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# PORT TECHNOLOGY INTERNATIONAL

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DEME: creating land for the future

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**Tel:** +44 (0)207 871 0123
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**Web site:** www.porttechnology.org



**Publisher:**
Bernard Henry

**Editor in Chief :**
Gavin van Marle

Online Editor:
Linton Nightingale

Editorial Coordinator:
Claire Farrell

**Production:**
Viki Hämmerle, Daniel Brown

**Design:**
Andy Crisp

**Publication & Sales Manager:**
Michael Stewart

**Online Sales Manager:**
Gerdi Altman

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Van Oord's latest self-propelled cutter suction dredger Athena of the Dutch coast.

Picture courtesy of Van Oord Dredging and Marine Contractors bv

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## Introduction

Panama continues to exercise the minds of US port executives – and there will be no end to this until the US federal government finally begins to release some of those excess funds it has built up in the harbor maintenance fund, which to anyone in the port and shipping industry seems to be a shocking oversight.

The bald fact is that many US east coast ports are simply not ready for the increased ship sizes that they will see following the Panama Canal's expansion. There is no question of Panama slowing down its growth programme, so US ports have to ready themselves, as they well know.

But transferring that knowledge from port authority executives to Washington appears to be a painfully slow process, a problem that stems from the curious half world that the US port industry exists in. It operates in one of the freest markets in the world, if not the freest, and yet they also operate in a government controlled vacuum. For crucial capital improvements – in this case read dredging – the purse strings are held by the federal government and are only opened on the recommendation of the US Army Corps of Engineers.

One of the enduring anomalies is that the bastion of free trades still forbids its port authorities raising money themselves – there are surely enough quality financial brains in the country to help these authorities out – and forbids non-US dredging companies, with their incredible track record of global port development, from bidding for US contracts.

It remains a mystery, and also means that US ports continue to develop with one arm tied behind their collective back.

As many of the articles in this issue demonstrate, all major container ports – regardless of their proximity to Panama – are being forced to reengineer operations and increase productivity. In this respect, there is more than one way to skin a cat, and several are discussed here.

While the PTI journal offers an in-depth analysis of the some of the more intractable problems facing the port industry, to keep abreast of breaking news in our industry please visit our popular website, www.porttechnology.org and sign up for our free twice-weekly e-newsletter, which is sent directly to your inbox on Mondays and Thursdays.

Finally, as this is my first edition as Editor in Chief of PTI, I wanted to offer readers a salutation, as well as an invitation. If there are any suggestions you may have for how you would like to see PTI developed over the coming editions please drop me a line at the email address below.

**Gavin van Marle**
Editor in Chief
Email: gvanmarle@porttechnology.org
Twitter: @PortTechEditor

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"The federal government annually spends only about half of tax that it collects specifically for deep-draft channel maintenance. The rest- more than $6 billion since 1986- has essentially 'disappeared' into the US Treasury, while serious dredging needs have been neglected."

'US port-related infrastructure investments reap dividends', page 14.

# Ports and overweight containers

**Susumu Naruse**, Secretary General, IAPH, Tokyo, Japan

The issue of overweight containers, or incorrectly declared containers, has been one of the most critical safety issues for the port industry, as well as for the shipping industry. To ensure the safety of ship and port operation, some countries, such as the US, have already introduced domestic regulations that require export containers to be weighed on scales before being loaded aboard ships or being entered into container terminals. In other parts of the world, where strict local regulations do not exist, several accidents at ports were reported, which were apparently caused by overweight containers.

Recognizing that each mode of transport in the international supply chain is exposed to serious risks because of overweight containers, IAPH has adopted 'Resolution on the Safety of Containers in the Supply Chain' in its Busan Conference in May 2011. In this resolution IAPH declared the following:

1. IAPH requests international organizations such as ILO and IMO to adopt requirements for shippers to correctly pack and document cargo in containers, including the mandatory accurate weighing at the origin of the shipment;
2. IAPH urges shippers of containers at the origin of transport to apply such requirements to ensure safety in the international supply chain;
3. IAPH further requests governments and their agencies to establish effective legal requirements and control mechanisms to ensure the correct application of the requirements referred to above;
4. IAPH further requests parties responsible for road infrastructure to properly designate and promptly develop when necessary, road systems for special and bulky port cargo such as heavy containers and oversized cargoes.

As IAPH strongly supports IMO's initiatives to further strengthen the shipper's obligation to verify container weights before loading them onboard ships, we joined with WSC, ICS and BIMCO in issuing another press release 'Ports and Carriers United on the Need to Weigh Loaded Containers' in December 2011. As an interface between waterborne and land transport, ports need to act together with other related industries such as shipping and trucking to secure the safety of container transport.

On a practical side, however, the most appropriate final check point of weighing export containers could be at the gate of ports or container terminals when declarations of shippers seem dubious. The procedure may impose two major challenges on port authorities: the cost to be involved in weighing containers at ports, and, more critically, the physical space required for such operation. As the responsibility for declaring the container's weight correctly lies with the shipper, the cost incurred by the operation should be passed on to shippers in the form of a weighing charge.

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Space factors may be harder to overcome, as it would be difficult for already space-limited ports to find sufficient space to weigh containers in front of gates. When it comes to import containers, weighing containers during the operation of yard equipment could be a good option and hopefully more accurate weighing systems with handling cranes will soon become a reality.

In order to accurately understand the current status of container weighing at ports and possible challenges port authorities would face, IAPH is now carrying out a questionnaire survey to all the port members asking how they plan to deal with the issue. After analyzing the results of this survey, we will discuss these further in May 2012 when we meet at Mid-term Conference in Jerusalem. Then, we are going to establish the official position of the IAPH toward the issue and discuss this at the IMO MSC meeting in September. There will be a long way to go, but recalling what ports in the world went through with the ISPS code a decade ago, I am sure they will be able to find the solutions for this.

## ABOUT THE AUTHOR

**Susumu Naruse** first participated in IAPH activities in 2000 as one of the Members of the Executive Committee, a position he held until 2006. He was Chairman of Port Planning and Development Committee from 2004 to 2009. In 2009, he assumed his current position as Secretary General. From 2006 to 2009, he also worked for the Overseas Coastal Area Development Institute of Japan as the Executive Director. He has previously worked at the Ministry of Transport in Japan.

## ABOUT THE COMPANY

The **International Association of Ports and Harbours** (IAPH) is the global alliance of the world port community, it represents some 200 ports and 140 port-related organisations across about 90 countries worldwide. IAPH actively addresses critical issues facing the port industry through its technical committees. IAPH also proactively plays a significant role in tackling global issues at maritime-related UN agencies and other international organisations.

## ENQUIRIES

International Association of Ports and Harbors (IAPH)
7th floor South Tower New Pier Takeshiba
1-16-1, Kaigan, Minato-ku
Tokyo 105-0022
Japan
Tel: +81-3-5403-2770
Fax: +81-3-5403-7651
Email: info@iaphworldports.org
Web: www.iaphworldports.org

# Containers: opportunities and challenges

**Captain Richard W A Brough OBE**, Technical Adviser, ICHCA International Ltd, Romford, UK

## 50 years of containerisation

Believe it or not, we have been living and working in the world of containerisation for 50 years. Love them or hate them, containers have revolutionised the logistics chain and transformed many of our ports and the vessels that ply their trade between them. The number of containers moving around the globe is truly staggering: at over 27 million TEUs, that is over 17 million boxes and the vessels themselves are steadily growing in size.

The new generation of 'triple E' class container vessels being built by Maersk will be truly impressive, each over 400 meters long and with a capacity of 18,000 TEUs. According to Maersk's own website, if that number of boxes were on a train, the train would have to be 110 kilometers in length.

These enormous vessels are so called 'triple E' because of their economy of scale, energy efficiency and environmental impact. They will initially be able to call at very few ports but the industry, as is usually the case, will catch up very quickly. Ports face headache-inducing logistics and handling challenges when presented with such a large volume of containers in one go. However, it also opens up opportunities for ports. The industry is being pushed inexorably down a path of ever increasing efficiency, which drives superfluous waste out of the supply chain process. Major shippers, such as Walmart, are actively seeking greener efficiencies from their supply chain partners.

That 'waste' includes idle equipment, inefficient operations, over-manning and unproductive journeys with empty or underutilised containers. There is also an emphasis on reducing emissions, which is the subject of much current debate.

## Safety concerns

Whilst it is also true that containerisation has revolutionised cargo handling productivity, safety and security, there are still some serious issues that need to be addressed. Serious injuries to port personnel and vessel crews alike were pretty commonplace in the days of universal break bulk cargo, but containerisation has not eliminated this completely and has presented some new dangers of its own. Whilst this article was being prepared, news came in of a fatality as a container dropped on to a port worker in Peru and two senior staff were injured severely in a US port by heavy container handling equipment. An operative is fighting for his life in Rotterdam after his straddle carrier overturned.

Moving large heavy boxes around means we are using large pieces of handling equipment and they all have inherent challenges. People and machinery do not really mix very well and if there is a conflict then invariably the machinery wins. Containers themselves are very unforgiving and the environment they are handled in creates challenges, working at height being just one. It comes as no surprise then that the industry is beset with continuing serious and fatal injuries to personnel.

This is not to suggest that the industry is complacent, far from it, but the challenges it faces are issues that are not easy to resolve. Vessel design needs to be examined, with an eye to eliminating the need for personnel to be working at height and juggling heavy and awkward lashing bars. Similarly the utilisation of semi-automatic and fully automatic twistlocks should be looked at, to remove the need for so many staff in the first place. Such issues are at the forefront of the minds of terminal and vessel planners and equipment manufacturers. For example, there are currently two manufacturers offering products that eliminate the need for personnel to be in the dangerous area under the ship to shore crane. The products do this by providing a mechanical solution for automatically collecting and inserting twistlocks.

Other port developers are improving the semi and fully automated container terminal concept and remote controlled quay cranes are on the horizon. However, there will always be a tremendous lag from the more traditional ports in the world's developing regions and older technology will still be in use for decades.

## A weighty problem

By far one of the biggest challenges is what actually goes in the container itself and whether the originator of that cargo has done what he or she is supposed to have done, for example, is the cargo as declared on the Bill of Lading? Is the cargo lashed and secured inside the container in a sufficient manner that will withstand the rigours of a high stowage position on a large container vessel going through a severe tropical storm? Are there non-compatible cargoes stowed together in the same unit? Are there undeclared, dangerous goods?

Last but not least, the topic that is engaging much of the industry in debate at the moment: is the gross weight of the container and its contents actually the same as it is declared to be? If any of the transgressions mentioned above are present, singly or in combination, then the consequences can be disastrous to the container, its contents and personnel in the vicinity, or even to the entire vessel! What about the rest of the route the container will take before and after its sea journey? It is not uncommon

Container vessel instability.

Damaged corner casting.

Stacking failures.

occurrence for containers to turn over whilst they are en-route inland and there is much evidence of vehicle and rail cars overturning because of badly stowed and secured contents in the containers they are carrying.

What about the container itself? Is it safe? Is it well maintained? Can it stand up to the rigours of the journey in its own right? Most of the world's containers are covered by what is termed an Approved Continuous Examination Programme (ACEP). This is designed to identify container defects which require the unit to be withdrawn from service until it has been adequately maintained. However, one major shipping line was found to be at fault and could not produce adequate evidence that its own ACEP programme was utilised properly.

There are even a significant number of containers out there that are not up to ISO standard in terms of their stacking capability. These are now to be given their own unique identification characters so that ship planners are alerted in good time.

In recent months the cargo world was shocked to realise that counterfeit refrigerant gas was being introduced into some reefer containers. Even worse, three workers were killed as the machinery exploded.

## International solutions

The reader then will not be surprised to learn that the industry and its regulatory bodies and trade associations are embarking on a number of revisions to its guidance and are developing new international legislation in an attempt to counter some of these threats.

Significantly, there are calls for the International Maritime Agency (IMO), the only UN agency based in London, to embrace 'verification' of container gross weights into the provisions of The Safety of Life at Sea Convention (SOLAS). The IMO has agreed to take these measures after lobbying from many national administrations and the combined efforts of some powerful trade associations, including the World Shipping Council (WSC), International Chamber of Shipping (ICS) and the Baltic and International Maritime Council (BIMCO).

ICHCA International have called for such new legislation to have comprehensive guidance attached, the rationale being that if you merely add another piece of legislation, saying that shippers must provide a verified weight before the container is loaded, it may well be ignored. After all, there is already a well established legal principle that cargo weight must be accurate on presentation and there is clear evidence that some shippers are either blissfully unaware or actively engaged in false declarations.

The idea of such guidance has been readily taken up and the various trade associations are actively seeking their members' views. This is no easy task though; not one solution fits all and just by way of example; SOLAS applies to vessels of 500 gross registered tonnes or above, but there are many smaller craft carrying containers around the world's waterways that will therefore not be covered by any new legislation. Therefore, provision for when these smaller crafts containers are transferred needs to be in place. Another example of problems with the proposed legislature is: what if the shipper has no means of accurately weighing the container and what does that mean for the inland leg of the journey where other regulations are meant to apply? The industry has some way to go before it concludes its findings, but international legislation is definitely on its way.

The containers themselves must be in good condition and the US is leading on an IMO initiative to produce guidelines for ACEP schemes mentioned above. We at ICHCA are becoming aware of difficulties though, with sub-standard corner castings and container floors, and expect to see some international guidelines on this shortly.

Back to that matter of what is inside the container and whether it is stowed and secured properly. There have been numerous incidents around the world where containers and their contents have been destroyed because either the contents were unsuitable for this type of shipment and/or they were inadequately packed. As previously mentioned, this has led to many vehicles overturning and killing the driver and/or innocent bystanders.

There have been some excellent guides for safe packing of Cargo Transport Units (CTUs) produced recently by trade bodies, individual companies and their insurers, in fact there is so much information out there it is hard to know where to turn! Nevertheless incidents are at an unacceptable level and in this modern age of hyper-communications, can any shipper or packer of goods into a container plead ignorance?

Several UN agencies have agreed, therefore, to work jointly on a revision of the Guidelines for Packing of CTU's that was originally published in 1997. The previously mentioned IMO have asked International Labour Office (ILO) to update the Guide and indeed elevate it to the status of an approved Code of Practice. Such a code would afford national administrations greater leverage in local enforcement. The first meeting of the 'Group of Experts' met in Geneva in October 2011 and started the monumental task of updating the guidance into a comprehensive set of documents that will, hopefully, become the bible for container and CTU packers. The code will cover the packing of CTUs in all modes of transport, including sea, rail, road and inland waterways.

## Final thought

All of this affects sea carriers and port operators, as well as those with whom the container load originates. The inexorable rise in container movements, if all this works, does not have to correlate to a similar rise in accidents and incidents! All it requires is that the industry works together in a spirit of harmony and cooperation.

### ABOUT THE AUTHOR

**Captain Richard Brough** OBE has had a successful career both ashore and afloat and gained considerable experience in all types of cargoes, vessels and port operations. He is associated with many marine organisations and now brings that experience as Technical Adviser to ICHCA International.

### ABOUT THE COMPANY

**ICHCA International Ltd** is the only organisation dedicated to the promotion of safety and efficiency in the handling and movement of goods by all modes and during all phases of international transport chains.

### ENQUIRIES

ICHCA International Ltd
Suite 2, 85 Western Road
Romford, Essex, RM1 3LS UK
Tel: +44 (0) 1708 735295
Fax: +44 (0) 1708 735225
Email: info@ichca.com
Web: www.ichca.com or
www.ichca.org

# The Panama Canal expansion and its impact on world trade

**Marianela Dengo**, Customer Relations Unit Manager, Market Research and Analysis, Panama Canal Authority

## Introduction

In 2007, the Panama Canal Authority (ACP) started work on its $5.25 billion expansion project, which will change world trade patterns and open the waterway to new markets. The expansion will double canal capacity by 2014 and allow for the transit of larger and wider vessels, with a 160 foot beam, 1200 foot LOA and 50 foot of draft. To provide for the transit of today's post-Panamax vessels, the most powerful dredging equipment in the world is currently deepening the waterway's entrances in the Pacific and the Atlantic, while huge excavators open the access channel that will join the post-Panamax locks with narrowest section of the canal -the Gaillard Cut. In this section of the canal, explosives are being used to deepen and widen the navigational channel to make space for the larger vessels that will use the waterway in the near future. Thousands of cubic meters of concrete are currently being poured in the new locks- structures which will incorporate environmentally-friendly water- saving basins. These new locks will use 7 percent less water per transit.

## The project

The Panama Canal expansion is a project of global importance, designed to maintain the waterway's competitiveness and enhance the value of the Panama route. After years of analysis and hundreds of studies performed by the ACP, the people of Panama decided that it was in the best interest of the nation to engage in a project that would not only guarantee the sustainability of its main asset, but that would also be an economic engine capable of offering a myriad of opportunities for generations to come. Last year, the Republic of Panama's gross domestic product grew by 10.5 percent and unemployment is at the lowest levels ever experienced, at 3.5 percent.

The execution of the project has drawn the interest of the international community, and has put Panama on the map in a way never imagined during the project's conceptual stage. The new locks' dimensions were designed to handle vessels of up to 170,000 deadweight tonnage or 12,600 TEU. However, ingenuity have been the norm around all aspects surrounding the project, and recently, the Korean shipyard, Samsung Heavy Industries, unveiled its design for a 13,200 TEU containership that will fit the dimensions of the expanded locks. Containers are the main commodity through the Panama Canal, accounting for over 50 percent of toll revenues.

By the time the expanded canal opens, the ACP expects the deployment of containerships of more than 10,000 TEU through the new locks. Ports in the East and Gulf Coast of the US are making every effort to upgrade their infrastructure to meet the demand of post-Panamax vessels.

## The benefits

It is clear that those ports that are ready to handle the larger ships will reap the most benefits, and these benefits will translate into more cargo at the terminal as well as in more jobs related to the handling and distribution of the cargo, as well as other business-related transactions.

There has been some debate as to the impact of the Panama Canal expansion in the West Coast of the US. Most of the focus is on the possibility of the East Coast stealing cargo away from the West Coast. However, a good opportunity is being overlooked and that is that trade will open between the West Coast of the US and the East Coast of South America, particularly Brazil, which is an important emerging market.

The Panama Canal expansion impact will be felt in several market segments. Grain, the second most important commodity to go through the waterway, will also benefit, as the expansion will facilitate the flow of grains originating in the Midwest of the US. Annually, around 40 million metric tons of grains – particularly soybeans, corn and sorghum – move in barges through the Mississippi River system to ports in the Gulf Coast where they are loaded into dry bulkers that reach Asian markets via the Panama Canal. The expanded canal will allow for the transportation of grains in vessels of around 100,000 deadweight tonnage, generating economies of scale in shipping. Additionally, the ACP is currently assessing the potential of soybean movements originating from northern Brazil to Asia.

Other South American commodities that could be shipped in larger volumes through the expanded canal are coal and iron ore originating from Colombia and Venezuela, with destinations in Asia. In particular, coal exports from Colombia are expected to increase

The Panama Canal.

Courtesy of the Panama Canal Authority


The expansion project construction site.

by more than 200 million tons in the next ten years. Colombian coal shipments to China could transit the canal in capsize vessels of 175,000 deadweight tons, and they have the advantage of having a lower cost than coal originating in alternate production sources. Most investments related to coal production and export are concentrated in the Central and Northern Departments in Colombia. For this reason, there are many port and future railroad investments in the Caribbean coast of Colombia. In terms of iron ore shipments through the Panama Canal from Venezuela and Northern Brazil, they could benefit from an expanded canal with a larger utilization of ship sizes used in this trade route. Both coal and iron ore shipments will have the opportunity to explore the growing Asian market with the expansion of the Panama Canal.

Since the ACP announced to the international community its intent to build a third set of locks, different players of the LNG sector have approached us about their interest to deploy this cargo through the expanded canal. LNG is a completely new trade for the ACP, as the existing locks cannot accommodate this type of specialized vessel. The ACP foresees the deployment of LNG vessels with the capacity to transport over 100,000 cubic meters of liquefied natural gas through the new locks. The Panama route could become a new competing route for some cargoes originating in Peru with destinations Europe, and from shipments from Trinidad in the Caribbean to Chile. However, the greatest potential for LNG through the canal depends on the developments of shale gas in the US and Canada; particularly, if shale gas is exported from the East Coast of the United States to Asia. We have been following very closely the developments in terms of permits, production and liquefaction plants location and are inclined to believe that the first LNG exports from the US may coincide with the completion date of the Panama Canal expansion in 2014.

## Conclusion

The Republic of Panama is rapidly positioning itself as the transportation and logistics hub of the Americas. The country, located at the narrowest point of the Americas, provides unparalleled connectivity to world markets. The Panama Canal connects 144 routes and the country's modern port system. With terminals operated by SSA Marine, Hutchison Whampoa, Evergreen and PSA, it ranks among the most productive port systems in the Americas, handling 6.5 million TEU in 2011 and with projections for 8.4 million TEU by 2015.

Only 80 kilometers separate the Atlantic and Pacific oceans in Panama, and connectivity is available by water, land and air. Panama's dollarized economy, the Colon Free Zone, its strong banking system, the availability of warehousing space and third party logisitcs, and the special tax and migratory incentives available to multinational companies doing business abroad, all compose a cluster of value-added activities that are making of Panama the best place to consolidate cargo in the Americas.


### ABOUT THE AUTHOR

**Mrs. Marianela Dengo** is the Customer Relations Unit Manager of the Panama Canal Authority. Prior to her current position, she led the ACP's Marketing Division Specialized Services Segment, responsible for market and economic research, competitive intelligence, and customer relations. Mrs. Dengo has worked with the Canal organization since 1991 holding several managerial positions in various divisions of the agency.


### ABOUT THE COMPANY

The **Panama Canal Authority** (ACP) is the entity of the Government of Panama established under Title XIV of the National Constitution with exclusive charge of the operation, administration, management, preservation, maintenance, and modernization of the Canal, as well as its activities and related services.


### ENQUIRIES

Email: info-mercadeo@pancanal.com

# US port-related infrastructure investments reap dividends

**Kurt Nagle**, President, American Association of Port Authorities (AAPA), Virginia, US

## Introduction

For centuries, US seaports and the waterways that connect them have served as a vital economic lifeline by bringing goods and services to people around the world, facilitating trade and commerce, creating jobs, helping to secure US borders, supporting the military and serving as stewards of valuable coastal environmental resources.

As the primary gateway for overseas trade, seaports are essential for economic prosperity, and federal funding for infrastructure in and around ports pays dividends for the country. Deep-draft coastal and Great Lakes ports are the nexus of critical transportation infrastructure that connects America's exporters with markets overseas. They also provide access for imports of raw materials, components, and consumer goods that are a key part of US manufacturing and standards of living.

Investments in port infrastructure and the intermodal connections that serve seaports – both land and waterside – help the nation prosper and provide an opportunity to bolster the employment and economic recovery.

## Economic impacts

Today, international trade accounts for more than a quarter of America's gross domestic product, while ocean-going vessels that load and unload cargo at US seaports move 99.4 percent of the nation's overseas trade by volume and 65.5 percent by value. Furthermore, customs collections from seaport cargo provide tens of billions of dollars a year to the US federal government, including $23.2 billion in financial year 2007, $24.1 billion in financial year 2008, $20.3 billion in financial year 2009 and $22.5 billion in financial year 2010.


Image courtesy: Port Miami 2012, USA.

In the latest economic impacts analysis conducted in 2007, US seaport activities generated $3.15 trillion in annual economic output, with $3.8 billion worth of goods moving in and out of seaports every day. The impacts go far beyond the communities in which seaports are located. On average, any given US state uses the services of 15 different ports around the country to handle its imports and exports.

From a jobs standpoint, America's seaports support the employment of 13.3 million US workers, and seaport-related jobs account for $649 billion in annual personal income. For every $1 billion in exports shipped though US seaports, 15,000 domestic jobs are created. With ambitious greening initiatives nationwide, seaports have begun generating jobs outside of their traditional sectors, such as opportunities in the environmental sciences.

In addition to handling international trade, US seaports, and the waterways that serve them are also important transportation modes for the movement of domestic freight. Greater utilization of America's coastal and inland water routes for freight transportation complements other surface transportation modes, helping to provide a safe and secure alternative for cargo while offering significant energy savings and traffic congestion relief.

## Waterside

While US investment in its waterways infrastructure is trending downward, countries like India, Brazil and even the UK are committing the equivalent of billions of dollars to modernize their ports and channels. The first major expansion of the Panama Canal in more than a century is slated for completion in 2014, and it is driving ports around the world to deepen their navigation channels and improve harbor facilities.

India plans to invest $60 billion, including both public and private funds, in creating seven new major ports by 2020 to handle a rapid expansion in exports of merchandise, which is forecast to triple by 2017. Brazil expects tonnage at its coastal ports to more than double, to 1.7 billion tons by 2022 and has committed $17 billion, including $14 billion from the private sector, for port improvements. In the UK, the world's fourth largest marine terminals operator, DP World, plans to spend $2.5 billion on London's Deep-Water Gateway, the country's first such development in the last 20 years.

Back in the US, public funding for new navigation channel improvements has all but dried up as lawmakers focus on reducing the deficit and eliminating appropriation 'earmarks' that have traditionally funded federal navigation deepening projects. At the same time, funding for projects already approved and underway is slow, incremental and insufficient.

Insufficient appropriations also make it impossible to maintain most federal navigation channels at their authorized and required dimensions. The US Army Corps of Engineers is responsible for improving and maintaining the nation's water access to ports. Nevertheless, the federal government annually spends only about half of the tax that it collects specifically for deep-draft channel maintenance. The rest – more than $6 billion since 1986 – has essentially 'disappeared' into the US Treasury, while serious dredging needs have been neglected.

Projects to maintain these critical waterways would create jobs immediately and would provide transportation savings to benefit US businesses. With decreases in the cost of freight transportation, these sectors can enhance their global competitiveness and can create more jobs. AAPA continues to strongly urge Congress to take action to ensure 100 percent of the annual amount collected from the Harbor

Image courtesy: Port of Houston Authority, USA.

Maintenance Tax (HMT) is utilized to maintain federal navigation channels.

## Landside

In addition to navigable waterways, reliable, uncongested roads, rails, bridges and tunnels give American businesses a competitive advantage in the global economy by providing them with the ability to deliver products at lower costs while reaching larger markets. And the role of international trade is only projected to increase.

As recently as 2005, the World Economic Forum ranked the US number one in infrastructure economic competitiveness. In 2011, the US was ranked 16th. This isn't surprising, considering that the US spends only 1.7 percent of its gross domestic product on transportation infrastructure while Canada spends 4 percent and China spends 9 percent. Even as the global recession has forced cutbacks in government spending, other countries continue to invest significantly more than the US to expand and update their transportation networks.

China has invested $3.3 trillion since 2000 and recently announced another $105.2 billion for 23 new infrastructure projects. Brazil has invested $240 billion since 2008, with another $340 billion committed for the next three years. Consequently, China is now home to six of the world's ten busiest ports – while the US is not home to one. Brazil's Açu Superport is larger than the island of Manhattan, with state-of-the-art highway, pipeline and conveyor-belt capacity to ease the transfer of raw materials onto ships heading to China.

According to the National Surface Transportation Policy and Revenue Commission, US freight movements are increasingly choked by a lack of capacity, and the current system of funding improvements won't even sustain what has already been built. Inadequate infrastructure hurts the economy, and the businesses, workers, farmers and consumers that drive it.

The American federal government has a unique constitutional responsibility to maintain and improve the infrastructure that enables the flow of commerce, and much of that infrastructure in and around seaports has been neglected for too long. US federal surface transportation programs have largely ignored freight mobility and the importance of intermodal connectors that provide the link between the federal highway system and intermodal marine terminals that move goods from land to water.

To get the American economy back on track, a national infrastructure strategy for the future must be developed. Washington must finally pass a reauthorized multi-year transportation bill and target federal dollars toward economically strategic freight transportation infrastructure of national and regional significance.

By fully considering the needs of freight transportation infrastructure, including infrastructure in and around America's ports, it will help reduce congestion, improve the environment, facilitate goods movement, enhance international competitiveness and create jobs.

## The future of US exports

In July, the AAPA and the US Department of Commerce's International Trade Administration entered into a Memorandum of Intent to support President Obama's 2010 State of the Union goal to double US exports in five years. Creating and enhancing opportunities for US manufacturers to export their goods overseas is a key component of this important goal, but getting there will require enhancements to America's transportation infrastructure. For American businesses to compete internationally, they must have an efficient, cost effective transportation system to move their goods.

In addition to funding, another major challenge of infrastructure planning is time. The US population is forecast to grow by 100 million, a 30 percent increase, before the middle of the Twenty-first century. From conception to completion, it can take two decades or more to build a bridge, deepen a navigation channel or improve an existing highway; the projects now being proposed need to be designed for future users and uses, not just those of today.

In order to develop and implement policies and programs that will stimulate trade and business development, create jobs, and sustain and improve America's critical gateways for global trade, the maritime and transportation communities need as many voices as possible repeating the same messages. These voices must be raised individually and together to urge federal lawmakers to adequately fund freight movement programs and reform policies to raise the priority of freight and seaport-related infrastructure.

By raising the priority of seaports and their connecting infrastructure, America can achieve modern, navigable ports with efficient intermodal connections, while creating greater trade and job opportunities for both today and the future.

ACKNOWLEDGEMENTS

This article originally was a feature by Kurt Nagle for *Industry Today* October 17, 2011.

ABOUT THE AUTHOR

**Kurt Nagle** has a Master's degree in Economics and over 30 years experience in Washington, DC, related to seaports and international trade. Prior to joining AAPA in 1985, he was Director of International Trade for the National Coal Association and Assistant Secretary for the Coal Exporters Association.

ABOUT THE COMPANY

Celebrating its Centennial in 2012, the **American Association of Port Authorities** (AAPA) today represents 150 of the leading seaport authorities in the United States, Canada, Latin America and the Caribbean, and more than 250 sustaining and associate members, firms and individuals with an interest in seaports. To meet the growing demand for trade, the AAPA and its members are committed to keeping seaports navigable, secure and sustainable.

ENQUIRIES

American Association of Port Authorities
1010 Duke Street
Alexandria
VA 22314, US
Tel: +1 (703) 684 5700
Fax: +1 (703) 684 6321
Email: info@aapa-ports.org
Web: www.aapa-ports.org

# PORT PLANNING, DESIGN AND CONSTRUCTION

## FEATURING FINANCE


"In manually operated terminals, containers get lost- and this happens even on fully automated terminals. As Khalifa Port has a manual waterside operation, we have devised a way to not misplace containers."

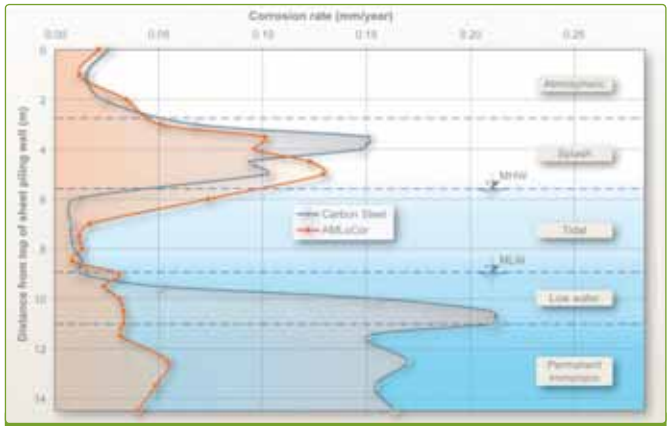
'Khalifa Port, the birth of a giant', page 31.

# New corrosion resistant steel grade for marine applications

**João Martins**, Head of Engineering and Promotion, ArcelorMittal Commercial RPS S.à r.l., Luxembourg

AMLoCor offers a significant reduction of the corrosion rates in the low water zone (LWZ) and in the permanent immersion zone (PIZ), which is normally the location of the maximum bending moments, and consequently the highest steel stresses. This new steel grade is the solution to address one of the major concerns of designers and port authorities: durability of marine structures like quay walls, breakwaters and jetties.

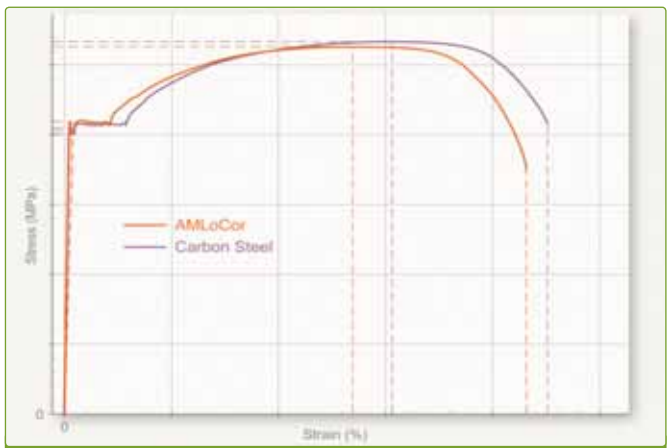
Eurocode 3 Part 5 contains reference tables with typical corrosion rates valid for standard structural steel in northern European countries. In-situ tests during the last two decades in Northern European ports have proven that, in comparison to standard structural steel in the critical zones, the loss of steel thickness of AMLoCor is reduced by a factor 3 in the PIZ and a factor 5 in the LWZ.




Measured corrosion rates in an European port over 15 years: regular structural steel versus AMLoCor.

The recipe to achieve these extraordinary properties is a special chemical composition which contains specific alloys. The final formula has been improved based on the results of several research and development projects.

AMLoCor leads to considerable savings in steel weight, in the case of high corrosion rates of regular structural steel in the permanent immersion zone. Cathodic protection or coatings can be used to increase the service life of the sheet pile structure, and are compatible with this new steel grade. However, AMLoCor will in many cases yield the most cost effective solution in the long-term, without any additional steel protection. AMLoCor also protects steel from accelerated low water corrosion, which is related to biological activity enhancing degradation of steel in the LWZ.




Typical stress – strain diagram of structural steel and AMLoCor.

Port of Shoreham, UK (2010). First quay wall with AMLoCor sheet piles.

The mechanical properties of AMLoCor steel are fully equivalent to standard piling grades, so that structural resistance can be determined according to all relevant design codes used for steel sheet piling structures, like EN 1993-5:2007 in European countries.

An important feature of any new development is the drivability. Hence, a driving test was performed in Denmark. Several sections in steel grades S 355 GP and AMLoCor Blue 355 were driven into very hard soils with some boulders. They were monitored during driving, then pulled out and inspected. This driving test demonstrated that the behavior of AMLoCor sheet piles driven into hard soils is at least as good as standard structural steel sheet piles.

The manufacturing process had also to be adapted in order to cast the steel and produce the beam blanks used for the rolling of the first AZ sheet pile sections. AZ sections are now available with yield strength up to 390 megapascal.

The first project with AMLoCor sheet piles is a quay wall in the southern part of the UK, in the Port of Shoreham. It consists of an anchored wall with 16.0 meter long AZ 37-700 in AMLoCor Blue 355. Some sheets are equipped with extra elements to enable monitoring of the residual thickness during the first five years, and to compare these results to two reference sheet piles in S 355 GP.

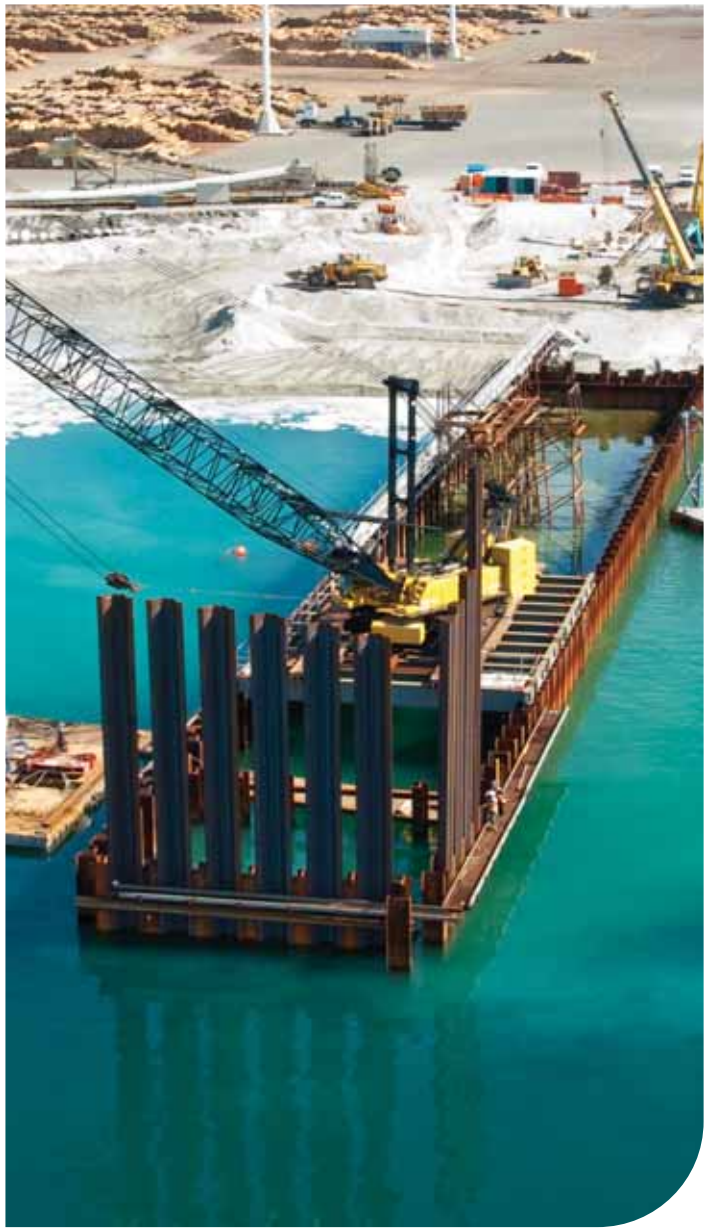
AMLoCor is the new low corrosion steel grade that will undoubtedly revolutionize the design of port structures in the future.

## ABOUT THE COMPANY

**ArcelorMittal** is the largest manufacturer of hot rolled steel sheet piles worldwide. The experienced engineers of the sales and technical departments can assist all project stakeholders towards cost effective and sustainable foundation solutions for permanent and temporary applications. ArcelorMittal develops innovative products and delivers high quality steel sheet piles produced from recycled steel.

## ENQUIRIES

ArcelorMittal Commercial RPS S.à r.l.
Sheet Piling, 66, rue de Luxembourg, L-4221 Esch-sur-Alzette
Email: sheetpiling@arcelormittal.com Web: www.arcelormittal.com/sheetpiling



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Sheet Piling | 66, rue de Luxembourg | L-4221 Esch/Alzette | Luxembourg
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www.arcelormittal.com/sheetpiling

# Hamburg-Le Havre Range topped 40 million TEU in 2011

**Sönke Maatsch**, Port Expert, & **Michael Tasto**, Shipping Expert, Maritime Economics and Transport, Institute of Shipping Economics and Logistics (ISL), Bremen, Germany

With six TEU millionaires on a coastline of only 500 sea miles and a seventh port to enter this league soon, the North Range is one of the busiest port regions in the world. A recent study conducted by the ISL provides new insights on the various traffic flows passing through these ports.

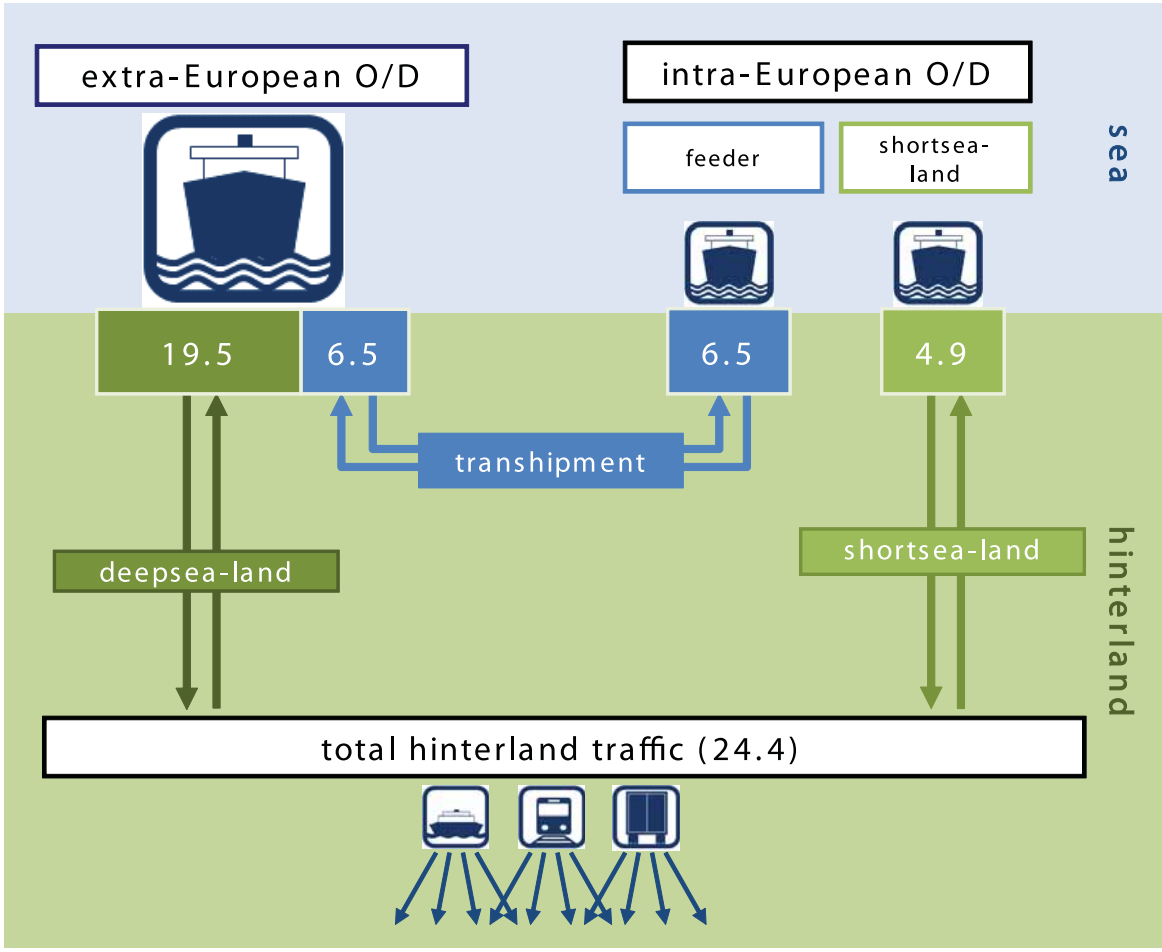
In 2010, the base year of the study, the six major North Range ports Rotterdam, Hamburg, Antwerp, Bremen/Bremerhaven, Zeebrugge and Le Havre handled 37.3 million TEU. This traffic includes three major types of trade:

- Deepsea-land: traffic between extra-European origins/destinations and the North Range ports' hinterland
- Shortsea-land: shortsea traffic between European countries and the North Range ports' hinterland
- Transhipment: containers shifted between mainline and feeder vessels.

