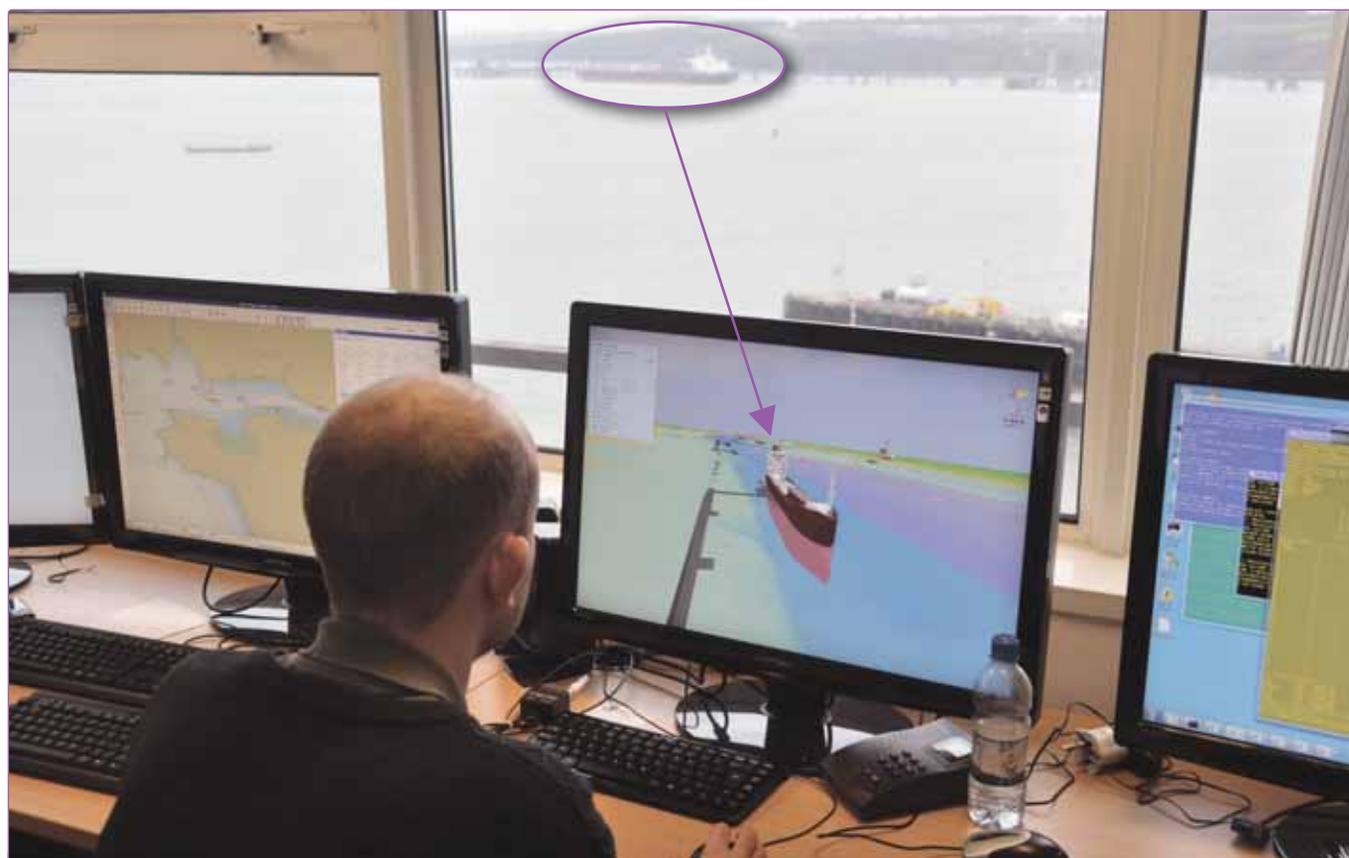
This is partially due to the technical capabilities of smaller and more powerful chips and displays, but also – in a large part – due to advances in human machine interfaces. It was realised that technology should no longer be a closed domain of clunky user interfaces for experts and highly trained operators. Instead the human spirit should be brought to the world of machines, which ought to become more ergonomic, intuitive and usable. Mobile phones and tablet computers are typical examples of such a human-centric approach.

## Upgrading to three dimensional charts

According to the new paradigm, it is not people who should have to learn how to operate complex technology, often using badly designed interfaces, and then have to constantly keep bending themselves to its peculiarities and limitations – it is the computer systems that should be optimized to better cater to our needs, enhance our natural capabilities and compensate for our limitations. This approach dramatically enhances efficiency and improves operational comfort of the technology users.

In the marine world, as a result of that thinking, the idea of the three dimensional chart emerged. At first it was not completely clear whether, and how exactly, it would be better than its two dimensional counterparts. However, it seemed sensible to assume that removing the extra workload and concentration required to interpret two dimensional charts, and instead use the natural three dimensional cognitive capabilities of the human brain, should have some merits.

Indeed, formal research proved the benefits of three dimensional charts over two dimensional representations. In experiments, conducted for example by Dr Thomas Porathe at the Malardalen University in Sweden, it has been shown that the use of three dimensional charts leads to a significant reduction in human error and a similar increase in the navigator's



C-Vu® 3D VTS: observing a ship docked at the jetty across the bay.