More than half of the North Range ports traffic (19.5 million TEU in 2010) is deepsea-land traffic, for example, imports from China destined to the North Range ports' hinterland. Transhipment traffic between mainline and feeder vessels generated 13.0 million TEU of container handlings (35 percent), while shortsea-land traffic accounted for 4.9 million TEU of the ports' handlings.

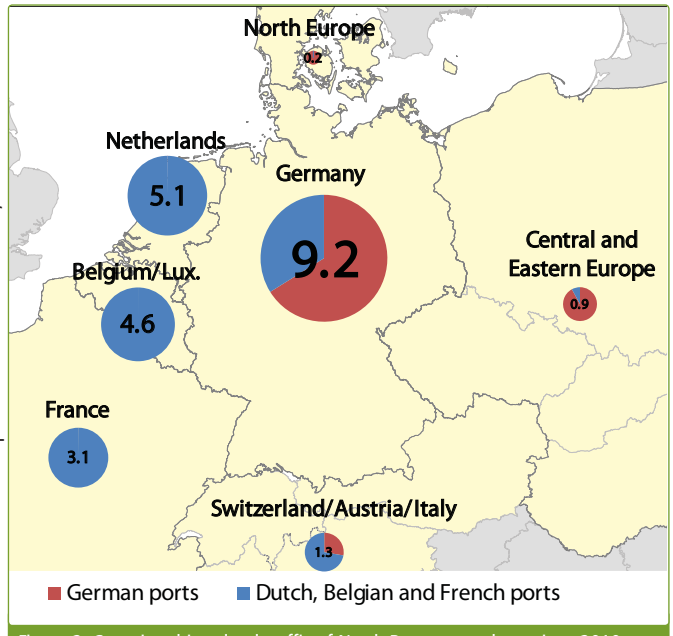
## Hinterland traffic

Overall hinterland traffic, that being deepsea-land and shortsea-land, totalled 24.4 million TEU, almost as much as in 2008 (24.9 million TEU). The largest market is Germany with a share of 37.5 percent (9.2 million TEU). The total container traffic generated by the German economy is still higher since many of the goods unloaded in Dutch or Belgian distribution centres continue their journey to Germany by conventional trucks. For the Belgian distribution centres, Northern France and the Paris area are also very important markets. This explains the rather high shares of the Netherlands (20.1 percent) and Belgium (19.1 percent) in container hinterland traffic in relation to their population.



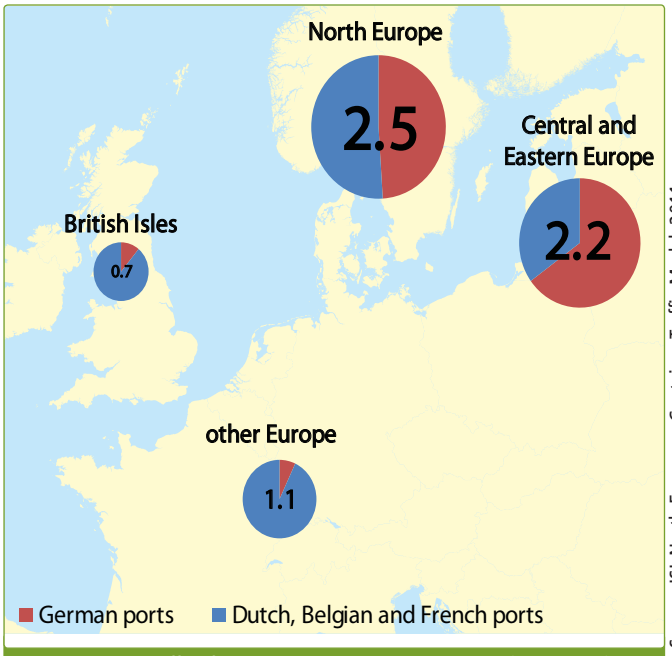

Source: ISL North European Container Traffic Model, 2011

Figure 1. Container traffic of North Range ports by market segments 2010 (million TEU).




Source: ISL North European Container Traffic Model, 2011

Figure 2. Container hinterland traffic of North Range ports by regions 2010 (million TEU).




Source: ISL North European Container Traffic Model, 2011

Figure 3. Feeder traffic of North Range ports by regions 2010 (million TEU).

The regional distribution of container hinterland traffic changes only gradually as some regions grow more quickly than others. Shifts between ports are usually less frequent and less pronounced than for transhipment traffic. Despite the rather stable development of hinterland traffic, there was a noticeable change between 2008 and 2010: the Danish and the Polish market were increasingly served via the national ports in 2010 – either through feeder traffic or through direct calls of deepsea vessels. This shift of traffic from the hinterland of North Range ports to the regional ports was apparently favoured by low charter rates and overcapacity in the market. Some of the traffic may shift back to the North Range ports in the years to come.

The market share of German ports among the six major North Range ports' hinterland traffic was 30.3 percent in 2010. It reached more than 90 percent for hinterland traffic to Northern and Eastern Germany, Denmark and parts of Central Europe, while it was below 50 percent for practically all regions west of the Rhine.

As regards the seaward origins and destinations, about half of the hinterland traffic (51 percent) was to or from Asia in 2010. The Americas and European shortsea trade followed with 21 and 20 percent, respectively. Africa and Oceania only played a minor role. Once again, there are marked differences between the North Range ports. In Hamburg, Asia had a share of about two thirds, while in Zeebrugge, intra-European traffic was by far the most important in 2010.

Notwithstanding a rather weak fourth quarter, the year 2011 will have marked a new record of container transports between the North Range ports and their hinterland with more than 25 million TEU. Still higher volumes are expected in 2012 – a challenge for ports, infrastructure, and freight forwarders.

## Transhipment traffic

The North Range ports also serve as hub ports for large amounts of container transhipment. According to ISL estimates, 6.5 million TEU were moved between main line and feeder vessels in 2010, hence generating 13.0 million TEU quayside handlings. The volumes would have been even higher if it had not been for Maersk's rearranged AE10 Far East service, which is now also calling in Gdansk and hence reducing the volume of boxes that need to be transhipped in the North Range ports.

The Baltic Sea/North Europe is the North Range ports' most important feeder market, accounting for 4.7 million TEU of feeder traffic in 2010 (72 percent of the total market). This traffic was evenly distributed between Northern European countries (such as Finland, Sweden, Norway, and Denmark) and Eastern European countries (Poland, the Baltic States, and Russia). Both markets are traditionally covered mostly by the German ports. However, their combined market share dropped from 71 percent in 2008 – the last year ISL conducted a detailed analysis – to just 57 percent in 2010.

The British Isles represent the second largest feeder market at a distant 0.7 million TEU (11 percent). Most lines call at least one UK port in the south-east of Great Britain, for example Felixstowe or Southampton. The transhipment in Rotterdam, Antwerp and Le Havre focuses on smaller ports in the south-west and north of the UK and also ports in Ireland which are not regularly served by deepsea lines.

There is also some intra-range transhipment traffic, even boxes transhipped between neighbouring ports such as Antwerp and Zeebrugge or Bremerhaven and Hamburg. This repositioning mostly occurs in merchant haulage, when the port of loading figuring on the Bill of Lading is not on the schedule of the mainline vessel. Finally, transhipment also takes place between the North Range and ports on the Atlantic Coast and in the Mediterranean.

Transhipment traffic was much more volatile during the past years than hinterland traffic. On the one hand, the transhipment market reacted stronger to the crisis, most notably due to a decrease of Russian traffic by 33 percent in 2009. On the other hand, transhipment can be shifted more easily between ports than hinterland traffic. In 2009 and 2010, the German ports lost large parts of their market shares to Rotterdam, Antwerp and Zeebrugge. The significant decline of both bunker prices as well as time charter rates for container vessels made shifting cargoes away from Hamburg and Bremen/Bremerhaven easier during the crisis, regardless of their proximity to the Kiel Canal. The larger proportion of deepsea liner stakes in Zeebrugge, Antwerp and Rotterdam might have played a role as well as operators had to fill 'their' terminals first.

In 2011, however, transhipment traffic started to move back to German ports. At the same time, a rapid expansion in Russia and

Poland fuelled the development in this segment. As a result, the growth of total container traffic could have hardly been spread more unevenly between the North Range ports. According to preliminary estimates, handling volumes grew by about 20 percent in Bremen/Bremerhaven and by around 15 percent in Hamburg, whilst traffic in Zeebrugge and Le Havre actually declined in 2011. Rotterdam also lost some ground but was able to defend parts of the market shares it gained in 2009 and 2010. As a result, container traffic in Europe's largest port was already 10 percent higher in 2011 than before the crisis, while Hamburg will only reach its previous record of 9.9 million TEU in 2012 or 2013.

## ABOUT THE AUTHORS

**Sönke Maatsch** is an economist at ISL's Maritime Economics and Transport department with a focus on port traffic development and forecasting. He conducted a variety of consulting projects for ports in the North Range. Besides his consulting activities, he is responsible for ISL's statistical publications.

**Michael Tasto** is an expert for shipping at ISL's Maritime Economics and Transport department and managed numerous projects focusing on liner operator strategies and shipping markets. Next to his consulting activities, he teaches at the Universities of Applied Sciences of Bremen and Bremerhaven.

## ABOUT THE COMPANY

The **Institute of Shipping Economics and Logistics** (ISL) is an independent non-profit foundation conducting research and providing consultancy to private and public organisations around the world. The Maritime Economics and Transport department closely monitors the development of shipping markets, seaborne trade, and port traffic.

## ENQUIRIES

ISL – Institute of Shipping Economics and Logistics
Maritime Economics and Transport
Universitätsallee 11-13, 28359 Bremen
Germany
Web: www.isl.org

Sönke Maatsch
Tel: +49 (0)4 21/2 20 96-32 Email: maatsch@isl.org
Michael Tasto
Tel: +49 (0)4 21/2 20 96-73 Email: tasto@isl.org

# The preferred scale of container terminals

**Vicky Kaselimi**, Research Fellow & **Dr. Theo Notteboom**, President, Institute of Transport and Maritime Management Antwerp (ITMMA), University of Antwerp, Antwerp, Belgium

## Mind the scale

Both terminal operators and port authorities are interested in knowing the optimal scale for a terminal they are going to operate or lease. Container terminal operators are interested in the terminal scale as it will affect their operational cost structure and will have implications on the commercial strategy needed to attract container volumes. Landlord port authorities, or any other managing body of a port responsible for strategic decisions regarding the provision of a port's infrastructure to terminal operators, are (or should be) implicitly or explicitly interested in the scale of terminals in their ports in the context of the concessioning of port land. When developing a new port area, port authorities might opt to concession one big terminal or, alternatively, to divide the available land into more sections and thus more and smaller terminals.

### The purely economic approach: the Minimum Efficient Scale

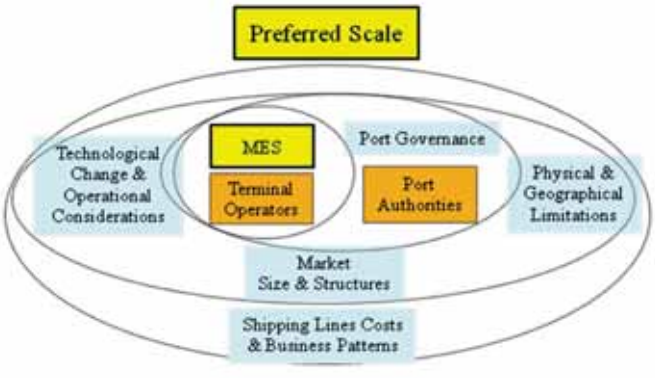
From a strictly economic point of view, the best possible scale for a terminal is guided by the Minimum Efficient Scale (MES). MES is a central concept in economic literature, with applications to plants and/or firms, mainly in the manufacturing, electric power generation, agriculture, banking and air transport industries. One possible way of defining the MES of a container terminal is by linking this scale to operational efficiency as reflected by the average cost function and therefore to define it as the smallest scale at which output can be produced at minimum average long- run cost.

### 'Preferred' scale is more than Minimum Efficient Scale

In practice there are more parameters, apart from MES, that define the best possible scale of container terminals. In terminal concessioning procedures, the terminal scale that is 'preferred' in the end is usually different from MES. For example, terminal operators typically want to benefit from economies of scale, while port authorities also have to consider the (internalized) social costs arising from the (imminent) monopoly power of single terminals. The result of this could be that port authorities, when awarding new concessions, encourage container terminal development at less than MES level.

In addition, the geographical segmentation of the container terminal market contributes to the existence of different sizes and cost structures of these markets, which leads to different terminal scales. Also, the development of terminals in different periods of time means that they have access to different technology and thus have different cost curves, leading, in the end, to different terminal scales. In some other cases, the space available for terminal development is so restricted that new terminal capacity development is not possible and expansion can only be achieved through substantial changes to the input mix. Finally, the container terminal scale is also linked to the local shipping patterns and the minimum amount of infrastructure and equipment required for handling the smallest basic unit of shipping using the port as a standard of service acceptable to the ship operator.

From the above, we can conclude that the preferred scale of container terminals is the result of a complex interaction between the MES of the relevant terminal and a number of other parameters, such as the port governance framework and policy objectives, the market size and structure, technological change and operational considerations, the physical and geographical limitations and shipping lines' costs and business patterns (see Figure 1).




Source: Kaselimi, E.N., Notteboom, T.E., Pallis A.A., and Farrell, S. (2011). Minimum Efficient Scale (MES) vs. 'Preferred' Scale of Container Terminals. Research in Transportation Economics, 32(1), 71-80.

Figure 1. Preferred scale of container terminals: determining factors.

## How can we estimate the preferred scale?

When it comes to the estimation of the container terminal scale, the acceptance of the assumption that the preferred scale is not solely based on MES gives us the freedom to choose a method other than the purely economic measurement of the MES. In that framework, the typical statistical cost estimation and engineering approaches that are widely used in economic literature are not so relevant. On the other hand, the proxy methods, that have received a lot of criticism for being unable to give good estimates of MES and efficiency, can be used for the estimation of the preferred scale. Taken into consideration that the actual terminal size is the preferred scale, a revealed preference technique can be used to measure the preferences of terminal operators and port authorities on container terminal scales.

Based on the hypothesis that the observed distribution of terminal sizes will be clustered in some way around the best possible size, we expect that the preferred scale of container terminals can be deducted from the size distribution analysis of terminals. We also argue that the preferred scale is not a single value but instead lies within a range.

### Empirical evidence on preferred scale

We performed a size distribution analysis of 333 container terminals worldwide. All terminals operate in ports that handle more than 150,000 TEU and have up to four terminals. Terminal size was measured by focusing on container throughput in TEU at terminal level. The size distribution of container terminals was explored in relation to the following parameters: the continent in which the terminal

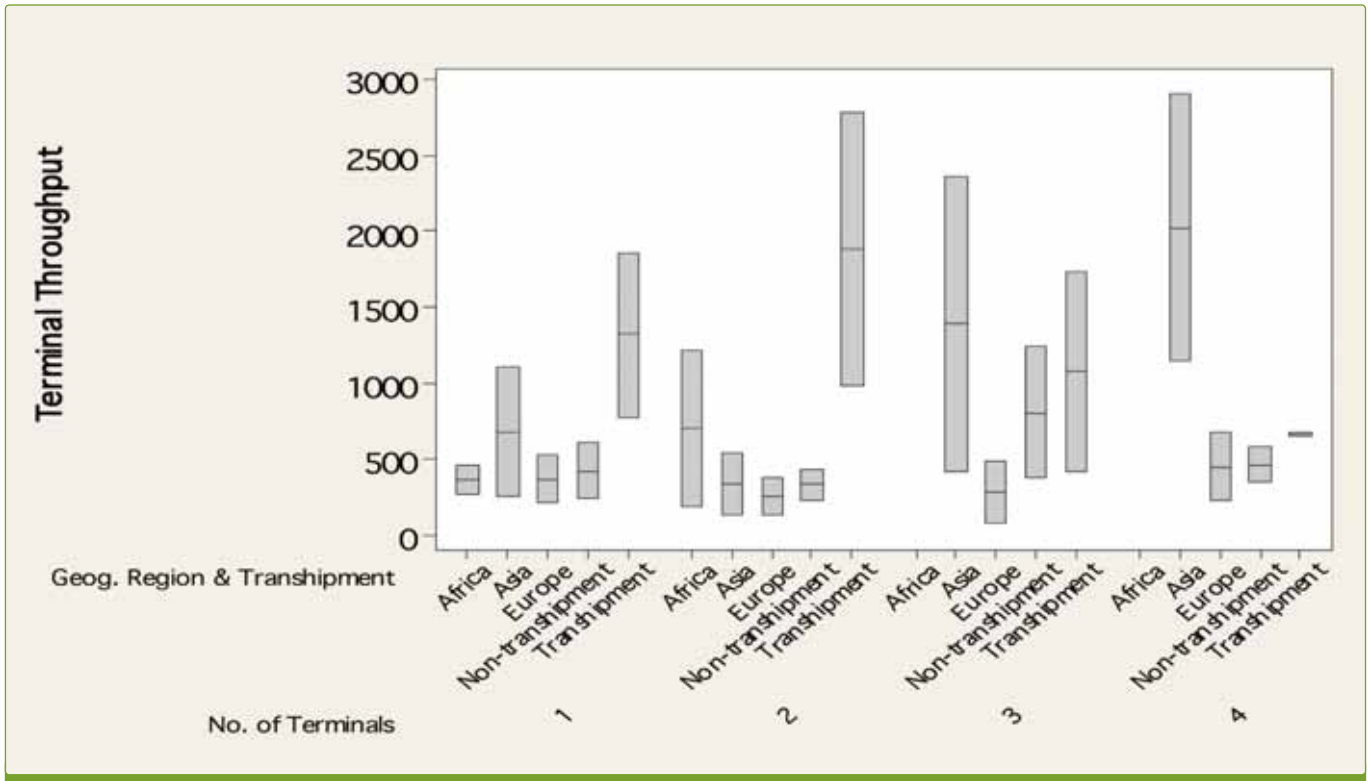



Figure 2. Terminal preferred scale (in 1,000 TEU) by number of terminals in the port.

operates (Africa, Asia or Europe), the number of terminals in the port and the transhipment incidence of the terminal (0-100 percent). Following a differentiated approach, we thus examined three different cases:

- The size distribution of transhipment container terminals with a transhipment incidence of at least 65 percent compared to the size of the remaining non-transhipment container terminals;
- The size distribution of container terminals by continent;
- The size distribution of container terminals by number of terminals per port.

Figure 2 presents the results by number of terminals per port, geographical area and transhipment incidence.

For terminals located in ports with only one terminal, the typical preferred scale ranges from 205,000 TEU to 1 million TEU with the exception of transhipment ports. For two-terminal ports, in Asia, Europe and Africa, the lower bound of the preferred scales start from a throughput of around 130,000-180,000 TEU and goes up to 1.2 million TEU. The exception, once again, is the transhipment terminals that influence the ranges up to 3.2 million TEU. For terminals in ports with three terminals, the range of the preferred scale shows a wide dispersion. For Europe, the range fluctuates between 80,000 and 500,000 TEU, while in Asia it lies between 400,000 and 2.4 million TEU. For four-terminal ports, there is again a large spread in the range of preferred scales.

The analysis reveals there is not a clear relationship between the scale of container terminals and the number of terminals inside the same port. In Africa, it seems that the scale of terminals increases as the number of terminals in a port increases. In Europe and Asia, the scale ranges are similar but again it seems to be an upward trend in ports with three and four terminals. The scale of transhipment terminals seems to be similar with a slight downward trend especially when it comes to ports with four terminals. Also in non-transhipment terminals, the range in the terminal scale is similar but with an increase when it comes to ports with four terminals. In summary, the scale of the terminals is not decreasing when the number of terminals inside a port increases.

## ABOUT THE AUTHORS

**Ms. Evangelia (Vicky) Kaselimi** is a Research Fellow at University of Antwerp. She is currently conducting Ph.D. research on port and terminal competition. Ms. Kaselimi is also a Civil Servant at the General Secretariat of Ports and Port Policy, Hellenic Ministry of Maritime Affairs, Islands and Fisheries. Her scientific interests include port economics and policy, port and terminal competition with application of game theory and statistical analysis. Ms. Kaselimi is a member of PortEconomics.eu, a web-based initiative aiming to advance knowledge exchange on port economics, management and policies.

**Dr. Theo Notteboom** is President of ITMMA (an institute of the University of Antwerp), Professor at the University of Antwerp, a part-time Professor at the Antwerp Maritime Academy and a visiting Professor at Dalian Maritime University in China and World Maritime University in Sweden. He published widely on port and maritime economics. He is also President of International Association of Maritime Economists (IAME), Chairman of the Board of Directors of Belgian Institute of Transport Organizers (BITO) and co-director of PortEconomics.eu.

## ENQUIRIES

Evangelia (Vicky) Kaselimi
Institute of Transport and Maritime Management Antwerp (ITMMA), University of Antwerp
Kipdorp 59, 2000, Antwerp, Belgium
Tel: +32 (0) 3 265 51 55 Fax: +32 (0) 3 265 51 50
Email: vicky.kaselimi@ua.ac.be

Professor Dr. Theo Notteboom
Institute of Transport and Maritime Management Antwerp (ITMMA), University of Antwerp
Kipdorp 59, 2000, Antwerp, Belgium
Tel: +32 (0) 3 265 51 52 Fax: +32 (0) 3 265 51 50
Email: theo.notteboom@ua.ac.be
Web: www.itmma.ua.ac.be and www.porteconomics.eu

# Port centric logistics

## Providing competitive advantage for gateway ports

**Budha Majumdar**, Director, Port Centric Logistics Partners Ltd (PCLP)

## Port centric logistics needs little introduction

There are a few things about port centric logistics (PCL) we should clear up at the beginning.

Firstly, there is nothing new about the concept of PCL – most port managers would say that ports have provided warehousing and lot-specific deliveries forever. And they're right. What's changed now is who is asking, why and what they require.

Secondly, PCL is not about using valuable port land for value-adding activities. In fact, the biggest benefits of PCL might come from locating just outside the port curtilage. Finally, PCL is not a viable proposition for every port. If you operate a pure transhipment hub, with no or minimal gateway traffic moving into the hinterland, then PCL is not necessarily for you. Some of the rationale and principles behind PCL may still apply, especially those relating to energy use and avoiding waste, but little else.

PCL is driven by a number of desirables:

- The imperative of reducing costs across the entire supply chain – be it global or regional
- To add certainty to delivery times and undertake timely quality checks, and
- To respond to societal pressures.

There are other reasons, of course, and we'll come across some of them as we develop the theme in this paper.

## Supply chain pressures

Our world is changing and these changes are becoming increasingly unpredictable as economic conditions buffet producers, consumers and transportation service providers from every direction. Who would have thought in those heady days of 2007 and 2008 that the large, so-called 'fast' container ships would now be plotting how to steam at speeds where they could be overtaken by the Clipper sailing-ships from almost two centuries ago ?

This, along with the manipulation of slot availability by hard pressed liner operators, has simply added to the woes of shippers and their global logistics providers, because on top of everything else, that elegant JIT system of having a continuous production line providing an optimum inventory exposure has just blown out of the window. So now that the shipper cannot rely on fast deliveries, there is a greater need for certainty; certainty of knowing when the consignment is going to arrive and certainty in the knowledge of the condition of that consignment. Who is going to provide this service and how will they do that?

In the UK context, the conventional wisdom was to take the containers to the 'golden triangle' for consolidation and onward despatch to satellite distribution centers or to the processor. This involved a laden journey of the container and an empty haul back to the port for restitution. PCL enables the 'system track and trace' to be augmented by 'mark one eyeball' to report consignment received, checked and the quantity and condition confirmed at a point that is much more local to the port. Note again, not necessarily inside the port, but co-located, so as to minimise and perhaps even avoid the 'inspect and confirm' transport leg.

## Cost pressures

Rising energy prices, but perhaps more importantly volatile energy prices, are adding to this uncertainty. Everyone is looking at ways to reduce fuel consumption, avoid unnecessary journeys, avoid carrying less than full loads and increase rail and, preferably, increase sea miles over road miles. The same goes for multiple handling. Every time someone touches a container or consignment, it adds to the risk of damage or loss - on top of increasing the cost.

PCL allows the shipper or his global logistics partner to pre-plan bulk deliveries of containers from the port, turn-out in the security of their own premises- adjacent or co-located to the port using their own trained staff- and return containers without the risk of incurring demurrage and damage. Reports to the cargo owner, at this point, carry the certainty of consignment having been received in correct quantities and in sound condition.

The theory behind logistics strategies for major importers looking to reduce supply chain costs are already pretty well known. Robert Leachman from the University of California, for example, described the options for large US retailers importing products from Asia.

The 'push' strategy is appropriate for low value goods to reduce transportation costs. Importers make their allocation decisions when the product is still in Asia. They ship the containers intact through a US seaport and on to an inland distribution center before they decide the final destination.

The 'push/pull' strategy is employed to reduce inventory carrying costs. Consumer goods imported through a major gateway are trucked to a nearby distribution center where they sit until the retailer determines where in its regional network the product will end up.

But what about strategies for the port? Traditionally, the port's customer for most non-bulk products has been the shipping line. This is especially true on the burgeoning containerised trades. Deeper and wider channels, 1 kilometer long clear quays in a straight line, rail-mounted ship to shore gantry cranes (extending from handling just a few containers across deck to spanning 22 rows of containers) and large yard to store containers, which are sometimes stacked up to six high. So the shipping line, quite rightly, has determined the development of container terminals. But who would deny the inherent lack of stickiness of a shipping line's custom? Most port managers would testify to the experience of being told that a line would gladly call at his terminal – no problem with facilities, productivity, reputation and perhaps even rates – but they need their customers to want them to call at that terminal. And no prizes for guessing what the cargo owner customers say: yes, we would happily move our containers through your facility but our shipping line of choice doesn't call there.

So, here's the strategy now being followed by new container terminals servicing a sustainable hinterland – be it national or transnational – the 'pull' strategy. If you are building a terminal,

or expanding an existing facility, in a location that can service a significant hinterland, then look at what DP World are doing at London Gateway, look at the development of storage facilities around Felixstowe South and in Busan New Port read again the comments made by Forth Ports management, extolling the benefits of having large warehouses in the vicinity of their newly acquired 100% ownership of London Container Terminal.

The subliminal message from each is that they are providing first-class facilities for cargo owners and for the global logistics providers whose influence is rapidly gaining traction. These global third party logistics are increasing their share of the global container trade and require cost effective facilities for their mixed bag of customers who all demand that costs be taken out of their supply chain and, at the same time, that service reliability is improved. More and more of the larger importers are demanding greater transparency in the structure of supply chain costs and, perhaps even more importantly, greater confidence in cargo availability.

The large warehouses, which are co-located to deep-sea container terminals, provide just this. The container terminal operators are hedging their bets by providing the excellent facilities for their important ship-owner customers, and also making sure that their cargo owner customers get what they need. If a number of large cargo owners are co-located to an efficient deep-sea container terminal – where is the shipping line going to go? This is the terminal operator's 'pull' strategy – provide facilities and have the cargo owner on site (so to speak) and the ships will come. This is the essence of PCL: provide transparency, reduce costs, reduce waste and provide certainty, for all the parties.

## Societal pressure

The final thoughts on this matter reflect the pressure that a provider of goods faces. As consumers, we not only demand our household goods and consumer items at low cost and in perfect condition, but we want it on time and we want the producer to demonstrate that his carbon footprint is not excessively wasteful. Annual reports and CSR publications now require global multinationals and large producers to report on the carbon emissions arising out of their business, especially from their transportation choices. This so called 'green' argument is also driving the concept of PCL and has been enthusiastically embraced by the global logistics providers as a way of helping their clients (the cargo owners) to report continuous improvement in carbon emissions.

Witness the GoGreen programme instigated by Deutsche Post DHL, which is committed to increase the carbon efficiency of the company's operations and those of its subcontractors by 30 percent by 2020, while also helping customers achieve their (own) sustainability goals.

Container terminal operators are included in the catch-all phrase of 'subcontractors' and will not be able to avoid the scrutiny of third party logistics companies acting for their principals for much longer. These global logistics providers are skilled in cost effective logistics flows and have mastered the art of Value-Stream Mapping and now commonly employ Six Sigma black belt practitioners. Amongst other things, they will have an 'interesting' view of the common practice of shuffling and re-shuffling boxes in the yard (which is euphemistically called 'house-keeping'). This is 'waste' which arises due to ineffective yard management systems and, more commonly, due to untimely requests for deliveries. This is an additional terminal operating cost which can be effectively tackled by a customer using the PCL concept.

## Summary

There remains some confusion about the meaning and application of PCL and this short paper has tried to remove some of the mystique and to correct any misunderstandings. The benefits of PCL are undeniable, especially when faced with the problems of ageing infrastructure of large distribution centers located in the 'golden triangle' of distribution centers in the UK. The benefits are improved visibility of stock; faster availability of stock once landed in the port; direct delivery to market avoiding wasteful double handling and empty hauls and enabling order fulfilment direct from a port-adjacent site.

However, PCL is not a panacea for the container transportation industry. There are even more pressing problems which must be confronted, and PCL may not even be appropriate for the ultra-large container transhipment hubs operated by shipping lines. But if you handle gateway traffic into a hinterland, then PCL ticks all the boxes for all your customers.


### ABOUT THE AUTHOR

**Budha Majumdar** is a Director of PCLP Ltd and also a freelance Ports and Terminals Consultant. He has worked in UK and overseas advising on port master planning, capacity analysis, port marketing and operations. He is Ports Consultant to major offshore wind farm developers in the UK, assisting them in identifying suitable construction and O&M ports.


### ABOUT THE COMPANY

**Port Centric Logistics Partners Ltd (PCLP Ltd)** is a UK based advisory firm operating in the global logistics and port-related economic development fields. They build value for clients in the public and private sectors by developing the business case for investment into logistics hubs. The business case is built on forensic market analytics, logistics infrastructure appraisals, supply chain opportunities and a clear market proposition. The PCLP offer is built upon our extensive knowledge and experience in the fields of global logistics, supply chain efficiencies and port-related economic development.

### ENQUIRIES

Email: enquiries@pclp.co

Web: www.pclp.co

# The Panama Canal expansion: business as usual or game changer for ship design?

**Paul Stott**, Senior Lecturer & **Dr. Peter Wright**, Senior Lecturer, School of Marine Science and Technology, Newcastle University, Newcastle, UK

## The question has to be posed in the right way

Ever since the development of panamax vessels around fifty years ago, the beam limitation of 32.3 meters imposed by the Panama Canal's locks has presented a fixed constraint for the design of ships, defining a parameter that is etched into the minds of naval architects. This constraint is set to disappear with the opening of the expanded canal in 2014, but is this likely to lead to a change in ship dimensions?

In the Port Focus section of edition 51 of this journal, Dr. Jean-Paul Rodrigue and Dr. Theo Notteboom considered the question: the Panama Canal expansion- business as usual or game-changer? They considered this question from the point of view of trade development, noting the 'divergence of opinion' on the subject due to the complexity of trade and the number of variables and feedback loops involved. Research by the authors of this article has looked at this question from a different perspective – what effect may the expansion have on ship design?

Whilst at first reading it may seem counter-intuitive, not least because shipping is famously a 'derived' demand and only exists to service trade, the conclusion in terms of ship design is to some degree decoupled from the question about trade developments. The reason for this is because within certain size bands ships will comply with the canal's constraints whether they will be trading through it or not, to maintain flexibility. The imperative to do so is simply expressed in terms of maritime economics: reduced flexibility leads to increased volatility of earnings and therefore increased financial risk for the ship owner. The capital value of a higher risk vessel will also be compromised.

The impact of the panamax constraint on ship design is therefore greater than would be suggested by analysis of trade alone. In 2010, around 208 million tonnes of cargo passed through the canal, barely 2.5 percent of the total global trade figure of 8.4 billion tonnes recorded by UNCTAD in that year. Set against this is the ocean-going commercial sector of the fleet, defined here as being over 5,000 gross tons, which numbers about 33,500 ships, of which about 8,500, or 25 percent, have panamax beam. Ship types that comply with the constraint include both wet and dry bulk carriers, passenger ships, car carriers and others, in addition to container ships at which the expansion is primarily targeted.

The implications of the expansion of the canal on ship design are therefore significant, irrespective of the final effect on trade patterns, as they potentially affect one quarter of the ocean-going fleet. Having said this, there has been remarkably little research on what the future shape of ships might be post-expansion, even though the new locks are due to be opened in about two years. There remains, on order, significant numbers of vessels with panamax beam, some of which may be delivered after the anticipated opening date in 2014. In the face of this uncertainty Newcastle University School of Marine Science and Technology has conducted research to start to define the possible effects on ship design resulting from this change in infrastructure. This has been undertaken in the context of the Low Carbon Shipping Research Consortium, of which Newcastle University is a member.

## The unexpected link to carbon reduction

The starting point for this research was originally a question relating to the design of ship repair drydocks. Up to now, the dimensioning of a new dock has been, at least within certain size categories, simple. The panamax beam constraint can be used and many drydocks have an internal width of between 36 meters and 40 meters for this reason. This constraint has now become redundant in the designing of drydocks.

The research took a turn, however, when reviewing ship performance and, in particular, the potential for increased ship efficiency that the relaxed constraint will afford. Increased efficiency means less fuel per unit of cargo carried and less fuel means less carbon produced in direct proportion. This is important given that much effort is currently being expended in the development of designs, operations, logistics and systems to reduce the output of carbon dioxide and other noxious emissions from ships. The IMO predicts that shipping will be responsible for between 12 percent and 18 percent of global carbon dioxide emissions by 2050, unless the industry does something significant to improve.

The reduction of fuel consumption is also, of course, of great interest to ship operators for less altruistic reasons than the saving of the planet. With bunkers costing between $650 and $750 per tonne, the industry is focused on cost saving. Clarkson Research, in their *Shipping Intelligence Weekly* of 20 January 2012, estimated that bunkers in the 1990s accounted for 28 percent of daily voyage costs, but that this has now risen to 78 percent. Minimising fuel costs has become a matter of survival in a shipping market subject to low freight rates that appear to show little prospect for recovery in the near future and it turns out that the expansion of the canal can assist significantly in this quest.

Newcastle University's research so far has concentrated on the most numerous panamax sector of the fleet, the dry bulk carrier sector, of which in 2010 there were 1,700 ships with a further 914 on order. The limitation of the beam restricts panamax bulkers to around 85,000 deadweight tonnes maximum and dictates some compromise in the optimisation of the hull form. The optimisation of a dry bulk carrier includes the requirement to maximise internal hull volume to maximise the volume of grain that can be carried within the deadweight capability. This requires the ship to be longer than would perhaps be chosen if the beam could be increased further instead. Empirical research, based on existing designs, suggests that the efficiency of the hull could be around 5.5 percent higher for a panamax ship if it were designed without the constraint. That is 5.5 percent saving in fuel and emissions. Research is underway to quantify this and the mechanisms involved more precisely.

## The dry bulk sector appears to be ready for a new ship class

Further saving could be made through economy of scale if panamax bulkers could increase above the current 85,000 deadweight tonnage maximum. The first question is whether the market wants a larger bulk carrier between 85,000 deadweight tonnage and the next size class up, that being 'capesize' at around 180,000 deadweight tonnage. Examination of the parcel size function and the distribution of cargo parcel sizes being fixed on charter shows that over the last decade this has moved to skew firmly up against the 85,000 deadweight tonnage limit. The research team are proposing that this provides evidence that shippers are ready for larger parcel sizes in this sector, at least to some extent. There are already early adopters for this new ship size with an emerging class of ship currently referred to by the shipping industry as the 'mini-cape'. In 2010 there were around 150 ships in this size range, typically around 100,000 deadweight tonnage. Orders in hand will increase this new class to around 450 by 2014. Newcastle University's research estimates that, through economy of scale, a 110,000 deadweight tonnage dry bulk carrier would use around 16 percent less fuel per tonne-mile than a conventional panamax bulk carrier.

A further question is whether or not infrastructure is ready for the larger ship class. After all, inflexibility and port access problems have seen the demise of ship developments in the past, not least the pursuit of the million deadweight tonnage tanker in the 1970s. In terms of port access, the larger ship should be achievable without a significantly deeper draft, so for many ports there may not be an issue. For ship repair infrastructure, the drydock capacity for larger ships is adequate unless the ship is constrained to the Mediterranean or Baltic Seas.

## The conclusion and unexpected consequences

The conclusion of the research in the dry bulk sector is therefore that panamax ships are likely to get larger and that this will lead to significant gains in efficiency and reduction in emissions. This will be additional to the other technologies and strategies being developed to reduce the carbon foot print of shipping. It further begs the question: what about other sectors of the fleet that have panamax beam and how far can this carbon reduction windfall stretch?

Research has already started on the next most numerous fleet sector: panamax tankers. Initial results suggest that market demand for a larger ship is limited but that the gains to be made from hull optimisation are greater than the 5.5 percent seen for bulk carriers. Further and more significant gains could be made through optimisation of the logistics of refinery and products trades between the East and West coasts of the Americas, to allow larger vessels to operate as afforded by the canal expansion, with resulting economies of scale.

It is concluded therefore that the expansion of the canal will be influential in ship design irrespective of the effects on trade. The expansion also has a part to play in the goal of reducing shipping carbon emissions, a side-effect that has thus far been largely un-acknowledged. This is a positive example of the 'unintended consequences' of the changes underway in Panama, referred to by Dr. Rodrigue and Dr. Notteboom, resulting from the extreme complexity of the Panama Canal expansion conundrum.

### ABOUT THE AUTHORS

**Paul Stott** is a Senior Lecturer at the School of Marine Science and Technology at Newcastle University. He is stream leader for the MSc in Marine Transport with Management and teaches in the fields of shipping market analysis and marine production. Before joining academia in 2010 he spent more than twenty years as a marine business consultant specialising in market research and strategic planning, working for clients in over forty countries. His research interests are primarily centred on low carbon shipping, competitiveness and the regulation of trade in the shipyard industries.

**Dr. Peter Wright** is a Senior Lecturer at the School of Marine Science and Technology at Newcastle University. He is stream leader for the teaching of Naval Architecture and Ship Design and is undergraduate Degree Programme Director for all Marine Technology programmes. He has been involved in a number of international research programmes on aspects of warship and merchant ship design. His research interests include novel structural configurations and hydrodynamic optimisation for existing and innovative cargo ship types in order to seek more efficient ship designs. He has published many papers relating to these aspects of ship design. He is a Chartered Engineer and corporate member of Royal Institution of Naval Architects.

### ENQUIRIES

Paul Stott
Senior Lecturer
School of Marine Science and Technology
University of Newcastle upon Tyne
UK
Email: paul.stott@newcastle.ac.uk
Web: www.ncl.ac.uk/marine
www.lowcarbonshipping.co.uk/

Dr Peter N. H. Wright
Senior Lecturer in Naval Architecture
School of Marine Science and Technology UK
Email: p.n.h.wright@newcastle.ac.uk
Web: www.ncl.ac.uk/marine

# The impact of the global economic crisis on international trade

**Ben Hackett**, Founder, Hackett Associates, LLC, US

## Introduction

The continuing financial and economic crisis, primarily in the US and Europe, has had a direct dampening impact on global trade flows with a concomitant impact on jobs and incomes as national fiscal policies have swung towards austerity measures in an attempt to reduce sovereign debt. The result of austerity, however, has been at a time of slow growth and is causing further reductions in growth and a drop in international trade as consumer and industrial demand evaporates.

All countries were impacted by the 2008 to 2009 recession through falling exports, rising unemployment and thus falling incomes. The global recession created an unprecedented decline in trade growth in 2009, affecting the capacity of trade to be an effective engine of growth. According to United Nation's Committee on Trade and Development (UNCTAD), world trade declined 4.5 percent in 2009 as a direct result of the global recession, with most of the decline coming in consumer and industrial goods, with container volumes down by 9.7 percent.

Conversely, with only mild growth in gross domestic product worldwide in 2010 to 2011, container trade expanded despite the hesitant state of the Western economies. According to the World Trade Organization (WTO), the expansion in the volume of world exports witnessed the largest annual growth recorded since 1950. The recovery was robust from mid-2009 to mid-2010, when trade volumes expanded at an annualized rate of nearly 20 percent. As economic growth faltered in 2011, as a result of austerity measures and sovereign debt crisis, this growth could not be sustained and trade again faltered.

## Background

International trade had been growing up to late 2007, before encountering the recessionary storm. From mid-2008, trade flows contracted sharply, affecting a large part of the OECD countries. The sharp drop in container traffic was unprecedented as consumers headed for cover and began to boost their savings in fear of becoming unemployed. Added to this was the banking crisis, with credit drying up completely. If no other lessons have been learned in the 2007 to 2011 period, the link between international trade and macroeconomic conditions in the main consuming countries of the Western economy is the most important to take to heart.

A major change in global trade and its relationship with gross domestic product growth has been globalization. Through the mid-1990s, expansion in the annual percentage growth of gross domestic product was broadly similar to the expansion of consumer goods defined as merchandise trade, which in turn was similar in seabourne trade. By the late 1990s however, as the result of the huge foreign direct investment in China, we began to experience the impact of the shift in sourcing of end consumer products and their reliance on international container trades. This shift became particularly visible during the period up to 2007 when world seabourne trade consistently outpaced gross domestic product growth. Hence the popular, but somewhat misunderstood concept of the back of the envelope calculation that for every percent of gross domestic product growth, container trade expands 2.5 to 3 times as much.

What was interesting was that most of the shipping related industry, including the wholesalers and retailers, claimed not to have seen the recession in trade coming, nor, as many carriers claimed, did they see the 2010 resurgence in trade coming their way in late 2009. It was not until April to May 2010 that the shipping industry began to react to a strong rebound in international deep-sea trade.

## US case study

The linkage between the global economic crisis and the volume of international trade, particularly in the container read consumer sector can best be illustrated by a case study of US economic indicators.

Consumption makes up 70 percent of the US gross domestic product, making it a good economy to compare macroeconomic

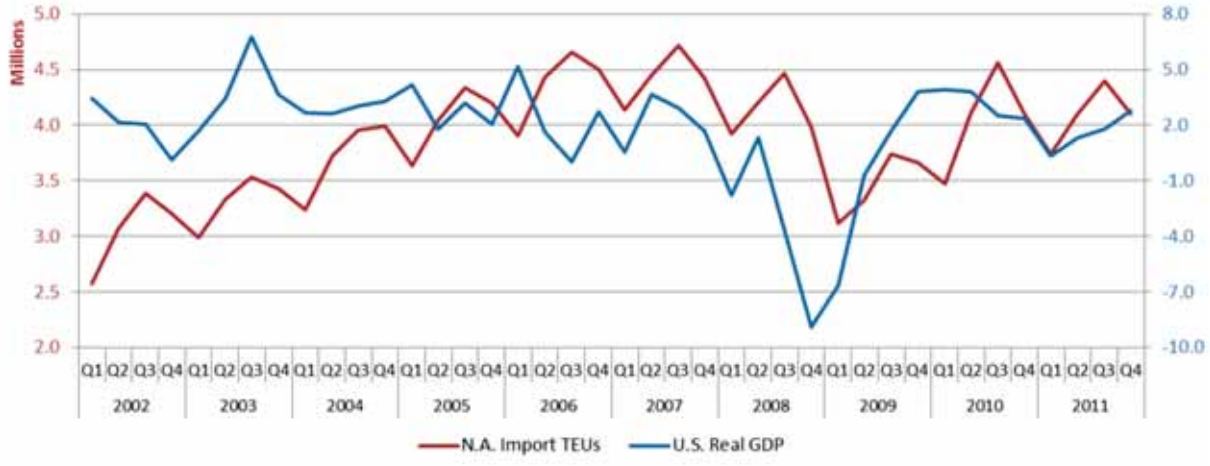



Figure 1. Gross domestic product and containerised imports (gross domestic product quarterly percent change on right axis).

Source: US Government for gross domestic product and North America Global Port Tracker for trade data

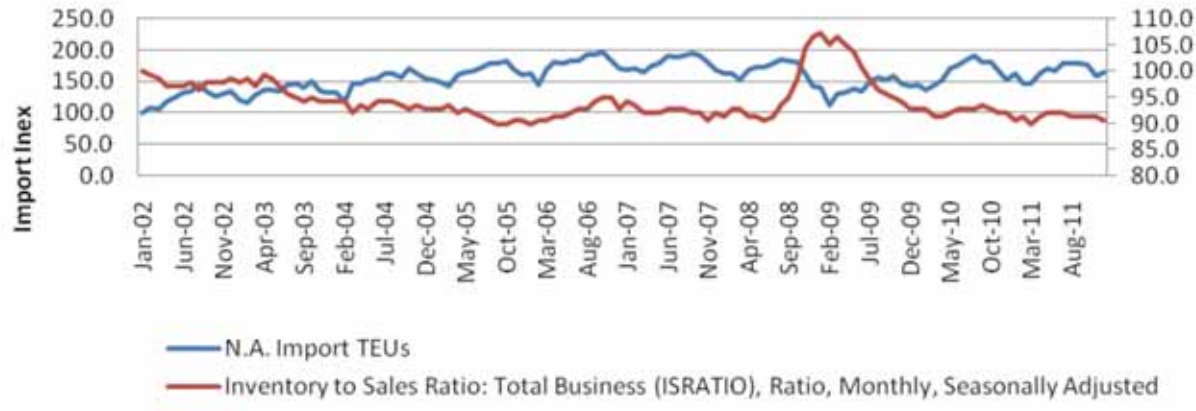



Figure 2. Inventory vs. import volumes.

Sources: Inventory: US Dept. of Commerce; Import Volumes: Volumes: North America Global Port Tracker, Hackett Associates, LLC

impacts on trade. In particular, the financial problems that have been ongoing since the collapse of Lehman Brothers in September 2008 provide us with an excellent opportunity to assess the interplay between the economic crisis and trade.

The relationship between real gross domestic product and the volume of container imports is demonstrated above. Trade is in actual volumes and gross domestic product as the percentage change on the previous quarter. We can note that during periods of recovery trade growth is more rapid than gross domestic product growth, but in general they tend to correspond in timing. This suggests that gross domestic product cannot be used as a good forecasting tool, as the data is released in arrears of the quarter and is then revised two to three months later.

A short-term leading indicator of the direction of trade is the manufacturing output measured by industrial production and the Purchasing Manufacturers Index (PMI). The PMI tends to lead the changes in import volumes by one to two months. As industrial output is reported in a timely fashion on a monthly basis, it is one of the better macroeconomic indicators to consider when assessing the direction of trade.

US trade growth is primarily driven by consumer confidence and a reduction in the savings ratio, as more disposable income shifted to consumption suggests that measures more closely linked to these should be used. The deterioration in the consumer confidence index, as reported by the University of Michigan and the Reuters index appears to reflect the economic environment fairly closely. It is not a guarantee that trade moves in direct proportion to the index, but the index is certainly a strong leading indicator, particularly during a time of crisis.

The consumer index in January 2007 reached a height not experienced since January 2002 shortly after the 2001 recession. By June 2008 it had plummeted by 58 percent to levels not experienced in the previous six years. It was obvious that the consumer was being impacted by the banking crisis and lack of confidence in the economic system and was concerned by rising unemployment. Economists were still arguing as to when the US recession had started. The index was clearly indicating that it was most likely in the first quarter of 2007.

The shipping industry, wholesalers and retailers were oblivious of the warning signs. Import volumes continued to grow, bar the seasonal downturn of the fourth quarter in 2007 and the first quarter in 2008. It was not until August 2008 that imports collapsed. This lack of connectivity to a growing economic crisis can partly be explained by the levels of inventory being held by wholesalers and importers oblivious to the changing environment as their stockpiles began to rise to unprecedented levels from June 2008 through March 2009. The huge overstock situation led to a collapse in import volumes in the period from September 2008 through to February 2009, followed by low volumes for another eight months until inventories were reduced. This is clearly demonstrated in Figure 2.

As the economic recovery faltered in the second quarter of 2011, we again experienced a drop in consumer confidence but not in the manufacturing index, suggesting that recovery was still underway but very hesitantly. Wholesalers and retailers meanwhile adapted their supply chains in order to maintain as low an inventory as possible, keeping in line with retail sales, which has tended to flatten import volumes, leading to a no-growth situation in 2011.

## Conclusion

By observing the macroeconomic indicators we can surmise that the impact on trade has a very short response time in countries where consumption plays a significant role. This is certainly true for the western economies of North America and Europe. Exporting countries probably have a slightly longer response time to an economic crisis which in itself is counter intuitive. We can also conclude that by using the right economic indicators it is possible to improve our ability to predict changes in the pattern of the flow of trade. Gross domestic product, so often quoted as the foundation of forecasting, is shown to be somewhat lacking in predicting changes in the short to medium-term. Making use of other indices, such as manufacturing, industrial production, inventory to sales ratios and consumer confidence helps us to hone our skills as reliable forecasters in a tumultuous world.

### ABOUT THE AUTHOR AND COMPANY

**Ben Hackett**, runs his own consulting business, Hackett Associates LLC, working with container shipping lines, terminal operators, port authorities, trade associations, national governments, and international institutions. He advises on strategy issues, long-term planning and forecasting. He is a frequent speaker at industry conferences. He writes a monthly column for PortStrategy (The Economist). He is an adjunct lecturer at the University of Denver Intermodal Transportation Institute, a business executive MBA course, teaching a course on maritime economics and the interrelationship with supply and demand.

**Hackett Associates** was established in August 2007. Hackett Associates produces two monthly newsletters monitoring container trade at major ports with port specific forecasts.

### ENQUIRIES

Hackett Associates, LLC
US Tel: +1 (202) 558 5292
UK Tel: +44 (0)20 7993 2824
UK Mb: +44 (0)7881 816 932
Web: www.hackettassociates.com
www.globalporttracker.com

# Khalifa Port, the birth of a giant

**Jan Grinwis**, Deputy Project Manager, Khalifa Port Project, Abu Dhabi Ports Company (ADPC), Khalifa, Abu Dhabi

## The background of the project

### Kizad

Khalifa Port is situated next to the Khalifa Industrial Zone Abu Dhabi (Kizad), a cornerstone of the Abu Dhabi Economic Vision 2030, an industrial development of massive scale, which is under construction and is intended to stretch over an extraordinary 417 square kilometers. It marks a substantial drive towards the diversification of the economy in pursuit of sustainable growth that becomes less dependent on oil and gas.

The Emirates invested considerably in order to attract world-class industries. Global and local companies alike recognize outstanding market access, the low cost operating environment and the support services and facilities. Khalifa Port and Kizad are being developed to support this vision.

### Environment

Just offshore from Khalifa Port and Kizad (the megaproject) lies the United Arab Emirates (UAE) and the Gulf's largest coral reef, the Ras Ghanada reef, 4 kilometers off shore and about 35 square kilometers in size. It supports coral such as Acropora downingi, Poritis Harrisoni, Acropora arabensis and flourishing marine life, such as turtles, dugongs, seasnakes, clownfish and much more. In order to protect the reef, an off shore terminal quay (the port island) was developed 4.6 kilometers out to the sea. Furthermore, 8 kilometers of internationally recognized and award-winning protective breakwater was constructed to help conserve the reef. The longest bridge in the UAE, to the port island, 1 kilometer long, allows for the current flow to the reef to be maintained.

### Timeline

It was in 2008 that construction of the port island began and the first dredger started to build bunds in the Gulf. In July 2010, ADPC started to write the equipment and TOS specifications; in September 2010, the tendering for equipment started, and orders for six STS cranes, 30 ASC and 20 sprinter cranes (SCs) went out at the end of November 2010.

From 2012, Khalifa Port will be able to handle, if needed, 2 million TEU containers a year and 12 million tons of cargo capacity a year. By 2030, that figure is scheduled to rise to up to 15 million TEU containers and up to 35 million tons of cargo a year. In February 2012, 3 STS, 20 ACSs and 10 SCs had arrived in good shape and tests began. In the fourth quarter of 2012, the official opening of the megaproject will take place.

### Infrastructure

The infrastructural design is solid and designed for a long life and low maintenance costs. The STS cranes run on an A150 rail with a rail span of 35 meters. The landside rail is mounted on beam stands on concrete piles of 1.2 meter diameter, every 6 meters. The waterside QC rail lies in the centre of the capping beam; a concrete beam 2.8 meters thick and 12.7 meters wide, which is built on top of a concrete block wall.

There are 30 ASCs, in 15 stacks, run on a 350 meter long AS86 rail, which is fixed on a concrete beam. This massive beam (1.5 meters by 1.2 meters) is fixed on 0.8 meter diameter concrete piles, every 6 meters on average. In the stack, the containers stand on massive concrete transverse beams as well. In general, beams are 0.9 meters by 1.5 meters, but in areas of 45 foot containers the beams are 0.9 meters by 3.3 meters. In between

Photo: ADPC/choppershoot.com

Overview of ongoing construction works for roads, utilities, buildings and cranes on the Offshore Port Island.

the beams, the stack is paved with interlocking concrete blocks. The pavement on the terminal is a special concrete mix which is applied in different thicknesses, depending on its functionality.

## Equipment for the project

The equipment specifications were made in a period of six weeks and the planning for the delivery of a working terminal was challenging. It was in this way, therefore, that the TOS became linked to the ASC supplier, as it has the strongest interface and risk. This is how the ASC supplier Konecranes became responsible for the delivery and implementation of ASCs and the Navis SPARCS N4 TOS system.

Looking at market developments, more and more full system implementers are developing. Konecranes, Cargotec and Terex. These are global suppliers who can supply a whole range of container handling equipment. Cargotec, who recently took over TOS supplier Navis from Zebra Technologies Corporation and Terex Corp, who took over Demag cranes AG, became owner of Gottwald. For the customers this is intended to result in lower overall implementation costs.

The equipment specifications are adapted to the harsh environment of Abu Dhabi .The design temperature range for components is therefore from 0 to 50 degrees Celsius, while the direct sun impact is up to 65 degrees Celsius and humidity up to 100 percent. Cooling capacity of the e-houses is designed in a way that if one unit fails, 100 percent cooling capacity is still left.

The duty factor for hoist and trolley is set to S1 100 percent (designed for continuous duty). All motors outside are installed with stainless steel shields to protect against direct sunlight and sand. Stainless steel has to meet minimum DIN1.4401 (316) standards.

The STS cranes run on a rail span of 35 meters and have a lifting capacity of 110 tons under the ropes and are equipped with a Stinis long twin spreader. The cranes designed by ZPMC are fully prepared for a single hoist tandem lift. The electrical installation is delivered by TMEIC - also the electrical supplier of the installation of the ASCs. The crane has a long back reach of 38 meters, enough to accommodate six SC lanes for future fully automation. Under the portal another four SC lanes are

Photo: Jan Grinwis

available. The lanes are equipped with the maxspeed straddle carrier positioning systems of TMEIC. This system signals to the straddle carrier driver when he is close and when he has reached the point to place his container. The height under the spreader above the waterside rail is 44 meters. The crane is equipped with a Merford operator cabin, including the Ergo seat.

The semi-automated cranes are delivered by Konecranes and the electrical installation is supplied by TMEIC. The landside of the system is manual and is operated by a remote operator station, which is equipped with camera images from several positions from the crane, spreader (Bromma) and lanes. The waterside transfer zone is fully automatic and serves containers to and from the straddle carriers, and is 32 TEU in size.

When the waterside crane is in maintenance and standing on the waterside transfer zone, the landside crane is able to handle containers on the waterside too, the storage area is then 16 TEU in size. The waterside crane is able to handle trucks on the landside too. The power is connected to 11 kilovolts. The gantry speed of the crane is 4 meters per second.

The straddle carrier is the Sprinter of Noel Mobile systems from Terex. The Sprinter is also equipped with the Stinis long twin spreader and is equipped with a GPS and a RTLS positioning system. The straddle carriers are prepared for a fully automated operation. A call center is set up with 24/7 staff able to monitor all equipment


Photo: Jan Grinwis

The first ASCs.

online. The technician, working in the call center, starts by checking the status in the remote crane management system when a problem is reported. If this problem cannot be solved by computer a staff member is available to solve the problem.

The workshop is equipped with below floor service pits, two straddle carrier service bays have wide service pits for reach stacker/empty handler repair. One power shop bay has a combined-width (wide on one side, narrow on the other) service pit for forklift repair. The SC wash bay has one deeper service pit than the pits at the straddle carrier workshops so that the worker can clean from underneath and hold the gun upward. Service pits where vehicles will be maintained are connected to each other below ground.

## Operational zero error

In many manually operated terminals, containers get lost – and this happens even on fully automated terminals. In manually operated terminals this number could rise. As Khalifa Port has a manual waterside operation, we have devised a way not to misplace containers. The idea behind it is that containers in SC only can be unlocked in designated places and confirmed by TOS, in addition the locking of containers can be done only after approval from TOS.

All pick-ups and drop-downs of containers by shuttle carriers (and other container handling equipment) are within the full control of the TOS. Only movements that match a valid job order are possible. This applies to the whole terminal area, not only the quay area.

Optical Character Read (OCR) systems on cranes register all incoming and outgoing container movements. An OCR system is a fully integrated system that automatically reads and records the container's ISO code number as it is handled by the crane. Every container is matched against the load and discharge lists. The location and movement of every container outside the automated stack is controlled. As a result, the stack and yard inventory are always 100 percent up to date and checked by the system. The number of crane team members is lowered.

The software remembers the position of all containers outside the automated stack (including transfer areas) and translates positions of vehicles into logical positions. With the combined input, the system requests validation from the TOS (in a similar format to the job orders given to the drivers). The TOS simply accepts or rejects the request. If the request is accepted, the vehicle's twistlocks can be applied. If not, the vehicle has to go to the correct position as indicated in the job order or the TOS will generate a new job order based on the vehicle's current position. For emergencies a big button in the cabin overrules the TOS and the straddle carrier driver can unlock his container and drive away. The button is resettable by operational people who have the unlock key.

### ABOUT THE AUTHOR AND COMPANY

**Jan Grinwis** has worked for 28 years in the technology of container handling equipment, of which 14 years were spent as Technical Maintenance Manager of the fully automated containers terminal at ECT in Rotterdam and 4 years as a Project Manager at Kalmar industries at CTB Hamburg and Cargotec, China. He is now Deputy Project Manager of the Khalifa Port Project in Abu Dhabi.

Formed by the Abu Dhabi Government in 2006, **Abu Dhabi Ports Company** (ADPC) is a master developer of ports and industrial zones. Its primary function is to propel economic expansion by establishing the firm foundations of modern infrastructure, real estate and business services across Abu Dhabi.

### ENQUIRIES

ADPC
PO Box: 54477
Abu Dhabi
United Arab Emirates
Email: jan.grinwis@adpc.ae
Web: www.adpc.ae

# Trade costs and corruption in ports

**Sandra Sequeira**, Assistant Professor, LSE, London, UK & **Simeon Djankov**, Economist and Deputy Prime Minister and Minister of Finance of Bulgaria

## Introduction

Recent years have brought an increased awareness of the importance of trade costs in hindering trade, particularly in the developing world where these costs are highest. The most salient type of trade costs have often been tariff duties and costs associated with the physical transportation of goods. As a result, several countries embarked on extensive programmes of tariff liberalization and a significant portion of aid effort was channelled to investments in hard transport infrastructure, such as rebuilding railways and ports (the World Bank alone devotes more than 20 percent of its budget to transport infrastructure projects worldwide).

More recently, new light has been cast on the importance of a different type of trade cost: the cost imposed by the soft infrastructure of transport, defined as the bureaucratic infrastructure handling the movement of goods across borders. While there are many possible sources of inefficiencies stemming from the soft infrastructure of transport, recent research is beginning to document the role played by corruption in transport bureaucracies in driving trade costs. This article provides an overview of this research.

## Research into corruption

Corruption can take many forms and emerge in many different phases of the process of clearing goods across borders. Sequeira and Djankov (2011) documented in great detail the ways in which port corruption emerges in Durban and Maputo in Southern Africa. This research was based on a unique dataset of directly observed bribe payments to each port bureaucracy for a random sample of 1,300 shipments.

The study began by defining two broad categories of port officials that differed in their administrative authority and in their discretion to stop cargo and generate opportunities for bribe extraction: customs officials and port operators. In principle, customs officials hold greater discretionary power to extract bribes than regular port operators, given their broader bureaucratic mandate and the fact that they can access full information on each shipment, and each shipper, at all times. Customs officials possess discretionary power to single-handedly decide which cargo to stop and whether to reassess the classification of goods for tariff purposes, validate reported prices of goods, or request additional documentation from the shipper.

Regular port operators, on the other hand, have a narrower mandate to move or protect cargo on the docks, and at times even lack access to the cargo's documentation specifying the value of the cargo and the client firm. This category of officials includes those receiving bribes to adjust reefer temperatures for refrigerated cargo stationed at the port; port gate officials who determine the acceptance of late cargo arrivals; stevedores who auction off forklifts and equipment on the docks; document clerks who stamp import, export and transit documentation for submission to customs; port security who oversee high value cargo vulnerable to theft; shipping planners who auction off priority slots in shipping vessels, and scanner agents who move cargo through non-intrusive scanning technology.

The organizational structure of each port created different opportunities for each type of port official to extract bribes: the high extractive types -customs agents- or the low extractive types -port operators. These opportunities were determined by the extent of face to face interactions between customs officials and clearing agents, the type of management overseeing port operations, and the time horizons of each type of official.

## Durban and Maputo

In Durban, direct interaction between clearing agents and customs' agents was kept to a minimum since all clearance documentation was processed online. In contrast, all clearance documentation was submitted in person by the clearing agent in the Port of Maputo. The close interaction between clearing agents and customs officials in Maputo created more opportunities for corrupt behaviour to emerge in customs relative to Durban.

In Maputo, port operators were privately managed but in Durban, most terminals (for containerized cargo) were under public control, with very lax monitoring and punishment strategies for those engaging in corrupt behaviour. Private management in Maputo was associated with fewer opportunities for bribe payments due to better monitoring and stricter punishment for misconduct. As a result, the organizational features of each bureaucracy determined that the high extractive types in customs had more opportunities to extract bribes in Maputo, while the low extractive types in port operations had more opportunities to extract bribes in Durban. While corruption levels were high in both ports, bribes were higher and more frequent in Maputo relative to Durban.

Finally, port officials with opportunities to extract bribes at each port differed in their time horizons. Customs in Maputo adopted a policy of frequently rotating agents across different terminals and ports, and since bribes varied significantly by the type of terminal at the port, customs agents were aware of the risk of being assigned to terminals with lower levels of extractive potential. On the other hand, port operators in Durban had extended time horizons given the stable support received from dock workers' unions. Customs officials were therefore the high extractive types with the shortest time horizons, the broadest bureaucratic mandates and more opportunities to interact face to face with clearing agents. As a result, they extracted higher and more frequent bribes, relative to port operators in Durban (the low extractive types) who had longer time horizons and narrower bureaucratic mandates.

## Collusive corruption and coercive corruption

Sequeira and Djankov (2011) further differentiate between two types of observed corruption: collusive corruption, when public officials and private agents colluded to share rents generated by the illicit transaction, such as when a bribe was paid for tariff evasion, and coercive corruption, when a port official coerced a private agent into paying an additional fee just to clear the goods through the port, above and beyond the official price. Bureaucrats would engage in collusive or coercive corruption depending on the opportunities and constraints created by the bureaucratic structure under which they operated. More importantly, each type of corruption had different implications for firms: collusive corruption was cost-reducing whereas coercive corruption was cost-increasing.

The authors then show that firms exposed to collusive corruption revealed a higher proportion of internationally sourced inputs and higher usage of the port, whereas firms exposed to coercive corruption were associated with a higher proportion of domestically sourced inputs and lower usage of the port. These findings suggest that firms respond to different types of corruption by organizing production in ways that increase or decrease demand for the transport service.

Moreover, coercive corruption at the Port of Maputo was diverting import traffic from South African firms to the Port of Durban. This diversion effect appeared to increase congestion in Durban but also in the corridor connecting Maputo to South Africa, by generating imbalanced flows of cargo along the transport network (more exports, which are less vulnerable to corruption, relative to imports). Even though the actual cost of physical transport was similar across the corridors under study, transport services on the transport corridor leading to the most corrupt port carried almost a 70 percent price premium for users.

## Tariff evasion

This research also revealed that tariff evasion was one of the most prevalent types of corruption at the Port of Maputo, and the one that was associated with the highest level of average bribe payments. Sequeira (2011) takes advantage of the phasing in of a long-standing tariff liberalization agreement in Mozambique in 2008 and 2011 to identify how corruption patterns changed in response to this reduction in tariffs.

This study finds a clear decline in the number of bribes paid for tariff evasion following the tariff change, but it also finds compelling evidence of how corruption appears to have simply been displaced into products that did not experience a tariff reduction or into other methods of bribe extraction. In fact, customs officials responded to the change in tariffs by extracting more bribes from products that remained in high tariff categories and by extracting bribes through means other than tariff evasion, such as identifying irregularities in the documentation or by selling speed due to alleged congestion at the port. The study also identifies a displacement of bribe payments from customs to other public officials along the clearance chain, namely towards those in charge of scanning technology. Overall, the study concludes that while the probability of paying a bribe and the total amount of bribes paid declined with the tariff reduction, the average bribe per shipment increased. Moreover, this displacement of corruption represented a shift from collusive forms of corruption (tariff evasion) to coercive bribe payments, which ultimately increase costs for firms.

## Conclusion

This emerging research allowed us to peer into the blackbox of corruption at ports for the first time in order to understand the importance of bureaucratic organization in determining the opportunities that different types of agents have to extract bribes, and to begin to document the impact of different types of corruption on firms. It also highlights the importance of understanding the dynamics of the entire clearance chain when attempting to design optimal anti-corruption strategies. Targeted interventions that address just one method of bribe extraction can end up not eliminating, but simply displacing corruption into other stages of the clearance chain.

These results are also likely to extrapolate to other settings beyond Southern Africa, where the original studies took place, and to affect investments in hard transport infrastructure that are currently under way. Sequeira (2011) identifies a positive correlation between a country's trade costs and general levels of corruption using a sample of OECD countries, while Sequeira and Maachi (2010) point to the complementarity between hard and soft transport infrastructure by arguing that corruption in ports can even dampen the returns to investments in the hard infrastructure of transport, via its effect on demand for overall port services. Future research should therefore be directed at testing the impact of different anti-corruption strategies through rigorous empirical studies.

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## ABOUT THE AUTHORS

**Sandra Sequeira** is a Lecturer (Assistant Professor) in Development Economics at the London School of Economics. Her research focuses on the role of transport infrastructure, private sector development and bureaucratic corruption on firm development and economic growth. She has conducted fieldwork in several countries in Sub-Saharan Africa and in India.

**Simeon Djankov** is an economist and Deputy Prime Minister and Minister of Finance of Bulgaria. Prior to his cabinet appointment, Simeon Djankov was a Chief Economist of the finance and private sector vice-presidency of the World Bank. In his fourteen years at the World Bank, he worked on regional trade agreements in North Africa, enterprise restructuring and privatization in transition economies, corporate governance in East Asia, and regulatory reforms around the world.

## ENQUIRIES

Email: s.sequeira@lse.ac.uk

# Port Vision 2030 shows the way for the Port of Rotterdam

**Nico van Dooren**, Project Manager Port Vision, Port of Rotterdam Authority, Rotterdam, The Netherlands

## Introduction

Port Vision 2030 outlines the vision for the future of the Port of Rotterdam. The vision was drawn up with the aid of various clients, government departments, knowledge institutes and societal organisations. The vision for the port is that:

"In 2030, Rotterdam is Europe's most important port and industry complex. It is a strong combination of the Global Hub and Europe's Industrial Cluster, both leading in efficiency and sustainability. Rotterdam is closely connected with other North West European industrial and logistic areas. Leading companies invest in modern facilities. Cooperation between companies, government and universities result in a high quality labour market, good quality of life and accessibility. The adaptive powers are unique. Thus, Rotterdam is a major pillar for the prosperity in the Rijnmond area, The Netherlands and Europe."

Together, the Global Hub and Europe's Industrial Cluster, make up the port of the future. The Global Hub has the following characteristics:

- **Global and intra-European freight flows:** In 2030, Rotterdam is an important hub for freight flows from and to Europe, as well as being a key junction for cargo flows between other continents. This involves both existing freight flows, such as oil, petrochemical products, containers, coal and new products such as LNG, biomass and carbon dioxide.
- **Chain efficiency:** In 2030, the logistics chains that run via Rotterdam are the most efficient in the world. Collaboration and coordination between logistics players is of essential importance in this context.
- **Sustainable hub:** In 2030, the port of Rotterdam is part of logistics chains with the smallest ecological footprint per tonne-kilometer in the world. This is achieved by sustainable modes of transport, clean fuels and efficient logistics chains.
- **Integrated port network:** In 2030, the port is closely connected to logistics hubs found in the hinterland and to other seaports. Hubs in the hinterland will increasingly develop into gateways for the Global Hub.

Europe's Industrial Cluster has the following characteristics:

- **Integrating industry:** In 2030, companies use each other's (residual) products and residual heat far more.
- **Connections between the regional industrial complexes:** In 2030, the industrial complexes of Rotterdam, Antwerp and

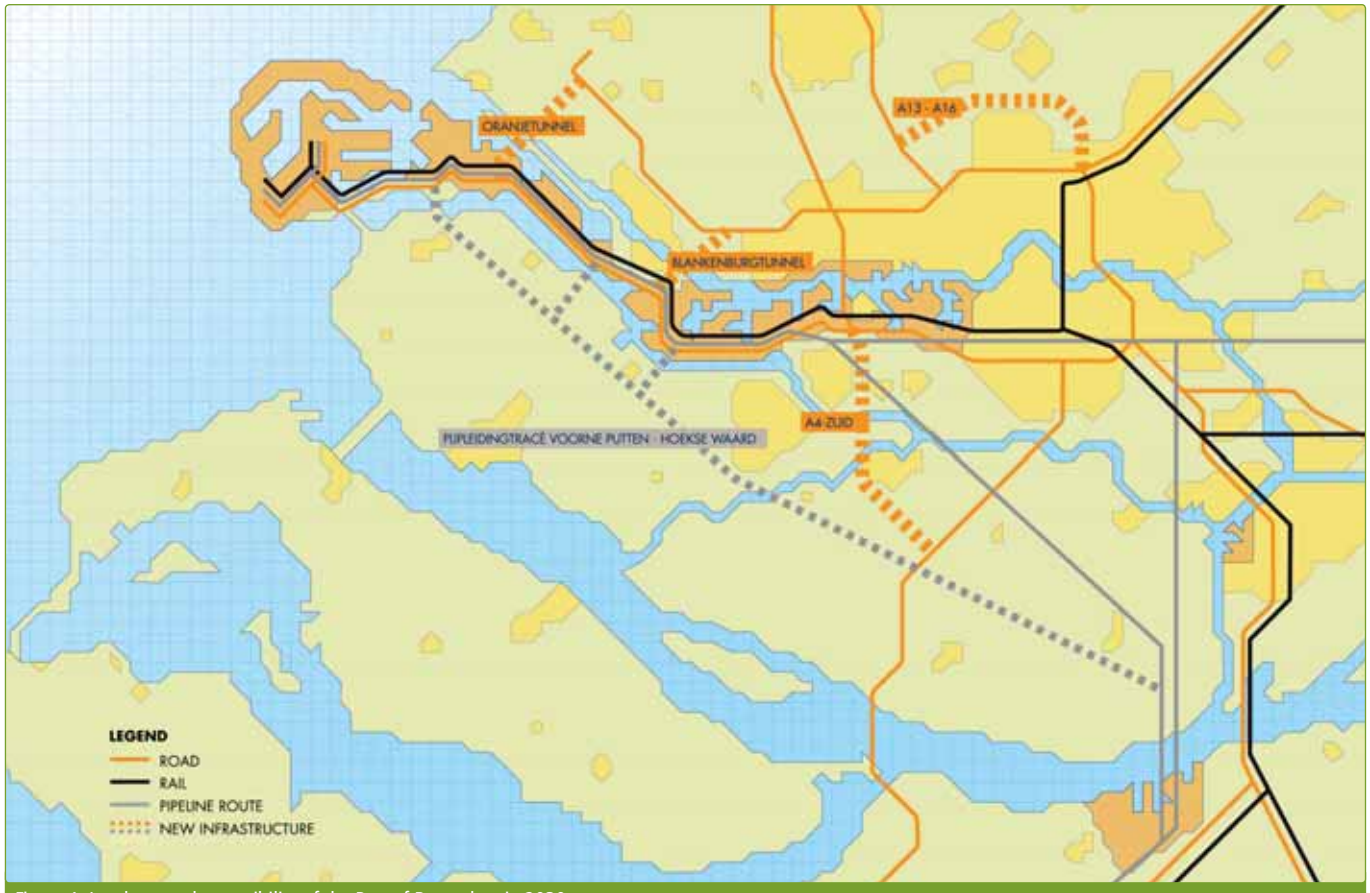


Figure 1. Land use and accessibility of the Port of Rotterdam in 2030.

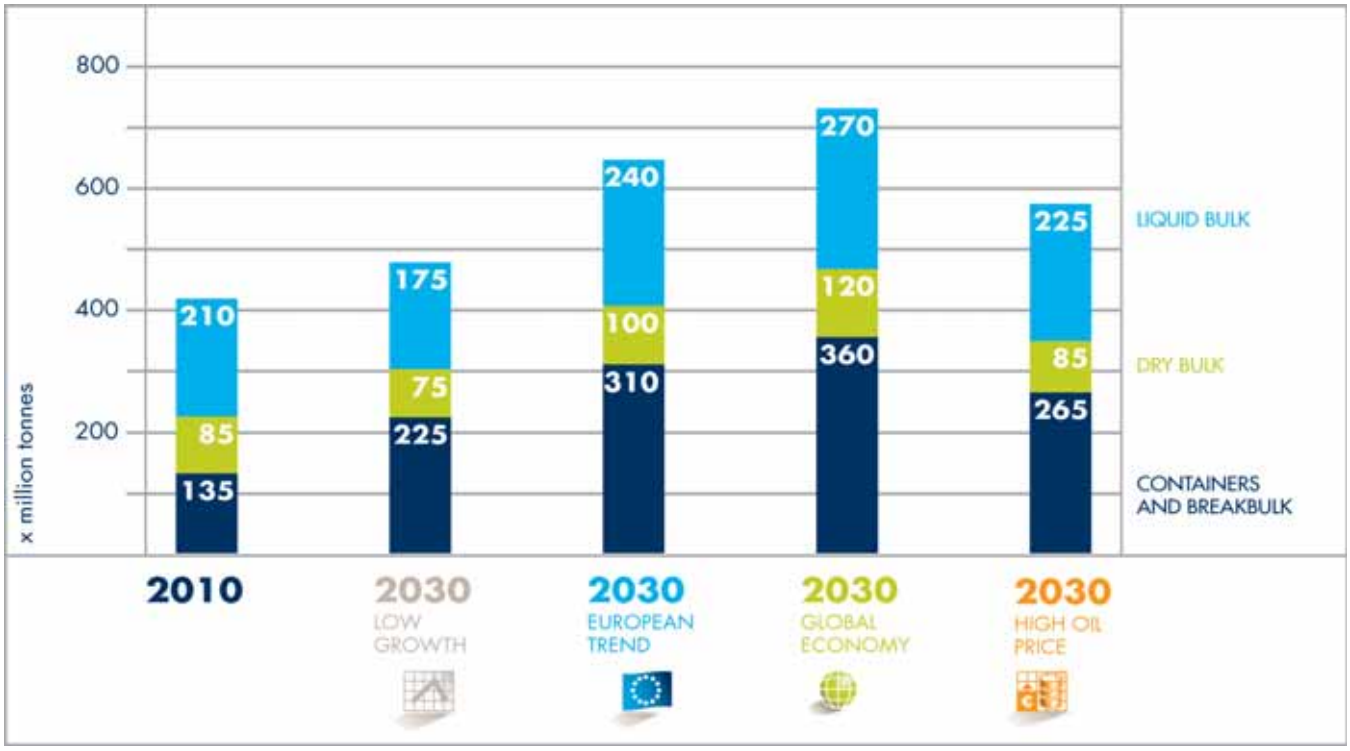


Figure 2. Estimated throughput in Rotterdam in 2030 according to different scenarios.

Moerdijk are entirely integrated with one another, so that they function as a single large industrial complex: Europe's Industrial Cluster. This will yield considerable advantages in the field of efficiency, enabling the regional industry to continue to compete with industrial clusters elsewhere in the world.

### Throughput estimates

To determine the right course that needs to be taken in the run up to 2030, it is vital to have knowledge of relevant global developments. With those in mind, four scenarios for the prediction of future freight flows have been selected. The factors that have the greatest influence on the estimates of future freight flows in these scenarios are economic growth, development of global trade, the price of oil and environmental policy. The estimates show that throughput will rise from 435 million tonnes in 2011 to 475 to 750 million tonnes. Growth is not distributed evenly across the various types of freight. In some cases, the market will even contract. Containers are the most important growth market. The Port of Rotterdam Authority and companies in the port aim to ensure that, in 2030, the total throughput will be in the top segment of these estimates.

### Realization

The Port Vision 2030 has an implementation agenda that lists all the actions needed to realize the ambitions. The agenda shows actions, timeframes and leading actors responsible for carrying out actions. Realizing the Port Vision 2030 is a responsibility shared by the business community, the government and the Port Authority. The progress of realization will be closely monitored and agreements about milestones will be made with all parties involved. The Port Authority will provide an annual update of the implementation agenda and a status report. Then it will be assessed if actions need to be carried out sooner or later and if additional action is needed. This monitoring system will be carried out in close cooperation with the business community, the government and the municipality of Rotterdam.

- **Diversifying and increasing the sustainability of energy production:** In 2030, much more energy is produced on the basis of new and renewable sources of energy. Carbon dioxide is collected and stored in empty offshore oil reservoirs in the North Sea, or recycled in green houses, for example.
- **Production of clean fuels:** In 2030, the refineries produce even cleaner fuels. LNG is an important fuel that enters Europe through Rotterdam. In addition, second generation biofuels are produced in abundance.
- **Growth of the bio-based chemical sector:** The petrochemical and green chemical sectors are integrated in 2030 and the a transition towards bio-based chemistry is in motion in Rotterdam. Oil is more and more replaced as a raw material by renewable materials using, for example, algae or enzyme technology.

Both the Global Hub and Europe's Industrial Cluster generate a large number of jobs and business activities in the region, for example by attracting business houses, logistics management organisations, industrial service providers, (maritime) maintenance companies, inspection services and (European) head offices.

## Taking action

This vision will not materialise on its own accord. In a wide range of areas, action is needed to facilitate companies optimally in the Global Hub and in Europe's Industrial Cluster. Action is also needed to realize an attractive residential environment in the area surrounding the Port of Rotterdam. In total, 188 actions have been defined for the next 20 years. The five most important areas are described below.

### Transition of the industrial sector

Investments in additional production capacity in the European industrial sector are not self-evident. The European population is ageing, Europe has relatively small resources of fossil materials,

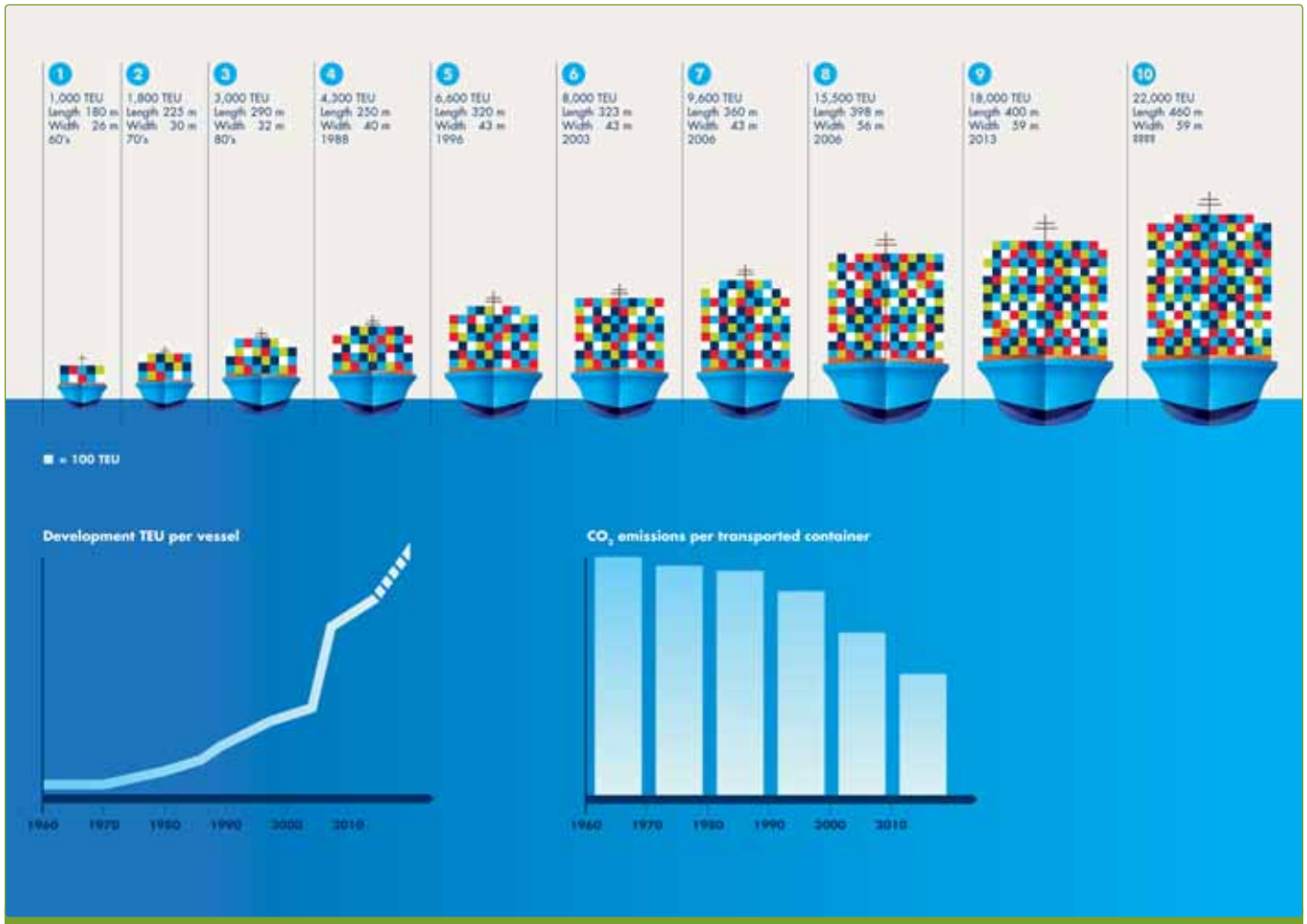


Figure 3. Development of container vessels over the years.

and economies elsewhere in the world are growing at a far higher pace. The European market is mature.

Fortunately, the industry found in the Rhine-Scheldt Delta is an exception. Thanks to its favourable location for the supply of raw materials, major cluster advantages and economies of scale, the industry in this area has a strong competitive position.

However, further integration is needed, between companies in Rotterdam itself, and between the Antwerp and Rotterdam industrial sectors. This creates greater economies of scale and larger cluster advantages for the companies in the area. Connecting companies with pipelines will basically create one single large industrial cluster. This enables companies to produce more efficiently.

Prices of raw materials are expected to go up because of increasing scarcity. There will be more need for crude oil, coal and more LNG and biofuels will be used. The sector's dependency on oil should be reduced to avoid high prices and to increase the sustainability of production. To achieve this, a transition will take place in the (petro)chemical sector towards production on the basis of bio-based raw materials and recycling. In addition, a greater variety of raw materials will be used for the production of electricity.

To reduce climate change, we need to reduce carbon dioxide emission levels. The capture, storage and utilisation of carbon dioxide will contribute to this objective (Carbon Capture & Storage, CCS). To this end, special CCS infrastructure (pipelines) and capture installations need to be constructed.

## Efficient logistics chains in a European network

Ports form a link in global logistics chains. The accessibility of the hinterland will become increasingly important in the competition between ports. For shippers, the choice for a specific port is mainly determined by the efficiency (and, as a result, the costs) and the reliability of the logistics chain.

To improve the efficiency of logistics chains, it is essential that the different parties that play a role in these chains coordinate their efforts. If shipping companies, terminals, transporters and shippers know which container is where, at what time and where it needs to be sent to, this will prevent hold ups and unnecessary empty transportations. In addition, sailing times can be synchronized to the occupancy of berths. This saves fuel and reduces carbon emissions. The use of IT systems, such as Portbase, is of vital importance for the required exchange of information and coordination.

In the Netherlands and North-West Europe, a network of logistics hubs that are connected to Rotterdam via roads, rail and inland shipping needs to be developed. Through such a network of inland hubs, cargo can be transported to its destination fast and efficiently. The inland hubs need to develop into gateways for the port and customs should be able to check the cargo at these locations. Venlo and Duisburg already serve as important hubs for rail and inland shipping. Ultimately, the ambition is to realise a comprehensive European network of intermodal inland hubs.

## Improving accessibility

Accessibility is crucial for the port. Improving accessibility does not solely come down to constructing extra infrastructure. Improving the efficiency of existing infrastructure is important. At the moment, there is congestion during rush hours, while at other times of the day the roads are quiet – particularly at night.

To utilise the available infrastructure more efficiently, Rotterdam needs to realise pro-active traffic management for all modes of transport. Management organisations like De Verkeersonderneming (for road traffic) and Keyrail (for rail transport) need further development. De Verkeersonderneming needs to execute traffic management at the ring road of

Rotterdam and for the access roads. A management organisation for inland shipping needs to further streamline the dispatch of containers transported by barges to the port. It is necessary to assign these organisations with far-reaching authorities and responsibilities. Only then it becomes possible to optimally utilize the capacity of the existing infrastructure. If a national system for road pricing is not introduced, road pricing at the regional level is a means to spread road usage better in time. Besides improving utilisation of infrastructure, up to 2030, more cargo needs to be transported by rail and inland shipping rather than by truck: the so-called modal shift.