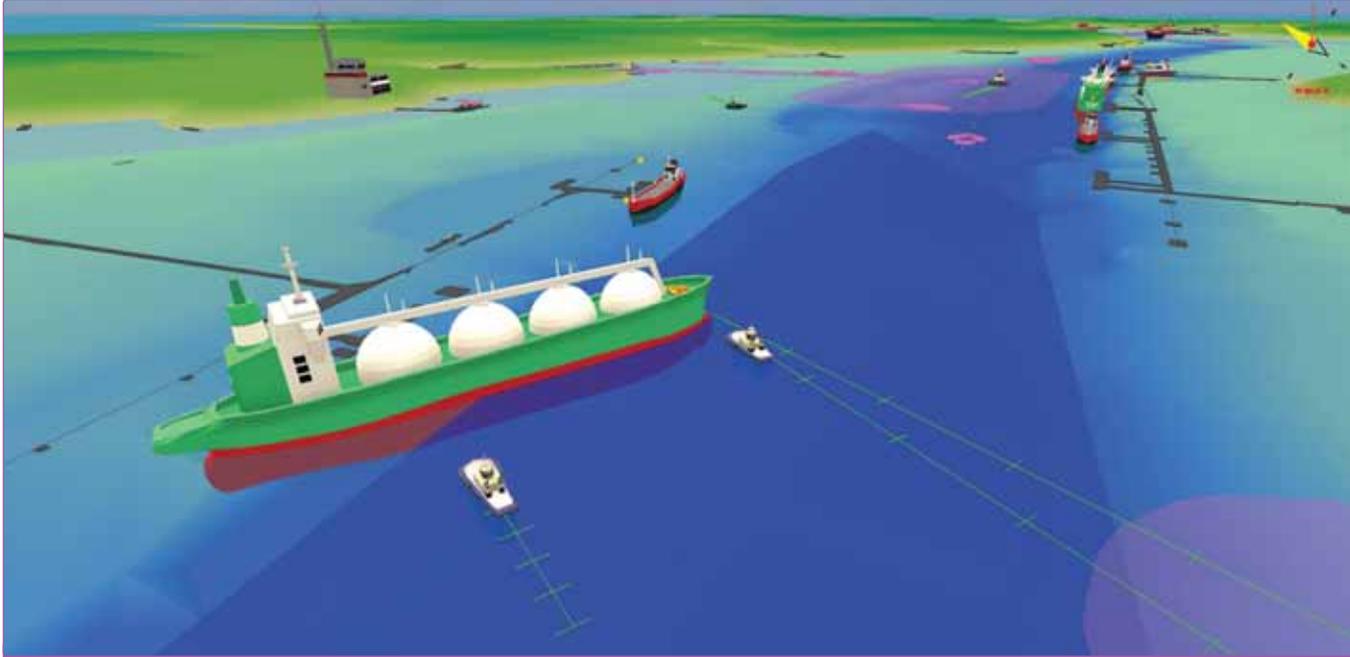
efficiency. In the experiment, a large group of participants, with different levels of nautical expertise, were asked to complete a simulated navigational exercise using two dimensional and three dimensional charts. Not only was the average time required to complete the exercise about 50 percent shorter using three dimensional charts, but the participants made on average 80 percent fewer errors and selected the three dimensional chart as by far the most ergonomic. What is more important, the results were similar in all experience groups, from novice to expert.

**The challenges**

Despite such exceptionally encouraging results three dimensional charting is not easily achieved and currently is hardly ever seen in professional shipping and VTS. This is due to several



Milford Haven: escorting gas tanker into the port.



Milford Haven: gas tanker docking manoeuvre.



Milford Haven: Q-Max LNG tanker turned around on the way out, with depth safety markers on.

factors. Although it may be tempting to blame the natural (and undeniably healthy) conservatism of the marine industry towards new technologies, the far more important reason seems to be the difficulty of producing a three dimensional chart display which would be 'right', meaning as good for the purpose as the two dimensional charts are.

The traditional charts have a number of advantages: they have been around, and the art of cartography has been perfected, for hundreds of years. They are also much simpler with the removal of the third dimension. This allowed for a relatively easy transition from paper charts to electronic chart plotters. As interactive three dimensional environments are more complicated, and there is no similar body of cartographic knowledge and practice to tap into, the task of producing a truly usable three dimensional chart display becomes much more challenging. The third dimension brings new requirements in terms of data processing and presentation, visual optimization and symbolism, as well as design of user interfaces to allow efficient use.

A common misconception is the use of excessive photorealism, where a virtual reality representation is created, instead of a cartographic presentation. While this works very well in training simulators, where all real life perceptible limitations should be reconstructed for the purpose of realistic training, this is not the right approach to charting. In the same way as an aerial photo is much less efficient for navigation than a nautical chart created with cartographic skill for specific purpose, a photorealistic three dimensional visualization is not a three dimensional chart. What is needed is a truly cartographic approach where the visualization is optimised for fast comprehension of the important information.

Research in this particular direction has been conducted since 2001 at the Hong Kong Polytechnic University, French Naval Academy, University of Glamorgan and GeoVS Limited. The project has been conducted by a team consisting of sea going captains and computer experts, and involved studies in human cognition, user interface design, GIS and three dimensional cartography.

## C-Vu® 3D VTS – Real Space Enhancement Engine

For the past twelve years my colleagues and I have been grappling with the complex realities of enhancing situational awareness for maritime safety. It's only now that we can integrate data from many sensors around a port to produce a real time three dimensional traffic management visualization tool. The tool is all about what the operator sees and interprets, and relies on an advanced software engine – RealSEE™ (Real Space Enhancement Engine) – operating with modern port computers and sensors. The real challenge has been to apply RealSEE™ without affecting the operational integrity of existing VTS. We can confidently state that we have achieved this.

The research resulted in the world's first three dimensional ECDIS prototype being demonstrated at SeaTechWeek in Brest in 2007. The three dimensional ECDIS and RealSEE™ technologies were subsequently commercialized and applied to C-Vu® 3D VTS, which was presented at the UK Harbour Masters Association and European Harbour Masters Committee seminar in April 2011, and

officially released later that year. The system works on its own or as a bolt-on to existing systems, and employs the cartographic three dimensional technology to an ecosystem of port and navigational products, which also includes three dimensional chart displays for pilots and port boats, creating an integrated safety management system (ISMS). In this ISMS, different elements work together to efficiently distribute navigational safety related data and provide the most complete situational awareness picture allowed with modern technology.

The users work with efficient and ergonomic three dimensional interfaces which allow them to quickly comprehend static and dynamic data and respond quickly to developing situations. The static elements include official ENC S-57 charts, custom bathymetric surveys, and any custom objects (port infrastructure or buildings). Chart updates are automatically incorporated, and bathymetric surveys can be updated as often as needed. The dynamic data come from sensors such as AIS, radar, tide gauges, current profilers, meteorological buoys and others, but also from existing port systems (PMIS, VTS) or manual VTSOs' entries (marking of diving areas, adding custom objects or refining ship attributes.)

Ships are represented with their correct (symbolic) types and dimensions (including draught). System users can freely select any viewpoint and efficiently navigate within the chart area. They can also select a view from any ship's bridge, and observe vessels from any perspective. This supports a closer and more confident cooperation of VTS operators with pilots. To simplify the system's operation the user interface is highly automated.

All data are constantly recorded into safe database storage for over ten continuous years, and may be easily retrieved for replay or analysis at any time. This offers excellent incident analysis, training and evaluation capabilities. The traffic data stored in the database is also highly useful in port planning and risk assessment activities. C-Vu® is also a useful tool for presentations to non-experts, for example in litigation or to improve public engagement.