In addition, several connecting links in the national infrastructure that are of vital importance for the development of the port are currently missing. These links need to be constructed with necessary vigour. In terms of the road network, the most urgent projects are the Blankenburg tunnel and A4-South. For railways, a good connection of the Betuweroute, a dedicated freight railway, to the German network is essential. For inland shipping it is necessary to enlarge the locks along the Rotterdam-Antwerp route.

## Improving the quality of life

A successful port of the future cannot do without a successful region and vice versa. The port needs a region that people like to live and recreate in. In 20 years time the economic activity in the port area is expected to have increased by at least 150 percent. All of this growth needs to be realised within environmental thresholds that will probably only become stricter in the years to come. Consequently, investments in measures that reduce noise and air pollution are needed.

Road traffic has a major impact on local air quality. Although the transport from and to the port only forms a small proportion of the total road traffic in the region, the optimisation of logistics chains will have a positive effect on the emission levels of freight transport.

The use of cleaner trucks, electric trains and cleaner ships will cut the emission levels of freight transport even further. And in the next 20 years the emission levels of the industry will show similar results; thanks to innovations and substantial investments, manufacturing processes will become cleaner.

In areas where the regional population experiences serious nuisance from the port, measures need to be taken to reduce this nuisance. This will improve the quality of the social environment and will only increase the appeal of the Rotterdam region.

At the same time, no more houses or other functions that are susceptible to nuisance should be realised in close proximity to the port (with the exception of the City Ports area). After all, building houses in the vicinity of the port only increases the nuisance experienced by residents.

## Innovation & decisiveness

Innovations are of vital importance for the realisation of the Port Vision 2030, from process optimisation and chain integration in the industrial sector and the realisation of fast container cranes to increasing the sustainability of modes of transport. However, it is not enough to simply realise innovations and think up new solutions. The trick is to ensure that new approaches are adopted on a large-scale.

In the future, the Netherlands will find it increasingly difficult to compete on the basis of traditional production factors. Knowledge promises to be the competitive factor of the future. It is needed to make targeted investments in the development and application of knowledge that will help to promote the traditionally strong sectors of the Dutch economy. Social innovation is an important component in this context, together with the renewal of legislation and regulations.

Complicated procedures that bog down developments, endless permit procedures and countless consultative bodies mean that it takes a very long time before projects and investments are realised. As a result, the Port of Rotterdam – a driver of the economy – loses valuable time. In other parts of the world, actions are often taken quicker and more decisively. This is also shown by the growth of the European economy, which is falling behind. Furthermore, Europe has already lost the monopoly on the development of new technology a long time ago. Therefore, the pace of planning, decision-making and realisation needs to increase, among all parties involved. Speeding up is the motto here.

*You can read about the vessel traffic management at the Port of Rotterdam in Raymond Seignette's article on page 105.*

### ABOUT THE AUTHOR

**Nico van Dooren** is Project Manager Port Vision within the Port of Rotterdam Authority. He has a background in business development, spatial planning and environmental technology. Previously he held positions within the projectorganisation Maasvlakte 2 and Royal Haskoning.

### ABOUT THE ORGANISATION

The aim of the **Port of Rotterdam Authority** is to enhance the Port of Rotterdam's competitive position as a logistics hub and world-class industrial complex. They manage, operate and develop the port and industrial area. They invest in the development of the existing port area, new port sites (Maasvlakte 2), public infrastructure and the handling of shipping. Together with their partners, they aim towards a multipurpose, sustainable, safe and attractive port that meets the high demands of society.

### ENQUIRIES

Nico van Dooren – Project Manager Port Vision
Havenbedrijf Rotterdam N.V.
Tel: +31 (0)10 252 49 64
Fax: +31 (0)10 252 44 30
Email: nja.dooren@portofrotterdam.com
World Port Center
Postbus 6622, 3002 AP Rotterdam
Web: www.portcompass2030.com

# CONTAINER HANDLING

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# Remotely controlled STS cranes

**ABB Crane Systems**, Västerås, Sweden

## Summary

The performance of STS cranes is a limiting factor in the achievement of maximum throughput in container terminals. The need for high performance has driven the recent rapid development of these cranes. Having the crane operator on board has become a critical factor; maintaining essential lines of sight and operating controls puts limitations on the location and position of the operator which can result in severe strain and fatigue. Also, since the operator's cabin moves with the load. there are restrictions on the rates of acceleration and deceleration, thus increasing cycle times.

ABB Crane Systems has considerable experience from having supplied more than 300 remotely controlled ASCs. Working in collaboration with Manzanillo International Terminal (MIT) in Panama, ABB Crane Systems has successfully applied this experience to an existing STS crane. This is the world's first remotely controlled STS crane.

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Summary and analysis of last night's production using the Terminal View to provide both real-time and historical data.

## Requirement

Despite many significant improvements to the design of operators' cabins there remain significant problems. In order to see the load at all times the operator has to lean forward and look down between his feet. This causes some discomfort and possibly strain. The operator is subject to constant movements, accelerations and decelerations of the cabin.

These factors cause discomfort and fatigue and affect the operator's performance. There is significant absence due to sickness. To avoid harmful effects on operators there are limits on the rates of acceleration and deceleration of the cabin, which leads to cycle times being longer than could otherwise be achieved. Safety of all crane operations is paramount. It is therefore necessary to ensure that any changes do not jeopardize safety and, where possible, improve safety standards.

## Solution

Remote operation of the crane offers a complete and effective solution to the above needs. By operating the crane from a


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Remote operation at Manzanillo International Terminal, Panama.

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Crane operation from a remote control room means improved working conditions for the operator's while allowing aggressive tuning of the crane.

remote location there is no compromise on the operator's posture and, in a well designed control room, the conditions minimize the effects of stress and fatigue. ABB Crane Systems' remote control station (RCS) was developed for ASCs and is well proven; it has an established layout of push button and joystick controls, camera screens and a computer screen. The layout of the RCS and the operator's chair are ergonomically designed to enhance comfort and performance.

State of the art camera technology is used to ensure that the operator has all views necessary for safe and efficient movements. Contact with personnel working local to the crane is through radio links, in the same way as from an on-board operator's cabin.

## Further benefits

Working from a remote control station has many advantages beyond operator comfort and higher acceleration rates. All the operators can be located in one control room. Of course, operators will benefit from a more social environment and by grouping the crane operators more flexible routines and arrangements are possible, benefiting the operators and the employer.

It is anticipated that the control room will be located near to the terminal control room and that there will be improved communication between all of the personnel involved. Using cameras gives the operator access to views that are not available from the cabin. Thus it is possible to achieve higher levels of safety – particularly for those working on board ships.

With the operator no longer on the crane, more aggressive rates of acceleration and deceleration are permissible. This applies not only to the main traversing movements but also to corrective operations such as sway control and skew pendulum dampening. These features add further to the savings in overall cycle times. The more aggressive ramp rates reinforce the benefits achieved by automation such as ABB Crane Systems' Automatic Container Landing System and Double Trolley Systems.

On new cranes built for remote operation, there will be no cabin and so a significant reduction in live loads is achieved. For future full-scale implementations, ABB will also deliver its new Terminal View solution which integrates real-time information from several levels of equipment and different suppliers throughout the terminal. In a large screen, multi-monitor environment, the Terminal View provides easy analysis of both overview and detailed information for operations as well as maintenance.

## Implementation

ABB Crane Systems has undertaken many retrofitting projects on STS cranes and is therefore well aware of the need to minimize the period for which the crane is out of service. When an STS crane is out of service it also blocks access to the quayside. Therefore the project was implemented in two quite separate stages and the engineering and operating personnel were closely involved in the planning.

The two stages were:

1) Operation from a fixed cabin mounted on a crane leg

2) Operation from a remote control station.

In Stage 1 the operators worked from a stationary cabin which was equipped as a standard crane cabin but using cameras and screens. Thus the operators were in familiar surroundings but were controlling movements on the basis of camera images. Stage 2 left the cabin set-up all together and instead the operators worked from the remote control station located in the office area.

## Results

The project was subject to continuous joint evaluation by ABB Crane Systems and MIT. The evaluation is still in progress but the project is already judged a success on the following basis:

- A basic objective was that with remote operation, cycle times must be no longer than was already achieved using operators in crane mounted cabins
- Reductions in cycle times have been achieved on a regular basis
- The operators are pleased with their new environment, with less physical strain
- Provided that these improvements are maintained, then the cost of conversion will have an attractive pay-back period

ABB Crane Systems is proud of the achievement at MIT and acknowledges the commitment and cooperation of the management and personnel of MIT.

### ABOUT THE COMPANY

**ABB** is a leader in power and automation technologies that enable utility and industry customers to improve performance while lowering environmental impact. The ABB Group of companies operates in more than 100 countries and employs about 130,000 people.

### ENQUIRIES

ABB Crane Systems, SE-721 59 Västerås, Sweden
Tel: +46 21 340243
Email: cranes.sales@se.abb.com
Web: www.abb.com/cranes

# Extreme crane upgrades

**Derrick Lind**, Structural Engineer & **Jonathan Hsieh**, Structural Engineer and Vice President, Liftech Consultants Inc., Oakland, CA, US

The Panama Canal is being expanded. Jumbo vessels, 23 rows wide, are being constructed. This means larger ship to shore cranes will be needed at many terminals.

When a crane owner considers his options, he may be concerned that upgrading will not be feasible. However, extreme upgrades are often feasible. This article presents a recent crane upgrade study that included major modifications.

## Background

A terminal operator is considering expanding his existing terminal to service larger vessels. The existing cranes are in good condition and can be productive for at least another 25 years, provided they are upgraded to service Jumbo-23 vessels. For operational reasons, the rail gage will be increased from 30 meters to 35 meters.

Liftech studied the modifications required to expand the existing cranes so that they may operate on the larger rail gage and service larger vessels.

Figure 1 shows the existing and proposed upgraded cranes – the existing crane in light green and the upgraded crane in dark green and red.

## Approach

Several upgrade concepts were developed and evaluated to determine the most feasible upgrade solution, considering cost and schedule. Cost and schedule estimates helped the owner decide whether to proceed with the upgrade or buy new cranes.

The owner also used the cost and schedule estimates to reexamine his original performance requirements. Some requirements were costly to implement with relatively little benefit and some were not costly but offered significant benefit. Consequently, the owner reduced or eliminated some desired features and increased others.

## Significant upgrade considerations

The following section describes the significant issues considered for the upgrade options. An overview of the selected upgrade concept is shown in Figure 2 overleaf.

### QC girder strength

Strength of the existing waterside crane girder was a concern. Initial upgrade concepts resulted in excessive waterside girder loads.

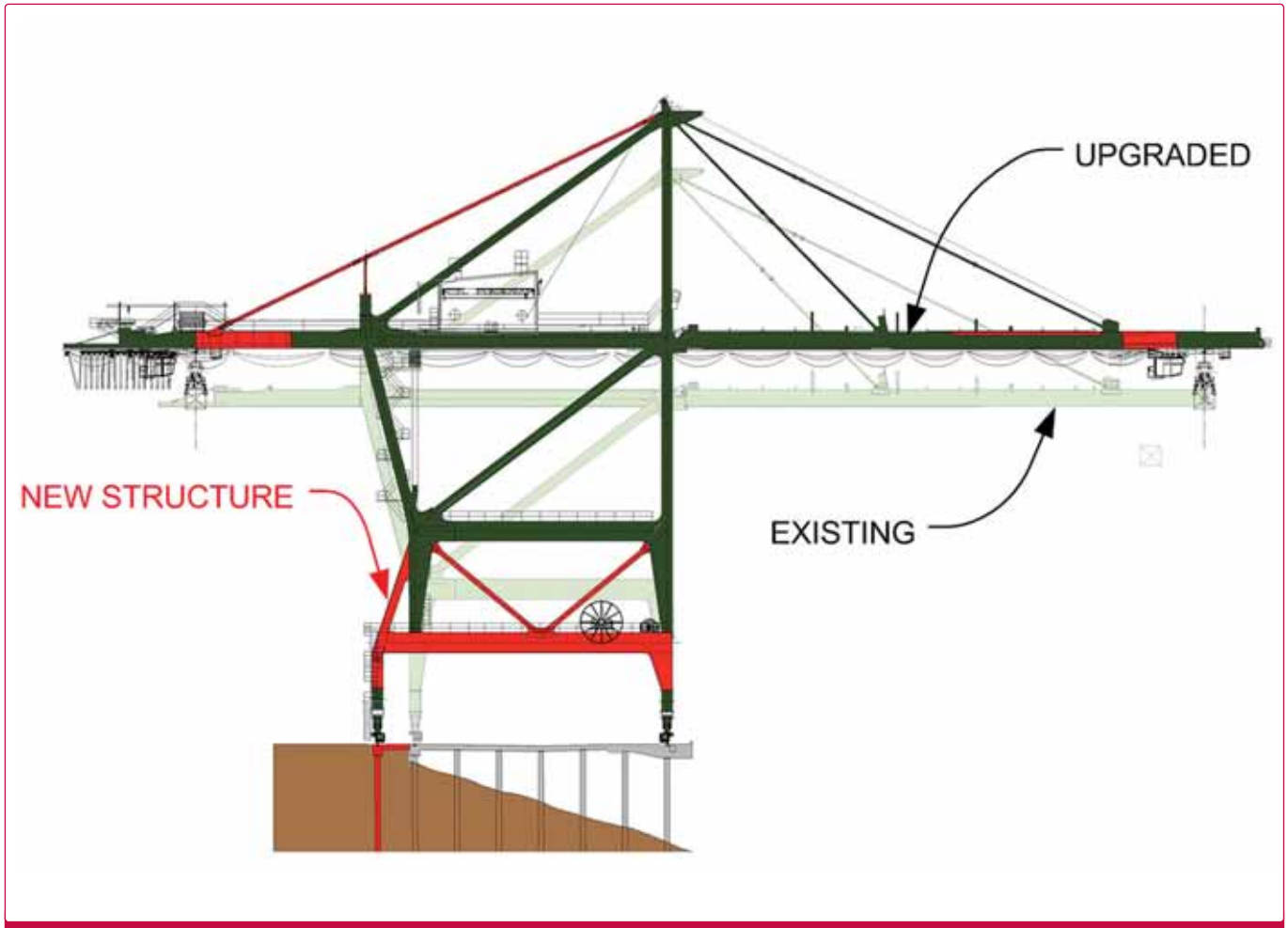



Figure 1. Existing and upgraded crane configurations.

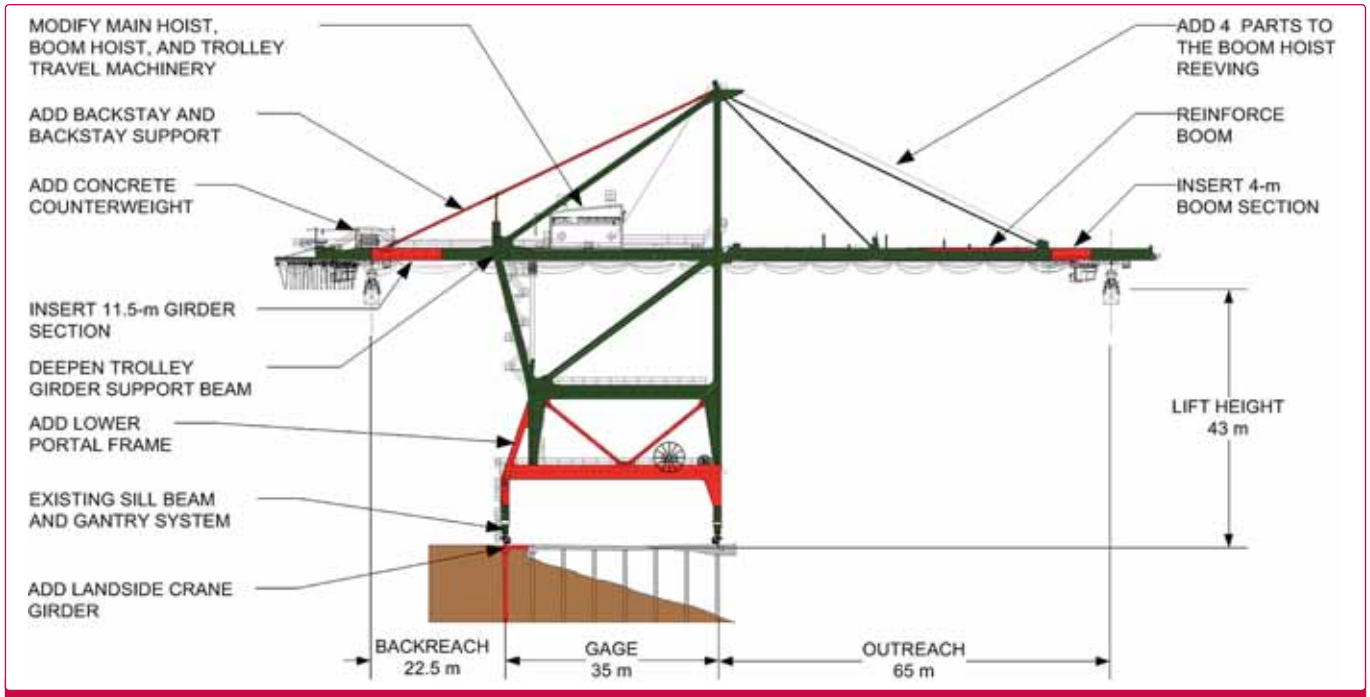



Figure 2. Selected upgrade concept.

The following options were investigated to reduce the waterside girder loads:

1. Placing the existing crane structure, the light green crane in Figure 1, toward the landside end of the lower portal frame
2. Relocating the machinery house farther landside
3. Reducing the outreach
4. Reducing the rated load at the full outreach
5. Adding a counterweight near the trolley girder end
6. Revaluating the existing crane girder strength
7. Strengthening the existing crane girder

Although the counterweight increases the landside girder loads and requires a new backstay, Option 5 is the most desirable, as the other options are more costly or do not meet the owner's needs.

### Crane structure

Reinforcement of some fatigue sensitive components will be required, primarily due to the increased outreach. Cover plates will be added to portions of the existing boom, but some cover plates could be eliminated without reducing reliability by inspecting fracture critical details more often. The landside trolley girder support beam will need to be reinforced by deepening the existing beam.

A new backstay will be added to support the extended backreach and the new counterweight. Crane stiffness in both the gantry travel and trolley travel direction was considered during the design. For operation motions, the period of vibration in the trolley travel direction was limited to 1.5 seconds. The deflection in the gantry travel direction would increase, but still be acceptable according to the original design criteria. Therefore, it was not necessary to stiffen the O-frames or the boom.

Crane stability was found to be adequate for both operating and non-operating conditions. No additional ballast or tie-downs are required.

### Boom hoist system

The longer, heavier boom increases the load on the boom hoist system. The existing crane used two sets of ropes, seven on each side, to lift the boom. Four hoist rope parts will be added to each set. The magnitude of this change is unusual. Typically, only two or three additional parts per side are added and, if necessary, a higher strength rope will be used. However, the existing boom hoist already uses high-strength wire ropes, so using a stronger wire rope was not an option.

The additional parts will increase the amount of rope wound on the drum. This extra rope could be accommodated in several ways: double wrapping the ropes, machining the existing drum for more grooves, relocating the rope dead end, or replacing the drum.

For this upgrade project the ropes will be double wrapped. This method involves a second layer of rope on top of the first layer. Double wrapping is usually avoided for heavily loaded, frequently wrapped and unwrapped ropes. Fortunately, the double wrapping occurs when the boom is nearly fully raised and the rope load is relatively light. Therefore, double wrapping is acceptable. This is a simple, common, and cost effective solution.

The additional rope length significantly increases the time to fully raise the boom. One method for mitigating the impact of the increased boom hoist time is to stow the boom at a partially raised position, such as 45 degrees from horizontal, to clear the vessel.

### Main hoist and trolley travel systems

The greater lift height increases the length of the main hoist ropes. Unlike the boom hoist, the main hoist rope load is too large to double wrap. For this project, the additional rope length was accommodated by relocating the dead wraps to the ungrooved portion of the existing drum. A similar approach was used to adjust the trolley tow rope dead wraps for the longer trolley travel path.

### Gantry travel and braking system

The gantry motors and brakes were evaluated for the increased vertical, wind, and inertial loads on the gantry travel system. Additional gantry motors and brakes will be provided for adequate performance. The equalizer system structure is adequate for the larger loads without reinforcement.

## Summary

The project study indicates that even an extreme upgrade is feasible, and may be preferable to procuring new cranes.


### ABOUT THE AUTHORS

**Derrick Lind** is a Liftech Structural Engineer and Associate, with 15 years of experience designing and evaluating various structural systems for commercial, industrial, and transportation facilities, including buildings, marine structures, wharves, bridges, and container cranes. His work includes structural analysis and design, supervising engineers, coordinating subconsultants' work, and managing project budgets and schedules.

**Jonathan Hsieh** is a Liftech Structural Engineer and Vice President, with 15 years of experience in design, review, analysis, and modification of container cranes, bulk handling cranes, and special structures. His expertise includes crane procurement, fatigue failure investigation and repair, and computer modeling and analysis. He has also worked on structural maintenance programs, seismic design of container cranes, crane instrumentation, and voyage bracing.


### ABOUT THE COMPANY

**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. Our experience includes structural design for wharves and wharf structures, heavy lift structures, buildings, container yard structures, and container handling equipment. Our national and international clients include owners, engineers, operators, manufacturers, and riggers.


### ENQUIRIES

Liftech Consultants Inc.
344 – 20th Street, #360
Oakland, CA 94612-3593
US
Tel: +1 (510) 832 5606
Fax: + 1 (510) 832 2436
Email: liftech@liftech.net
Web: www.liftech.net

# Fuelling productivity, conserving energy, saving space

**Franz Wölfer Elektromaschinenfabrik Osnabrück GmbH**, Germany

Franz Wölfer Elektromaschinenfabrik supplies three-phase asynchronous hoisting squirrel cages and slip-ring electric motors, with power ranges of 2.2 kilowatts to 2,000 kilowatts, for all types of cranes including yard cranes. None of Wölfer's motors can be described as a standard solution application, as each is designed to meet the specification demanded by the crane manufacturer. As such, the company has a flexible approach to its design.

"If we are asked to position the terminal box of a motor at 45 degrees rather than at 90 degrees, we will do it," confirmed Mr. Sprekelmeyer, Head of Sales at Wölfer.

By having a higher pull-out torque, the company's motors can be driven smoothly over a higher range of speeds, which, coupled with their lower inertia, gives a much shorter acceleration time and lower energy demand. This, in turn, gives the crane operator a more comfortable environment to work in.

In normal circumstances, torque would drop off to zero if motors on cranes are operated at speed between 1,600 and 1,800 resolutions per minute. Wölfer-designed motors can be driven at higher speed with lower loss of torque. This, in turn, makes it possible to operate several motors in parallel, with a high range of speed and significant torque for moving loads.

Wölfer is extremely flexible concerning the mounting dimensions of motors, as all motors can also be delivered in a steel-welded design. If a crane is upgraded from DC to AC-inverter or from slip-ring motors to inverter driven squirrel cage motors, Wölfer is able to deliver the new AC-motor with the same mounting dimensions as the existing motor. Through this, retrofitting can be done much sooner, saving over a week of work as the machinery house does not need to be modified. Therefore the terminal operator can minimize the standstill time and can save a huge amount of money.

The company has developed an IP23 inner-cooled motor: air is blown through the motor itself, where the heat occurs. Standard motors have cooling fins that air is blown over. For motors mounted in a machinery house, IP23 inner-cooled motors can be used. This achieves the same power output but from a smaller unit, reducing the energy required for acceleration, as the inertia is much lower. Because of the lower starting current, smaller sizes of frequency inverters and cables can be used. Furthermore, the required space is reduced, as is the weight of the motors. All these parameters enable crane manufacturers to reduce the size and weight of the machinery houses on cranes and finally greater numbers of containers can be handled. In total, motors from Wölfer enable the terminal operators to run greener terminals, as energy savings for 2 to 8 percent per hoisting application can be achieved.

## ABOUT THE COMPANY

**Franz Wölfer Elektromaschinenfabrik** produces electric motors with a performance up to 2,000 kilowatts. The high-capacity motors are still produced exclusively at the business location in Osnabrück-Sutthausen, Germany. Wölfer is constantly expanding this location and modernising the production technology. In 2007 they acquired a modern testing station for electric motors.

## ENQUIRIES

Franz Wölfer Elektromaschinenfabrik Osnabrück GmbH
Industriestraße 14, 49082 Osnabrück
Tel: +49 (0)541-990 22-0 Telefax +49 (0)541-990 22-22
Email: info@woelfer-motoren.com Web: www.woelfer-motoren.com

Photo: panthermedia

Customers throughout the world are convinced by the high degree of efficiency of Wölfer's products.

# The future of marine terminal software

**Richard Butcher**, Group Marketing and Sales Director, IMS Ltd, Southampton, UK

## Current market conditions

The container shipping sector has again entered unsettled times. With the world economy still in a state of flux, financial pressures are being exerted across the shipping and transportation chain. All players are looking to squeeze additional revenue and reduce operational costs.

The global carriers are seeking consolidation and economies of scale with the reduction of services, as well as moth-balling smaller vessels and looking at increased capacities for larger vessels, along with more fuel efficient engines and designs to offer some relief against the harsh market forces.

The carriers, along with all the other elements of the transportation supply chain, will be seeking areas to improve and reduce operational costs and drive efficiencies. This is where they start to turn towards newer technology to help achieve these goals.

## Container terminals

The current conditions have also taken their toll on the container terminals that serve these carrier groups; they have to become ultra – efficient in order to achieve greater financial returns. Many are facing the challenges imposed by the introduction of the mega container ships: the new 12,000, 14,000 and even 18,000 TEU goliaths (ULCC) that are beginning to call their facilities.

These vessels bring challenges for the operational and planning teams: to ensure that every aspect of the port call is optimized in order to maintain the agreed service levels that their carrier principals have come to expect.

Terminals are becoming even more dependent on newer technology and although many might have sufficient solutions that cope with the cargo volumes of today, it is certain that world trade will again start to recover during the next several years. It is now that marine terminal executives should be evaluating their current and future technology requirements.

With restrictions on land usage, environmental issues and the sheer capital costs involved in expanding marine facilities, it is sometimes just not feasible for terminals to further expand the facilities they operate. Thus the pressure will be on delivering greater volume throughputs with the terminal space available. This is where the next generation software will play a critical role in the future profitability of the container terminals.

## Current solutions

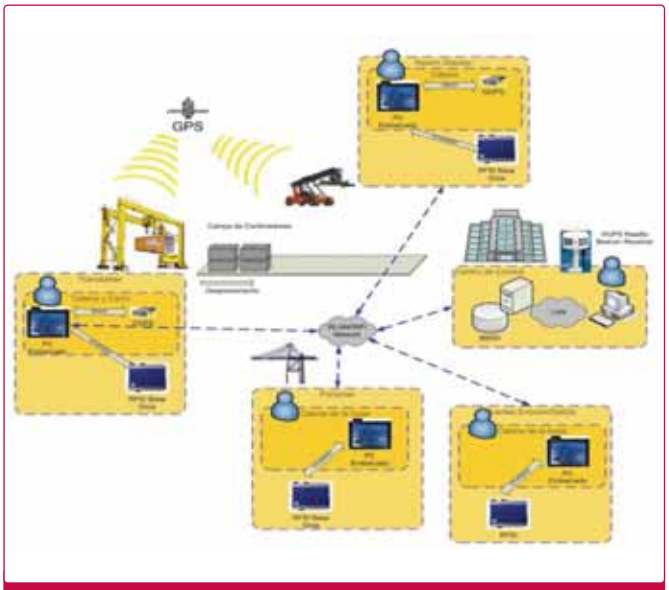
Marine terminals today are running a mixture of technological solutions, either developed internally or sourced from one of the current terminal operating software vendors. These solutions normally embrace four main elements:

1. Operations applications
2. Terminal planning
3. Gate control
4. Financial accounting

### 1. Operations applications

These core solutions manage the following aspects:

- Commercial contracts
- Import documentation
- Export documentation




RFID Terminal Layout.

Courtesy: IMS

- Gate control
- Booking and reservation systems (trucks/mother vessels/trains/feeder ships)
- Customs interface
- Electronic data interchange (EDI)
- Human resource aspects
- Equipment management (terminals handling equipment)
- Financial processing (collating all the data pertaining to expenses and feeding into a third party financial solution)
- Cargo claims/damage reports

### 2. Terminal planning

- Graphical view of the terminal facility
- Export stacks
- Import stacks
- Damaged stacks
- Reefer equipment
- Yard buildings (offices and workshops)
- Gates
- Quayside layout

Within the terminal planning application, certain leading players have incorporated:

- Yard optimization
- Equipment optimization
- Vessel scheduling/berth allocation

### 3. Gate control

- Inbound control – RFID and automated gates
- Security scanning and inspection areas
- Camera capture

**4. Financial accounting**

- Accounts payable
- Account receivable
- General ledger
- Financial reporting

} These tend to be ORACLE or SAP financial applications

## Who currently leads the way?

When looking at these current core applications, there are really only a handful of skilled solution providers that can deliver quality solutions that have been exposed to the markets. These providers tend to come from America, with market leaders such as NAVIS. Asia also offers skilled providers, such as TSB (Total Soft Bank) and HIT with their N.GEN solutions. Europe has seen the likes of COSMOS in Belgium making a revival.

These groups tend to cater for the larger global market operators with multiple facilities and a demand for leading and cutting edge applications. They also tend to carry a high price premium.

Other second tier players are making market inroads, with Tideworks, Jade and Autostore all looking at delivering the viable cost effective applications to mid-sized terminals. Of course there are a number of other groups that have developed terminal solutions and also terminals that have developed in-house applications.

In order to achieve greater productivity within the existing terminals framework, greater emphasis must also be given towards improving the following:

- Documentation processing
- Inbound and outbound gate moves
- Better resource planning (labour and equipment)
- Yard congestion

## The future of technology requirements

Keeping up with technology and looking at delivering continual cutting edge applications is paramount with both the development companies and operators that strive to achieve greater productivity whilst driving higher financial returns.

The next generation applications will indeed be focused on these areas and the IMS believes that the following solutions will make more of an impact during the next three to five years:

- Advanced revenue management engines
- Forecasting tools
- Optimization engines
- Four-dimensional graphical planning
- Integrated maintenance applications
- KPI and full dashboard monitoring solutions
- Greater utilization of RFID and real-time performance monitoring
- Resource planning applications
- SAAS deployed cloud technology

### Advanced revenue management

Contract levels and margins are being squeezed and the carriers of today are looking for the following: lower rates and higher service levels, with fewer delays and quicker turn-around of vessels.

The ability to analyse the contract value and to measure the contribution levels of the carriers is paramount, as is the way in which revenue is generated. Transportation operators in other industries have been using various forms of contribution analysis models, but few have adopted full blown revenue management.

For a terminal it would be very useful to adopt the utilization space method and look to capture salient data such as:

- Service agreement levels
- Associated contribution on every container processed and handled
- Measuring fixed and variable costs against the TEU revenues and volumes
- Analysis of the various cargo mixes and revenue potential against space capacity within a terminal
- Measuring a slot value – these are associated with the stacks found in the yard. Every slot will be tied to a numerical value and these can be measured against the service contracts
- Pricing models will help analysis of the usage of yard space and allow for tighter control on space allocation
- Peak and seasonal pricing can be monitored

The data provided will help the commercial teams better negotiate contracts and have a much clearer grasp on the value of each carrier agreement they commit to.

At the heart of these revenue management solutions lies a powerful mathematical engine that can process the complex algorithms necessary to produce the information. There are a number of companies that have developed these powerful revenue management solutions, including cutting edge provider, the Dutch ORTEC group.

### Forecasting engines

Today's container terminals do a fair bit of forecasting to evaluate a number of factors. These include:

- Vessel calls
- Berthing allocation
- Equipment requirements
- Staffing levels.

### Mapping out the container optimizations

Much of these are done manually, or through the use of Microsoft Excel spreadsheets, and not many terminals have yet deployed the really sophisticated optimization engines. Some of the existing TOS providers have some aspects incorporated into their planning tools, but these do not have the complex mathematical engines that are found in specific solutions, such as those designed by leading players, such as ORTEC and QUINTIQ. Both of those solution providers have developed advanced algorithm engines.

The advantages of deploying these mathematically enhanced engines will allow the terminal operational teams to better prepare for vessels and help with the measuring every aspect of the containers being handled, received or shipped out, whilst also measuring the physical yard capacities.

Having resources capable of these mathematical tasks will help improve productivity and will be able to offer a more exact science of container through-puts, whilst also making certain that containers are handled in the most effective manner. These forecasting engines will also be responsible for capturing and measuring data projections and will allow terminal managers to feed into the solution a number of 'what if' scenarios. This data will provide the necessary flows for calculations and predictions on what type of resources and equipment and space will be required during a fixed or variable time frame. Much of this data capture can be fed into the four-dimensional modelling tools.

### Four-dimensional planning tools

Optimal yard planning is structured around the physical constraints and looking at the way in which a yard is arranged. Of course, with established container yards, the restrictions are governed by the original layout. However, with advanced planning and graphical tools it is possible to make assessments of these yards constraints and measure what differences could be achieved through restructuring yards stacks, layouts, gates and buildings. These solutions need to be able to configure full three-dimensional terminal layouts. These types of visual and graphical planning tools are excellent for operators that are looking at the

best potential layout for a Greenfield site.

The new fourth dimension comes into play when mapping the physical data involved with growth projections of a terminal. The metrics need to be pulled from the terminals forecasting modules. This type of data would look at the projected growth patterns and what impacts would be as TEU throughput increases – it will need to also be linked to the KPI and Management Information Modules. Data such as:-

- Vessel calls
- Vessel capacities
- Current TEU volumes
- TEU volumes projected by the carriers (year on year growth)
- Stack capacities
- Gate moves
- Equipment availability
- Equipment productivity per hour
- Labor productivity

These along with regional and global economic data must be captured and analysed, thus providing terminal management with almost a 'crystal ball' solution on what potential volumes might be during a normal 25 year contract life.

This data would form the fourth dimension and projects a full graphical depiction of the terminal during the phases of its contract life. It can also demonstrate and graphically depict what the terminal used to be against what it might be in the future.

The ultimate goal will be that any new Greenfield terminal site can have the visibility of growth and see when new phases or capital investment will be required, be it for more infrastructure or handling equipment.

## Integrated maintenance applications

Much focus has been given by the operators of terminals towards terminal planning and operational aspects of the business. However, it is vital for the operating machinery to be fully functioning, serviced and in prime condition to meet the demands and be able to achieve the set key performance indicators (KPIs) set by the terminals management. It comes down to the engineering department to work on the scheduled maintenance and inventory control for spare parts and consumable items.

Many of today's leading manufacturers of quay cranes, straddle carriers, RTGs, yard hustlers, front loaders, top loaders and forklift trucks all provide service manuals. These are either electronic or book format and provide critical data on the maintenance schedules that are required.

Integrated maintenance applications include:

- MES
- HYSTER
- KALMAR
- LIEBHERR
- ZPMC
- MI-JACK
- NOELL
- HYUNDAI

What seems to be lacking is an automated interface between maintenance and service schedules and operational solutions. Although many terminals are covering this very well, most are using various forms of spreadsheet data and working on maintenance programs outlined by the manufacturers.

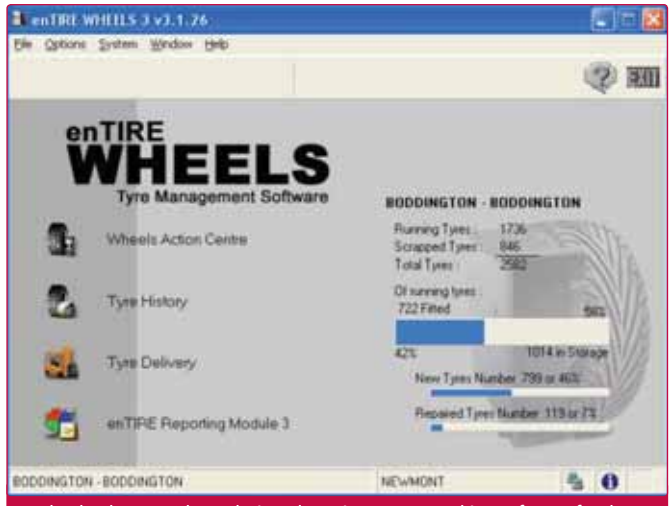
What needs to be monitored is the overall equipment demand and this is where links to the advanced forecasting and optimization solutions will come into play.

Increased container throughputs will increase wear and hours of machines. This will create demand for more frequent inspections and services. The additional loads will also shorten the life expectancy of the machines, so it will be important to factor in the life expectancy of the equipment against the potential terminal growth.

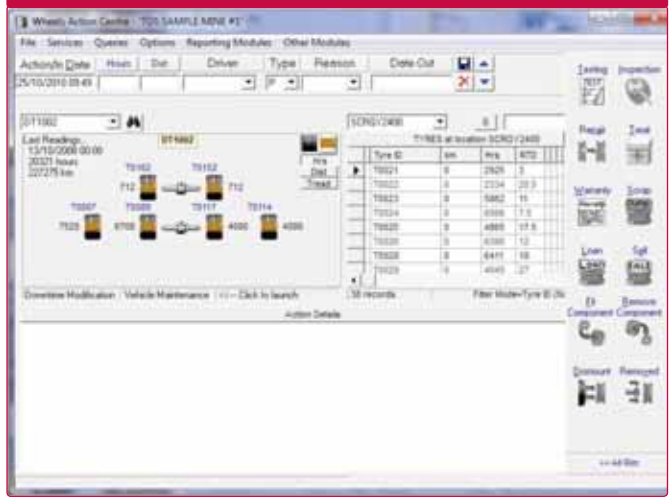
Allowing terminal operators more time in selecting new equipment for the terminals, data should also be measured and compared as to the durability of the equipment and overall maintenance costs over the life of the equipment. If a terminal is part of a group then this data should be accessed across the group so that comparable equipment can be assessed or alternative manufacturer's data can be compared and cross-referenced, therefore allowing the terminals to select the best piece of equipment or look at potential manufacturing issues and warranty claims.

In the area of consumables, demand for components will need to be linked to current stock, and an analysis of when an order is required will be needed to avoid holdings lots of expensive spares and consumables, and so achieve minimal stock levels.

The other factor that is critical in terms of engineering is to achieve greater cost savings at a consumer level. Tyres are one of the most expensive elements that a terminal will have to purchase from a consumer point of view (after diesel and/or bio-fuels). A medium to large container terminal can spend upwards of $4.5 to $5 million a year on tyres. New advanced products such as the enTIRE application from VMC can help track the life cycle of a tyre, as well as analysing and monitoring every aspect of the tyre, leading to savings of between 10 to 30 percent, which can equate to $500,000 to $1.5 million over a 12 to 36 month period.




Market leaders VMC have designed a unique asset tracking software for the use of tyres on any moving equipment. 30 percent savings have been achieved through its deployment.



Photos courtesy:VMC Australia

It's this type of cutting edge solution that will help achieve greater productivity, reduce operational costs and achieve a longer lifetime from the current equipment.

## Analysis of operations

As touched upon earlier in this article, the demand to have an accurate Business Intelligence and Management Information System is paramount. It allows the terminal managers to monitor operations. At every stage, KPIs will help measure how containers, equipment and human resources flow. Below are some of the key areas where these new solutions can help improve overall productivity:

**Yard inventory performance analysis** Interactive visual models allow executives to understand container movement impact analysis by container size. It will provide an analysis of blockage, in terms of how many containers are not moved in last seven to ten days. It will analyse containers entered into the yard and exited from the yard by rail or road. It will also examine of how many containers has been moved from the community and the yard, as well as vessel.

**Quay crane analysis** This will allow executives to understand about the quay crane productivity. It will give an analysis on load, unload and total performance ratio of quay crane in the last hour, quay crane productivity in last 24 hours, quay crane container movement in the last hour (20 footer, 40 footer, empty and full containers) and quay crane movement analysis (load, unload and total movement).

**Truck turnaround time analysis** This visual model allows executives to understand the collective truck turnaround time of trucks by gate, by truck, by container and container size. Executives can further analyse truck results by comparing their 12 months truck turnaround time by their container type and size. It will also give analysis of average truck turnaround time of gate to equipment, equipment to gate and gate truck turnaround time with in-time and out-time of a truck.

**Vessel productivity analysis** This will provide an executive with data to understand vessel productivity analysis, including an hourly comparison of container movement, and analysis on container arrival ratios. It will also give the hourly comparison of equipment performance analysis of the last five hours and analyse daily productivity of vessels. It will also give the daily analysis of how many vessels arrived and how many vessels discharged and quay crane productivity of vessels in one day.

The point of a marine terminal operations enterprise dashboard is to allow the marine terminal management to monitor yard operations in real-time and to alert them to conditions outside of normal boundaries. Marine terminal operations fall into three main areas of focus, in terms of production management:

- Crane operations from/to vessel and train/truck
- Yard production of container stacks
- Container parking and rail cars, and gate operations involving entry and departure into the terminal

These dashboards help operational users avoid congestion, such as lines of trucks awaiting access to terminals. Some examples of marine terminal KPIs are:

- Container gate moves
- Average turn time for trucks
- Yard inventory of containers
- Outbound trucks still on terminal over an hour

In the case of business intelligence, multiple databases and multiple applications can be connected to give a single unified vision of enterprise-wide data, which offers benefits such as time saving, accuracy, authenticity of report, labor saving and much more. Business intelligence turns enterprise-wide data into actionable information. It helps monitor, measure and analyse the health and performance of terminal operations.

The main point, obviously, is that time equals money.

Users of business intelligence could be:

- Shift managers
- Gate managers
- Maintenance heads
- Finance users
- Commercials managers
- Department heads

Functional areas that can be targeted with business intelligence include:

- Operations
- Railway movement
- Internal and external truck movement
- RTG movement
- Quay crane movement
- Berth productivity
- Ship production
- Shift production

Commercial areas to target with business intelligence are:

- Service revenue
- Service, line and voyage productivity

Claims and contracts areas are:

- Vendor data analysis and comparison
- Claims for accidents and near misses
- Third party as well as own claim tracking

Financial areas are:

- Profit and loss analysis
- Outstanding receivables/payables
- Customer/vendor ageing
- Balance sheet comparisons and analysis
- Budget versus actual, and monitoring
- HR – head count reports
- Attrition rate
- Blue/white collar analysis

Cranes are the bread and butter of the terminal freight service industry. So reports like these should be provided by the Management and Information Systems solutions:

- Gross/net crane rate
- Crane idle hours
- Avoidable/unavoidable delay
- Scheduled/un-scheduled crane maintenance.

The following are some of the KPIs that should be tracked by the terminal management and continually measured to maintain service and quality levels.

### Port terminal performance

KPIs are very important for Port managers in providing direction for business. The following parameters may help with an overall analysis of business if compared against 'actual', 'forecast' and 'variance' on a monthly or quarterly basis.

- Headcount – white/blue collar/total
- Hectare
- Total slots available (80 percent of maximum)


Courtesy: KPI Monitoring

Example of the type of KPI monitoring solutions.

- Quay (Wharf) length in meters
- Number of quay cranes
- Number of material handling cranes
- RTG or straddle carriers
- Number of RMGC
- TEU per hectare/quay meter/headcount
- Container moves per quay crane/RTG/straddle carrier (vessel and road)/RMGC
- Total number of accidents and incidents
- Number of lost work day cases
- Number of lost work days
- Accident frequency rate
- Safety related claims and incident cost
- Quay crane utilization, availability, emergency maintenance or planned maintenance percent
- Material handling crane utilization, availability, emergency maintenance or planned maintenance percent
- RTG/straddle carrier utilization, availability, emergency maintenance or planned maintenance percent
- RMGC utilization, availability, emergency maintenance or planned maintenance percent
- Yard stack utilization – percent full/empty
- Yard stacking factor
- Yard shifts percent
- Container dwell time – import, export, transhipment, total or empty
- Gate container moves – truck, rail or total
- Gate truck turn-around time (minutes)
- Gross crane productivity – main/others
- Berth productivity – mainliners/others
- Berth utilization (percent of available meters)
- TEU/vessel container moves ratio
- Vessel container moves/quay crane cycle moves/import/export/transhipment/shifting/total quay crane
- TEU – total throughput

## Resource planning solutions

Most resource planning solutions have resided within more integrated ERP applications, like the ones produced by ORACLE, SAP and SAGE. However, the fundamental elements within any of these solutions are the following:-

- Purchasing
- Inventory
- Finance
- Customer relations
- Sales

### Purchasing

Avoid overspending by ensuring that you get the right price, from the right supplier.

- Manage requests for tender and responses, contract and blanket orders, comprehensive supplier rating and classification, and statistics
- Create free pricing criteria and associated rules
- Plan and order with or without MRP replenishment
- Create delivery scheduling and receiving
- Control commitments against budget
- Open item management and tracking
- Manage payment term scheduling and mass payment campaigns
- Create user-defined payment processes

### Inventory

Simply and easily manage your inventory from movements and transactions to quality control and replenishment. With the inventory system you will have:

- A multi-level warehousing and location management system and the inventory system
- Flexible location management so that you can use dedicated, suggested, or random storage for single or multiple item location
- Stock management by physical location, lot and sub-lot, quality status, serial numbers, expiration dates and potency
- Consigned inventory and third party inventory
- Inventory replenishment with or without MRP

- Intra-company movements
- Forward and backward traceability
- Cost accounting

### Finance

Capture and analyse every detail of your company's financial status and make decisions, fast. Sage X3 ERP gives you:

- User-defined fiscal calendars, general ledger accounts, and analytic dimensions
- Extensive budgeting capabilities
- Financial extraction, reporting and intercompany consolidation
- Employee expenses entry and management
- A complete audit trail available across the entire ERP system
- Detailed risk analysis

### Customer relationship management

Get a 360 degree view of all your customers across sales, marketing, customer service and support.

- Build strong relationships with customers
- Create effective marketing campaigns
- Build contact management strategies
- Manage your sales pipeline
- Deliver outstanding customer service
- Support call centre capabilities
- Manage warranties and service orders
- Create and share customer information from 'quote to cash'

### Sales

Create a sales order process designed to meet your individual needs.

- Manage quotes, contracts, blanket orders, orders, inventory allocation, delivery scheduling, shipping, returns, and invoicing
- Use a customised product configurator
- Carry out credit checking and customer ratings
- Create your own matrix of pricing rules
- Calculate sales commissions
- Track and manage all open items
- Create your own cash collection process
- Manage customer reminders

### SAAS solutions

With every aspect of system deployment there will always be a fairly high initial capital cost to be taken into consideration. Terminal IT departments are under pressure to reduce their internal costs, the associated high costs of system installation and the various application configurations.

The ability for terminals to perform their own system configurations is certainly the way the world of software is heading towards. The new terminal operating solutions today need to be highly user-configurable. The central database will hold every type of potential configuration that embraces the majority of terminal operating modes.

By allowing the users to configure the solution, it saves costs and will allow for the unique tailoring of the software being deployed at each facility. Savings can be substantial for both the system vendor and for the terminal acquiring the application.

**KEY BENEFITS OF DEPLOYING A SAAS APPLICATION**

| Security system lifecycle | Item | Company hosted | Speed to deploy | Outsourced cloud | Speed to deploy |
|---|---|---|---|---|---|
| **Aquire** | | | | | |
| | Acquire software | Capital | Slow | Zero | Fast |
| | Purchase servers and infrastructure | Capital | Slow | Zero | Fast |
| | Train technical staff | Capital | Slow | Zero | |
| | Configure, customize and deploy | Capital | Slow | Capital or Expense | Moderate |
| **Maintain and support** | | | | | |
| | Pay software support | Expense | | Zero | |
| | Purchase upgrades | Expense | | Zero | |
| | Pay IT to manage system | Expense | | Zero | |
| | Pay shared cost of infrastructure | Expense | | Expense shared with community | |
| **Refresh** | | | | | |
| | Purchase more software | Capital | Slow | | Fast |
| | Retrain technical personnel | Expense | Slow | Zero | |
| | Purchase more hardware | Capital | Slow | | Fast |
| | Configure, customize and deploy | Capital | Slow | | Moderate |
| **Business Considerations** | **Questions to ask** | | | | |
| | Can I change quickly | No | Slow | Yes | Fast |
| | Do I need capital | Yes | Slow | Minimal | Fast |
| | Total cost of ownership | Static | | Less | |
| | Is the data mine | Yes | | Yes | |
| | Security of systems | Good | | Best | |
| | Independently audited and certified | Unlikely | | Yes | |
| | Triple redundancy | Unlikely | | Yes | |
| | Availability of service | Good | | Best | |

Having a SAAS deployed application will help reduce deployment costs, save on the required hardware and will always ensure that the most up to date version of the software is being run. Online system enhancements and support can again further reduce costs of software ownership.

## Conclusion

It must be said that terminal operators have to do some fairly advanced work at present, but things will have to change and pressure is on the various IT vendors to dig deeper into the new areas to drive the future of the industry. The carrier clients that these terminal operators serve will drive for greater efficiencies. They will demand that their large mega vessels will be dealt with faster and that their service level expectations will be met, as well as wanting a lower TEU throughput rate to be achieved. They will continue to be at the forefront during the next 12 to 24 months as global economies start to turn the corner to recovery.

Many terminals around the globe are trying to visualize what future growth projections might be and it is these advanced optimization and forecasting engines that will help establish a more precise business model. Revenue management will help to achieve greater returns on every contract and client served and will help to establish what works best for the terminal during the current climates.

Centralized maintenance and advanced solutions such as the enTIRE asset management software will help achieve greater continuity of service and better planning for scheduled maintenance and repairs to terminal capital equipment.

IMS also envisage that marine terminals will be seeking 'One Stop Shopping', whereby they can go to one party that provides a total turn-key solution that embraces all of the above aspects. We see that there are only a few true players in this market that have the network and infrastructure to achieve that goal and the leader of that is NAVIS LLC (Part of CARGOTEC conglomerate).

We welcome your feedback and comments to this article. It is meant to stimulate market interest and bring to the attention of the skills and industry knowledge that IMS can offer to the marine terminal sector.

### ABOUT THE AUTHOR

**Richard Butcher** has been connected to IMS for the past 25 years, and has served in a consulting capacity during this period. Richard's background is related to the commercial, logistical and technology areas of the maritime industry. Richard has held senior roles with a number of leading edge maritime technology providers, and his exposure in these areas is considerable.

### ABOUT THE COMPANY

**IMS Ltd** was founded in 1979 to serve the maritime community with its unique blend of industry consultants and market expertise. Over the last 33 years, our consultants have worked on a wide range of transportation and maritime related consulting projects.

### ENQUIRIES

Invicta Management Services Ltd
17 William Road
Lymington, Hampshire UK
Tel: +44 (0) 5602 092451
Mob: +44 (0) 7531 621222
Email: rbutcher@invictasolutions.com
Web: www.invictasolutions.com

# New paradigm on double cycling

## Double cycling by multi-quay cranes in container terminals

**Jang-Ho (Remy) Song**, Operation and Planning Team Manager, Pusan Newport Co., Ltd. (DP World), Pusan, South Korea

## Introduction

Under the rapidly changing maritime environments, worldwide container terminals are concentrating on improving productivity to reinforce market share and obtain competitiveness. Modern container terminals are quickly developing their equipment and facilities, and their productivity is increasing. This is largely due to a great deal of investment in equipment and infrastructure.

Double cycling can improve productivity without the need for extra investment on current equipment and infrastructure. It merely needs manpower, training and research into operational methods. If research on double cycling is revisited, the crane productivity will be vastly improved upon, because double cycling can maximize equipment efficiency.

Until now double cycling has generally meant the stevedore work conducted by a single quay crane, and in practice each crane achieves only around 10 percent of total exchanges. In other words, although in theory double cycling is great, it fails to live up to expectations due to low frequencies. Now we need to approach double cycling with a new paradigm to maximize the frequency of the practice.

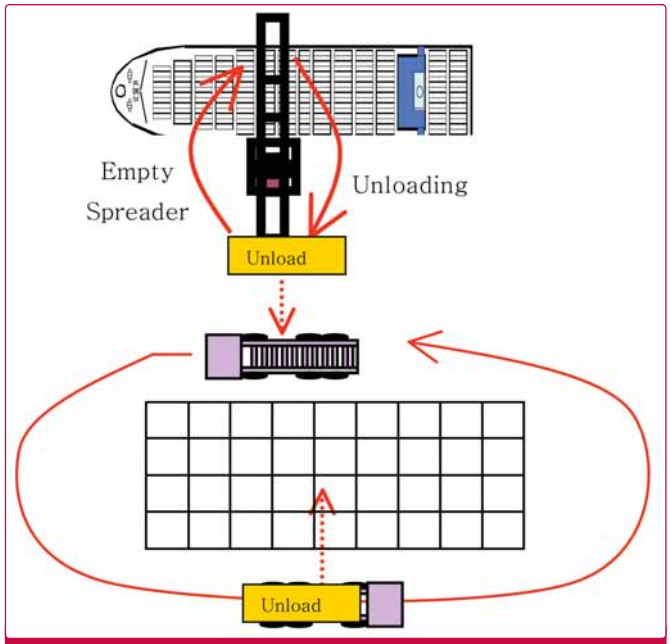



Figure 1. Single cycle.

## Concept

We do not have to define double cycling based on quay cranes any more, since the biggest factor that has impact on the quay crane productivity is the yard tractor. There are three factors that have impact on quay cranes: the productivity of the quay crane, RMGC productivity and yard tractor productivity.

How many yard tractors have to be allocated to one quay crane to guarantee target crane productivity? It varies depending on the environment of the terminal, which is a problem in terms of cost effectiveness, though from the yard tractor perspective, the issue can be solved easily with double cycling. Moreover, the target quay crane productivity can then be achieved through less yard tractors.

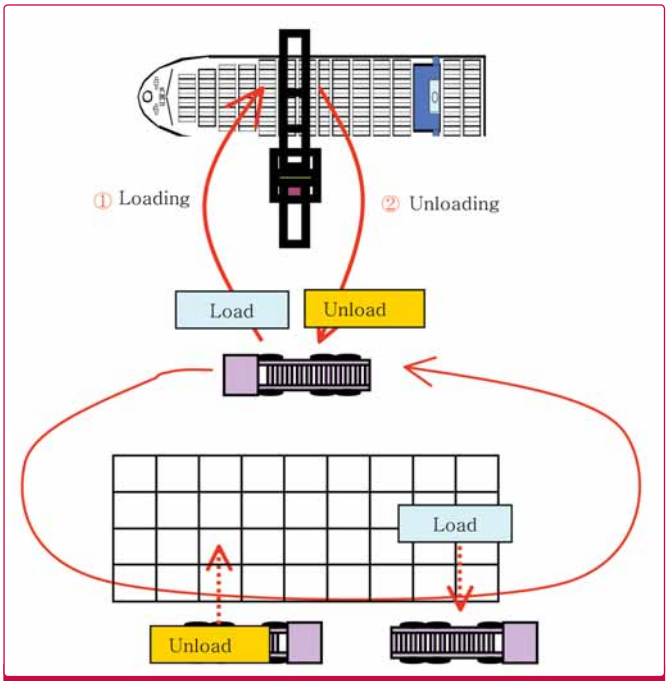



Figure 2. Single quay crane double cycle.

It is time that the double cycle is conducted on individual yard tractors using multi-quay cranes to enhance the frequency of the double cycles. Due to the complications of terminal operations caused by the introduction of automated cranes and pooling systems of yard tractors, TOS should back-up the yard tractor double cycling with multi-quay cranes. This will require the enhancement of TOS and the development of work procedures for users.

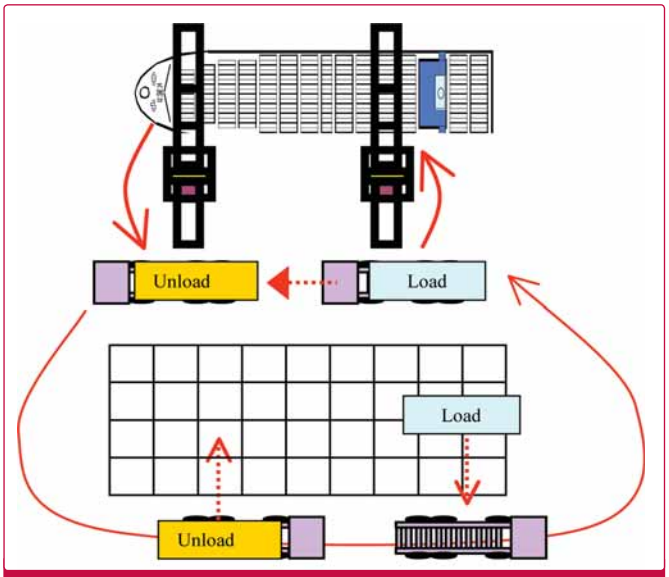



Figure 3. Multi-quay cranes double cycle.

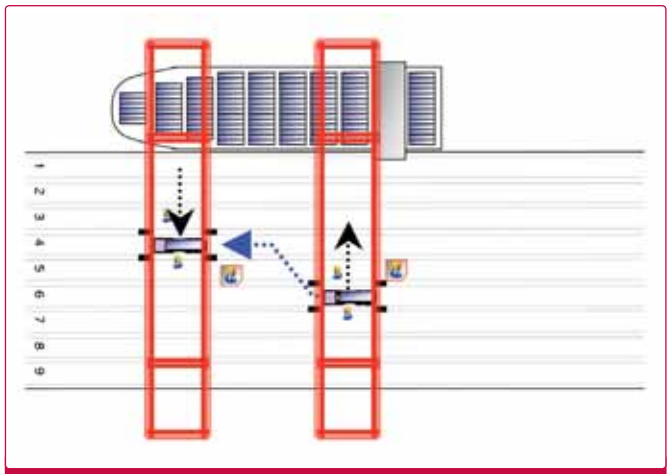


Figure 4. Multi-quay crane double cycle at current pinning station.

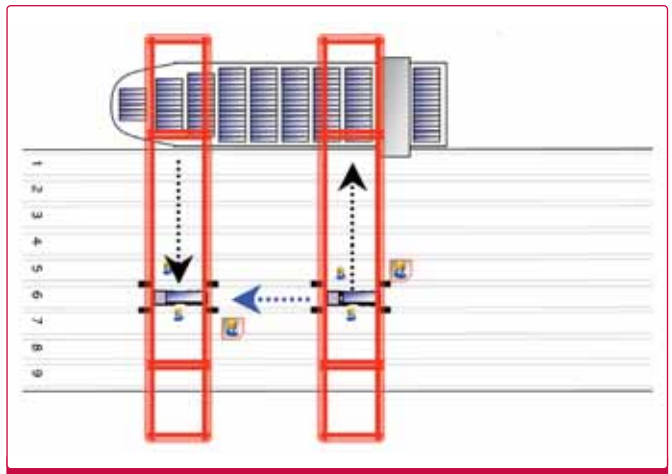


Figure 5. New pinning station procedure for multi-quay crane double cycle.

## The first stage; pinning station for double cycling by multi-quay cranes

Current pinning stations are not right for double cycling multi-quay cranes (like Figure 4 above), in terms of achieving both productivity and safety. As yard tractors must move sideways then along, this increases the risks of incidents and it takes unnecessary additional time for yard tractors to drive into the designated lane.

Therefore, a new type of pinning station should be developed to conduct multi-quay cranes double cycling. In Figure 5 above, where the back quay crane is loading and the front one is discharging, the pinning station for the discharging quay crane should move to make a straight line with the pinning station for the loading quay crane. This way, both the safety and productivity can be achieved.

## The second stage; sub-pool concept

For the multi-quay cranes double cycling with two quay cranes, there is no special consideration for yard tractors; the current yard tractor pooling system can be used without any problem. However, for three or more quay cranes, the current pool plus the concept of sub-pool should be introduced.

The current pool should be designated as a main pool and the additional sub-pool should have quay cranes that will conduct multi-quay cranes double cycling. The important thing is to maximize the frequency of double cycling, TOS should work by simple means and operators should support the practice. Too much reliance on the system may jeopardise safety and it will not boost the frequencies.

There are two methods for operating the sub-pool or connection pool. Firstly, two or more loading quay cranes are connected with only one discharging quay crane. Here, operators should be able to adjust the working schedule of quay cranes so that multi-quay cranes double cycle in real-time. This will make loading and discharging happen simultaneously.

Secondly, two or more discharging quay cranes should make a connection pool with only one loading quay crane. It is very important that the vessel supervisors and dispatchers make the right decision for safety here.

## Conclusion

I have not discussed in detail the parameters and system requirements here, since the system development is ongoing. I aim to apply the multi-quay cranes double cycling within my own company and will write about the system development and test performance, trial and error in a future article. My target is to achieve more than 50 percent frequency, enhance yard tractor efficiency by 20 percent and reduce the fuel cost by 10 percent.

As single quay crane double cycling emerges, it creates a sensation in terminal operations. The evolution into multi-quay cranes' double cycling will also have a big impact. In addition, double cycling on RMGC will be further studied in depth.

I am convinced that the realization of comprehensive double cycles on quay cranes, RMGC and yard tractors is the ideal of terminal operations in the near future, and that the container terminal that realizes this will be the winner in port industry.

### ABOUT THE AUTHOR

**Jang-Ho (Remy) Song** is Operation and Planning Team Manager at Pusan Newport Co., Ltd. He has a Masters degree in Port Logistics from Korea Maritime University in Busan and has been working at container terminals in Busan for 15 years. Since 2006, he has been working at Pusan Newport Co., Ltd.

### ABOUT THE COMPANY

**Pusan Newport Co., Ltd** (PNC) is the largest terminal operator in Korea, with six berths. PNC provides efficiency, productivity and state-of-the-art facilities and systems. It works in partnership with a leading international port operator, DP World. Furthermore, PNC has secured 16-17 meter water depth to accommodate 10,000 TEU and bigger container vessels as large vessels are on stream. Annual throughput records over 3 million TEU.

### ENQUIRIES

Pusan Newport Co., Ltd. (DP World)
Pusan
South Korea
Tel: +82 51-601-8111
Fax: +82 51-601-8130
Email: remysong@pncport.com
songch2002@yahoo.co.kr
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# Analysing electric yard cranes with simulation

**Kim Le**, Transportation Analyst, AECOM, Oakland, CA, US

## Introduction

Electric yard cranes, such as RTGs and RMGCs, are becoming increasingly common in terminals today. Although RTGs have traditionally been diesel powered, there is a major trend in the container handling industry to shift towards electronically powered RTGs. Electric RTGs can be powered from a cable reel, but the most common electrical solution is an above ground bus bar power system. RMGCs are electrically powered, usually via cable reels, similar to the kind used for dock cranes.

Compared to diesel machines, electric yard cranes reduce emissions and noise, as well as power consumption and maintenance costs, while sustaining operational performance. With no oil being involved for fuel, there are no spills or emissions to consider. Several major terminal operators, such as Modern Terminals Ltd in Hong Kong and APM Terminals, are retrofitting their current RTGs with electric power systems.

Many port authorities are becoming increasingly aware of, and concerned by, the looming increase in demand for electric power on marine terminals. A detailed analysis of peak electrical demand is difficult to quantify because machines are constantly shifting on a second by second basis and these electric machines are also able to regenerate power. With electric yard cranes, the energy that would have been lost through crane braking and decelerating can be captured and reused. Electric motors acquire and store energy generated by deceleration and lowering of containers; this later provides for acceleration and therefore reduces the overall energy needed.

Tracking this change in energy manually or with estimations and spreadsheets can be tedious and lead to broad and potentially inaccurate results. This is where having a simulation that is capable of tracking the energy expended and used by all machines would be useful.

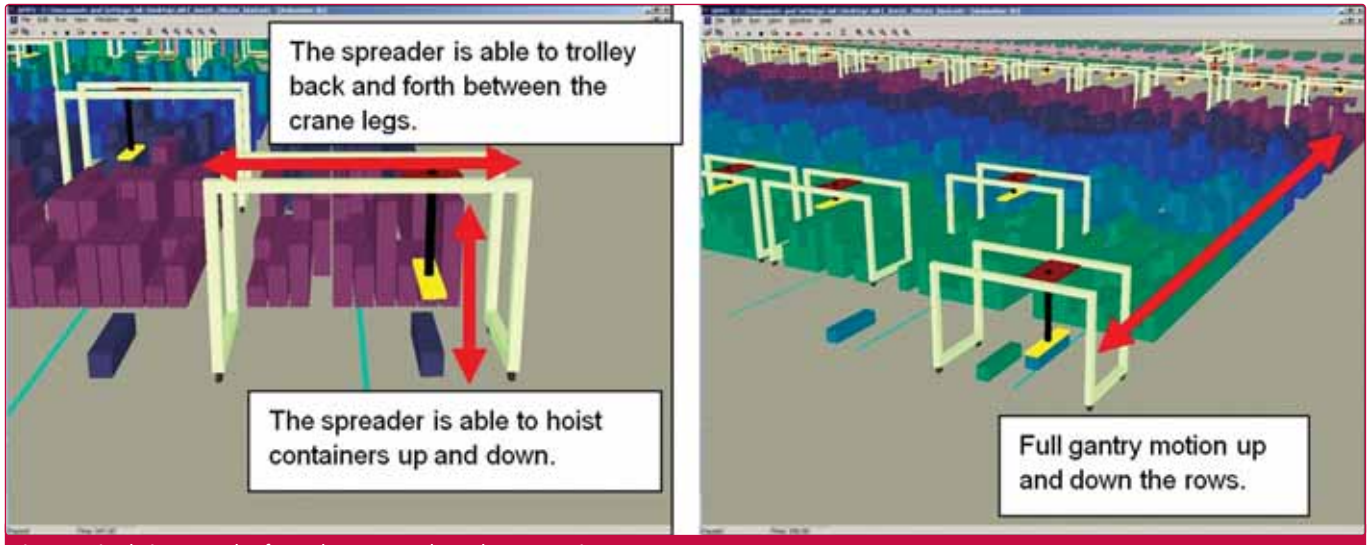
## Simulation models for electric power

A good simulation model can help quantify the power used. It does this by tracking and graphing electrical power use and generation of the machines. AECOM's simulation software, General Marine Terminal Simulation (GMTS), models container yard operations in detail. It is used to size terminal equipment fleets and to compare different terminal layouts. As an output, it produces extensive statistics summarizing the course and pattern of simulated container operations. This can be analyzed to determine details between layouts.

The tracked movements of a yard crane are described below. Figure 1 is a screen shot of the three-dimensional AECOM simulation model; showing the back and forth trolley motion and the up and down hoist motion of a spreader. Trolley motion refers to the back and forth movement of the spreader within the frame of the RMGCs and takes a user-defined amount of energy. Hoist refers to the up and down motion of a spreader and uses energy hoisting up, but produces energy in the downward motion. Gantry is the whole machine moving up and down the rows and draws energy to accelerate.

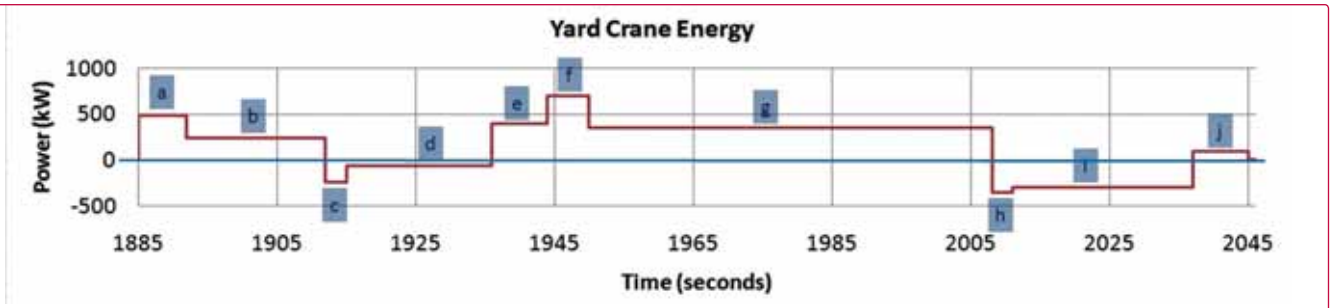
Figure 2 shows a sample energy output chart from a container yard crane generated from a simulation run. In the sample snapshot of time, the yard cranes are moving along the rails and hoisting containers up and down with the spreader. The machine consumes power while moving along the rail or while hoisting up the spreader with a container and generates power to be used when decelerating and lowering a container.

Traditional methods of calculating the overall electrical demand may result in radical overestimation of the true demand. For example, if a single machine can draw a maximum of 700 kilowatts. A straight multiplication of this by 36 machines yields a theoretical maximum of 25,200 kilowatts for the entire fleet of machines. Even after applying some correction factor to account




Source: AECOM

Figure 1. Simulation example of a yard crane spreader and gantry motion.




| | | |
|---|---|---|
| a | Acceleration to maximum gantry without container | Consuming about 500 kW |
| b | Gantry without container | Consuming about 250 kW |
| c | Deceleration without container | Generating about 200 kW |
| d | Lower spreader down without container | Generating about 50 kW |
| e | Hoist spreader up with container | Consuming about 400 kW |
| f | Acceleration to maximum gantry with container | Consuming about 700 kW |
| g | Gantry with container | Consuming about 300 kW |
| h | Deceleration with container | Generating about 350 kW |
| i | Lower spreader down with container | Generating about 300 kW |
| j | Hoist spreader up without container | Consuming about 100 kW |

Source: AECOM

Figure 2. Sample yard crane energy output chart with annotation.

for the non-simultaneity of peak demand, of say 50 percent, this still yields a peak power demand of 12,600 kilowatts.

Compare this to the simulation output that computes the second by second power demand for the overall fleet of machines shown in Table 1. Taking the 99th percentile, the total power draw is about 3,240 kilowatts – a much smaller number than is likely to be computed by traditional methods.

Figure 3, below, is an overall peak shift run for a sample simulation model of 36 yard cranes. The x-axis is the kilowatts usage and the y-axis shows the frequency. On average, the amount of power used is about 1,000 kilowatts.

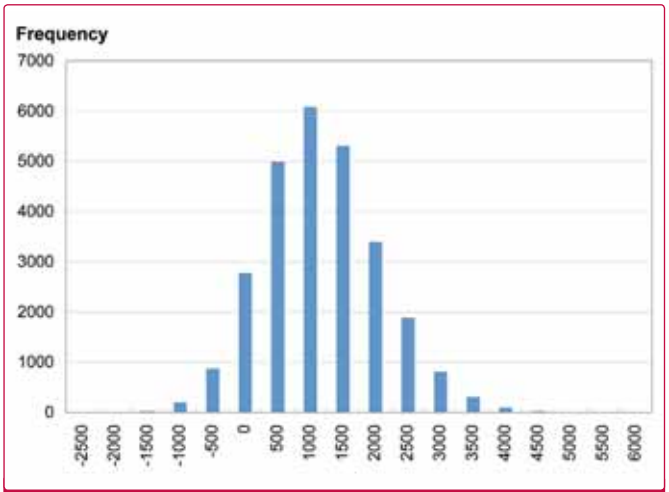
## Conclusion

Traditional electrical analysis methods are likely to be too conservative and may waste money with overdesigned facilities.

TABLE 1: PERCENTILE OF POWER USAGE

| Percentile (%) | Total kW |
|---|---|
| 100 | 5,808 |
| 99.9 | 4,187 |
| 99.5 | 3,553 |
| 99 | 3,239 |
| 95 | 2,474 |
| 90 | 2,102 |
| 80 | 1,643 |
| 50 | 874 |

The capabilities of simulation would be useful to terminal designers who are investigating the proper sizing for electrical power supply to marine terminals. If cranes are equipped with electrical regenerating capability, the mean overall use can be surprisingly low, and designs with conventional safety factors may lead to dramatically oversized facilities. One of the benefits is the ability to conduct sensitivity analysis with different yard equipment manufacturer specifications to figure out ones that are the best fit in order to gauge what capacity the terminal is able to handle. A simulation-based design can potentially save a lot of money by optimizing the size of electrical infrastructure.




Source: AECOM

Figure 3. Overall peak shift run for a simulation model.


### ABOUT THE AUTHOR

**Kim Le** has experience in developing simulation modeling software. She has experience with discrete event simulation projects for the marine and oil sectors. At AECOM, she works on developing and maintaining the proprietary simulation modeling tools for marine and intermodal container terminal projects to assist in the planning and analysis of marine terminal layouts and operations.


### ABOUT THE COMPANY

**AECOM** is a global provider of professional technical and management support services to a broad range of markets, including transportation, facilities, environmental, energy, water and government. AECOM provides a blend of global reach, local knowledge, innovation and technical excellence in delivering solutions that create, enhance and sustain the world's built, natural and social environments.


### ENQUIRIES

AECOM
2101 Webster Street, Suite 1900
Oakland, CA 94612
US
Tel: +1 (510) 844 0564
Email: kim.le@aecom.com
Web: www.aecom.com

# Modern energy and data transmission systems for terminal cranes

**Conductix-Wampfler Group**

## Introduction

The international crane business had to critically review its long-standing development strategies in light of the 2009 worldwide recession. This particularly impacted worldwide transport of cargo by containers. Based on an important extension of globally operated sea terminals, national networked domestic ports and goods distribution hubs, the focus is currently on the modernization of technology already in operation. There is also an increasingly strong orientation towards consolidating total terminal costs, and for reducing environmental pollution as a result of container terminal operations.

On account of these new challenges, the crane operators and crane manufacturers have intensified the installation of optimized and custom-made technical solutions. This also means a special challenge for the supplying industry. On one hand, optimization processes must be found for the modernization of the existing technologies. However, on the other hand, a critical review of the technical solutions that have been the standard so far is required. The objective is minimizing the capital expenses and operational costs in order that they are adjusted to the new international environmental standards. Due to the particular impact of energy and data transmission systems on the functional reliability and cost efficiency of container cranes, their modernization and optimization will be important for safeguarding the future of container terminals operating advanced technology.


Figure 1. Cable guidance pendulum on high-speed motorized cable reels for RMG-Yard-CC.

## Solutions for flexible energy and data transmission

The Conductix-Wampfler group accompanies this process of technical and organizational modernization in the terminals through early and determined development of new techniques and technologies in the field of energy and data transmission systems for container cranes. Depending on the position of the interface to the crane and on the crane itself, there could be new concepts for modernization of existing crane techniques and manufacture of new container cranes.

Especially in the field of crane feeding for STS container cranes and for RMG, advanced and novel Conductix-Wampfler solutions of the electronic controls for motorized cable reels

Figure 2. Combination of electromotive and mechanical additional drives for heavy duty cable trolley system on STS-CC.

Figure 3. Conductor rail type 0813 with inductive data transmission IDAT 2.

provide a technically sophisticated application of the reel technique. With the application of mobile (oscillating) cable guides (see Figure 1), the tensile forces will be determined by their position and always be held contemporarily by the custom-made drive control (Sinamics/AC800M) in the area of the permissible cable tensile force. So it will be possible, even with the feeding point in the center, to pass it smoothly at high speed without any reduction.

At the interface of the STS container crane, between crane control and main trolley supply, advanced components for the heavy duty cable festoon systems can be applied. The increased use of modern STS container cranes, with rope-driven technology for travel, and hoist movement of the main trolley, has produced a rigorous reduction of transfer demands on energy and control signals between crane and main trolley.

There are currently high speed festoon systems available for speeds up to 250 meters per minute, with standardized drive versions. Depending on the operation conditions and length of travel, the distance of the main trolley is up to 180 meters. The inclusion of a second mechanical drive section, by means of the catenary towing trolley, or alternative, and the installation of partially arranged additional electromotive drives, will significantly harmonize the dynamic course of motion in the cable loops. These additional drives (see Figure 2), together with advanced frequency inverter drive control by Conductix-Wampfler, will produce a very gentle and low-wear operation and movement of the high cost cable packages. With these special motorized cable trolley systems, average operating lifetimes of more than 12 years can be achieved, even during extreme crane operation.

In order to be able compensate the differing qualities in the accuracy of the assembly on the cable trolley track, special chassis with asymmetric arrangement of the rollers can be installed, if required. This technique has proved particularly valuable on highly loaded, high speed cranes, with a technically insufficient layout of track. Generously dimensioned rollers, in combination with the inherent travel characteristics, will make the required drive forces for the festoon system much more favorable than on a comparable installation on energy guiding chains.

The most favorable option for a rope driven container crane is the installation of modern conductor rail systems. This technically mature system solution allows for the complete economy of the station area for the heavy duty cable trolleys and of the track extension for the energy guiding chains in the final positions. This can lead to a radical reduction in the size and number of maintenance platforms in crane construction. The minimization of the components in number and weight allows shifting of the load center on the seaward side, leading to an increased lifting capacity and improved structural statics of the crane. The focus on worldwide development works is a continuous improvement of the operational performance of the current collectors, but also the further development of a powerful data transmission technique.

The new System IDAT 2 developed by Conductix-Wampfler, differs from alternative solutions due to a complete abandonment of autonomous, flexible guiding elements and a sufficiently

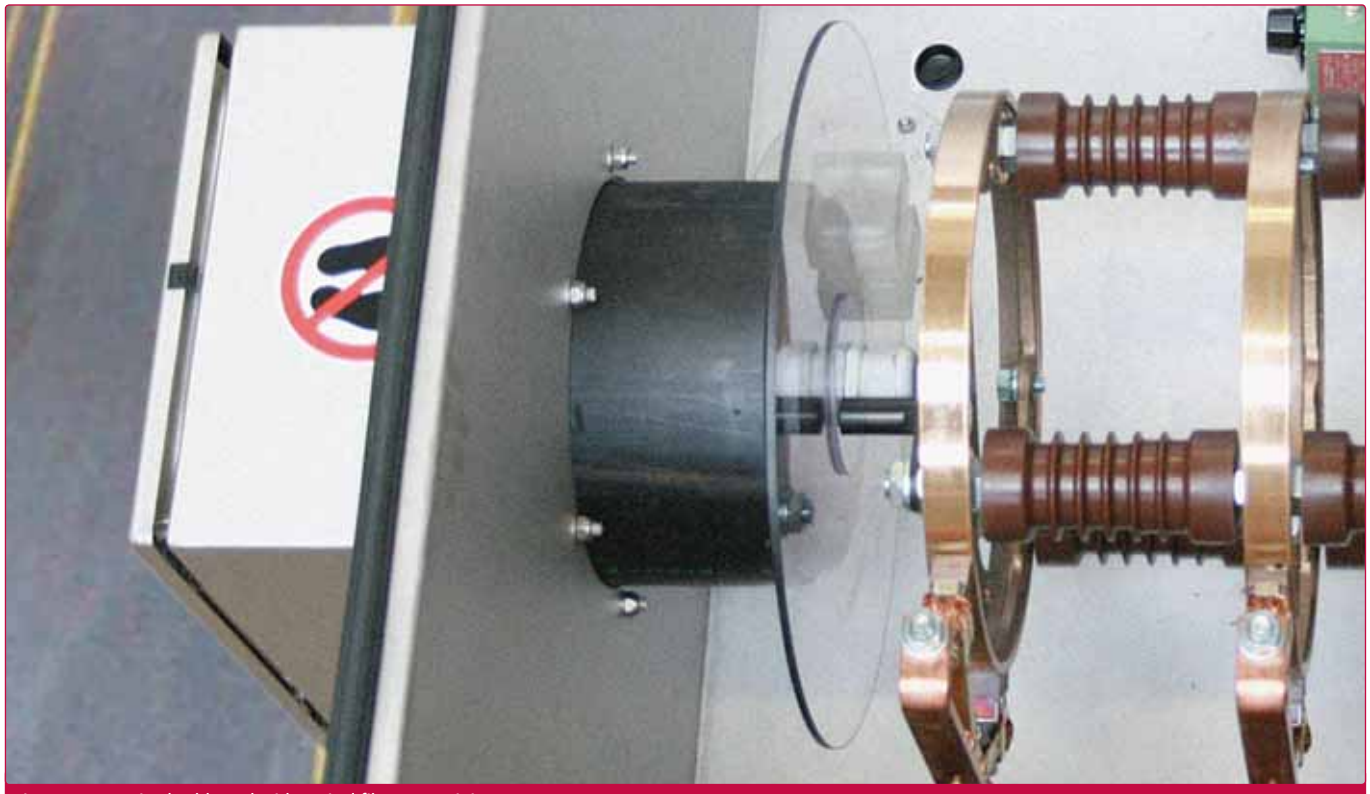


Figure 4. Motorized cable reel with optical fiber rotary joint.

dimensioned data transmission performance that meets market requirements. The IDAT-2 system, based on purely inductive communication, allows a steady exchange of data and signals, regardless of the speed, up to a data rate of 100 megabytes per second, via Profinet-/Ethernet couplings, even with intensive crane operation and erratic climatic conditions. A particularly favorable aspect of this development is the fact that a completely wear-free data transmission system exists, which is resistant to changes in weather. Mutual interactions and electromagnetic feedback, as they might occur on the market in radio data transmission systems, have been completely eliminated. This will allow an important contribution to better security, as well as improved reliability for the fast and steady data communication between crane and main trolley control at an extremely high level.

The installation of high speed rotating, frequency-controlled motorized cable reels has been created for the interface of the spreader. With the help of the ultra-modern stand-alone electronic drive control, modified by Conductix-Wampfler it has been possible, in spite of an increased hoist/lowering speed of a maximum of 240 meters per minute, to considerably increase the lifetime of the special spreader cables supplied by Conductix-Wampfler. Additional damping and relief components at the motorized cable reel and at the spreader secure an over average lifetime of the special cable. The further development of the two company internal optical rotary joints for a maximum lifting height of up to 70 meters allows the trouble-free transmission of redundant electrical signals, as well as audio and video signals (see Figure 4) for an automatic operation.

A heavy cost explosion and the systematic extension of environmental protection, especially in connection with the worldwide depression, had an influence on the development of the market and have lead to a determined optimization of the drive solution used for the RTG cranes in operation. With this technical conversion of the crane-internal diesel-driven energy production to an electrical long distance central supply, a combination of cost savings and environmental compatibility has been achieved.

There are considerable savings on costs (of 70 to 80 percent) and a significant reduction of noise, dirt and exhaust emissions (of up to 60 percent) which can be achieved with these E-RTG.

The system solutions for energy supply and data transmission developed by Conductix-Wampfler, are not only the basis for a stepwise conversion of the worldwide 8,000 strong RTG fleet, but increasingly also provide technical solutions, even for new crane investments. As alternative solutions, they have been established on the market as electrical power supply for the RTG container cranes by means of motorized cable reels or conductor rails. 850 RTG container cranes have currently been converted, and are currently the preferred products to be used, due to their better automation and higher flexibility conductor rail systems, or horizontally shifted conductor rail installations and current collector trolleys.

Automatic coupling and decoupling at the drive-in systems installed by Conductix-Wampfler significantly increases the flexibility and efficiency of the RTG container cranes in the respective storage area (see Figure 5). A combination of inductive

Figure 5. E-RTG with drive-in system as 2 + 2 version.

Figure 6. Racer energy guiding chain with support trolley on Intermodal-CC.

data transmission type IDAT 2 secures the real-time loss-free data exchange with the central processor by means of the installed motorized cable reel technique. A complex system solution is achieved by the simultaneous installation in the respective storage section of an automated drive control for the RTG drive units, joined to the conductor rail geometry.

To permanently secure the strong handling capacity of the RMG, there are today high-speed motorized cable reels available at the interface to the crane supply. The modern drive systems, equipped with magnetic couplings or electronic controls, allow adjustment to the respective crane operating conditions at optimal costs. The newly launched trailing cables, with integrated measuring line for the control of the tensile force, in combination with customized electronic drive controls, will provide additional security for the motorized cable reels.

For the fast and highly frequented crane and main trolley movements typical on RTG, the predominantly used products for a travel distance of up to 100 meters for main trolley tracks at the interface between crane and main trolley are today energy guiding chains as energy and data transmission systems. However, in order to secure a trouble-free automatic operation in the long-run, increased maintenance efforts and special preventive measures are crucial.

At Conductix-Wampfler, studies were undertaken and after much analysis, it was found that to minimize the 'wear and tear' on the installed energy guiding chains and flexible cables, that plastic chaines with single links have proven to be successful. (see Figure 6). With the system inherent accompanying support trolley, this results in a significant relief on the chain lines and the electrical cables or hoses installed within. Optimized wear behavior, as well as a longer operational life and an increased functional security, will help reach reduced drive forces with these special energy guiding chain solutions.

Conductix-Wampfler has been directly involved with the container terminal industry in developing and deploying energy and data transmission systems. Often these systems are customized as well as being standardized complex systems. A major factor in deploying such technologies is that project planning, delivery, installation and maintenance for all interfaces must be considered with experts.

Working in collaboration with crane manufacturers, such as Kalmar, Künz and ZPMC, Conductix-Wampfler is developing a new generation of sophisticated energy and data transmission systems. Furthermore, it is important that the demands from the customers, such as global container terminals operators like APMT, DPW, HPH and PSA are identified to be latter incorporated as system requirements for development. Overall, the importance of maintaining contacts to the industry is vital to ensure a properly designed and engineered system.

## Outlook

In combination with the already available existing data transmission system IDat 2, there will be a completely wearless and cost effective energy and data transmission system available for the crane main trolley interface.

Another trend is becoming apparent for a self-sustaining energy supply of a spreader. If it can be made to decouple the drives and electronic components on the spreader from the energetic supply of the electric energy supply by means of a decentralized energy generation, a minimized motorized cable reel with spiral fiber optics with all associated effects for economies and technical advantages might be possible.