C-Vu® 3D VTS facilitates enhanced situational awareness, but also improves the efficiency and operational comfort of its users. Feedback from VTS operators from the Port of Milford Haven, which supported system development in its latest stages, confirms the benefits. VTS operators agree that C-Vu® is more ergonomic than the traditional VTS, and allows them to analyze local situations in much more depth. The claims vary from 'In a few years, all VTS systems will have to look like this' to 'it is difficult to switch back to using the traditional VTS system after C-Vu.' Even initial sceptics admit that 'this is definitely the move into the right direction' and emphasize the systems value to less experienced colleagues – which is an important benefit in its own right, given the current situation of diminishing sea-going experience in the port industry.

C-Vu® 3D VTS is a very new system, and the transition to three dimensional data in VTS is just starting, with eight out of ten top UK ports in various stages of the process of adopting the technology. That transition is inevitable, and exemplifies the process of technology becoming more user-centric, amplifying natural capabilities, and neutralizing the limitations of its human operators. The Twenty-First Century may already be a decade old, but for the VTS systems the best part of it is just beginning.

### ABOUT THE AUTHOR



**Dr Rafal Goralski**, GeoVS' technical director, was the lead designer of the world's first three dimensional ECDIS prototype, and currently heads the development of C-Vu® 3D VTS. He

is an expert in three dimensional cartography, with 15 years of experience researching human cognition, design of ergonomic interfaces, interactive three dimensional maps and GIS.

### ABOUT THE COMPANY

**GeoVS** is the producer of C-Vu® 3D VTS and other three dimensional cartographic products that offer unmatched ergonomics and efficiency, improve operational comfort and situational awareness of VTSOs, port managers and navigators. The company specializes in bridging the gap between technology and people in port safety, management, planning, training and navigation.

### ENQUIRIES

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**Counter-Piracy and Maritime Security Strategy**



**WORKSHOP B – 13.30-17.00**

**The European Commission DG Move Study into C-IED for Passenger Ships and Ro-Ro Ferries in the Wider Context**



**CHAIRMAN:**

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**Lieutenant Colonel Bernd Allert**, WMD Non-Proliferation Centre, **NATO HQ**



**Lieutenant Yuri Linden**, Seariding Instructor, CBRNDC/FF School, **Royal Netherlands Navy**



**Alan King**, CBRNe Terrorism Prevention Programme, **Interpol**



**Örjan Martinsson**, Division of Emergency and Maritime Surveillance, **Swedish Coast Guard**



**Lauri Luht**, Rescue and Crisis Management Policy Department, **Estonian Ministry of the Interior**



**Ojars Gerke**, Environment Management Specialist, **Latvian Coast Guard Service**



**Dr. Roberto Mugavero**, National Observatory on Security and CBRNe Defence (Osdife), **Italy**



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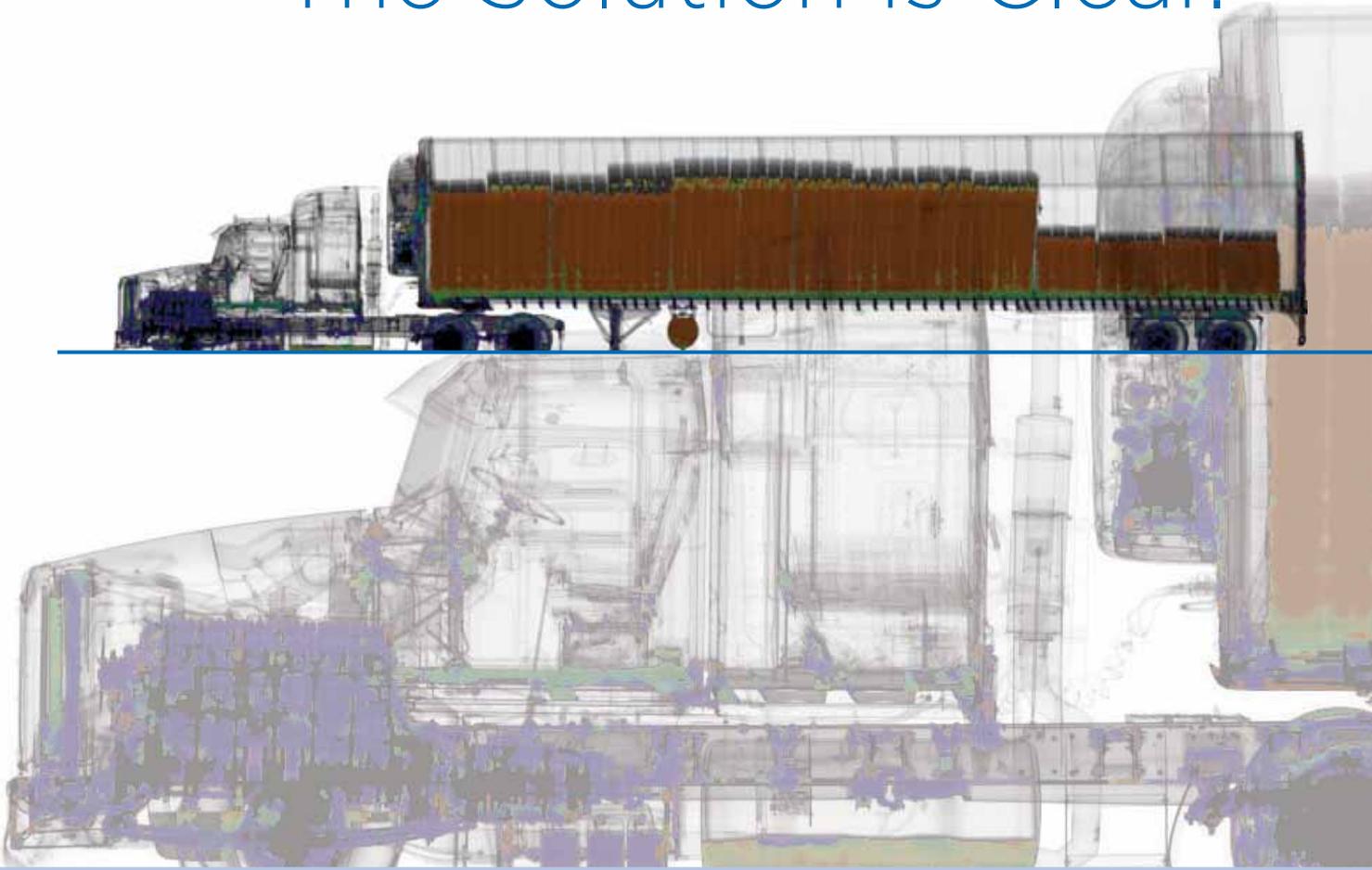


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“In some countries, port security is provided by a combination of military and police forces. In others, it is a commercial arrangement where private enterprises hire private security companies. Herewith lies the problem – there is no European-wide appreciation and handling of port security matters.”