Conductix-Wampfler's inductive energy transmission systems allow continuous energy supply during movement in the terminal area, but also the stationary charging of batteries for the electric drives at and on the vehicle. In order to enable the increased demands on energy performance for transport vehicles, Conductix-Wampfler is currently working on various system solutions and technologies in cooperation with interested parts of the electronics industry.

This underlines the intensive and worldwide cooperation with container crane manufacturers, crane operators and crane service companies that firms such as Conductix-Wampfler are committed to.

### ABOUT THE COMPANY

**Conductix-Wampfler** is the world leader in the design and manufacture of efficient energy and data transmission systems for all types of mobile machinery. Dedicated electrification solutions help to keep customers' operations up and running 24/7 – 365 days per year. Conductix-Wampfler offers all available technologies and products to meet flexible and mobile energy and data transmission requirements, all from one source. Customers benefit from unbiased consulting, engineering, and offering of the most suitable products.

### ENQUIRIES

Conductix-Wampfler Group
Web: www.conductix.com

# An operations perspective on new twistlock handling in terminals

**Dr. Yvo Saanen**, Managing Director and Founder, TBA, The Netherlands & **Peter Walker**, Founder, StaffaIPI, US

## Introduction

What would be the impact on the container terminal industry, if containers were equipped with integrated twistlocks? A cost efficiency analysis demonstrates the significant cost savings to the industry and highlights safety, productivity and sustainability benefits.

For a long time, the handling of twistlocks (or cones) and semi-automated twistlocks (SATL's) has been a heavy burden for the container industry. The burden consists of the operational cost to place and remove these cones in every step of the container supply chain (on the vessel, on road trucks and on trains). Moreover, the handling (coning and deconing) typically takes place in areas where dense traffic takes place, such as the apron of a container terminal, or where inherently unsafe situations take place, such as the hold of the vessel, or close to moving containers. It is therefore often a source of injuries or casualties.

The introduction of the SATL has already removed the locking and unlocking of the cones on the vessels, but still requires the manual placement and removal of the cones, and as such only addresses some of the costs, and does not address the safety issues.

## Automated twistlock handling stations

There have been many efforts in developing automated twistlock handling stations (see *Port Technology International* editions 50-58), which could carry out this placement and removal of the twistlocks. Although various tests have been carried out, it has not led to a large-scale application. Here, various reasons can be identified, both technical and economical. To mention a few:

- Not all types of twistlocks can be handled
- When the twistlock station gets jammed, it is blocking a large area under the QC
- Ideally, the station is placed on a sill beam rather than on the ground. However, this adds a significant weight to the QC, which may have impact on the crane rail, and possibly reduces crane lifting capability
- The stations still have to be supplied with sufficient twistlocks
- The stations needs to be replaced every time the QC moves, even when it moves only half a meter the station is not positioned correctly
- The stations are not easily applicable to on-dock and inland rail environments
- The stations require skilled labor for maintenance
- The stations will reduce productivity in bombcart environments
- The investment required for a single station is quite high (more than $1 million), leading to a quite long return on investment

## Universal Container Locking System: how it works

Another development, and the focal point of this paper, is the Universal Container Locking System (UCLS), a system that is fitted into the corner castings of a container, and fulfills the container locking and unlocking without the need to place or remove it every time a container gets handled.

The UCLS was devised on the premise that the container shipping industry needs a single, safe, easily adaptable and truly automated system for securing containers during transport across the entire container supply chain. It is designed to improve safety, productivity, environmental sustainability and profitability for shipping companies, railroads and terminal operators.

The UCLS is in the final stages of development and early stages of field testing with RMG cranes, straddle carriers, top picks and side picks are promising. The safety and economic opportunities are compelling and worthy of serious consideration by the maritime community (shipping lines and terminal operators), railroads and trucking community.

The first image in Figure 2 shows a UCLS locking unit mounted in the lower corner fitting of a standard ISO container. A UCLS actuating unit is housed in the upper corner fittings of containers as shown in the second image of Figure 1. Simple, rugged linkage connects the actuating and locking units. The linkage is protected by existing container structure and does not reduce the cargo carrying capacity of the container. When the


Photos: Peter Walker

Figure 1. Automated twistlock handling station (RAM, left; KALP, right).

Photos: Peter Walker

Figure 2. UCLS. A brief description of the UCLS is provided where with numerous animations, videos answers to frequently asked questions and additional details provided at www.staffaipi.com.

twistlock of a hoisting spreader locks to the container to hoist it, the twistlock engages the UCLS actuating unit which in turn causes the UCLS locking unit to rotate to the unlocked position. The container can then be hoisted clear from its base as shown in the third image of Figure 2. When the spreader twistlock unlocks from the container, the UCLS locking unit, returns to its natural, fully locked position. When a conventional twistlock (SATL or fully automatic twistlock) engages the upper corner fitting of a UCLS equipped container, the UCLS locking unit remains in its fully locked position allowing conventional containers to be stacked on UCLS containers onboard ships and in container yards exactly as they would on any other container. Other common container securing equipment such as lashing rods or bridge fittings etc. do not interfere with UCLS components.

## Safety and savings

The UCLS solution will improve safety in maritime and rail container handling operations. Additionally, the trucking community will realize safer working conditions at marine and rail container terminals.

- No men aloft on ships to unlock twistlocks
- No falling twistlocks
- No maritime twistlock handlers in congested areas under gantry cranes
- No rail twistlock handlers exposed in rail yards or climbing up and down double stack cars
- No truck drivers leaving the safety of their trucks to lock/unlock chassis twistlocks

**Savings attributable to the UCLS solutions are:**

- Safety – reduced costs of twistlock and twistlock handling injuries
- Reduced manning
- Increased productivity – crane lifts per hour
- Loose gear replenishment
- Improved operational expense per container

TABLE 1: LABOR COSTS VERSUS DIRECT SAVINGS IN OPEX PER CONTAINER (US$)

| Manhour cost | Saving/container | OPEX/container | Saving (%) |
|---|---|---|---|
| 5 | 0.44 | 38.00 | 1.2 |
| 10 | 0.88 | 42.50 | 2.1 |
| 15 | 1.31 | 47.10 | 2.8 |
| 20 | 1.75 | 51.60 | 3.4 |
| 25 | 2.19 | 56.10 | 3.9 |
| 30 | 2.63 | 60.60 | 4.3 |
| 40 | 3.50 | 69.70 | 5.0 |
| 50 | 4.38 | 78.70 | 5.6 |
| 75 | 6.57 | 101.30 | 6.5 |
| 100 | 8.76 | 124.00 | 7.1 |

Fitting 18 million containers for a global implementation requires a large, one time, upfront investment. So what are those savings, and how quickly can they be earned back?

The saving associated with reduced manning consists of the complete elimination of the twistlock handling on shore, as well as some of the twistlock handling at the ship. Lift drivers for shifting cone bins in some environments are not considered here. For a terminal of 1 million TEU, six QCs, there is a saving of approximately 50-55,000 man hours annually. In Table 1, we have listed the typical direct savings per container for a terminal of that size. Obviously, the higher the labor cost, the higher the possible savings.

The payback period for the terminal's share in the overall investment ranges from 1.5 years in a high cost environment ($100 per man hour) to 7.7 years in a low cost environment ($20 per man hour); which are both fully acceptable for the entire industry. The estimated average global labor rate of $50 per man hour suggests an average industry payback in the range of three years.

In addition to the direct savings, we could expect that at a straddle carrier terminal, the QC productivity increases approximately 10 percent because UCLS containers convert indirect lifts (those lifts that must stop mid-hoist for twistlock handling purposes) into direct lifts (those lifts that go directly from the quay to the ship and vice versa). These savings will also be realized at terminals that load or discharge directly to street chassis. For terminals that only utilize bomb carts, the QC productivity would not increase substantially, as the impact on tractor-trailer cycle time is less than 1 percent. UCLS related savings attributable to increased productivity (direct lifts) is estimated at $1.25 per global lift.

Safety related savings and loose gear replenishment costs are not considered here, however the upside potential should be recognized.

## How to implement globally

Worldwide, there are approximately 18 million containers. How can our industry implement the UCLS, as it offers such profound impact in terms of handling costs, and operational safety?

Photos: Peter Walker

Figure 3. Types of Terminal Deck Sockets (TDS) for storing UCLS equipped containers (Type 1 – Type 3 from left to right).

Photos: Peter Walker

Figure 4. Using the TOS to stack UCLS in second tier or higher or designated areas, where the grounded slots have been equipped with TDS during early phases of a UCLS implementation.

Here we elaborate on one of the possibilities, departing from the idea that the key stakeholders are the terminal operators. The number of injuries and lost time injury frequency will drop significantly, as one of the most dangerous jobs is eliminated from the process. As with all automation efforts, the reduction of jobs will, in a highly unionized environment, be a challenge. However, given the potential improvement in safety of members, unions should embrace the UCLS solution.

So, how can the joint terminal operators get this system implemented, overcoming the chicken and the egg problem? Let's first look at upgrading the existing fleet of containers. Existing containers can be upgraded with UCLS components in approximately one hour in a workshop. New build containers can be manufactured today with UCLS linkage access holes in anticipation of a UCLS rollout which reduces container upgrade time by more than 50 percent. Following UCLS implementation, it is expected that installation of UCLS components will be fully incorporated into the new build process. A container visits a marine container handling facility approximately 18 times per year. Obvious locations are low cost ports where many containers are transshipped, such as Shanghai, Hong Kong, Singapore or Los Angeles/Long Beach. Shanghai sees approximately 13 million containers passing through, Singapore 8 million and Los Angeles/Long Beach approximately 7 million.

Besides introducing these dedicated locations, large repair shops could be supplied with the UCLS, so that every container passing there will also be equipped. Of course, there will be containers that only move within a limited region, as they are owned by lines that are not global operators. For these containers, a more detailed strategy has to be developed.

Although UCLS equipped containers can be landed directly on the terminal surface (UCLS components and corner fittings have been compression tested and withstand the compressive force of eight fully loaded containers), it is anticipated that terminal operators will make use of Terminal Deck Sockets (TDS) to eliminate damage to the terminal surface (see Figure 3 for TDS images).

Type 1 TDS are flexible in that they can be put into position and picked up quickly. It is anticipated that Type 1 TDS will be used in early stages of a UCLS rollout or in areas of terminals that store container on a temporary basis. Type 2 TDS are easily put into position and picked up with lifts or other container handling equipment and have a means of semi-permanently securing them to the underlying terminal surface.

Type 3 TDS are more substantial, with additional anchoring qualities and support under the terminal surface. Type 3 TDS may allow high density terminals to expand vertically, if necessary, with more safety. Long-term, this would be the way forward when UCLS gets implemented. The higher the stacking, the lesser TDS will be required for a certain volume.

Equipping the yard with TDS will be a large, one time exercise. However, as the following example indicates, investment in TDS is in the best interest of the terminal operator. Given the variety of TDS and the even greater variation of terminal

operations and configurations it is challenging, within the scope of this article, to quantify the cost and reward of TDS on a global scale. However an analysis at the terminal level can shed some light. Analysis of a straddle carrier terminal showed that the terminal recently handled approximately 1.3 million vessel lifts annually. The terminal has approximately 13,800 decked 20 foot container slots. Given the estimated UCLS related savings at this terminal, the operator could expect savings per 20 foot slot in the range of $3,000 annually (assuming the terminal operator retains all UCLS savings). TDS are expected to last 20 years or more. Given that RTG/ASC environments generally have fewer grounded slots, the savings per slot in those environment is expected to be slightly greater.

Of course, as the percentage of containers with will grow steadily, the installment of TDS can also be gradual, across one or two years. For example, in early stages of a UCLS implementation, today's TOS can be used to code and plan UCLS containers on the second tier or higher. In a one over three straddle carrier environment, the use of TDS could be postponed until the transition to UCLS containers is approximately 50 percent complete. In RTG/ASC environments, TDS can be added to terminal bays over time as UCLS containers become more and more common as demonstrated in Figure 4. The TDS are able to be used for containers without UCLS, so storage capacity should not be affected.

A secondary advantage of TDS is that they can reduce damage to terminal surfaces and the associated costs of occasional resurfacing projects caused by conventional containers (see Figure 5). Applying TDS reduces pavement maintenance significantly, also improving the availability of yard space over time.

Furthermore, upgrades for some hinterland transportation equipment (train wagons and truck chassis) will be necessary. Equipment that has fixed male chassis pins require upgrades to female ISO sockets. All upgraded equipment can handle conventional and UCLS containers during a transition period to the UCLS solution. Additionally, the rail community will realize UCLS related savings similar to the maritime community and the trucking community can likely realize indirect benefits beyond the scope of this article. All in all, it is a large investment in infrastructure, but not significant compared to the cost of fitting 18 million containers with UCLS (approximately $5 billion).

Furthermore, logistically, we consider it achievable, in a manageably short period, if industry leaders (terminal operators and shipping lines) initiate acceptance of,and guide implantation of the UCLS solution.

## Business models for implementation

Another challenge to consider is how to equitably share investment and reward of UCLS related savings. The general view of terminal operators is the UCLS solution helps operators achieve safety, productivity and economic goals. However, since the equipment (containers) belong to the shipping companies, they can do nothing until shipping companies drive implementation of the UCLS.

Figure 5. Impact of container grounding on pavement.

The general view of shipping companies is the UCLS solution will help lines achieve safety, productivity and economic goals. However, lines are generally of the opinion that terminal operators will retain all of the economic benefits. Therefore, what is needed is open, constructive dialogue between leading shipping companies and leading terminal operators potentially via conference and industry work groups.

Several high level models may be considered to spark discussion:

1. Shipping lines drive implementation and demand reduced terminal handling charges (the generally perceived traditional approach)
2. Terminal operators offer shipping lines reduced terminal handling charges for UCLS equipped containers, for example:
   a. Load/discharge standard ISO containers - $200
   b. Load/discharge non-standard ISO container - $200 plus
   c. Load/discharge UCLS equipped container - $180*
   *Rates to be negotiated by shipping line and terminal operator.
3. Terminal operators jointly invest in a mutual association to fund UCLS investment in container upgrades (on behalf of, and in coordination with, shipping lines) and retain 100 percent of the ensuing savings.
4. Terminal operators and shipping lines jointly invest in a mutual association dedicated to UCLS implementation. A per lift license fee is collected to fund investment and redistributed to investors.

In order to have a few pivotal terminals mount all the UCLS devices, they need to be paid by all the terminals worldwide to share the benefits. For this, we deem that an intermediary organization of united terminal operators (they would be the joint venture partners) raise the money needed. Every terminal would pay its share based on the waterside moves it performs. The terminals executing the retrofitting process get paid from the jointly collected funds. Each terminal would need to raise approximately $10 per container handled over the quay. In addition, they would need to equip the yard with the required TDS in some form. However, these costs are small compared to the contribution to the container retrofit.

## Conclusion

The safety benefits of the UCLS solution are clear. Economic analysis suggests a managed, timely global UCLS implementation is achievable and an attractive investment for the container shipping community as a whole. To achieve the safety and economic benefits of the UCLS requires buy in and guidance from industry leading shipping companies and terminal operators. UCLS work groups at upcoming conferences and industry organization events should be created to spark discussion about funding approaches and implementation strategies for the mutual benefit of all industry stakeholders.

ABOUT THE AUTHORS

**Peter Walker** is the inventor of fully integrated automated twistlock solutions for shipping containers including the Universal Container Locking System (UCLS). He has 15 years experience in marine terminal environments including terminal operations, IT software implementation in global terminals, and working with a twistlock manufacturer. Peter founded StaffaIPI L.L.C. to implement the UCLS.

**Dr. Yvo A. Saanen** is Managing Director and Founder (1996) of TBA, a leading terminal design and simulation company in The Netherlands. He is in charge of the design process of container terminals by means of simulation for ports and terminal related projects, globally. During the last 13 years, he has carried out over 150 large terminal design projects.

ENQUIRIES

Peter Walker, Founder, StaffaIPI L.L.C.
Mobile: +1 (510) 289 9300
Email: peter.walker@staffaipi.com

# LED lighting delivers cost savings to terminal operators

**Ryan Hertel**, Director of Business Development, Phoenix Products Company Inc., Milwaukee, Wisconsin, US

## Introduction

Ports and terminals compete fiercely for container traffic. Those with the most efficient operations stand to win the most business and generate the highest profits. Driving down costs is crucial to remaining competitive. Upgrading to the latest light emitting diode (LED) lighting technology contributes to terminal cost control.

Light fixtures installed on port container cranes endure constant vibration, moisture and corrosion – elements always present in marine environments. These extreme conditions result in premature lighting fixture failure, demanding constant maintenance and increasing material and labor costs. Installing properly designed LED fixtures on port container cranes can immediately reduce energy usage, reduce crane maintenance costs and increase operator safety.

## LED technology evolving to industrial applications

LED technology has existed in basic form since 1962. It has long been used in outdoor promotional lighting, and more recently in television screens and street lights. While most of these are stationary applications, solid-state LED technology is ideal for installation on industrial equipment subjected to high vibration environments.

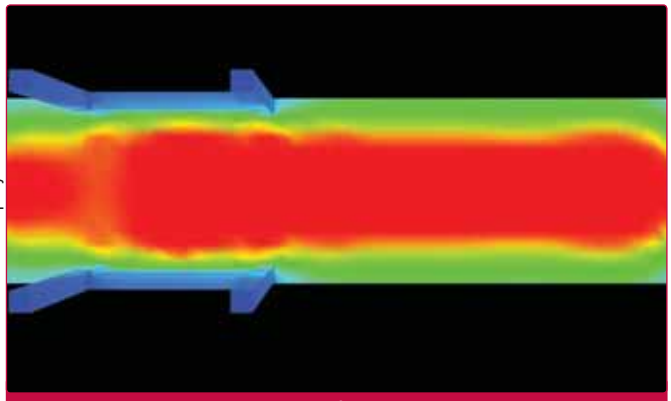
Heavy industrial equipment and above ground mining equipment now often operate with LED lighting. Properly designed and manufactured LED fixtures for installation on port container cranes will last, maintenance free, for 50,000 hours, all the while reducing crane electricity draw and maintenance expenses.

In the last two years, high brightness LED chips have increased the potential light output from a single fixture. This enhancement quickly broadened LED applications beyond televisions and flashlights. LED technology can now illuminate an area as large as a football field as well as container cranes and terminal yards – all at a fraction of the previous power consumption.

While traditional HID, incandescent and fluorescent fixtures spill light in every direction before reflecting it towards a target, LEDs emit light in a single forward direction. Properly designed LED modules can produce high lumen output at lower wattage. They are also 'instant-on' and illuminate immediately upon powering. As terminals begin to electrify RTG cranes, LED technology offers a considerable performance advantage over traditional high pressure sodium (HPS) or metal halide (MH) fixtures that require 15 minutes plus of warm-up time.



Mounted hundreds of feet above the working surface, this 300 watt Phoenix ModCom™HI LED floodlight delivers energy savings and dramatic reductions in maintenance costs to the equipment operator.





Lighting layout. Ship-to-shore crane outfitted with Phoenix ModCom™HI LED floodlights. Pseudo-colors represent specific light levels achieved and light level consistency.

Varying optics can be used to control emitted light, offering a range of light spreads towards a target. LED floodlights mounted on an STS trolley use a narrow distribution to focus light on the container below. RTG cranes can use a mix of optics to simultaneously illuminate the stack below, yet provide enough perimeter light to maintain safe working conditions at ground level.

A traditional RTG lighting package includes at least 14 fixtures at 400 watts each, totaling 5600 watts of power consumption. An equal or lesser quantity of 150 watt Phoenix ModComLO™ fixtures, with a combination of proprietary optics in the same fixture, can match light levels, reduce fixture quantities, and reduce power consumption to 2100 watts – a considerable saving. In addition, an automated stacking carrier outfitted with four units of 300 watt Phoenix ModComHI™ floodlights achieves ground light levels of 200 lux. Traditional lighting packages required upwards of ten fixtures to achieve a comparable light level.

## LED also reduces maintenance costs

The positive reputation of LED lighting stems from the benefits of energy reduction, ensuring cost savings for terminal operators, particularly in countries with high energy costs and an elevated electricity rate for peak hours. Outfitting an RTG with LED floodlights and area lights reduces yearly operating costs by as much as $5,000 per RTG. With a fleet of 50 RTGs or more, a port stands to save over a $250,000 per year through the use of LED light fixtures.

While LED lighting is touted for reducing power consumption, ports and terminal operators will realize the greatest savings from reductions in maintenance expenses. A properly designed and produced LED fixture should operate maintenance free for 50,000 hours. With average usage of 12 hours per day, an LED fixture should last over ten years. Compare this to the numerous lamps, ballasts, capacitors and resistors that would typically be changed over the course of this time to maintain traditional lighting.

LED chips alone can last for more than 100,000 hours under controlled conditions but there are perhaps overly optimistic projections about expected fixture lifespan. It is critical that ports, terminal operators and crane engineers determine if all fixture components share this published lifespan. A terminal will not benefit from incorporating LED crane lighting if the fixture manufacturer cannot establish with certainty that all components of the fixture – including the driver – are rated equally and backs that fixture with an extended warranty.

Most fixture manufacturers indicate an expected life of 50,000 hours. To realize the full 50,000 hour lifespan of LED fixtures and all associated cost savings, the fixtures must be designed properly for the high vibration, moisture and corrosion inherent in a marine environment. Small LED chips may be rated for 50,000 hours, but if other electrical components fail prematurely due to vibration or succumb to moisture intrusion, a crane owner will lose money on the investment. A potted driver encapsulated in a gasketed housing is recommended for best resistance to the elements. In addition, LED modules should be coated in optically clear silicon to provide a complete moisture seal.

## Module design prevents fixture failure, makes repair easier

An important consideration for crane maintenance personnel is the ease with which LED fixtures can be repaired. Many LED fixtures on the market today are not built for repair, so if a failure occurs, the user will be forced to purchase an entire new fixture. Designing and manufacturing modular LED fixtures allows for individual modular replacement. As an added benefit of modular design, failure of one LED module will not result in complete fixture failure, so replacement can be made during prescheduled preventive maintenance.

Terminal operators can take advantage of LED technology for crane retrofits as well as new crane purchases. Two years ago, the largest above ground mining equipment manufacturers in the world approached Phoenix Products Company to convert all equipment lighting to LED. Applications included exterior floodlighting, electrical and mechanical rooms, and emergency lighting. These fixtures have been in use on mining equipment for up to 18 months without failure.

Terminal operators and ports around the world can now begin to use this same technology to install LED fixtures for future implementation on port container cranes and equipment. A total cost of ownership evaluation of LED crane lighting incorporates a wide range of cost savings:

- **Energy**: less electricity consumed
- **Maintenance**: lower labor costs
- **Safety**: reduced need for maintenance work at extreme heights
- **Parts**: fewer purchases of spare components
- **Disposal**: less environmentally sensitive material to discard

After years of few or no advancements, lighting technology is in the midst of a major transition. LED technology offers multiple benefits to those ready to embrace and invest in the newest technology. Transitioning to LED lighting offers savings on multiple fronts for ports and terminals, boosting their competitive position.

### ABOUT THE AUTHOR

**Ryan Hertel** joined Phoenix Products Company in 2008 and serves as Director of Business Development for the port crane market. He graduated from the University of Wisconsin in 2006 with a degree in Mechanical Engineering. He is currently pursuing his Masters in Business Administration from the University of Chicago-Booth School of Business.

### 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 exacting specifications, improving equipment performance and reducing equipment maintenance costs in multiple markets. Founded in Wisconsin in 1892, the company maintains its headquarters in Milwaukee.

### ENQUIRIES

Ryan Hertel, Director of Business Development
Phoenix Products Company, Inc.
8711 W. Port Avenue
Milwaukee, WI 53223, US
Tel: +1 (414) 973 3349 (direct)
Email: rhertel@phoenixproducts.com
Web: www.phoenixproducts.com

# Technology and commercial aspects of container terminal management using Solvo.TOS

**Solvo**, Saint Petersburg, Russia

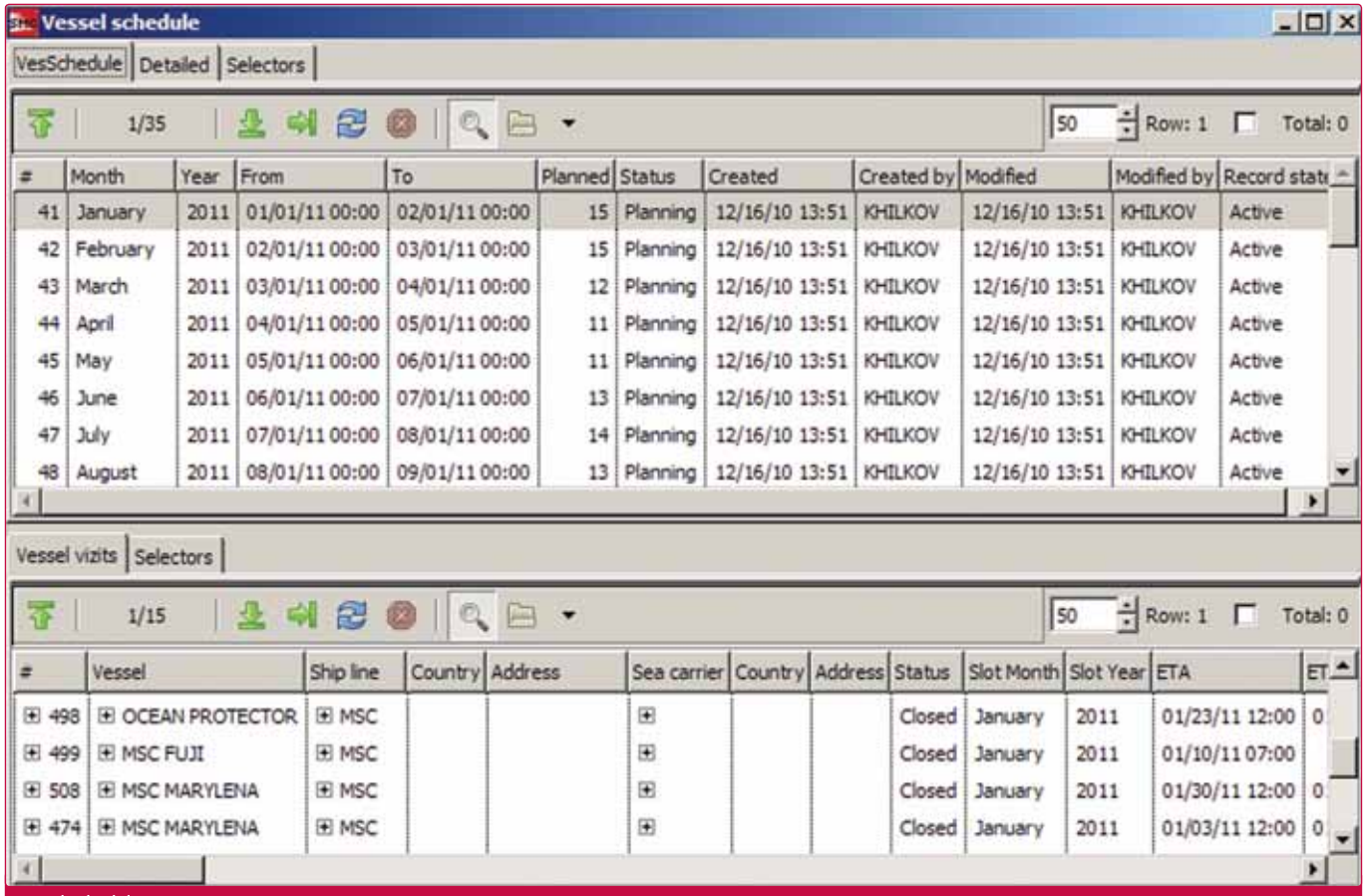
## System design and development

Solvo has operated on the logistics automation market since 1999. One of its first projects was to develop a real-time management system for container terminals. The solution was called Solvo.CTMS (standing for container terminal management system). This system has been specially designed to automate technology processes and handle container operations at terminals. Thus far, Solvo has successfully completed more than a dozen deployments for Solvo.CTMS at container terminals in Russia, Ukraine and Estonia.

In previous versions of Solvo.CTMS, different document management tasks, such as contract processing, job orders, EDIFACT messaging, intermodal shipment and government relations, were done using third-party host systems. To do these tasks, Solvo.CTMS had to be integrated with third-party host system XML-file exchange mechanisms. In mid-2000, Solvo.CTMS successfully developed as a software product and acquired a wider customer base. However, most of the users lacked their own reliable host system. So it was obvious that Solvo.CTMS needed a dedicated functionality to manage contracting party relations, along with other technological aspects.

To this end, Solvo started to develop the Solvo.DMS document management system in 2005. This system has been designed to be a tool for planning and report generation. The combination of Solvo.DMS and Solvo.CTMS is a comprehensive suite to handle all tasks related to terminal management. Further on, after three successive projects to introduce Solvo.CTMS and Solvo.DMS at different terminals, an integrated terminal management system called Solvo.TOS was created.

Unlike its Western competitors, the main distinguishing feature of Solvo.TOS is that it integrates all terminal operating functions, while Solvo.DMS is an additional system to perform document management functions. Consolidated information generated by both systems makes it possible to easily manage and streamline the operations of such an elaborate and large-scale business as a container terminal.



Vessel schedule.

To manage their operations, many terminals try to develop a proprietary system to handle the information flows running between contracting parties. Despite a seeming simplicity in using staff programmers to build up the needed software, this way of solving the problem frequently ends up being very costly, because the resulting system will inevitably require constant efforts and additional costs to maintain and update regularly.

In fact, business processes and documentation management techniques are generally standardized at container terminals, even though specific requirements may vary. The Solvo.TOS container terminal management system will meet the general needs of any terminal, while the terminal's specific needs can be easily addressed by customizing the system during the system deployment process.

As a result of this modularity, before choosing the Solvo.TOS management system, terminal owners can make an accurate and efficient assessment of not only the required amount of investments but also the time costs that are needed to automate their terminal.

## The Solvo.TOS featured capabilities for terminal management

The featured capabilities include commercial operations management and contracting party relations management.

### System architecture

Solvo.TOS has two management levels, each related to one of the following two sub-systems:

- Solvo.DMS, designed to manage an entire container terminal as an industry object and commercial enterprise;
- Solvo.CTMS, designed to manage technological container handling processes at the terminal.

The first level is responsible for external operations, mostly including relations with the terminal's contracting parties, such as line agents and forwarders. At this level, the management objects include containers and transport vehicles, such as sea vessels, railroad trains and cars. Of particular importance is the management of transshipment operations. Another important aspect of terminal operations is customs procedures.

The planning and managing tasks done by Solvo.DMS at the first level are mostly of a discrete character and are assigned to specified days, months or shifts, while the operative management is exercised continuously.

The second level relates to Solvo.CTMS and accounts for the technological processes at the terminal. The management process at this level is based on data, such as orders and plans received from Solvo.DMS. This is done continuously in real-time. Actual data about container movements within the terminal is then sent to Solvo.DMS.

Within the framework of Solvo.TOS, both aforementioned sub-systems run as a single mechanism. In other words, the interaction between them is absolutely transparent for the end user.

Container length.

### Basic parameters of Solvo.TOS

Solvo.TOS has been designed to handle major terminals, such as seaport container terminals, with three operational fronts: vessels, vehicles and trains. A necessary line of activity of this terminal is customs operations. Moreover, Solvo.TOS enables the processing of containers that are transported via import, export or cabotage operations, including cargoes transported between European Union ports. Transshipment container operations are also paid special attention.

Additional container operations can also be performed by the system, such as stuffing, unstuffing, restuffing, cleaning and repairing. For empty containers, return-to-terminal control functions and choose-by-parameter functions can be used.

Some additional functions can be unnecessary for some terminals. For example, the stuffing and unstuffing of containers may be unnecessary at major sea terminals, while vessel operations are obviously unnecessary for inland ('dry') terminals. Thus, the modular architecture of Solvo.TOS makes it possible to configure the system according to specific terminal needs.

### Configuring Solvo.TOS

Solvo.TOS provides flexible tools to configure and set up the core functionality of the system to meet the terminal operation requirements. In case of a requirements change, the current configuration can easily be adjusted by the system administrator.

The most important feature of the system is that it enables the user to select between agent mode and forwarder mode. The first one allows the user to perform all terminal operations on its own, while the second is used to interact with forwarders. Moreover, different types of container inspection can be used depending on technology (for example, weighing, visual inspection and X-ray scanning) or the requester (the customs agency or contract party).

Generating acceptance reports is also configurable. A special parameter regulates the terminal-inbound transportation of containers with/without booking. Another option is configuring time slots for transport vehicles (see below).

The above described features allow the user to quickly and easily prepare data in a suitable form that is needed to make deals with contracting parties.

### Contracts and job orders

An important feature of Solvo.TOS is its ability to seamlessly integrate commercial functions, management and tracking of containers. The system can keep track of all partner agreements and related documents. This means that the system automatically maintains a complete directory of all services provided by the terminal to contracting parties. All terminal operations are carried out by partners' orders based on corresponding agreements. When containers are received at the terminal, the booking note, cargo manifest, or Bill of Lading is used as an order document. The following container operations can be specified in an order:

- Weighing operations;
- Empty container delivery operations;
- Inspection operations;
- Stuffing/unstuffing/restuffing operations;
- Other operations- such as cleaning, PTI, and ISPS.

Furthermore, orders for vessel operations, such as closing/unclosing of hatch covers and mooring operations, can be placed and managed in the system.

### Solvo.TOS planning tools

Solvo.TOS supports several planning levels for terminal operation, such as:

- monthly plans – a summary monthly plan for vessel processing or perhaps a container inbound delivery plan for railroad operations;

Solvo booking form.

- Inbound truck delivery (with time slotting);
- Operative plans for vessel loading/unloading operations;
- Operative plans for loading/unloading of railroad cars;
- Planning of other operations at the terminal (service orders).

The monthly plan for vessel processing is prepared according to line orders and notices. The planning of inbound/outbound time-slotted container transportations using vehicles is done based on partners' orders. The 'time slot' means a time period that limits the number of truck visits or container receipts. Flexibility in planning operations is achieved by varying the time slot size and by specifying limits for container types and clients. The planning period is unlimited (in practice, it may vary from one to ten days) and depends on partners' needs. A special module is designed for sending orders via Internet. Single and multiple orders can be processed, as well as combined ones including inbound and outbound container movements. Additionally, vehicles can be processed with the time slotting feature switched off.

Operative plans for loading/unloading vessels are designed by terminal dispatchers based on instructions from vessel representatives. Each loading plan includes a layout that shows how containers are arranged onboard the vessel and a schedule that regulates the work of terminal equipment and workers. The unloading plan is designed based on the vessel's cargo plan, while the work schedule for terminal equipment and workers is prepared by the terminal dispatcher. In addition, for railroad loading/unloading operations, special plans for arranging containers on railroad cars can be prepared with special scheduling for terminal equipment and workers as well.

### Time counting for vehicle processing operations

The system automatically records the time spent on processing vehicles at the terminal. For vessels, time sheets are generated. For railroad operations, the time spent on marshaling or removing railroad cars can also be registered. For vehicles, the time spent at each processing point can be recorded.

### EDI Module in Solvo.TOS

The EDI module is designed to ensure communications between the system's users and the terminal's clients. The module performs the following tasks:

- Automatically sends notifications about system events via e-mail, SMS or other instruments according to the administrator's settings.
- Generates and sends/receives messages. It then uploads them to the database. Messages can be formatted as EDIFACT, Excel or xml.
- Provides Internet access to the system, allowing clients to view container movement infomation. Each client's data is private and secure.

### Customs operations in Solvo.TOS

Customs operations are paid special attention in Solvo.TOS. The system controls the outbound flows of containers, including transit ones, and allows the user to add and configure different types of inspection procedures. For Russian terminals, customs documentation can be generated according to DO-1 and DO-2 forms.

## Conclusion

Solvo.TOS is a highly competitive product with comprehensive technology and management functions. The system is designed to ensure commercial operations at terminals. Unlike other similar systems, Solvo.TOS has an advanced platform for client relations management. This makes it possible for easy and cost effective integration of Solvo.TOS and accounting systems or ERP systems.

Solvo.TOS is embedded with ERP and CRM functions, enabling users to manage terminals that have an outdated host system or even no host system at all. The local advantage of Solvo.TOS is that it takes into account the specific and distinctive features of customs agencies and railroad systems in post-Soviet countries.

### ABOUT THE COMPANY

Founded in 1995, **Solvo** is the leading provider in Russia for high-end systems for real-time logistics control and automation at warehouses and container terminals. Solvo provides its customers with services required to keep business and technology processes efficient and cost effective. Major container terminals in Europe and CIS countries are among Solvo's customers.

### ENQUIRIES

Headquarters
Saint Petersburg, Russia, 197341, 33a Kolomiazhski pr.
Tel: +7 (812) 60-60-555 Fax: +7 (812) 60-60-771
Email: sales@solvo.ru Web: www.solvo.ru/en

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# DRY BULK & SPECIALIST CARGO HANDLING

"Vale's plan B has been to develop a floating terminal in Subic Bay in the Philippines to operate as a hub-and-spoke transhipment port, with the ore being loaded onto smaller vessels."

'Chinese port restrictions lead to Subic Bay floating terminal solution', page 81.

# A flexible solution for coal handling systems

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

## Mobile shiploaders for coal handling

The range of mobile shiploaders offered by Telestack ensures the operator has a mobile and flexible solution when loading vessels from barges to Panamax. The customized nature of the equipment allows the units to be designed to load a range of vessel sizes and production rates up to 2500 tonnes per hour of coal. The radial and telescopic features of the shiploaders offer unrivalled trimming capabilities that cannot be matched in comparison with other fixed length conveyor systems. These features ensure that multiple hatch trimming can be easily done from one position, ensuring that production is maintained and hatch change requirements are minimized. The mobility of the shiploaders caters for a complete range of requirements, from full drive wheeled units for parallel, radial and in-line/grab steering to tracked mobile units or wheels for towing into position.

Figure 1. Radial telescopic mobile shiploader loading pet coke to a hanydmax vessel.

When handling any type of material, dust suppression and containment is a key consideration for the Telestack mobile shiploaders. The units are complete with optional covers, under-trays, sealing, dust extraction and a range of telescopic cascade/freefall chutes, all fully integrated and designed for optimum performance to eliminate any dust or spillage issues on site. As well as dust issues, Telestack incorporate the telescopic cascade chute to limit the degradation of the material, such as pet coke, to ensure the material sizing is maintained within the required specification when loading into the hatch. The feature enhances the performance of the shiploader so operators can guarantee a quality material to their customers.

## An alternative to the typical stacker/reclaimer system

Typical operations in either developing a Greenfield site or upgrading a current stockyard operation would use a stacker/reclaimer system for all their needs, in terms of stockpiling and reclaiming of the bulk material. There are many manufacturers of stacker/reclaiming systems worldwide, with varying associated capital costs, depending on the customer's requirements. Other

Figure 2. Mobile radial telescopic stackers stockpiling coal in stockyard.

substantial costs associated with this type of installation include civil requirements, planning permission and government legislation, which further increase the capital expenditure and time frame of the project.

The Telestack mobile systems can offer a cost efficient alternative to stacker/reclaimer systems. Telestack equipment is designed for operators handling up to 5,000,000 per year with single system, while still maintaining the required production capacities. For those upgrading their current system from an older stacker/reclaiming system to a new design, the robust design of the Telestack equipment ensures that the operator can maintain their current tonnage per annum while limiting their capital expenditure. For those developing new Greenfield sites, the Telestack equipment is perfect for the initial start-up phase of the project. The lower capital costs and no civil requirements and limited planning permission are the main advantages of the equipment in comparison to fixed stacker/reclaiming systems. The equipment allows the operator to begin phase one of the stockyard very quickly and easily, with leads times on Telestack

Figure 3. Tracked radial stacker stockpiling pet coke in steel mill stockyard.

Figure 4. Mobile reclaiming unit fed from CAT 988 wheel loader.

equipment as short as 12 weeks from order. All Telestack units can be packed into 40 foot containers for shipping globally and are fully built on site within one week.

## Mobile equipment for stockpiling, reclaiming, truck unloading and linking

The mobile equipment allows for a range of stockpiling requirements depending on the customer needs and height restrictions within the stockyard. The radial telescopic conveyors are heavy duty stockpiling conveyors of up to 58 meters length (190 foot), which allows for a maximum stockpile height of 20 meters and up to 200,000 tonnes. The luffing (up/down) facility of the units allows the operator to use the units even in areas with restricted stockpile height. Also, the automatic PLC stockpiling system reduces the labor required to operate the equipment, while reducing the degradation, segregation, contamination and compaction of the material. The robust heavy duty design stockpiles up to 2500 tonnes per hour, with the ability to handle a complete range of materials from coal/pet coke to iron ore, which is ideal for multi-material stockyards.

The mobility of the units is crucial to ensuring that production rates are maintained when changing from one stockpile to another. Telestack also design and manufacture more simple units for stacking up to 10 meters (30 foot) in the stockyard. These fully tracked and radial conveyors can be packed into one 40 foot container or Ro-Ro for shipping globally. Telestack have sold over 200 of these units globally into ports, mines, powerstations and quarries. The mobility allows the units to move around the stockyard to maximize the space and efficiency of the yard as required, while limiting downtime in the stockpiling process.

Figure 5. Truck reclaiming coal in powerstation.

## Utilising the equipment for the reclaim system

The Telestack equipment is ideally suited for either the stockpiling process or the reclaiming process, the multi-functionality of the equipment limits the capital expenditure while still maintaining the production capacities. The mobility of the units allows the change over from stockpiling mode to reclaiming mode very easily. When the stockpiles are built, the mobile reclaim hopper is situated next to the stockpile with multiple link conveyors utilized to limit the haulage distance of the wheel loaders. These link conveyors can then feed directly onto the overland conveyor system.

The mobile reclaim hopper and truck unloader can both be used to feed directly onto the overland conveyor system (if required), which eliminates the double handling of the material. The mobile truck unloader can also be fed directly from trucks in the stockyard to the overland conveyor system, again to increase production capacities during the reclaiming process. The mobile reclaim hopper, truck unloaders and link conveyors, already used in the stockpiling process, give the operator the complete package for an efficient stockyard system. The customized nature of the Telestack units ensures they meet the needs of any application, with capacities up to 2500 tonnes per hour for both stockpiling and reclaiming. The overall benefit in the reclaiming process is the limitation of haulage distance of the wheels loaders/trucks to reduce fuel, labor and dust and emissions for the operator.

## Emergency back-up system for stackers/ reclaimers

As there as so many existing stockyards using large stacker/ reclaiming systems, the Telestack equipment can also be used as an emergency back-up to this equipment. In the event of a failure or planned maintenance of the stacker/reclaimer, Telestack equipment can be used to maintain the production rates in either stockpiling or reclaiming the material. This is also beneficial as the units can be utilized to service the small areas in the stockyard that the stacker/reclaimer cannot reach, the mobile Telestack equipment can 'pick up' this material and reclaim it back into the system, reducing the need for wheel loaders and trucks on site.