‘Enhancing port security’, page 144.

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# Enhancing port security

Jenny Gyngell, project manager for SUPPORT, BMT Group Ltd, London, UK

## Background

With the threat of international terrorism still looming large, port security remains of paramount importance to Europe, not only due to the direct threats to life and property, but for the potential economic damage that can arise from the effects on the relevant supply chains. With the introduction of the International Ship and Port Facility Security (ISPS) code in 2004, it is evident that much work has been done to tackle security issues, however, many would argue that there is still too much disparity between member states. As such, funding of approximately €14 million has been secured in a European Commission (EC) sponsored project called Security UPgrade for PORTs (SUPPORT), the aim of which is to help improve port security in major and minor European ports, as well as increase trade flow through these vital channels.

## The challenges

About 90 percent of the EU's external trade and 40 percent of internal trade is transported by sea. This corresponds to 3.5 billion tonnes of freight loaded and unloaded in EU ports each year. While individual port security breaches may cause much damage in themselves, the disruption that such security incidents cause to the supply chains can also become very costly. Thus, port security remains of paramount importance. However, as a concept, it is treated very differently, depending on the EU member state in question. In some countries, port security is provided by a combination of military and police forces. In others, it is a commercial arrangement where private enterprises hire private security companies. Herewith lies the problem – there is no European-wide appreciation and handling of port security matters.

Although the European Maritime Safety Agency (EMSA), FRONTEX and EUROPOL all touch upon port security, the biggest drawback is that they have no executive powers and therefore cannot control national operations. Furthermore, it would seem that the introduction of the ISPS Code, despite costing billions of dollars around the world, is perceived by many in the industry as something which has provided little benefit. The main issue is the fact that the legislation does not mandate specific security measures and provide the necessary consultation of how to implement them. There is no specification for basic requirements, such as fence quality or the frequency of security patrols. Consequently, this lack of detail has led to a situation whereby there are vast differences within the EU in how the ISPS Code has been implemented. Whilst some ports have interpreted the ISPS Code requirements for protected facilities in such a way that they require the use of code cards, fences, CCTV and alert systems, other ports believe that a simple yellow line around the terminal boundary is sufficient enough in order to comply. Clearly this is an unsatisfactory state of affairs.

Add to this the fact that the majority of ports see security as a low priority issue and the challenges are exacerbated. Many ports believe that the chance of a terror threat to their facility is low or in some cases, non-existent and that matters relating to terrorism are already being dealt with by the police and the military. Therefore, there is often reluctance by terminal operators to invest money in security measures that do not directly protect their income.

## The SUPPORT research project

It is within this challenging domain that the SUPPORT research project aims to bring about positive change to enhance port security within the EU, without the need for extra investment. The project is being led by BMT Group Ltd, the international maritime design, engineering and risk management consultancy, with a consortium consisting of 19 other experienced companies, including transport service providers (Securitas, Port of Piraeus, Europhar, Stena, Marac Electronics), port associations (EcoSLC), port administrations (Maritime Administration of Latvia) and transport research consultancies (FOI, VTT, Marintek, Marlo, NECL, INLECOM, eBOS, University of Innsbruck and INRIA). With so many partners involved, robust communication is paramount to ensuring the project stays on track and effectively addresses all of the issues surrounding port security in Europe.

The first part of the project, described as the analysis phase, was recently completed and saw the consortium study existing legislation, identifying drawbacks, gaps and ambiguities. One of the important outputs from this work was the introduction of a reference model for ports across Europe. Titled 'Port Nowhere', this model brings together around 1300 ports and 4000 ISPS facilities across Europe in order to better understand how they operate, whilst identifying commonalities.

Other outputs included:

- **In-depth risk analysis** – to understand the various different threats to ports, including terrorism and crime threats, such as smuggling and petty theft, which can also have a major impact on ports.
- **Regulation study** – various regulations exist in different countries and it was important to highlight where these may be disjointed and where the wording conflicts, causing potential challenges in the implementation process.
- **Technology assessment** – an analysis of various current and future security technologies, in terms of what they do, how effective they are and the investment required to implement them. This, in turn, will enable ports to better understand what these technologies can or can't do and whether they are indeed the optimum solution.

As part of the BMT group of companies, BMT Hi-Q Sigma's expertise in requirements and risk analysis has become a specialist resource for the project within the initial phase. Experts within the organization have played a key role in employing a methodological approach, which combines creative and analytical methods. This approach has proved to be particularly successful in identifying risk, threats and security gaps that may not have been immediately evident, even to experienced practitioners.

By collaboratively working with the other consortium partners, including BMT Group's R&D division, a number of generic port security models will now be identified as part of the next phase of the project. These models will be sufficiently adaptable to suit different configurations of ports, depending on their specific sizes, terminal types and ownership models. As the project progresses, new software security upgrade solutions will be developed including new sensors, communications infrastructure, container management guidelines and the R&D team at BMT Group will

be developing deception recognition software which will help address the problems with recognizing vessels which are trying to deceive port tracking systems.

Given the feedback received to date, it is clear to see that much of the analysis carried out made ports more aware that investment in security measures is not money down the drain, but rather an investment in business continuity. The project's ongoing analysis examines the investment cost of particular security measures and their impact on both the flow of goods through a specific port and their effectiveness against different threat scenarios, be that crime based or terrorism. This would indicate that past investments in security measures have not been able to demonstrate real cost benefit, which is a key part in ensuring everyone within the supply chain embraces the optimum solution for effective port security.

#### ABOUT THE AUTHOR

Following a career in the Royal Navy, **Jenny Gyngell** joined BMT Group Ltd in 1999. For the past 13 years, Jenny has been the senior project manager for a large number of EC-funded research projects in the areas of logistics and supply chain management, as well as safety and security in the transport and maritime sectors. Specific projects include FIRE EXIT and SAFEGUARD which aims to perform full-scale ship trials in order to gather data for calibration and validation of ship-based evacuation models.

The solutions that the consortium will now look to develop, based on its findings, will not impede, but accelerate the flow of goods through ports. Furthermore, they will be scalable in order to be affordable for the smallest single-quay ports and the largest megaports. These tools will be designed in such a way that the latest advances in technology and legislation are accounted for, whilst providing explanatory material so that end users can better understand how, where and when to deploy each solution.

#### Conclusion

By developing 'total' port security upgrade solutions, which encompass legal, organisational, technological, training and human factors, SUPPORT can facilitate a more secure and efficient operation of European ports, without stakeholders having to further invest in expensive security systems.

#### ENQUIRIES

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# Using sniffer bees for bulk screening of cargo

Ivan Hoo, chief executive officer, Inscintinel, Harpenden, UK

## REST technology with dogs

In the UK, freight forward companies screen 100 percent of all of their parcels. The first line of screening relies on X-rays followed by REST dogs for special items which cannot be screened. REST, stands for Remote Explosives Scent Tracing. This works by sampling the air from the cargo through a specially designed filter. This filter, which can trap explosives molecules, is then presented to the most accurate explosives detector ever – dogs. This method has proven very effective to exploit the accuracy of dogs while maximizing the throughput volume of screening, which a free-running dog cannot otherwise do. According to the information found on the website of Diagnose, a subsidiary of ICTS:

‘The technique has screened over 100,000 trucks and pallets and over 1.5 million metric tons of air cargo since live operations began in the UK and France. The RASCargO™ technique was specially developed to serve the mass screening cargo market that requires a solution for screening high volumes of dense cargo, with actually, no cargo size limitation, a solution that combines high detection rate with cost effectiveness.’

This method is, of course, not limited only to explosives but many other kinds of applications. The prevention of smuggling contraband, drugs and food quality control can all potentially utilize this technology. However, maintenance of dogs is high and would require a logistic setup beyond the reach of many smaller-scale operations. In addition, REST dogs have to be specially trained; it is said that it is tougher to train a REST dog than a search dog.

If we want to promote the use of REST, an alternative to dogs needs to be found. The potential sensor would need to answer the following points:

- As accurate and sensitive as dogs
- Easier to use and to maintain than dogs
- Cheaper than dogs

## Replacing the dog: here comes the sniffer bee

### Accuracy and sensitivity

Research into honeybees (*Apis mellifera*) started in the 1960s. The researchers were interested mainly in understanding the foraging behaviour of honeybees. These tiny creatures were shown to learn almost any odour and have subsequently inspired numerous researchers to explore the practical application of sniffer bees. In early 2004, Defence Advanced Research Projects Agency (DARPA) funded a project to use the honeybees for explosives detection. They discovered that honeybees can detect TNT at a parts-per-trillion (ppt) level. Our in-house research shows that the sniffer bees can detect down to at least 78ppt of 2,4-DNT. That is as sensitive as or better than dogs.

### Operational easiness

The bee sensor system was developed with the help of the Homeoffice (UK) in 2008. It begins with the capturing of honeybees, automatically loading them into bee holders, training them with explosives' scents and finally using them in a handheld



Credit: Rothamsted Research

detector, the VASOR136. This automation means that no special trainer or handler is required and anyone with minimal training can operate the entire system.

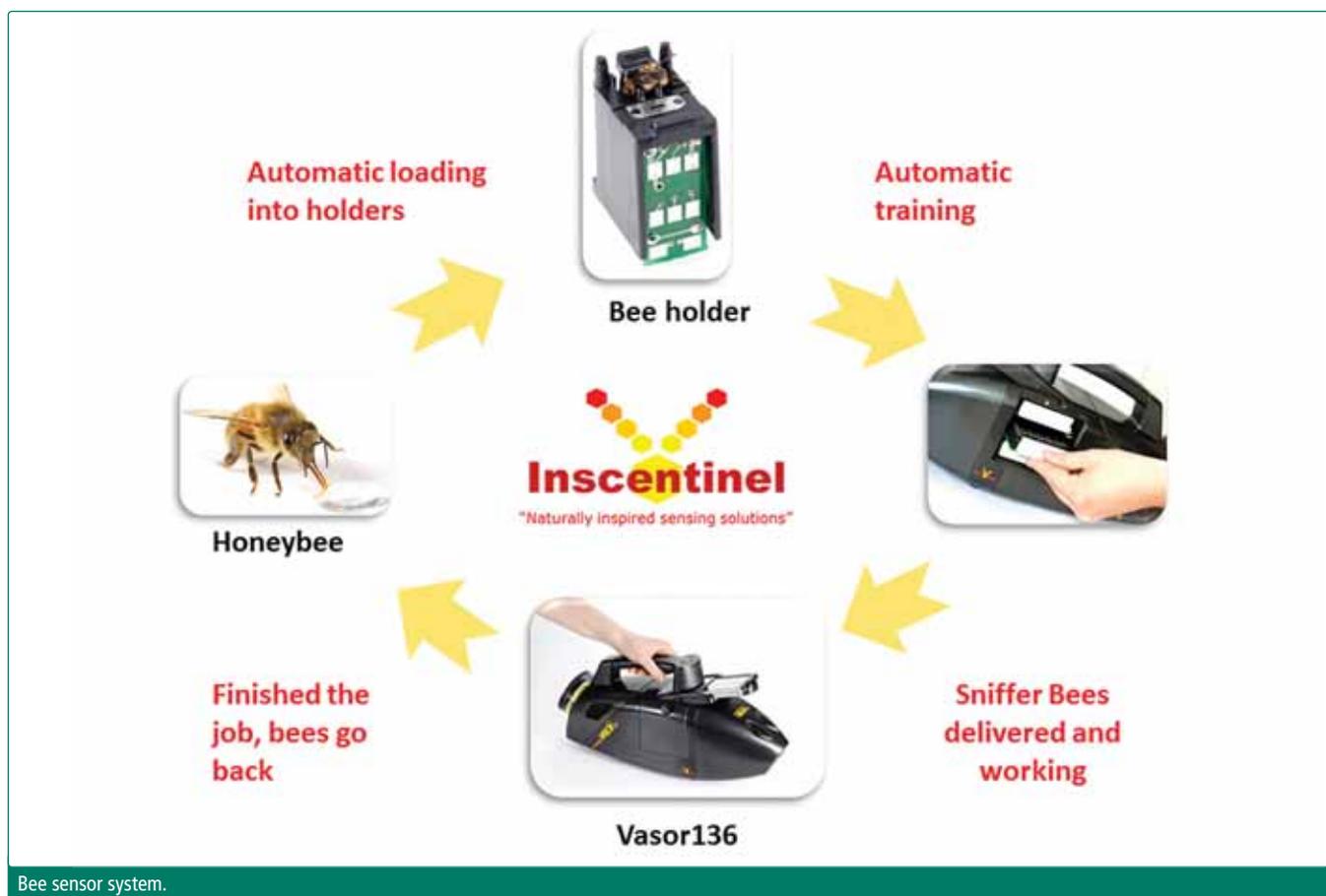
It is quite remarkable to know that our single automatic training unit can produce 500 trained sniffer bees in just five hours; training a single sniffer dog takes up to six months.