### 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/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.

### ENQUIRIES

Telestack Limited
Bankmore Way East, Omagh, Co. Tyrone
N.Ireland, BT790NZ, UK
Email: info@telestack.com
Web: www.telestack.com

# Chinese port restrictions lead to Subic Bay floating terminal solution

**Gavin van Marle**, Editor in Chief, Port Technology International, London, UK

Behind the creation of a new floating transhipment terminal in the Philippines on behalf of the Brazilian mining giant Vale, is the story of emerging geopolitical tensions over China's seemingly endless need for raw materials; between China, who believe that it is they who should carry the flows of raw materials into the world's manufacturing heartland; and one of the world's largest shippers, which sells said iron ore to the Chinese – and pays for its shipments.

The origins of this dispute lie in the desire by Vale to limit its exposure to the tempestuous swings in freight rates to which it was subject prior to the terrible depression into which the dry bulk shipping industry has found itself. Before the recession and subsequent crash in vessels values and charter rates, Vale found that its profit margins on the ore it was selling to Chinese steel mills were being eroded by a long-running bull market in freight rates and charter rates in the largest dry bulk vessel sizes – demand from China for iron ore was high and vessel space was in short demand, and Chinese and other shipowners made a lot of money out of transporting iron ore from Brazil to China.

In fact, such was the cost of transporting iron ore from Brazil to China at the height of the boom in 2008 that Vale almost lost its market share to Australian miners – despite the fact that the grade of ore mined in Australia is of a far lower quality – because of the differential in freight rates.

Vale then decided to enter the shipowning game itself, in what must be one of the most ambitious attempts by a cargo owner to assert its control over its supply chain with an original order of a series of very large ore carriers (VLOCs). At 362 meters long and 65 meters wide, and with a carrying capacity of 400,000 deadweight tonnage, Vale's VLOCs represent the largest dry bulk carriers on the seas, and have subsequently been termed Valemaxes.

The initial order, placed in 2008, was for a series of 12 vessels worth $1.6 billion, or around $140 million per vessel and, at the time they were ordered, represented considerable cost savings for the Brazilian company – it was estimated that a fully laden Valemax vessel running between Brazil and China would be carrying its cargo at 28 percent cheaper per tonne than a vessel half its size.

The first in the series, the Vale Brazil was delivered in the middle of last year, and unfortunately coincided with the complete devastation of the dry bulk trades. Demand from China for iron ore has slowed markedly, but far more destructive has been the glut of newbuildings of similar size, or in the slightly smaller capsize segment that have been delivered since Vale placed its orders – and eventually it is due to operate a fleet of 35 Valemaxes.

© Logmarin

Vale's Ore Fabrica is equipped with five Liebherr MPG cranes and has a handling capacity of 5,000 tonnes per hour.

This downturn in the market has had two effects – it has ruined the financial prospects of Chinese dry bulk shipowners, some of whom are partially state-owned and are now suffering dreadful losses, according to the latest financial results being posted on the Hong Kong and Shanghai stock exchanges; but it has also made iron ore cheaper for the Chinese steel mills to purchase.

As a side point, it is ironic that it is those self-same steel mills that provided the materials to the Chinese shipyards which continue to construct all these vessels that are causing such havoc to the market.

But crucially, there are only a few ports in China which are able to handle vessels of such sizes, and the Chinese government has yet to give its permission for the Vale vessels to dock at either Qingdao or Dalian – the two that it had earmarked to construct massive distribution facilities at.

There are reports that one Valemax did a trial docking at Dalian, but since then China's ministry of transport has placed a ban on vessels of that size entering its ports, citing safety concerns – and in that respect it has been vindicated by a recent crack found on the hull of the Vale Beijing.

Vale's plan B has been to develop a floating terminal in Subic Bay in the Philippines to operate has a hub-and-spoke transhipment port, with the ore being loaded onto smaller vessels, and thus partially losing the economies of scale that the Valemaxes were originally intended to achieve.

Nonetheless, until Vale and China come to some sort of agreement over the Valemaxes calling directly at Chinese ports, the interim solution, centred on the creation of a floating iron ore terminal, will have to suffice, with ore loaded onto capsize vessels.

Built with the assistance of Italian classification society RINA's supply chain consulting subsidiary Logmarin, Vale has converted the former very large crude carrier Front Duchess into the world's largest floating transhipment vessel.

Renamed the Ore Fabrica, managed by Singapore's MSI Ship Management and now moored at Subic Bay, the vessel was converted at the Chinese shipyard of Jiangsu Xinrong, which installed five Liebherr MPG cranes and a sophisticated conveyor belt/loading system designed and built by Bedeschi of Padova. The cargo handling facility is certified by RINA.

The double girder deck grab cranes have been designed for vessel to vessel transhipment operations, with a lifting capacity of 35 to 41 tonnes and radius of 38 meters, and have four independent drive systems.

Altogether 4,643 tonnes of new plant and structure went into the conversion of the vessel, and the installation of 9,680 kilowatts of power gives it a 5,000 tonnes per hour capacity – enough to load a capesize vessel in 36 hours. From design to delivery, the entire conversion took 333 days to complete.

Vale is also constructing a new land-based transhipment terminal in Malaysia, which is due to open in 2014 and will boast an annual handling capacity of 60 million tonnes. What will happen to the Subic Bay operation after that is operational is yet to be decided.

## ABOUT THE AUTHOR

**Gavin van Marle** is Editor in Chief of Port Technology International. He has been reporting on the ports, freight and logistics sector for 15 years from around the world, including stints as a foreign correspondent in Russia, China, India and South America. He has won several awards for his work, and was last year named Journalist of the Year by the Seahorse Club.

## ENQUIRIES

Email: gvanmarle@porttechnology.org

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# CUSTOMS & SECURITY


"When we work internationally, the bar is set higher and compromise is an art. Transportation and border security are local issues, yet require a new spectrum of international thinking."

'A leap in technology: fusion authentication', page 87.

# A leap in technology: fusion authentication

**Jay Grant**, Secretary General, International Association of Airport and Seaport Police – InterPortPolice, San Pedro, CA, US

## Introduction

Every day, all over the world, we strive to identify people to ensure we know who they really are in order to meet required safety and security protocols. Over the years, there has been an evolution of identification and trust factors that today has resulted in the use of smart cards with biometrics and other security features. While we have begun to minimize the risks, we have not been able to create a comprehensive system. For the transportation and border environments, this leap is essential.

The greatest challenge for any system is adoption and cost. Integration of a biometric authentication program must be comprehensive and flexible for effective use in the access control environment. One common challenge has been effectively integrating smart credentials on a universal basis. An ideal solution would not burden the user; is easy to manage; is cost effective; maintains the highest security requirements, and provides permission based access and global interoperability to applicable users, such as employees, law enforcement officials, other first responders, visitors and guests. To satisfy today's security demands, we require a new level of absolute authentication and access assurance, as well as a seamless entry system that is integrated into the normal flow process.

Physical security has long had a site-specific silo based approach. The administrative, security and usability challenges that arise from this are directly proportional to the number of physical sites an organization maintains. Our transportation system represents a worst case scenario. There are large numbers of employees and passengers using multiple entry sites with no central control over identification and little to no interoperability. In addition, the tragic events of 9/11 and Hurricane Katrina in the US illustrate such a system's weakness when qualified first responders are denied access due to the inability of responsible agencies to validate credentials.

The world truly has gotten smaller. We interact globally on several levels, from commercial traveling to issues of crime and commerce. Often, though, we still find ourselves building solutions locally rather than globally. Identity management still plagues us and document fraud is a daily and persistant challenge. Ensuring who people really are within our borders, aviation, maritime and transport environments has been a difficult task. We have seen hundreds of millions of dollars spent on single programs. It is projected that biometric smart card credential programs will cost over $40 billion to implement and $3.5 billion to maintain, just in the US.

## Policy

Government lead programs often come down to two key components: budgets and politics. Money for national governments has not initially been too much of a problem. However, the programs touted a few years ago are on the chopping block today. In some cases, security is coming in second place to other priorities. Policy is always tricky, especially when you have national government and local communities who must work together on federated issues. When we work internationally, the bar is set higher and compromise is an art. Transportation

and border security are local issues, yet require a new spectrum of international thinking. Retail manufacturers learned hard lessons that cost millions by not working together to agree on international standards before manufacturing the latest and greatest technology.

In today's environment, international standards should be a high consideration from the outset. In the case of credentials for transportation security, we look to the United Nation's International Aviation Organization (ICAO) and International Maritime Organization (IMO). Criminals have no borders and professional passenger expectations are high. We find maritime crews stranded on ships within many countries, not being able to get off their ships because we just cannot verify the identity of the individual.

I am not a technician, but have spent five years learning about identity technology. This is because I have found good intelligence and identity management provide the best ways to prevent terrorism and transnational crime. Much of my career has been spent working on legislation and regulation with policymakers. As Director of the US Port Security Council, working for the American Port Authorities after 9/11, my quest was to ensure security funding was achieved through the US Congress – we pushed and accomplished, receiving over $2 billion of funding for our seaport security programs in 2006.

That funding requirement is up for reauthorization in 2013 and it will be difficult to achieve the same success. Part of that funding was for the Transportation Worker Identification Credential (TWIC), a maritime security credential. Almost two million credentials have been issued, but the TWIC card, to date, is not much more than a flash pass and considered the most falsified national document. Trying to implement a centralized reader program that signals either a valid or not valid credential of an individual has been a chore beyond belief. The mistakes of the program goes back to a lack of standards and hurried implementation.

In 2007, working as the Director of the US Airport and Seaport Police, and 2010 being appointed as the Chief Executive of the InterPortPolice, I continued to move forward, trying to achieve the quest of a worthy solution. The objective was simple, the same one we had used when we wrote the TWIC legislation. But this time we had five years of experience, the good fortune of progressive technology and the knowledge of our mistakes.

In the end we surprisingly met our objectives and are able to present a platform that can span the transportation security and border requirements internationally, based on showing it to several leaders in the field. Until now, there has been no trusted system to validate the different permissions and privileges of credentials. Responsible officials are fearful of forgeries and the liabilities that unauthorized persons can create. We have always had to rely on ID cards. Smart credentials have set a higher standard but have not secured a total solution.

## One Personal Authentication Security Standard

We look forward to introducing the One Personal Authentication Security Standard - 1PASS at the ISC West exposition in Las Vegas, March 28-30, 2012. This leap in technology uses passive biometric fusion authentication technology to allow secure, user friendly entry control to an enrolled and authorized individual. The premise of 1PASS is to allow good people to enter safely and quickly. The evolution of the standard from verification to identification offers a dynamic increase in security.

How the solution works in quite ingenious. The software platform uses high definition video cameras and voice controllers to capture passive biometric elements of an individual, then the software fuses an individual's data through sophisticated algorithms based on facial recognition, behavioral analytics, speaker verification and speech recognition to individually identify the person's identity. Once identified, eligible access is determined, based on the combination of standardized attributes and local permissions granted to the individual.

What has been nice, is to see an official's eyes light up after experiencing the system and they start imagining all the ways the platform can be used. This versatile and flexible system allows for the maintenance of the highest security protocols, yet is user friendly, allowing for motion authentication and allowing over forty individuals to pass though an entry point per minute. The back end offers true risk mitigation information, alert protocols and comprehensive reporting.

The system has been successfully installed by the government in several housing projects throughout the US, along with some other commercial buildings and a police station. We have just begun pilot testing in the port authority environment. Yet as stated, the greatest challenge for any system is adoption and cost. Those factors will be crucial for this or any other system. As new as all this sounds, we are seeing similar programs being tested. The UK has in place facial recognition entries at Gatwick Airport and an employee program at Heathrow. They plan to implement full facial screening for EU passport holders later this year. Again, this moves the bar from verification to identification.

Having a multiple fusion biometric capability changes the game. Having multiple passive authentication makes it more palatable for the user and allows for swift completion of the identification in most cases. Once enrolled, the system always identifies the user with their multiple body biometrics directly. The body becomes the key to accessing the individual, and has the highest assurance of identity. The system will allow for other biometric reading, such as from the individual's fingerprints and their iris, but they are not required to achieve 100 percent authentication.

Many have tried to use black listing as a solution for catching the bad guys. While a fusion system will indeed do this, the premise of this system is to let the good people get through security; the system allows for a smooth, expeditious flow of enrolled and authorized traffic. If you are not enrolled or not authorized you are required to see an officer or official.

Return on investment is a critical factor when investing in new technology. Because of the use of relatively inexpensive cameras and the way licensing subscription fees are set, the overall costs can be 25 percent to 75 percent of today's smart cards solutions. Additional cost saving may also be achieved, depending on the build out requirements. In most cases, the system will integrate easily with the current legacy system.

A key factor of the program is the user group of the adopting authorities, who will become members and have input into how the system matures, how standards are adopted and policy is set. This, we hope, will encourage users to work together, not just as a committee developing a standard, but to gain knowledge in what the costs are and ramification of new requirements.

Best of all, the entire premise of the system will not change – fundamentally, the system is individual identity authentication – you are who you are – once identified and verified that will not change. We can improve the software and build better cameras – but we will remain the same individual, perhaps getting a bit older over time, but that too is recognized within the system.

### ABOUT THE AUTHOR

**Jay Grant** was appointed Chief Executive of the InterPort Police in September 2010. His prior positions includes that as director of the US Airport and Seaport Police and US Port Security Council, where his activities included national coordination and intergovernmental affairs for airport and seaport law enforcement and public safety with the Department of Homeland Security, Department of Justice and US Congress in the aftermath of 9/11.

### ABOUT THE ORGANISATION

The **InterPort Police** – International Association of Airport and Seaport Police – coordinates information sharing, intelligence, training, best practices and operational issues with member jurisdictions. It is responsible for law enforcement, as well as public safety at airports, seaports and the transport systems within their nation and community. Since 1968, departments and agencies have worked together as a global force to prevent transnational crime and terrorism; ensuring public safety of passengers, the supply chain and critical infrastructure worldwide.

### ENQUIRIES

Jay Grant
InterPortPolice
Tel: +1 (202) 595 9111
Email: jay.grant@leo.portpolice.us
Web: www.interportpolice.org

# CCTV and IP surveillance

**Tim Biddulph**, IP Product Manager, Samsung Techwin Europe Limited, London, UK

The security industry has long been synonymous with the term Closed Circuit Television (CCTV), but in fact the CCTV industry has been anything but 'closed circuit' for many years. For a long time now, analogue systems that use coaxial or twisted pair cable for transmission have benefitted from the ability to connect to networks via control equipment. Even with the most cost effective equipment, full viewing, control and administration of such a security system is possible via a PC connected to the Internet. However, the trend of plugging a surveillance camera directly into the network is one that continues to gather pace. As a result, IP and network security products are now the single largest contributors to the growth of the physical security market as new installations take full advantage of the benefits that operating over the network brings.

IP based surveillance systems allow users to gain maximum benefit from the latest generation of high resolution cameras that can deliver so much more than conventional analogue CCTV cameras, which typically generate images comprising of just 0.4m pixels. For example, depending on the field of view, a 1.3 megapixel camera can do the job of several analogue cameras as it can cover a wide area and then zoom in very close, to a distant object, without 'pixilation' appearing in the image.

It is perhaps worth defining the difference between the different types of high definition cameras. A megapixel camera is simply a camera capable of capturing an image at a resolution of 1 million pixels or more. 1.3 megapixel cameras are amongst the most common on the market and this figure equates to a resolution of 1280 by 1024 pixels. However, even though a camera may be able to capture images of 1 million pixels, it cannot be described as a true HD camera unless it complies with the widely accepted HD standard. This requires the camera to output resolutions of either 1920 by 1080 or 1280 by 720. Unlike standard CCTV cameras, an HD camera displays images in 16:9 format (widescreen) and has to be able to output images in real-time at 25 images per second. The 16:9 aspect ratio allows users to see a much wider field of view compared to the traditional 4:3 aspect ratio. In summary therefore, all HD cameras are megapixel but not all megapixel cameras can be described as HD.

Samsung IP Network Solutions.

## HD megapixel

HD megapixel cameras offer a lot more than just remarkable 'evidence' quality images and a helpful display aspect ratio. They also come with a range of other features which equip operators to respond more effectively to any suspicious activity or emergency. Most of these 'added value' features are likely to be incorporated into a camera's DSP chipset. The Samsung WiseNetIand WiseNetII DSP chipsets, for example, have been designed specifically to allow users to gain maximum benefit from megapixel camera technology.

Although megapixel cameras can capture very detailed images, one of the benefits is that there is the option to simultaneously transmit images at lower resolutions, which include QVGA (320 by 240), VGA (640 by 480) and SVGA (800 by 600) and with multiple compression methods available, different authorised users are able to simultaneously monitor live images at one location, record video evidence at another or view live and recorded images on a smartphone.

At the same time, JPEG images of an incident can be attached to an alarm email notification with the additional facility of storing pre and post-alarm images on a camera's internal SD memory card.

Of course, more often than not, users do not require the highest of resolutions across their entire site and it always comes back to understanding the operational requirement and then specifying cameras to match the specific requirements of the project. A security system will nearly always use HD megapixel cameras where they are required, coupled with standard resolution cameras for general overview purposes.

## Intelligent video analytics

Another substantial benefit of most HD megapixel cameras is the use of Intelligent Video Analytics (IVA), which includes optical tripwire and enter/exit direction detection, as well as an appear/disappear function to detect the movement of objects. IVA also has a scene change tampering function which creates an alert if, for example, paint is sprayed on a camera lens or there is unauthorised movement of a camera away from its usual field of view.

If we look at the home and how the take-up of HD TV has gathered pace to the point that virtually every TV on sale is HD, I think we will see this trend in the security industry too. Average selling prices for HD megapixel cameras have reduced compared to last year alone, meaning more applications can benefit from higher quality images as the market gets more competitive. Samsung has recently introduced 4 and 16 channel NVRs capable of recording HD images, offering a cost effective solution for smaller IP based systems and the trend will continue down to smaller applications.

To justify the spend in what will be, for the foreseeable future, tough economic times, security management will be looking for increased value from a CCTV or IP video surveillance system. In many cases it may be that the cost of the systems will be met with the support of HR, IT and marketing budgets with both departments, as well as senior operational


The SNV-7080R.

The SRN-1670D.


The SPE-100.

management, having the opportunity to share the valuable information captured by the cameras. This will certainly involve a 'solutions' approach where cameras and recording devices interact with a range of other systems, for example, access control, ANPR, point-of-sale, intruder, fire alarm and building management systems.

Fortunately, surveillance technology has been able to keep pace with the changing expectations of end users, which has been partly encouraged by the realisation that the latest generation of high definition cameras, with their ability to capture amazingly good quality images, can be used for so much more than just verifying what may be happening within a scene.

## Progressive scan

It can be quite frustrating for end users who have invested in PTZ domes to find that images captured when the camera is on the move lack clarity, or have what is referred to as 'motion blur effect.' If the end user is an airport or port or is involved in some other mission critical activity, video recorded from a PTZ dome that is of a poor quality is likely to reduce confidence in a video surveillance system. Car parks, industrial estates and retail parks may not be regarded as high security applications, but they are environments where PTZ cameras are commonly installed and where blurred images can seriously impact on the ability of security personnel to make fast and effective decisions when an incident or emergency is taking place.

Fortunately, yet again, technology has come to the rescue. A feature called 'progressive scan' optimises high quality video capture and provides sharper image edges. The improvement is most noticeable on paused images, providing picture-perfect stills of, for example, number plates without any blurring.

Samsung has included progressive scan technology in a new series of network speed dome cameras. All four of the new ONVIF compliant models, which incorporate Samsung's highly acclaimed SV-5 DSP chipset, are able to capture 4CIF resolution images at 25 frames per second. The SNP-3371 is equipped with a powerful 37x optical zoom as is its weatherproof counterpart, the SNP-3371TH, which has an object auto-tracking feature and is supplied in an integrated housing for easy installation. The SNP-3302 has a 30x zoom capability and the housed version, the SNP-3302H, is IP66 rated.

In addition to progressive scan, the dome camera's ability to capture superb quality images when on the move is enhanced by true day/night functionality and a high-end 600 TVL CCD which work extremely well in low light applications. The cameras are also equipped with wide dynamic range (WDR) technology which compensates for backlight problems and is 160 times more effectively than standard BLC.

### ABOUT THE AUTHOR

**Tim Biddulph**, who has worked within the electronic security industry for seventeen years, joined Samsung Techwin Europe Limited in February 2009 as a Pre-Sales Engineer to provide clients with support in system design, tender returns and compliance and product training. Tim has recently been promoted to the position of IP Product Manager.

### ABOUT THE COMPANY

**Samsung** manufactures video surveillance and access control products designed to meet the current and future needs of security professionals. The products utilise innovative technologies many of which are unique to Samsung, which can deliver tangible benefits to security personnel involved in combating criminal activity.

### ENQUIRIES

Tel: +44 (0)1932 45 5308
Email: stesecurity@samsung.com
Web: www.samsungsecurity.com

# Advanced security imaging technology

**DebTech**, Johannesburg, South Africa

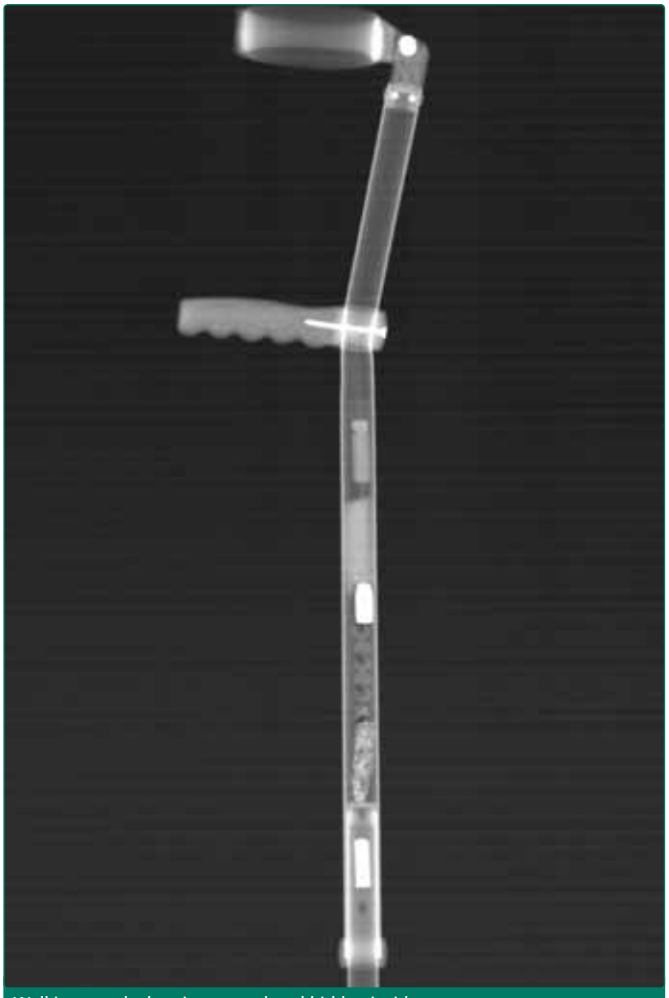
DebTech is the ISO 9001:2008 accredited technology business unit of De Beers, one of the top ranking diamond mining companies in the world. DebTech specialises in the development, manufacture, supply and worldwide support of innovative products and services for applications in diamond exploration, sorting and security.

## SCANNEX low dose, full body, X-ray scanner

The Scannex full body, low dose, X-ray scanning system was developed during the early 1990s for the primary purpose of deterring the theft of diamonds by diamond mine employees. The Scannex unit has application in many areas where contraband detection is required, such as airports, international sports events, prisons, border control and other high security installations.

The system produces high resolution and high contrast full body X-ray images of personnel. A single scan takes approximately ten seconds and the person being scanned remains stationary and is protected from the moving parts of the machine. The X-ray level required per scan is equivalent to that experienced on a two hour international flight. This allows an individual to be scanned up to 200 times per year and still not exceed the US Department of Health recommended safe limit for public exposure. The images are displayed on digital monitors and trained image analysts are able to identify items of a non-anatomical nature that may be concealed on or within the body.

To assist in the identification of foreign objects, human anatomical features are de-emphasized in the displayed images. This has the additional advantage of protecting the dignity of the individual being scanned. The display software comes standard with several image enhancement functions to further assist identification of suspect items. The display system is designed such that the viewing monitors can be located remotely from the scanning booth. This not only contributes to the protection of the scanned subject's privacy but also decreases



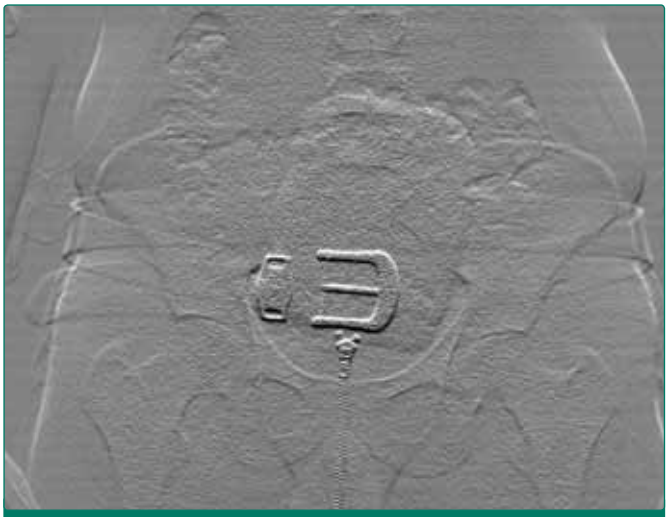
Walking crutch showing contraband hidden inside.

Two dimensional image of contraband strapped to the body.

the opportunity for collusion between the scanned subject, the scanner operator and the image analyst. Up to four monitors may be connected to a single scanner to increase the rate of people being scanned. At the De Beers Namibian operations up to 90 scans per hour have been regularly achieved through one unit.

The Scannex system is optimised to differentiate diamond, a material with relatively low X-ray absorption properties, from human anatomical features. This also enables the system to indicate the presence of other materials with similar low X-ray absorption properties, such as explosives, drugs, plastic fluid containers and syringes. Metallic items, including knives, guns and detonator wire are very prominent in the full body images by virtue of their significantly higher X-ray absorption properties.

For counter terror and border control applications that do not require the high performance characteristics of the original Scannex unit, DebTech is currently developing a smaller footprint and lower capital cost addition to the Scannex range. This is planned to be available late 2012.



Embossed image of contraband strapped to the body.

## ABOUT THE COMPANY

**DebTech**, a Technology division of De Beers Group Services (Pty) Ltd., conducts the full value chain of research, development, delivery and support of technology products.

The product range includes Scannex low X-ray dose body scanners and diamond X-ray sorters. DebTech provides full technical support, including consulting, commissioning, spares and maintenance.

## ENQUIRIES

DebTech
Tel: +27 11 374 7333
Fax: +27 11 374 5333
Web: www.debtech.com

# MOORING AND BERTHING

"In many of these locations there is limited access by road, rail or air, leaving water as the remaining route. A wise engineer will turn this to best advantage by designing a structure for the simplest possible delivery and installation."

'The buoyant future of fender technology', page 96.

# The buoyant future of fender technology

**Rob Gabbitas**, Director & **David Harrison**, Marketing Manager, QuayQuip, Malmesbury, UK

## Introduction

Floating docks and protective barriers cost often less to build than traditional fixed structures. They do not rely on heavy construction works, which can be costly and time consuming. Installing a prefabricated floating structure is generally much less disruptive to the berth's immediate surroundings.

As the mining industry spreads into ever more remote settings, port construction must keep pace. In many of these locations there is limited access by road, rail or air, leaving water as the remaining route. A wise engineer will turn this to best advantage by designing a structure for the simplest possible delivery and installation, using the minimum of land-based heavy equipment.

Floating structures have a long pedigree in urban settings. Recent innovations in floating protective barriers may extend their applications even further. This article will look at one installation in the fast developing mining industry of West Africa, and another in the heart of London.

Despite their superficial differences, the projects draw on a common design approach. They both incorporate fender systems into a much larger, more complex whole. Simply choosing components from a fender catalogue will no longer do. Stepping beyond traditional fendering and structures has many attractions, but there is no free lunch. New design methods and technologies are called for, and they must be properly integrated into every step of the design process.

QuayQuip has invested substantially in the latest generation of solid modelling, finite element (FE) analysis, soil analysis, and three-dimensional visualisation software. In doing so, it created a new design team with real world experience of these tools in civil and mechanical engineering applications, and in naval architecture.

Solid modelling and FE tools allow designers to optimize structural designs and production requirements from the outset. Load 'hotspots' can be spotted promptly and eliminated. Visualisation tools afford non-technical decision-makers a clear understanding of the proposed design long before it takes shape in the factory. After approval, solid modelled designs can be quickly converted to production drawings to meet tight deadlines.

## A floating dock at Marampa, Sierra Leone

Late in 2010, London Mining commissioned QuayQuip to design, manufacture, deliver and install a transhipment berth for their iron ore mining operation at Marampa, in Sierra Leone. London Mining's Marampa Iron Ore Mine exports its output via a barge loading facility, 20 kilometers from the capital Freeport. Marampa lies on the northern bank of the Sierra Leone River's vast natural harbor.

The tidal, floating, pile-guided berth is 260 meters long and comprises 22 modules, each 12 meters long and 3.5 meters wide. A 30 meter, fully articulated gangway was also supplied by QuayQuip, allowing operators easy access from the shore. On the riverbank behind the structure is a slewing ore loader. Built into the berth is a winch-controlled warping system. From a shelter mounted on the floating structure, a single operator controls the warping of barges along the structure's face. Designers decided early on that a modular, floating dock would be containerized for delivery to Sierra Leone. Road and rail links between Marampa and the capital are still in need of development, so modules would be unloaded from containers for transfer along the river by tugs, which could deliver each unit precisely where it was needed.

QuayQuip's 260 meter floating berth at Marampa, Sierra Leone. Inset: A winch mule tows barges along the berth for loading.

A barge moored at Marampa, ready for loading.

Modules are connected using an interlocking quick-fit system developed by QuayQuip for the project. The connectors require no special tools or expertise – an important consideration when the installation may involve non-specialist staff in remote locations. Moments are transferred through the connectors so that the entire structure behaves as a beam when subjected to berthing and mooring forces. The cones are concealed and are isolated from the surrounding module to prevent leakage into the flotation units. As the fender wall on each unit is neutrally buoyant, no buoyancy trimming is required to module itself.

A continuous yet fully hinge-interconnected 12 meter fender wall lies in front of each module. UHMW-PE facing panels allow vessels to warp safely along the structure. Paired QCN cone fenders are embedded securely within the structure and allow large energies to be absorbed at any point along the dock, as well as reducing reaction forces at the steel piles. Pile guides are protected by composite rubber/UHMW-PE fenders and UHMW-PE panels.

The lowered forces enabled QuayQuip to halve the number of piles from the original requirement of 45. The piling design process also included a programme of geotechnical analysis and calculations. The riverbed at the installation site featured gravel deposits and deep mud, both of which had to be allowed for during the design and installation phases. The piles, each 20 meters long, 610 millimeters in diameter and 19 millimeters in wall thickness, were supplied by QuayQuip and installed by contractors Jan de Nul.

During 2012, barges of 20,000 tonne displacement (16,000 tonne deadweight tonnage) will begin moving iron ore from Marampa to ships moored in deeper water.

**About London Mining**

London Mining plc was founded in 2005 to supply ore to the world's steel industry. It is headquartered in the UK and currently operates in Africa, the Americas, the Arabian peninsula and China. In 2006 it acquired the Marampa mine. Marampa formerly operated between 1933 and 1975, and approval was recently granted to London Mining to restart production. Between 5 and 8 million tonnes of ore will be exported annually.

## Protective barrier for London's new cable car

In 2011, Transport for London asked QuayQuip to design a floating barrier for the Emirates Air Line, a new cross-river

An early visualisation of QuayQuip's protective barrier for the Emirates Air Line cable car in London.

link from The Royal Victoria Docks to Greenwich Peninsula. QuayQuip worked closely with the main contractors Mace, and consultants Buro Happold and Royal Haskoning to create a floating barrier that could safely dissipate energies up to 13 megajoules. Turnaround time was short as the cable car is due to enter service before summer 2012.

One of the cable car's three pylons rises from the bed of the Thames. QuayQuip's barrier will protect this tower from accidental collisions by heavy vessels such as Thames barges, river ferries and cruise ships. Floating capsules contain elastic units and energy dissipaters that combine to form a progressive, tuned arresting system. Arresting will only start above a preset load, to prevent 'misfires' and accidental release after minor impacts. Trivial collisions will be dealt with by the elastic units which operate below the release load of the energy dissipaters.

The energy dissipaters work under either tension or compression. There are no sacrificial, plastically deforming components, so units can be reset after impact after the collision event without having sustained damage. The floating modules are assembled in twin 50 meter booms that form a protective 'V' shape around the river-based pylon. Each connects the central, dolphin-mounted floating pontoon to a peripheral pontoon. The central pontoon acts as an extra protective barrier against frontal impacts. QuayQuip provided the pile jackets and sleeves, ready for dropping into place and fixing with grout.

The new protective system is already being considered for other applications, including as the protection of bridges and large floating structures. For general information about the Emirates Air Line cable car project, please visit: http://www.tfl.gov.uk/corporate/projectsandschemes/15959.aspx

## ABOUT THE AUTHORS

**Rob Gabbitas** has led the design of some of the world's largest fender projects. One of the longest standing engineers in the industry, he has designed many innovative products and continues to research and develop the next generation of fendering and mooring systems. He co-founded QuayQuip in 2008.

**David Harrison** supports QuayQuip's marketing, publishing and web activities, and helps visualise new projects and products in 3D. He has worked for the marine engineering sector since 2001.

## ABOUT THE COMPANY

Since its foundation in 2008, **QuayQuip** has striven for a reputation as the world's most inventive fender and mooring system manufacturer. QuayQuip constantly develops its design and manufacturing technology and its quality and testing programmes. It has offices and factories in twelve countries.

## ENQUIRIES

QuayQuip Ltd
Gable House, 46 High Street
Malmesbury SN16 9AT, UK
Tel: +44 1666 824419
Fax: +44 1666 818172
Email: info@quayquip.com
Web: www.quayquip.com
www.eurotechbenelux.com

# VTMIS & AIDS to NAVIGATION
## FEATURING PMIS

"The current trends in VTS are likely to mean that it will play a central role in gathering and disseminating information for safety, security, environmental protection and economic performance purposes."

'Vessel Traffic Services – 64 years young', page 103.

# The new Sydney Vessel Traffic Service system: a tailored solution

**Captain Philip Holliday**, Executive General Manager Marine Services & Harbor Master, Sydney Ports Corporation, Sydney, Australia

## Background

In 2007 Sydney Ports Corporation undertook a formal marine risk assessment of their Vessel Traffic Service (VTS) requirements, following which they made the decision to replace the existing system with the most up to date technology available from Signalis. This formal approach ensured all aspects of Sydney Ports port area and environment were detailed and assessed. Sydney Ports area of responsibility comprises of two specific bays (Port Jackson to the North and Port Botany to the South), a complex shoreline and a high density of maritime traffic, in particular leisure vessels.

Based on the assessment, Sydney Ports produced a detailed specification which included an extensive three week real-time test phase to ensure the optimum sensors and system were selected for the VTS to ensure the protection of one of the most beautiful harbors. Sydney Ports new Vessel Traffic Management Information System (VTMIS) integrates radar, AIS, CCTV (including fixed and pan tilt and zoom cameras) and VHF sub systems on multiple sites using a loop microwave network.

## Tailoring the system

Each sub-system had to be tailored to meet the demanding requirements of the VTS and complex environmental conditions. The radar sub-system comprises of five TERMA Scanter 2001i Radar sites covering the area, with two radar sites (South Head at the entrance of Port Jackson and La Pérouse at the entrance of Port Botany) covering the port approaches and two radar sites (Blues Point Tower for the inner part of Port Jackson and New Molineaux Point for the inner part of Port Botany) monitoring the area inside the bays. The final radar site is on top of AMP tower in Sydney CBD, providing area overlap.

In order to achieve the optimum tracking and coverage from each radar site, radars had to be tailored as follows:

- Three radars (South Head, Port Jackson and La Pérouse) have dual frequency diversity
- Two radars (Blues Point Tower and New Molineaux Point) have dual redundant single frequency radars
- Two radars (Blues Point Tower and New Molineaux Point) have 4 kilowatt transceivers in order to monitor large ships sailing very close to the radars, all the three other radars have the standard 25 kilowatt transceivers
- Two radars (Blues Point Tower and AMP tower) have inverse square cosecant antennas to provide short range coverage, which would not have been possible with standard antennas because of the installation height (installed on top of tall buildings)

Port Botany, New South Wales, Australia.

© Sydney Ports

Sydney Harbor, New South Wales, Australia

It is of note that, of the five radars in the system, only two radar sites (South Head and La Pérouse) have the same specification. The complex shoreline with numerous coves and high density leisure traffic presented the problem of ensuring that the VTS operators were capable of continuous monitoring and observation of the vessel traffic at any point along the shoreline.

To resolve this, a specific CCTV solution was designed using Electron Magnified CCD cameras (EMCCD), which offer day and night vision capability, together with a mix of fixed cameras to monitor large angle zones and automatic directional pan tilt and zoom cameras either directed automatically by the system or manually by the operators to cover specific targets or areas of interest. Observation of the area was further enhanced by the use of programmed surveillance patterns for the pan tilt and zoom cameras when specifically tasked.

## Providing the best coverage

In order to provide the best coverage with minimal interference, a bi-static VHF radio sub-system, with independent transmitting and receiving sites and able to provide ten VHF working channels was installed. The system has two main coverage areas of Port Jackson Bay and Port Botany.

- For the Port Jackson Bay area, the transmitting site is located at South Head with the receiving site on top of a tall building at Bondi Junction.
- For the Port Botany area, the transmitting site is located at La Pérouse with the receiving site at the main Sydney Ports Operation Center, Brotherson Dock.

To provide long-range coverage and communication continuity, the system is also integrated with the radio equipment at the Port of Newcastle to the North and Port Kembla to the South.

It was essential that the system had a fully redundant network platform to deliver data across the nine sites. All sites were linked together to form a reliable integrated system via a loop medium wave network. The network design will ensure that a disruption of one link between any two sites would have no impact on performance of the system as the network would automatically re-route the data via the other side of the loop.

The whole VTS system encompasses nine different sites:

- One main operation center (Brotherson Dock) and one emergency operation center (Moores)
- Five radar sites that also, depending on which site, integrate cameras, AIS and radio equipment: Blues Point Tower, AMP tower, South Head, La Pérouse and New Molineaux Point
- 1 VHF radio site: Bondi Junction
- 1 MW relay site: Alpha House

Sydney Ports specification for power supply of the system required on-site back-up power systems at all necessary sites. To meet the specification and ensure continuity of operation of all VTS and related communications equipment (excluding radar antenna), for a minimum of eight hours, in the event of a loss of mains power to any site, high end UPS equipment was used. All sites were provided with highly capable UPS equipment with high performing battery packs. As part of the VTS modernization program, the VTS operations was relocated to a new VTS center at Sydney Ports purpose built Operations Centre located at Port Botany.

The new VTS center was furnished with three operator workstations, two stations for VTS operators and one for the VTS duty manager. To provide overall visibility of the traffic image for the whole area to all operators, an eight cube wall screen display (WSD) was installed. Additionally, ten dedicated CCTV display screens mounted either side of the wall screen provide an overview of all camera surveillance.

It was Signalis policy from the very beginning to offer Sydney Ports a system that would include a high level of Australian industry involvement. This was achieved with three core sub-systems being delivered by Australian companies:

- VHF Radio sub-system (C4i)
- Microwave network sub-system (Wave1)
- Energy sub-system (Daronmont)

Installation at Blues Point Tower.

Throughout the project, Signalis was supported by Daronmont, a Melbourne-based company with experience in delivering systems for the Australian Department of Defence for local representation and coordination.

It was important to undertake the installation and establishment of the new VTS system in such a manner as to minimize disruption to the existing operations and the associated Sydney Ports personnel. A specific strategy of implementation had to be defined and agreed with Sydney Ports, including the moving of the operations from the old centre at Port Jackson to the new VTS center at the Port Botany and Brotherson Dock location.

The installation provided a number of challenges but the installation of the radars at Blues Point Tower and AMP tower (the later being over 200 meters in height) were particularly interesting.

## Installation at Blues Point Tower

The successful delivery of this challenging project was on time and met the high initial performance specifications. It was achieved thanks to the excellent cooperation of all the parties involved. The images (right) show the crane extension for Blues Point tower during the installation works.

## Conclusion

Today, Sydney Ports new VTS center powered by a Signalis VTS system provides its operators with a fully integrated maritime traffic surveillance and management system that allows Sydney Ports to fulfill its obligations as one of the most modern and high profile ports in the world.

### ABOUT THE AUTHOR

**Captain Philip Holliday** joined Sydney Ports in May 2011 as Executive General Manager Marine Services & Harbor Master. Prior to joining Sydney Ports, Captain Holliday had worked for over 25 years in the Merchant Navy and Ports Industry. Philip has also taken a lead role in the UK representing ports in areas such as developing industry guidelines for Port Marine Safety, regulating the standards associated with Vessel Traffic Services and ensuring compliance with the requirements of the Port Marine Safety Code.

### ABOUT THE COMPANY

**Sydney Ports** is a state owned corporation that provides marine services and facilities to support commercial maritime trade in Sydney Harbor and Botany Bay. Trade through Sydney's ports is vital to the New South Wales economy with imports and exports through Port Botany handle almost one third of Australia's containerized trade. Other port cargo include containerized exports such as grains, cotton and wine, bulk goods which include sugar, gypsum, cement, salt and aggregates and bulk liquids.

### ENQUIRIES

Sydney Ports Corporation
Level 4, 20 Windmill St.
Walsh Bay, NSW, 2000
Australia
Tel: +612 9296 4999
Web: www.sydneyports.com.au

# Vessel Traffic Services – 64 years young

**Captain Terry Hughes**, FNI FRIN, Founder, International Maritime Consultancy

## Development of Vessel Traffic Services

In February 1948, the first port control radar was installed at the entrance to the Isle of Man's harbour. However, it was probably the Port of Liverpool which pioneered European Vessel Traffic Services (VTS) when in the same year they set up a radar/radio station, in order to facilitate the boarding of pilots from their cutter.

In 1951, Long Beach in California established a similar system to facilitate their port operations. Other major ports in Europe quickly followed. At this time, commercial radar was comparatively new, which made it possible under almost all weather conditions to observe vessel traffic from the shore. In combination with VHF radio, a traffic surveillance system was achieved and real-time information exchange between the shore and ships became possible.

## Legislation

In 1968, Inter-Governmental Maritime Consultative Organization (IMCO), as it was then called, published Resolution A.158 - Radio Advisory Services. This recommended that governments consider setting up such services in ports; to warrant it by the importance and nature of traffic, particularly in oil terminals and ports where noxious or hazardous cargoes are loaded and unloaded. It was also recommended that masters be instructed that, to improve safety, it would be best for them to notify appropriate authorities of expected times of arrival as early as possible.