On the detection side, there is no longer a requirement of a specialist handler or police officer at the front line. The sniffer bees inside the VASOR136 are monitored electronically through an infrared sensor. The information is displayed in easy to read: ‘YES/NO’ coloured squares on an LCD screen.

The advantage of a technology assisted solution is obvious in this instance.



Credit: Rothamsted Research



Bee sensor system.

**Cost**

We do not know the real cost of a REST dog, but we can consider search dogs’ costs. It costs \$118,000 for a one dog handler team in the first year and \$80,000 for the subsequent year. The US federal government owns 600 sniffer dogs; that is \$48 million in annual expenditure.

How does the bee fare in the cost category? The bee sensor system is a machine and, once developed into a product, the cost is low. The training of bees requires only sugar water (no more expensive than dog food). The cost of a honeybee itself is relatively cheap. A bee hive can contain up to 60,000 bees and a local beekeeper can manage 20 hives single handedly – that is 1,200,000 bees. Imagine housing that many dogs.

**Extra benefit: accountability**

Perhaps the single most important feature that is not available with dogs is the ability to account for the activities 24/7. Our sniffer bees, once housed in the bee holder, are monitored continuously by the electronics. Information such as the quality of training, the chemical it is trained to, the information of usage and detection can all be recorded and stored in a database of records and can be used for the audit by the DFT.

**How do the bees get trained?**

A honeybee sticks out its Proboscis (or less scientifically, its tongue) and gets a touch of sugar water on its antenna. At that point, if it were exposed to the smell of explosives, it will associate explosives with sugar water and thereafter stick its tongue out on the exposure to TNT. The entire process takes only six seconds.

**What is coming next?**

The central principle of the bee sensor system is to combine technology with animals. This allows us to harness the best of both worlds. Animals are ultra sensitive and highly accurate, on the other hand, technology provides the ease of operation. Right now, Inscentinel is at the stage of attracting investors to raise finance to complete the prototyping and looking for security companies to run this technology in a field test. I have no doubt that the bees will perform brilliantly – after all, sniffer bees were not developed only in the last decade but over millennium to achieve their level of sensitivity.

**ABOUT THE AUTHOR**



**Ivan Hoo**, chief executive of Inscentinel, graduated with a BA (Hons) in Material Sciences from the University of Cambridge in 2010. His entrepreneurial strengths led to him working on a £100 million seaside resort development project before graduating, and now, along with his team, brings sniffer bees from the lab to the real world.

**ABOUT THE ORGANISATION**

**Inscentinel** (more famously known as the Sniffer Bee Company), is an Oxford VC backed British startup with huge ambitions to use honeybees to detect explosives and drugs. A spin out from Unilever and Rothamsted in early 2000, Inscentinel is established right beside the world’s oldest agricultural research center. Inscentinel has since restructured in 2011 with a new team and with renewed focus.

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# HEALTH AND SAFETY



“Underpinning the new recommendations is a more structured appreciation of risk and its impact on safety. By analyzing the likelihood of events that cause damage to personnel or property, we can classify different types of risk.”

‘Maintenance guidance helps strengthen asset management’, page 149.

# Maintenance guidance helps strengthen asset management

**Peregrine Storrs-Fox**, risk management director, TT Club, New Jersey, US

Most businesses have assets and those assets must be efficiently and effectively controlled because this has a major impact on the bottom line. Maintenance – the servicing and monitoring – of fixed infrastructure and mobile equipment is an integral and important part of asset management that maximizes an asset's useful lifetime and minimizes its cost, whilst also enhancing its safety.

As a specialist insurance provider to ports, terminals and the freight transport sector, TT Club identified maintenance issues as a recurrent contributor to costly insurance claims. This was a key driver in the development of a newly published 76 page handbook 'The Importance of Maintenance – a handbook for non-engineers'.

The handbook – produced in association with the Port Equipment Manufacturers' Association (PEMA) and ICHCA International – is a comprehensive guide for good practice in maintenance procedures. It seeks to help port businesses assert or improve control over their infrastructure and equipment in straightforward and cost effective ways, thereby improving business operations and making meaningful cost savings.

## TT Club analysis

Analysis by TT Club has shown that, in the port and terminal industry, issues resulting from the application of inadequate or incorrect maintenance procedures cause about 25 percent of the cost of equipment damage. Furthermore, about 50 percent of quay crane claims arising from weather issues where cranes are blown along their rails are exacerbated by poor maintenance of gantry motors or brakes. Poor maintenance should clearly be a prime concern to those aiming for the optimum performance of their assets.

The handbook offers readers a general understanding of the critical issues concerning asset management. The guidance aims to be accessible to non-engineers, seeking to help management and decision makers in port facilities. It is also relevant to other businesses involved in cargo handling; it offers advice for improving control of their assets, while, at the same time, maintaining customer service levels.

"The handbook concentrates upon two stages of the asset lifecycle – maintenance and monitoring – but gives a concise picture of the entire lifecycle," explains James Callahan, TT Club board member and chairman, president and chief executive of Nautilus International Holdings Corporation Los Angeles. "It was specifically written with non-engineers in mind and, therefore, not intended to be very technical. Rather, the aim was to emphasize certain key processes that will, ultimately, protect your bottom line and improve profitability."

## Operations and engineering

The handbook highlights the need to balance the requirements of the operations and engineering and maintenance departments. There is often a cultural difference between these departments and operations people sometimes see maintenance as more of a hindrance than a help, but maintenance is like fuelling a car: if you don't do it then it will stop working!

While the engineering department is usually responsible for asset life cycle management, the operations department seldom has any significant involvement. As Laurence Jones, TT Club director global risk assessment argues, "This is a misguided strategy as the operations department has an integral role to play. We would urge port and terminal facilities to overcome inevitable cultural departmental differences and to implement an integrated maintenance policy and strategy."

## Two common issues

Senior management must address two common issues that often disrupt efficient operations – task scheduling, or the allocation of assets to tasks, and budgetary constraints. Operations and maintenance functions compete for access to assets. However, satisfying short-term operational needs may lead to major asset downtime because of failure – postpone maintenance at your peril!

One of several useful case studies in the handbook describes an incident in Asia when a quay crane suddenly collapsed due to rope failure. Despite broken strands having been found in the boom ropes several weeks earlier, the rope change was deferred due to operational pressure. This failure of task scheduling resulted in the loss of a quay crane and significant operational downtime.

## Budgetary constraints

When facing budgetary constraints, a quick and easy way to cut costs is to defer or reduce the maintenance budget – but take caution if considering this approach! A case study from Australasia details how a maintenance department was told to cut its budget by 20 percent. While this, initially, helped finances, it was continued for over six months, with planned maintenance jobs deferred and repetitive tasks and inspection frequencies extended. The number of equipment breakdowns increased, severely reducing ship loading rates, and more business was lost. The situation spiralled and, in the end, the only way to bring the equipment back to acceptable levels was to engage numerous contractors and additional staff for a year. The actual maintenance budget for that year was 200 percent above the norm.

So, if the maintenance budget must be reduced, make it a short-term solution! As an extended solution, it affects reliability and any costs incurred to regain reliability may substantially exceed any costs saved. Impacts on future reliability may adversely affect service delivery with consequent loss of business. It is, therefore, prudent to enforce a realistic maintenance budget on schedule.

## Key performance indicators

Having dealt with effective maintenance, the handbook considers the use of key performance indicators (KPIs) in monitoring asset performance from the perspective of both the engineer and the operational manager. In effect, the employment of such KPIs provides benchmarks of the asset status, availability and fitness for purpose.

Many companies view engineering, in general, and maintenance, in particular, as necessary evils, as an expense to the organization or as a non value-added function. Such companies

see little or no value in engineering, they have never learned to measure it and they may not understand how their future competitiveness hinges on it. After all, what you do not monitor and measure, you cannot manage.

Other companies view engineering as a way of reducing product or service delivery costs – in effect, they use asset management as a competitive weapon. Such companies can use the cost advantage to reduce their prices, improve their profit margins and deliver increased shareholder value.

Two different levels of KPIs should be developed: for senior management, the executive summary, indicating performance and, for the engineering department, detailed engineering reports to analyze the things that drive the results. This leads to better understanding and greater control. The handbook offers detailed examples of what should be included in the different levels of KPIs.

In general, the three main KPIs that monitor how a site's assets are being maintained include the safety of personnel and the environment, the performance of equipment and the cost of engineering.

## A preventative strategy

Rather than a reactive, tactical, approach to investment in maintenance, the Club argues for a preventative strategy to drive day to day decisions about how to sustain assets – from servicing intervals and frequency, to a responsibility hierarchy. The publication explains software tools that can aid the administration of a planned, efficient, cost based maintenance schedule, but it emphasizes that the fundamental issue is one of management attitude.

From on the ground experience, Laurence Jones says, “Maintenance performed too infrequently will lead to a loss, resulting in unplanned down time. Additionally, the cost of unexpected failure and repair can be up to six times that of planned preventative maintenance. Costs saved by delaying routine servicing are short-term savings that are likely, eventually, to incur financial loss.”

Maintenance should only be carried out within the structure of a documented plan, when all the required resources are readily available and at a time that will cause least disruption to customers. It may be performed by in-house employees or outsourced to contractors. This decision is based upon the degree of expertise and equipment which is required, as well as the funds and time available.

It is important that there is a well organized asset management structure. Frontline supervision, engineering and maintenance management, engineering support, training, participative teamwork, and planning and maintenance data management are all key aspects.

## Maintenance policy

Every maintenance department should have a maintenance policy that maximizes uptime and minimizes cost. The principal objectives of an overall maintenance policy are to: ensure a safe working environment; protect the company's investment in infrastructure and equipment by introducing a framework for regular maintenance and routine inspections thus maximizing useful life; and provide a structured plan for cost effective maintenance expenditure.

There are two important objectives of an equipment maintenance policy. The short-term objective is to satisfy day to day operational requirements by having equipment available as required. The long-term objective is to maximize the return on investment by performing ongoing maintenance to maximize whole life cost – minimum overall cost is not necessarily achieved by maximizing lifespan.

## Practical experience

The handbook brings together the practical experience of those in engineering, maintenance and the operation of ports and terminals, with the TT Club's claims and loss prevention expertise. The TT Club has also deliberately consulted widely with manufacturers and safety experts. The result is a cogent argument that from the strategy or policy level through to the detail of the maintenance plan, effective maintenance is the key to protecting and improving profitability. As James Callahan concludes, “Maintenance is the bedrock of efficient and effective asset management.”

‘The Importance of Maintenance – a handbook for non-engineers’ is available both in printed form and as a download online. It is free to members of the TT Club, PEMA and ICHCA International, and can be purchased by non-members at £36 (about \$57) through the TT Club website.

### ABOUT THE AUTHOR



**Peregrine Storrs-Fox** has been with the TT Club since 1984, firstly handling claims and providing advice to all types of transport and logistics operators, until the late 1990s when he was directing claims operations worldwide for the Club. Since 2002, Peregrine has led the TT Club's internal risk management framework as well as directing its loss prevention services to members. In this latter role he has particularly developed links with like-minded trade organisations and NGOs with a view to promote good practice in health and safety matters as well as general operations.

### ABOUT THE COMPANY

**TT Club** is the international transport and shipping industry's leading provider of insurance and related risk management services. The Club specializes in the insurance of liabilities, property and equipment for shipping and cargo handling companies. Its customer base comprises ship operators, forwarders, ports and freight terminals. As a mutual insurer, TT provides its policyholders with industry leading benefits, including specialist underwriting expertise and first class risk management and loss prevention advice.

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# New approaches to container terminal safety

**Stephan Stiehler**, vice chairman of PEMA's Safety Committee, PEMA, Brussels, Belgium

The Port Equipment Manufacturers Association (PEMA) is to publish new industry recommendations on equipment protection and human safety in container yards. This follows the positive response to last year's *Recommended Minimum Safety Specifications for Quay Container Cranes*. The persistence of accidents – costly in terms of injury and loss of life, equipment damage and reduced productivity – remains a concern, despite a positive trend in improved port safety over recent years.