In 1985 International Maritime Organization (IMO) published Resolution A.578(14) – Guidelines for VTS. This resolution recognised that the level of safety and efficiency in the movement of maritime traffic within a VTS service area is dependent upon close cooperation between those operating the VTS and participating vessels. It also recognised the use of differing VTS procedures may cause confusion to masters of vessels moving from one VTS service area to another.

In 1997, the IMO published an updated Resolution A.857 (20), which is still in force today. This latest publication includes two important annexes, namely, Guidelines and Criteria for VTS and Guidelines on Recruitment, Qualifications and Training of VTS Operators. Experience gained over the last 15 years both in operational technology and training means that this resolution is now in need of updating.

Whilst IMO have published various resolutions, including Guidelines on VTS, it is the Safety of Life At Sea (SOLAS) Convention, which is the most important with respect to VTS. The first version was adopted in 1914, two years after the Titanic disaster. In 2000 amendments to Chapter V were adopted and included Regulation 11, Ship Reporting Systems and Regulation 12, Vessel Traffic Services, some 32 years after the original Resolution A.158. Regulation 12 consists of five paragraphs, one of which states: "Contracting Governments planning and implementing VTS shall, wherever possible, follow the guidelines developed by the Organization." The word 'guidelines' points to Resolution A.857(20). This is extremely important as it now places VTS training and qualifications firmly in the forefront of maritime legislation.

## Training and qualifications

In 1998 International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) published Recommendation V103 on Standards for Training and Certification of VTS Personnel. This was followed by a series of model courses based on a similar format to Standards of Training, Certification and Watchkeeping (STCW). In May 2000 the IMO Maritime Safety Committee (MSC) published Circular 952, which invited Member Governments to bring the IALA recommendation and model courses to the attention of their VTS authorities and training organisations, when considering the training and certification of VTS personnel.

The VTS centre at the Port of London.

Credit: Kevin Gregory – Deputy VTS Manager.

The IALA VTS Committee has worked very hard to ensure that the building blocks are in place so that VTS personnel are provided with the highest standards of training and certification. However, it is up to the various training organisations to use the internationally recognised IALA model courses for VTS training. Keeping in line with the STCW format, the training organisations themselves should be accredited and have the IALA V103 courses approved by their competent authority. IALA has published Guideline 1014 – Accreditation and Approval Process, which will hopefully guide the various authorities as to how best to achieve both accreditation and approval for VTS training.

Unfortunately, at the moment VTS training is not mandatory. Whilst many ports do have V103 qualified operators, there are others that do not. In fact not all training organisations have accreditation or even approval for VTS training. This means that we could have a situation whereby a vessel entering a port with all the crew trained and qualified according to SOLAS and STCW are being regulated by an authority, which employs personnel to assist with the vessel's navigation and safe passage within the area of responsibility but do not hold the internationally recognised IALA V103 qualifications.

One of the major problems is the lack of worldwide expertise in training VTS personnel and there are many developing countries in desperate need of assistance. The three main areas of training are classroom theory and practice, simulation and on the job training. The cost of training abroad can be very high and may not always be carried out at accredited/approved training organisations. Simulators are not cheap either but manufacturers should be able to provide cost effective simulators, which could be used for multipurpose training. It is important that

the instructors used for VTS training have both having teaching experience and good background knowledge of VTS operations.

The STCW Manila amendments now include VTS awareness and communications procedures as part of the deck officer training curriculum. This is only a start as VTS operational procedures should be a normal part of both mandatory classroom and simulator training.

## Operational role of VTS

The role of a VTS operator is an extremely important one. Unlike other aids to navigation, VTS, being active, has the capability to interact and influence the decision making process on board vessels.

Protection of the environment is often a substantial driving force for determining the need for VTS. It has resulted in VTS being implemented in areas with relatively low traffic volumes and, in particular, in areas where relatively high quantities of polluting cargoes are transported, especially if these areas are considered to be environmentally sensitive, as well as densely populated.

Protection against terrorist action in the maritime domain requires, among many things, a complete image of vessel traffic in areas of concern, with information on the intentions and cargoes of those vessels, as well as vigilant monitoring of this vessel traffic. This information could also be of use to support actions against smuggling of goods and illegal immigration.

A VTS centre monitors almost all vessels in their area of responsibility. The VTS has trained operators (VTSOs) monitoring this traffic in real-time. Whilst it is recognised that security issues are a national matter, VTS centres can, at present, only contribute to certain security issues as they are not necessarily able to see all traffic, particularly small craft. Although VTS can also enhance port security, VTSOs themselves are not specifically trained to recognise potential security threats, neither are they qualified or equipped to deal with them.

Commercial pressures will demand ever more rapid and reliable transport and cargo handling schedules, while reducing costs and improving quality of service. Coastal waters and inland waterways will be increasingly used for recreational and other purposes. In addition, inland and short sea shipping will increase in environmental attractiveness as methods of transport of goods and passengers. Lastly, the coordination of port services will become increasingly important in the interests of safety, security, protection of the environment and improvement of economic performance, particularly where such services may be obtained from external sources.

## Summary

The current trends in VTS are likely to mean that it will play a central role in gathering and disseminating information for safety, security, environmental protection and economic performance purposes. Automated systems for the effective management and validation of transferred data between ships, VTS centres and networks will be increasingly required, as will VTS information, which will increasingly be used by various allied services in the global tracking of vessels. The need to manage recreational and other small craft traffic by VTS in order to ensure the safety of navigation in areas where commercial and high-density recreational traffic co-exists is increasing.

As these trends increase so too will the need for quality assurance to international standards for VTS systems, personnel, and operating procedures. The need to assure and certify the competency of VTS operators in order to reduce any exposure to increased liability will add to the scope and priority of such training, which is always ongoing and must in time become mandatory.

### REFERENCES

IMO Resolutions
IALA VTS Manual

### ABOUT THE AUTHOR

**Captain Hughes** is a Fellow of the Nautical Institute and Royal Institute of Navigation as well as being a Younger Brother of Trinity House and a Livery Member of the Honourable Company of Master Mariners. He is currently Chairman of the Personnel and Training WG in the IALA VTS Committee.

### ABOUT THE COMPANY

**International Maritime Consultancy** was established in 1996 by Captain Terry Hughes with a view to providing a quality, specialised service for all those connected with Vessel Traffic Services (VTS) and Management (VTM). As an independent Vessel Traffic Management Consultant he has undertaken expert witness projects in VTS related legal cases in the UK, Europe, United States and South Africa.

### ENQUIRIES

Email: info.maritime-vts@spamex.com
Web: www.maritime-vts.co.uk

# Vessel traffic management in the Port of Rotterdam

**Raymond Seignette**, Port of Rotterdam, Rotterdam, Holland

## Itsuwa Maru and the Port of Rotterdam

Motor tanker Itsuwa Maru approached the English Channel from her rough crossing of Biscay Bay, heading for the Port of Rotterdam. She encountered a delay of 90 minutes, and this was reported to her agent in the Rotterdam, 34 hours before her expected arrival at Shtandart Tank Terminal. Her agent forwarded a revised ETA to the harbour control centre of the Port of Rotterdam Authority, and 20 minutes after, a revised port passage plan was made available to the master of the Itsuwa Maru, including a requested time of arrival at pilot station and administrative clearance.

After pilot boarding, the master and the maritime pilot exchanged information and aligned their plans and intentions. Subsequently, VTS was informed that the vessels' passage plan could be maintained. Operational clearance was given by VTS and immediately a prediction of the intended path of the vessel to the terminal, including predictions of estimated traffic density and real-time hydro/meteo information, was shown on the pilot's laptop. The master – surprised by the vast amount of shipping movements in the port entrance – wondered why the efficiency he experienced was not standard practice for each big port. It was his first time to the Port of Rotterdam and, unlike any port entry he had experienced before, he felt relaxed and confident that his vessel would be moored safely and efficiently according to plan. He decided to ask the first officer to act as officer in command and assist the maritime pilot in his control, so he could prepare for the meeting with the terminal operator and his agent, as soon as the vessel moored. Certainly, no minute seemed to be lost in this port and as indicated in the port entry guide, traffic planning and terminal planning were aligned as well.

The prospects of vessel traffic management in the Port of Rotterdam have been discussed in Port Technology International previously (2004), but the effects of the investments of the Port of Rotterdam Authority in traffic management have become clearer in recent times. The port entry by MT Itsuwa Maru described above, pictures the port entry process as may be expected within a few years from now. It is one of the results of a changed approach by the Harbourmaster Division of the Port of Rotterdam Authority to sustain safety and efficiency in vessel traffic in the port and accommodate the effects on vessel traffic of foreseen growth of port business.

## New challenges for the Harbourmaster Division of the Port of Rotterdam Authority

As already foreseen in 2003, both developments in the maritime domain and other developments in the port's business raised the need for the harbourmaster to be proactive and to be prepared; prepared to manage the additional wet area and vessel traffic due

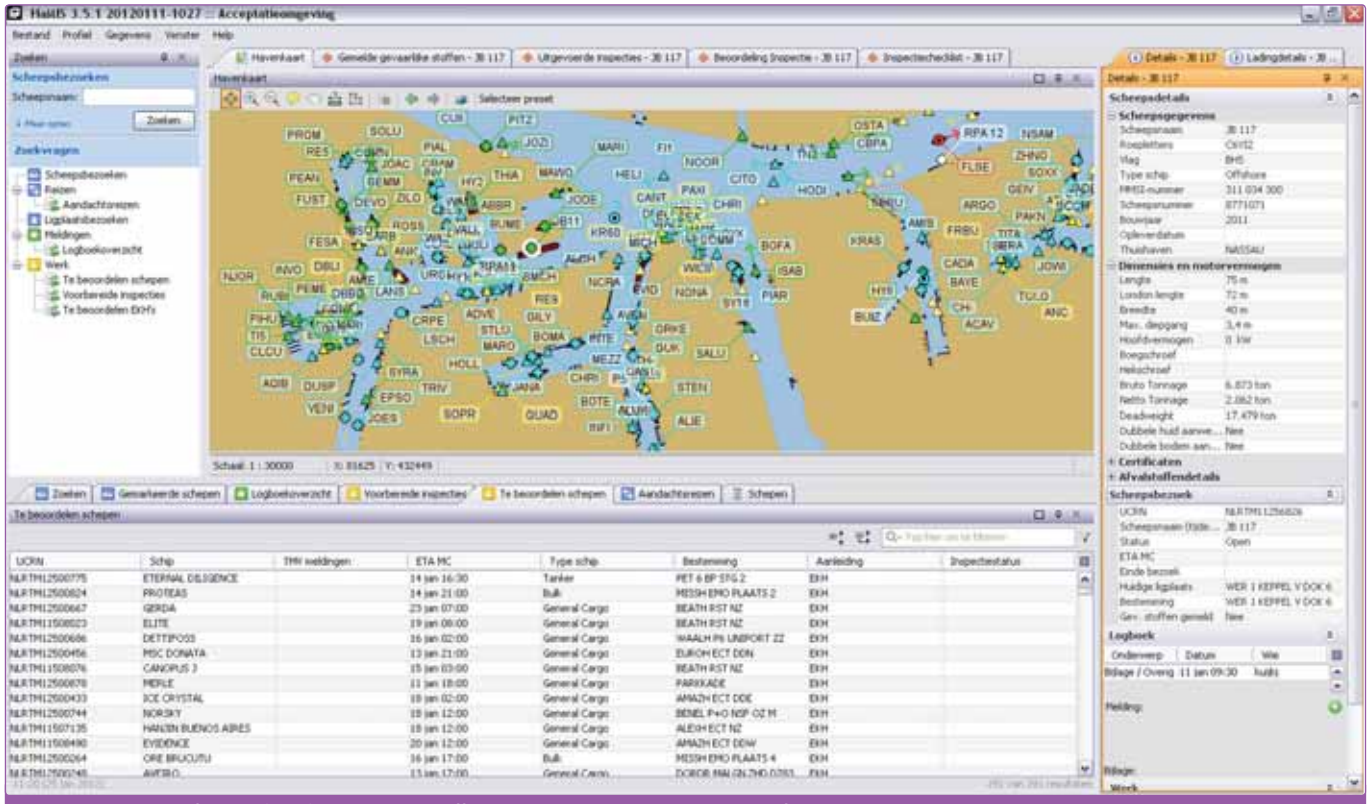


Figure 1. Screenshot of HaMIS (2011). The port and traffic image shows real-time movements of vessels based on radar and AIS data. The supporting data around it provides details on the voyage, the cargo, intended inspections and reference data for each vessel. A mouse click on the vessel in the image immediately makes the vessel, voyage and cargo related data available, it is shown in the tables. Alternatively, a mouse click on a vessel in the table will mark that vessel in the image.

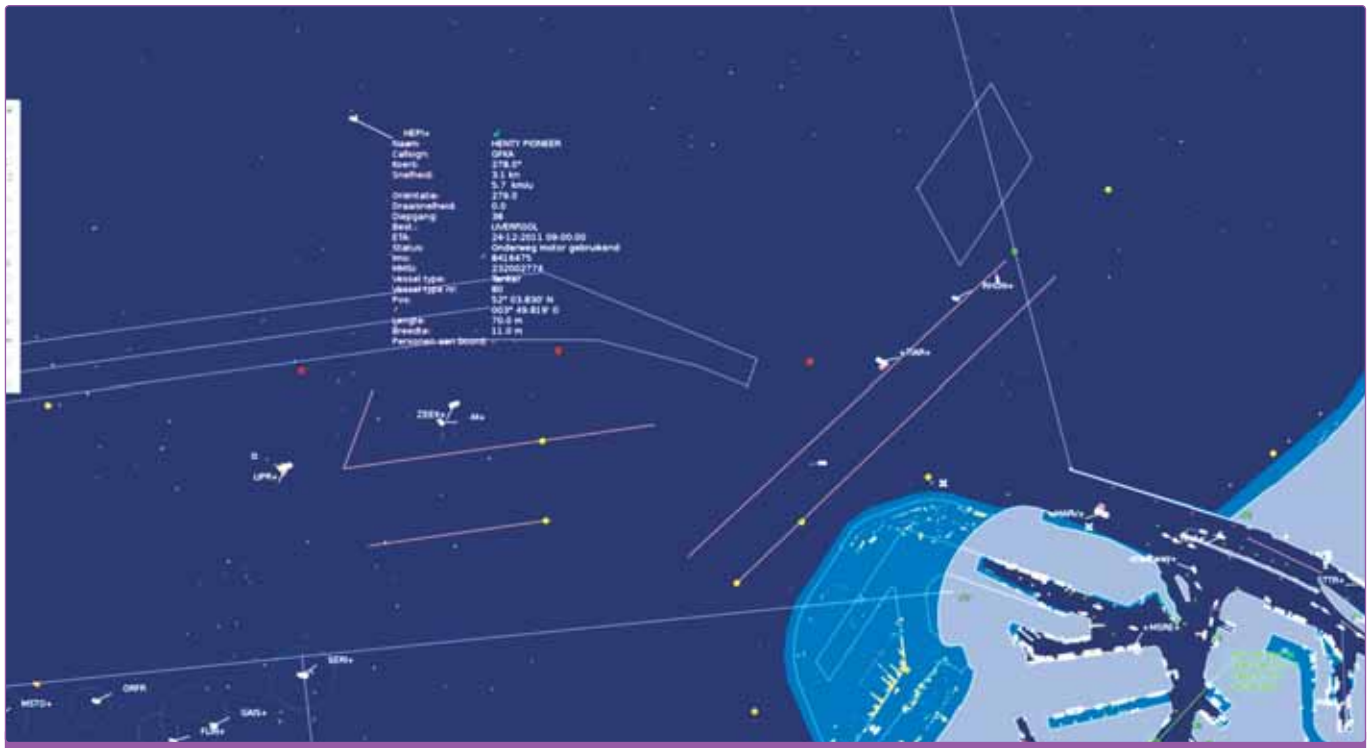


Figure 2. A screenshot of the traffic image based on Aramis (2011). Aramis V3000 is used by VTSO's in the Traffic Centres from January 2012, to monitor the traffic and identify individual vessels, tracks, intended routes, ATA's, ATD's, CPA's and TCPA's, amongst others.

to the seaward extension of the port, and safeguard nautical safety and efficiency at current level.

In the next 20 years, a 38 percent increase in visits of seagoing vessels (40 percent increase in vessel movements) and a more complex vessel traffic are expected. Other reasons for the Port of Rotterdam Authority to step up and to develop the vision on vessel traffic management include:

- Economies of scale in most segments, particularly in container shipping;
- Increase in maritime transport of dangerous goods (including LNG);
- An end to further adjusting physical risk control measures;
- Increase in market demand for traffic management;
- The sustainability objectives of the Port of Rotterdam – 'reduce emissions from shipping'.

The Port of Rotterdam Authority is happy to support and facilitate this 'change process' for the Harbourmaster Division, as from its investment, it expects a positive impact on the nautical competitive position of the port. This is not only due to the introduction of better traffic planning and cooperation between the nautical stakeholders, terminal operators and Harbourmaster Division, but also due to increased efficiency in vessel inspections and improved cooperation between the different inspection bodies involved. In this respect, the renewal and enhancement of the Harbourmaster Management Information System (HaMIS) and its connectivity to internal and external partners play an important role (see Figure 1).

Reuse of basic traffic information in the port community and exchange of planning information between chain partners is being arranged. This will take place firstly in agreements between the responsible organizations, and secondly, by means of information systems of associated partners and web-services between HaMIS and/or the port's PCS.

## Improving VTS

In the tactical and operational domain of vessel traffic management, the renewed VTS centres and upgraded VTS equipment play an equally important role. The interaction between VTS and the maritime pilot in the port entry of MT Itsuwa Maru envisages the teamwork of VTS and the maritime pilot in the tactical domain of vessel traffic management. Enhanced imaging of the traffic (Aramis) image and enhanced availability of voyage, cargo and inspections related information of each vessel traffic participant (HaMIS) provide the VTSO with the necessary information to carry out VTS, as well as assist in calamity abatement and emergency response in the port area when necessary.

## Coordinating the nautical chain

The harbourmaster of the Port of Rotterdam has to be prepared to play a new role: coordinator of the nautical chain. In this respect, the chain is formed by interacting organizations in the vessel traffic management process. In this new role, his aim is to enhance the efficiency of the nautical process to optimize port accessibility, for example, by reducing delays that are due to miscommunication and mismatch of servicing by the nautical service providers, to an accepted minimum. The aim is to acquire and share reliable and relevant vessel traffic related information, and to strengthen the cooperation between stakeholders involved.

In this new role, the harbourmaster acknowledges the unsegregated basis of all stakeholders in this cooperative vessel traffic management arrangement, and respects their individual interests. In all other activities under this arrangement, he will help to achieve the common goal set out by this agreement.

Preconditions for achieving this common goal (some still under development) are:

- All mandatory notifications to the harbourmaster are delivered, processed and settled electronically;
- The agent and/or the master of the vessel provides the harbourmaster with the necessary information – including updates and planning where applicable – in time;
- Planning horizon is extended until ETA – 72 hours before arrival and ETD – 24 hours before dispatch;
- Terminal planning is the basis of vessel traffic planning;
- Planning of each individual dispatch is checked against vessel

traffic planning and fixed based on agreement with the nautical service providers assisting in that dispatch;

- Planning and progress are monitored continuously, and where necessary, amended as agreed by all parties involved, under supervision by the harbourmaster;
- The harbourmaster monitors compliance with the vessel traffic management arrangement, and confront any non-compliant parties;
- Information related to a vessel's port call in the harbourmaster's domain is made transparent and available for the port community;
- Procedures and processes in the nautical chain; in particular between VTS and maritime pilotage;
- A platform for cooperation has been established to facilitate the parties involved in vessel traffic management in their cooperative efforts to improve the chain-process; and
- In this chain-process, planning is detached from financial arrangements between the nautical service providers and their clients.

## Conclusion

Vessel traffic management in the Port of Rotterdam is about sharing reliable information, about minimizing unnecessary delays along the chain. It is about planning, coordinating and respecting arrangements and agreements. This is not only for the benefit of the port's clients, but also for the benefit of the port itself.

The Port of Rotterdam Authority shared her vision and progress with, amongst others, IHMA and IALA. IHMA recognized the challenge out there for ports and supported awareness and initiated better disclosure of port information for stakeholders in the maritime domain.

IALA has become interested to further explore the relevant developments for VTS in particular, but also its eNavigation Committee is out looking for the stakeholders' functional needs to help rearrange the navigation and communication instruments, systems, networks and data management.

*You can read about the Port of Rotterdam's vision for the future in Nico van Dooren's article on page 36.*

### ABOUT THE AUTHOR

**Raymond Seignette** is engaged in maritime policy making and strategy development for the Port of Rotterdam Authority. He also serves as Adviser of the European Seaports Organization (ESPO), as Associate Member of IALA and in several other national and international platforms where public-private cooperation aims for a sustainable future of the port sector.

### ABOUT THE COMPANY

The **Port of Rotterdam Authority** is a public limited company (N.V.) and is amongst others involved in development, construction, management and operation of the port and industrial area in Rotterdam; and safe, efficient and effective handling of vessels and vessel traffic (VTS) in the port and port approaches.

### ENQUIRIES

Raymond W.P. Seignette MSc MM
Port of Rotterdam Authority
Tel: +31 (0)10 2522017
Fax: +31 (0)10 2521020
Mb: +31 (0)2523604
Email: rwp.seignette@portofrotterdam.com
Web: www.portofrotterdam.com

# OIL SPILL


"Despite the disaster, DeepWater Horizon has produced some positive effects. It has returned focus sharply toward oil spills, on everything from planning and equipment to disposal and logistics."

'DeepWater Horizon spill gives rise to OSR vessel surge', page 109.

# DeepWater Horizon spill gives rise to OSR vessel surge

**Andrew Nash**, Business Manager, DESMI Ro-Clean Ltd, Southampton, UK

The recent DeepWater Horizon incident has brought into sharp focus the requirement for current, up to date contingency planning, the correct mix of anti-pollution equipment and well practised recovery techniques and crews. Across the globe, this focus has promoted planning, gap analysis, training and a wide range of equipment orders, from the very basic boom to complete oil spill response vessels (OSR vessels).

On the latter, organisations have been looking for vessels that can undertake a wide variety of anti-pollution activities and also be an effective multi-role craft outside the OSR operations. The requirements are for simple, robust and reliable boats with a variety of features that can withstand the rigours of the marine environment. Typically, many companies now prefer and opt for steel built boats because they can withstand the everyday bruising of multi-role operations better than other, lighter material builds. In addition, steel can be easily repaired without the need for specialist equipment or skills, making it ideal for remote operations.

## Wide and open platform

Due to the variety of roles the vessel will be called upon to perform, catamaran hulls have edged to the forefront of the standard design and build. Catamarans can offer the beam and stability demanded in both OSR activities and multi-roles. For example, the vessel should be able to deploy and recover a wide range of boom systems. Ideally, this should also be from the stern of the boat, offering a stable, wide and open platform. Other requirements include, but are not limited to integral or built-in skimming systems; dispersant spraying; debris collection; the operation of other OSR equipment; onboard oil or chemical storage; a jib crane for general lifting duties, and propulsion systems that are not overly burdened by electronics.

## The Pollcats

The range of DESMI Ro-Clean Pollcats (POLLution - CATamarans) has been specifically designed and manufactured to meet the above demands. With a range of steel boats from 10 meters to 24 meters in length, the Pollcats offer a variety of platforms which can be custom outfitted as required.

By utilising the catamaran hull, DESMI has integrated a dynamic rope mop oil recovery system that can be raised and lowered between the hulls. This feature allows for the vessel to travel up to five knots while maintaining near zero relative velocity between the rope mops and the water. Typical boom or cusp recovery systems are restricted to below one knot recovery speeds, which can be easily upset by currents, tides, and even the speed of the vessel at tickover on the main engines. The DESMI mop system overcomes these issues and can operate at a claimed five times the speed of conventional OSR vessels.

The recovered pollutant can be stored in the high capacity tanks mounted in each hull. The tanks are linked and an onboard, positive displacement pump allows for tank to tank and ship to ship operations. The Pollcats can also carry a quantity of DESMI Ro-Clean temporary storage tanks which can be deployed, filled and marked ready for other vessels to recover, allowing the Pollcat to remain on station. The DESMI Ro-Clean Pollcat is usually fitted with 6.5 meter dispersant spray arms with in-built pumps


A Pollcat at sea.

The command center and bridge of a typical Pollcat.

and dispersant tanks. This allows the operator to use either neat or dilute dispersant and deploy over an impressive swath. The system can be operational within minutes, making a quick, first response a reality where dispersant use is approved.

Below decks, the Pollcat is offered with Doosan diesels as standard, with power ratings up to 480 horsepower. With an engine in each hull, the owner has choices of operational modes. In addition, a 160 horsepower diesel driven hydraulic power pack not only powers the unique mop system but the jib crane and capstan. Sufficient capacity is available to power other skimmers, pumps and booms through deck connections controlled either through a bridge mounted console or by a remote unit also mounted on deck. The Pollcat bridge is mounted some 2.5 meters above the deck, making for an excellent command center during all activities. The Pollcat can also recover surface debris. By lowering a discreet debris basket sitting below deck and between the hulls, the vessel can simply scoop and recover into the basket. The latter can be emptied and positioned by the onboard jib crane.

## The future

DESMI Ro-Clean has delivered five vessels to destinations as diverse as West Africa and South America. Despite the disaster, Deepwater Horizon has produced some positive effects. It has returned focus sharply toward oil spills, on everything from planning and equipment to disposal and logistics. The industry as a whole has enjoyed something of a revival, with the importance of having the correct range and combination of robust and reliable equipment systems available greater now than it ever was.

One of the 360HP, 6 cylinder main engine powering the Pollcat.

Looking forward, DESMI Ro-Clean is hoping to expand its market even further. Innovations over the last 18 months include single point boom inflation through the reel, a speed sweeping system using the Ro-Boom containment boom, an offshore umbilical skimming system, and the Arctic Range designs. There are intended specifically for the environmentally harsh but ecologically delicate polar climates. Listening to its clients, DESMI continues this train of smart engineering as well as supplying clients with custom products where appropriate. With this, over the next few years, DESMI are moving to the next level in which they will promote all the products, services and segments that sit under the DESMI name.

### ABOUT THE AUTHOR

**Andrew Nash** is a qualified Mechanical Engineer and holds a Diploma in Management Studies. He has been involved in the design and specification of equipment, including pumps and oil spill equipment to the oil and gas market for over 30 years. Andrew also has vast experience in the overseas markets. He has lived in South Africa, Saudi Arabia and the UAE. While overseas, Andrew also qualified as a rescue diver where his interest with the environment began.

### ABOUT THE COMPANY

**DESMI Oil Spill Response** has a pedigree that can be traced back to over 180 years of operation and is the proven and trusted product of the industry. Weather the requirement is for the offshore or the shoreline area; the arctic or equatorial environment. DESMI Oil Spill Response Equipment delivers proven solutions including oil spill recovery vessels, for all spill conditions.

### ENQUIRIES

DESMI Ro-Clean Ltd.
Unit 19, Shamrock Quay William Street
Southampton SO14 5QL, UK
Tel: +44 2380 829751 Direct: +44 7776 258890
Fax: +44 2380 339190 Mobile: +44 7776 258890
Email: ana@desmi.com Web: www.desmi.com

# Being prepared for mass, coastal and offshore oil spill recovery

**Ary van den Adel**, Sales and Project Manager, Koseq B.V., Puttershoek, The Netherlands

During a mayor offshore oil spill, response teams are facing difficult challenges. Going out to the casualty as quickly as possible is vital, however, collecting the oil in order to minimize the environmental impact of the oil coming ashore is not an easy task.

Boats normally carry oil containment booms and skimmers, mobilised from the various stock piles at response centers. When the spill is not too big, they might be able to get the oil booms around it to contain the oil. Response crews are often able to deploy the oil boom but face numerous difficulties maintaining the oil boom at sea in its required position due to currents, wind and wave action. Although it is already difficult to maintain an oil boom in rough sea conditions, it is even more difficult to get a large oil skimmer within the oil boom to collect the oil. Therefore, it is important to get to the scene with the right equipped offshore oil spill response vessels (OSR vessels) to avoid spreading of the oil spill.

The mere size of an oil spill marks the need for possessing large dedicated OSR vessels, equipped with high capacity remote operated vehicle (ROV) type skimmers and rigid sweeping arm systems, at stand-by at busy shipping lanes, touristic beach areas and offshore oil fields.

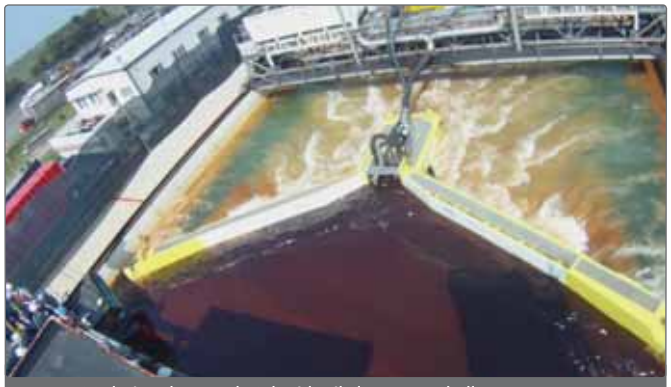
## Previous oil spill recoveries

History has shown us that often after a mayor offshore oil spill disaster, national and local authorities commenced to build OSR vessels or contracted dedicated offshore OSR vessels, as their existing vessels and equipment meant for inland incidents were not adequate to collect large amounts of oil at sea.

After the oil spill incident in 1999 with the tanker Erika in France, the European Maritime Safety Agency (EMSA), provided funds to interested tanker and offshore vessel owners to equip their vessels with adequate offshore OSR equipment. Now EMSA has 19 vessels under contract and fitted out to their established standards. The contracted vessels continue their normal commercial business within a certain pre-fixed area and only once an oil spill occurs do they pick up their OSR equipment and proceed to the affected area to recover the spill.

The Spanish Government opted, after the incident with the Prestige tanker, in November 2002, to build four large offshore OSR and emergency towing vessels (ETV) and one OSR tanker. It was also demonstrated that Spain had not the right OSR vessels to combat such a mayor oil spill and had to get, amongst others, the assistance of the Dutch Coast Guard dedicated OSR vessel Arca, the Dutch suction trailing hopper dredger Rijndelta and the German coast guard vessel Neuwerk. These vessels showed their effectiveness to recover large quantities of oil from the ocean under severe weather conditions using the Koseq, rigid sweeping arm systems. Pumps mounted in the arms are of the hydraulically driven submersible Archimedes Screw type, having each rigid sweeping arm a pumping capacity of 350 cubic meters per hour.

The BP Montana oil field blow out, April 2010, in the Gulf of Mexico showed that a large number of dedicated vessels were required to cope with such a huge offshore oil spill. The light containment oil booms got washed ashore and the shrimp boats were not properly prepared to act as oil spill recovery vessels, although, having done a very good job to fish large quantities of the floating oil.



Koseq VOS during the Wendy Schmidt oil cleanup X-Challenge.

However, based on the success of using large vessels equipped with rigid sweeping arms in Europe, the US Coast Guard and BP requested that rigid sweeping arms were flown in from Holland to Texas and Louisiana to help with the Montana oil spill. The main difference between an oil boom and the rigid sweeping arms is that an oil boom has to contain the oil first, whereas, the rigid sweeping arm chases the oil, enabling the vessel to move through the oil and manoeuvre in such a way that the best optimum angle is reached to collect large volumes of oil from the water surface.

Koseq BV was able to airlift 16 to 15 meter long dismountable rigid sweeping arms and their corresponding hydraulic power units and ancillary equipment to Houston and New Orleans. T&T Marine Salvage Inc. of Galveston, Texas, who had purchased the rigid sweeping arms from Koseq BV. However, the corresponding handling cranes were not shipped as they require ship based crane pedestals, which were not feasible to install in such a short timeframe. Instead, T&T installed a mobile crane on each of the vessels to deploy and retrieve the rigid sweeping arms. Operating the arms by only one crane on a rolling vessel is not very safe to crew and

Koseq compact 502 containerized self-deploying OSR system.

equipment, and is also difficult to handle. After the first 16 rigid sweeping arms, T&T ordered six more arms which were transported by sea. All 22 of the 15 meter rigid sweeping arms and corresponding equipment are now in store in the US, stationed along the coasts at response centers, in Texas, Louisiana and Mississippi, ready to be use at any moment.

History shows over and over again that being prepared is not easy to accomplish when having to respond successfully to mayor offshore oil spills, however, the general public expect their communities and officials to be as prepared as fire brigades. Operating rigid sweeping arms, weighing 5000 kilograms from a supply boat, without the use of purpose built arm handling cranes, is not an easy task and minimizes the workability of the vessel.

## Modular crane pedestal system

We at Koseq BV understand that it is not feasible to have dedicated OSR vessels in every main port or at busy shipping lanes around the globe. However, having access to vessels of opportunity (VOO) for small and major coastal and or offshore oil spills would dramatically enhance efficiency of the responder. Turning a VOO within hours into a proper OSR vessel with rigid sweeping arm systems is now possible due to the newly Koseq developed, innovative modular crane pedestal system. Together with the cranes, modular crane pedestal systems work with rigid sweeping arms and hydraulic power units can be lifted on board any VOO, and be operational within 12 hours. This saves the responder, oil companies and others high sums of money not having to possess specialized OSR vessels and therefore avoid associated costs. Furthermore, Koseq redesigned the Compact 5 meter long rigid sweeping arm system enabling the oil spill responder to transport the unit quickly on a small truck and/or aircraft.

For quick response, Koseq designed a containerized self-deploying system, making use of the Compact 5 rigid sweeping arm. The Compact 5 arm is placed in a 20 foot container frame and deployed by a built-in hydraulically operated marine knuckle boom crane. The container possesses also the diesel driven hydraulic power unit and two counter weight water tanks for stability. The pump mounted in the Compact 5 is of the hydraulically driven submersible Archimedes Screw type having a capacity of 150 cubic meters per hour.

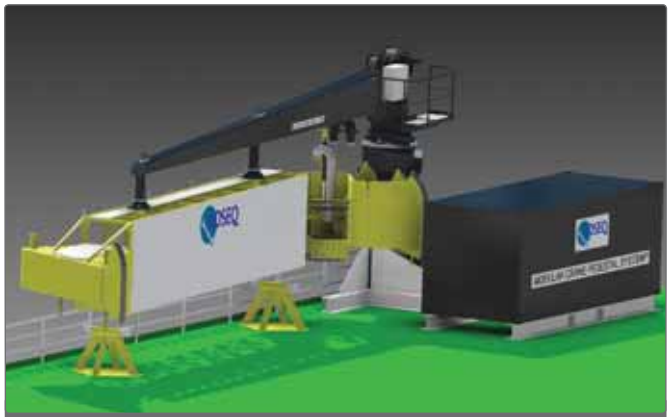
The container frame is covered with a tarpaulin and has ISO corners for handling. This way the 20 foot container can be on stand-by at any harbor side or jetty, ready to be used on any vessel or barge. These two new developments give the responder the opportunity to be immediately ready for small and major offshore oil spills, without the need to have the necessary vessels on their books or permanently under contract.

After the Montana oil spill, Koseq BV was among the ten selected finalists of oil spill equipment manufacturing companies who were invited by the Wendy Schmidt Oil Cleanup X-Challenge to participate in an oil spill recovery competition at the Ohmsett facility in New Jersey, USA.

Koseq BV participated with its X18 Victory Oil Sweeper model, its proven V sweep design and reached third place, collecting with the full 18 meters sweeping width 3472 gallons per minute (789 cubic meters per hour) with a maximum oil content of 95.3 percent. However, due to mechanical problems of the Ohmsett towing train device we had to reduce on speed and close our system to a sweeping width of only 9 meters! Even with our system downgraded, we reached a high oil content of 99.4 percent and a volume of 2390 gallon per minute (543 cubic meters per hour) and still got third place.

Koseq compact 502 – containerized self-deploying OSR system as stored on the deck.


Koseq modular crane pedestal system – configuration.



Koseq modular crane pedestal system – configuration 2.

### ABOUT THE AUTHOR AND COMPANY

**Ary van den Adel** commenced his professional career in 1967 with Wijsmuller Salvage B.V. as Salvage Diver. He co-founded the Spanish Diving and Salvage company Tecnosub, S.L. in 1975 and worked in Tecnosub as Technical Director and Salvage Master on many salvage and oil spill recovery projects in Spain, Portugal, Abu Dhabi, Libya and Mauritania. Since 2002 he has been the International Sales Manager for KOSEQ B.V.

**Koseq B.V.** is the inventor and manufacturer of the rigid sweeping arm, which has proven itself as being the best tool for the recovery of spilled oil offshore. The recently developed victory oil sweeper and compact sweeping arm are very well suited for oil recovery in harbors and rivers.

### ENQUIRIES

During Interspill 2012 in London you may find Kosaq at their booth W 600.

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**www.iala-aism.org**

## The International Association of Airport and Seaport Police (IAASP)

The International Association of Airport and Seaport Police (IAASP) is a worldwide, non-governmental and non-profit association dedicated to mutual co-operation in setting the highest standards of safety, security and law enforcement regarding the transportation of persons and property through air and seaports, across boundaries and other terminals. It was recognised in the late 1960s that there was an urgent need for police and other law enforcement agencies to develop a faster means of exchanging information and intelligence internationally. In 1969 the IAASP, the oldest and largest international police association of its kind, was formed, bringing together representatives of police, other enforcement agencies and the transportation industry in the movement of passengers and cargo at airports and seaports around the world. For the first time, a professional approach to policing airports and seaports was possible worldwide.

**www.iaasp.net**

## The World Customs Organization (WCO)

As the only intergovernmental organization with a unique Customs focus, the World Customs Organization (WCO), with its headquarters in Brussels, was established in 1952. It currently has 169 members across the globe, at all stages of economic development, who collectively process approximately 98% of world trade. The WCO is particularly noted for its work in areas covering the security and facilitation of the trade supply chain; the development of global Customs standards, the simplification and harmonization of Customs procedures, trade facilitation, risk management, integrity promotion, valuation, origin, the Harmonized System goods nomenclature, and sustainable Customs capacity building initiatives. Being the global centre of Customs expertise, the WCO provides an ideal forum for Customs administrations and their stakeholders to exchange experiences, and share best practices on a range of international Customs and trade issues.

**www.wcoomd.org**

## The International Maritime Pilots Association

The International Maritime Pilots Association is a forum for the exchange of information. Its main objective is to provide a representative voice for pilots in international maritime forums, particularly at the International Maritime Organisation (IMO), an agency of the United Nations, and the International Maritime Law-Making body. Consultative status at the IMO was formally granted in November 1973, and since that time IMPA delegates have played a very active role in the work of the organisation.

**www.impahq.org**

## ICHCA International

ICHCA International represents cargo-handling interests in the international field and is the only one to do so. It was founded in 1952 and for many years was run as an Association. The acronym stands for International Cargo Handling Coordination Association but in 2002 it became incorporated and took the name ICHCA International Ltd. Its role is to speak for cargo-handling interests at an international level and to consult, inform and advise its members accordingly. It has a worldwide membership and is a recognised Non-Governmental Organisation (NGO) with ILO, IMO, ISO and UNCTAD. It also liaises closely with other international bodies such as IAPH. It works through a number of panels and groupings and publishes a bi-monthly electronic newsletter, an annual publication "Cargo World" and many authoritative advice and guidance documents.

**www.ichca.com**

## AIM

AIM is the global trade association for automatic identification and mobility technologies. AIM members are providers and users systems that capture, manage and integrate accurate data into larger information systems. As a not-for-profit industry organization, AIM's mission is to stimulate the understanding and use of the technology by providing timely, unbiased and commercial-free information.

**info@aimglobal.org • www.aimglobal.org • www.rfid.org**

## International Harbour Masters Association (IHMA)

The objectives of the International Harbour Masters Association (IHMA) are to promote safe and efficient marine operations in port waters and to represent the professional standing, interests and views of harbour masters internationally, regionally and nationally.

**www.harbourmaster.org**

## The Coasts, Oceans, Ports and Rivers Institute (COPRI)

The Coasts, Oceans, Ports and Rivers Institute (COPRI) was founded in 2000, as one of the American Society of Civil Engineers' (ASCE) seven technical institutes. COPRI works to advance and disseminate scientific and engineering knowledge to its diverse membership, which is engaged in sustainable development and the protection of coasts, oceans, ports, waterways, rivers and wetlands. COPRI works to enhance communication and co-operation among our more than 3,000 members, both domestic and abroad, and the industry as a whole by advancing our members' careers, stimulating technological advancement and improving professional practice. With 16 technical committees, COPRI provides members with the opportunity to change the face of the industry, from actively developing policy change to developing standards and technically sound programs such as conferences and workshops. COPRI's committees are comprised of all members of the profession including: engineers, academicians, planners, elected and appointed officials and more.

**www.coprinstitute.org**

## CEDA

Members of CEDA are drawn from Europe, Africa and the Middle East. The Western Dredging Association (WEDA), serving the Americas, and the Eastern Dredging Association (EADA), serving the Asian and Pacific region, are autonomous sister associations which share the aims of CEDA. The three sister associations from the World Organisation of Dredging Associations (WODA). CEDA who are the Central Dredging Association promote the exchange of knowledge in all fields concerned with dredging. They enhance contacts between the various groups from which members are drawn and between the dredging fraternity and the rest of the world, enhancing understanding of dredging works from both theoretical and practical viewpoints. They also co-operate with other international organisations to safeguard the interests of the dredging profession.

**www.dredging.org**

## The International Association of Dredging Companies (IADC)

The International Association of Dredging Companies (IADC), headquartered in The Hague, is a trade organisation with more than 50 main and associated members in the private dredging sector, all of which operate sizeable fleets and are active in the world market. IADC companies have been involved with every major international dredging project of the last century. Their objectives are to advance fair trade practices and standard contracts to establish sound environmental practices, and to publish and encourage the publication of information about technological advances in the dredging industry. IADC works to attract worldwide recognition for the dredging industry in general and to increase the public's awareness of the significant contributions of dredging towards economic growth and prosperity.

**www.iadc-dredging.com**

## The International Association of Ports and Harbours (IAPH)

The International Association of Ports and Harbours (IAPH) is a worldwide association of port authorities whose principle objective is to develop and foster good relations and co-operation by promoting greater efficiency of all ports and harbours through the exchange of information about new techniques and technology, relating to port development, organisation, administration and management. Promoting co-operation among ship owners, shipping lines and other parties, the IAPH have been granted consultative status as a Non-Governmental Organisation from the following United Nations Agencies: International Maritime Organisation (IMO), United Nations Conference on Trade and Development (UNCTAD), Economic and Social Council (ECOSOC), United Nations Environmental Programme (UNEP) and the World Customs Organisation (WCO).

**www.iaphworldports.org**

## The Ports and Terminals Group (PTG)

The Ports and Terminals Group (PTG), based in London, is the UK's leading ports trade association. PTG's mission is to help facilitate its members' entry into, or growth of their businesses in, overseas markets; and in doing so assist port organisations and governmental authorities worldwide to undertake port development and expansion on a build-operate-transfer or similar basis.

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