PEMA's decision to compile its initial publication regarding safety standards for quay cranes, published in June 2011 as a joint initiative with the TT Club and ICHCA International, was prompted by the results of the global analysis carried out by the TT Club that showed 34 percent of asset related insurance claims were directly related to quay container cranes.

While existing technologies significantly improve the safe performance of quay container cranes, and help address some of the most common causes of accidents and claims, many of these features are not currently included as standard when specifying new cranes. Such findings formed the basis for *Recommended Minimum Safety Specifications for Quay Container Cranes*, which is now available for download on the association's website.

The recommendations were warmly welcomed by the industry, and triggered significant feedback and discussion. PEMA was extremely encouraged by the response, which signalled a high level of concern in the industry over safety, and demonstrated that there was a need for such materials to help improve standards at ports.

## A broader scope

The success of this first project led the association to acknowledge that the scope of its work needed to be broader to include yard equipment, not simply quay cranes. Furthermore, PEMA members decided to approach safety issues surrounding yard equipment from the perspective of human safety and equipment protection.

The association established special working groups to tackle the two areas. Marco Bernacchioni, sales manager at Advanced Microwave Engineering heads the human safety group, supported by Walter Schneider, TIM Logistics Automation at SICK, and Rainer Kapelski, managing director at KALP Technologies. Stephan Stiehler, strategic industry manager ports, Corporate Solution Center, Logistics Automation at SICK is chairing the equipment protection brief, supported by Oleg Ermolaev, president of Baltkran.

The results of the current initiatives will be made available in a document entitled *Recommended Minimum Safety Specifications for Yard Equipment*, which is scheduled for publication at this year's TOC Europe as a new joint initiative between PEMA, ICHCA International and TT Club.

The document is set to include safety recommendations for rubber tyred gantry cranes (RTGs), rail mounted gantry cranes (RMGs), automated stacking cranes (ASCs), straddle carriers, lift-trucks and reach stackers, automated guided vehicles (AGVs), terminal tractors and trailers.



Port of Rotterdam.

Credit: SICK AG

## New ways to identify risks

Underpinning the new recommendations is a more structured appreciation of risk and its impact on safety. By analyzing the likelihood of events that cause damage to personnel or property, we can classify different types of risk.

Risks that may result in injury to personnel include health risks, safety risks and 'crosscutting' or organizational risk. Health risks are defined as those that involve exposure to chemical carcinogens and mutagens, or physical or biological agents, sources of air or noise emission, vibration, and ultrasonic radiation. Safety risks cover situations that may result from an accident caused by contact with a tool or a mobile structure.

Crosscutting or organizational risk includes risks that are dependent on so-called business dynamics: the working relationships, interpersonal and organizational models that exist in



RTG safety: pathway protection.

Credit: SICK AG

a workplace. The PEMA working groups are dividing the process of risk assessment into five phases:

1. Identify hazards and risks
2. Evaluate and assign a priority order
3. Decide on preventative action
4. Implementation
5. Monitoring and review

The document seeks to advise port and terminal operators on how to resolve and prevent those safety risks that specifically concern the dynamics within the workplace which pose an accident risk.

## Prevention is the key

Serious accidents – causing injury to personnel and damage to equipment – can be more readily avoided with the implementation of effective data communication and advanced technologies that actively sense dangers, and identify and enable preventative measures before accidents happen. The fundamental innovation in thinking about safety that PEMA is seeking to support is to make continuous risk assessment, in real time, second nature to the port industry.

## Standards and certification

The legal framework governing such systems has yet to catch up with technological advances made in recent years. This is an area that we hope to gradually improve in the months and years ahead. We hope to see the wider introduction of ‘active safety technologies’ in the port industry and the regulatory framework associated with it.

Ideally, we would like to see industry bodies supporting the trend towards active and detecting technologies through standards and certification that make such technologies standard in working environments considered high risk. PEMA’s hope is that its upcoming document could form a starting point for input to improve current legislation which, given the new technologies in use and their continued rapid development, is today inadequate.



STS safety: boom collision prevention.

Credit: Getty Images

### ABOUT THE AUTHOR

**Stephan Stiehler** is vice chairman of PEMA’s Safety Committee, established to foster best practice and knowledge in port and terminal safety. Stephen is also strategic industry manager ports, Corporate Solution Center Logistics Automation at SICK AG, a global provider of sensors and sensor solutions for industrial applications.

### ABOUT THE ORGANISATION

The **Port Equipment Manufacturers Association (PEMA)** provides a forum and public voice for the global port equipment and technology sectors, reflecting their critical role in enabling safe, secure, sustainable and productive ports and thereby supporting world maritime trade.

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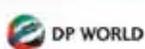
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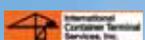
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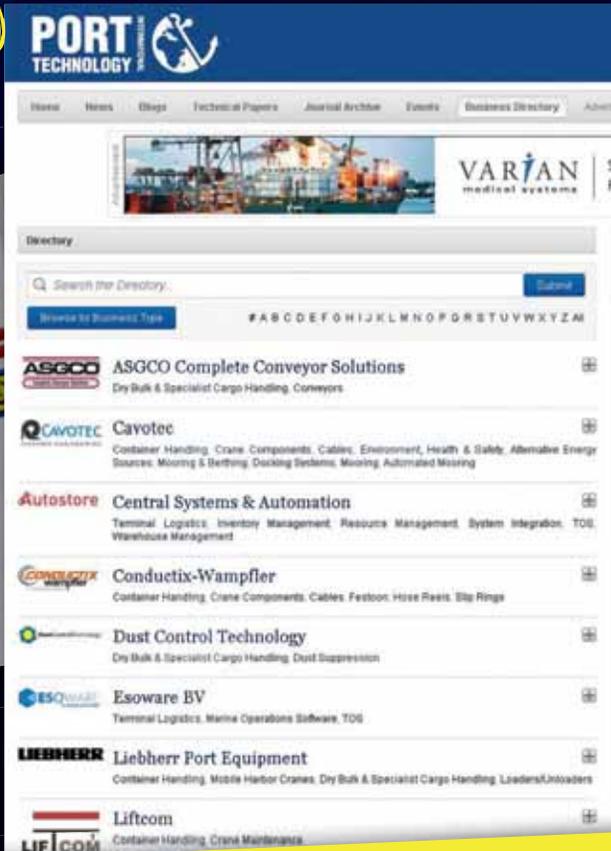
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