



- Terminal tugs
- GREENCRANES
- Simulation in VTS training
- Port Community Systems



SUSTAINABLE SHIPPING
LNG – fuelling debate



TRENDS IN THE BULK SUPPLY CHAIN
A terminal operator perspective



RISK MANAGEMENT
Fail to prepare, prepare to fail



Bringing Skill & Automation Together

TMEIC's advanced control and automation systems assist the operator, improving performance and reducing downtime.

When you are ready to bring skill and automation together – contact TMEIC.

TMEIC
We drive industry

www.tmeic.com

Phone: +1-540-283-2250

Email: MH@tmeic.com

1325 Electric Road

Roanoke, Virginia 24018 USA

Published by:
Maritime Information Services Ltd
5 Prescot Street
London, E1 8AP
United Kingdom

Tel: +44 (0)207 871 0123
Fax: +44 (0)207 871 0101
E-mail: info@porttechnology.org
Website: www.porttechnology.org

The entire contents of this publication are protected by copyright, full details of which are available from the Publisher. All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means electronic, mechanical, photocopying, recording or otherwise without prior permission of the copyright owner.

Commercial Director:
James AA Khan
jkhan@porttechnology.org

Editor:
Linton Nightingale
lnightingale@porttechnology.org

Business Development Manager:
Emmanuel Alade
ecalade@porttechnology.org

Key Account Manager
Daniel Ledger
dledger@porttechnology.org

Design & Production:
Tina Davidian

Printed by:
Buxton Press Ltd

Front cover:
The Ore Fabrica 285,000 DWT floating hub: Iron ore transhipment operation from 400,000 DWT Valemaxes onto capesize feeders - even the world's largest floating terminal is not too much for us. Bedeschi and Liebherr provided the cargo handling equipment. Logmarin design, advise and supervise.

For more information please visit:
www.bulklogisticlandmark.com



Sixtieth Edition, November 2013
ISSN: 1358 1759

While every effort has been made to ensure the accuracy of the contents of this book, the Publisher will accept no responsibility for any errors or omissions, or for any loss or damage, consequential or otherwise, suffered as a result of any material here published. The opinions expressed in the enclosed editorial are the sole responsibility of the authors and organisations concerned and not those of the Publishers. Neither Maritime Information Services Ltd nor its Agents accept liability in whole or in part howsoever arising from the content of the editorial published herein.

Foreword



I would like to begin our final issue of the year by looking ahead to the next, one that promises to be extremely exciting at PTI HQ. Last issue, I commented on China's growing influence on our industry and since then this has grown even further with the official opening of the Shanghai free trade zone. This has proved an overwhelming success with as many as 597 companies signing up in the first day alone to take advantage of new measures introduced to ease corporate registration and customs clearing procedures. Throughout 2014 we will look at the growth opportunities being offered by China and

how its port equipment and machinery solution providers have already started to offer their solutions overseas. Our focus will be complemented by a dedicated section in the journal and Chinese language news via our online platform and bi-weekly newsletter.

In this issue, we also focus on another area of change that is likely to have a profound impact on the global shipping community. In a little over a year the IMO's stricter sulphur emission standards will come into force, prompting the industry to explore the most cost-effective and practical solutions to meet these targets. Given its good environmental performance, the general consensus is that a shift from conventional ship fuels to LNG is the most viable option. However, there are still issues that need to be ironed out before the transition can run smoothly. These crucial challenges are highlighted in this issue by the PortEconomics team, who note the gaps in the existing regulatory framework and highlight the concerns related to both the economic viability and technological feasibility of its implementation (page 15).

With the number of LNG-fuelled vessels set to rise, as more and more cargo carriers continue to place orders, industry heads have been prompted to come together to form initiatives aimed at providing ports with a blueprint for safe bunkering operations. The progress of one such initiative, the LNG Fuelled Vessels Working Group, chaired by the Antwerp Port Authority in collaboration with other ports including Hamburg, Le Havre and Los Angeles, is the focus of an article provided by the Belgian port in our Environment & Sustainability section (page 82).

In keeping with the theme of industry collaboration is Greencranes. This four-year programme through its three-member states Spain, Italy and Slovenia, including public administration, ports and industry partners, aims to provide key port and terminal decision makers with the necessary tools to increase the energy efficiency of their cargo handling equipment. Turn to page 79 for a special contribution from José Andrés Giménez from the Valenciaport Foundation on the programme's progress and plans going forward.

Another issue that has been at the forefront of discussion in recent times is the impact of the Panama Canal expansion. Its completion will be no more keenly felt than in Latin America, where the region's export business is being held back by its creaking port infrastructure. If this is addressed, as explained by Water Kemmsies from Moffatt & Nichol, then Latin America, driven by the expansion of the Panamanian waterway, can become a robust and thriving economy (page 18).

Other highlights in this issue include contributions from industry stalwart Captain Terry Hughes (page 64), who discusses the outcome of the IALA's first ever seminar on simulation in VTS training held in the Netherlands, and MUC Engineering's Gert-Jan Roelevink. Gert was a key member of the engineering team behind the rapid expansion of Fujairah Port's oil tanker terminals, which has seen the port increase to such a size it can be compared to that of Singapore or Rotterdam. You can read his article on page 60.

Finally, I would like to take this opportunity to welcome Orbita Ingenieria, TMEIC and Varian as the first of our industry partners, and on behalf of everyone here at Port Technology International I want to wish you all a happy New Year and prosperous 2014.

Linton Nightingale
Editor

Email: lnightingale@porttechnology.org
Visit our website at www.porttechnology.org

 @PortTechnology

 <http://linkd.in/porttech>

Our Partners in Publishing



International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA-AISM) gathers together marine aids to navigation authorities, manufacturers and consultants from all parts of the world and offers them the opportunity to compare their experiences and achievements.
www.iala-aism.org



International Association of Airport and Seaport Police-InterPortPolice is a worldwide, non-governmental and non-profit association dedicated to mutual cooperation 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.
www.interportpolice.org



The World Customs Organization (WCO) is the global centre of customs expertise and research, with a primary mission to enhance the effectiveness and efficiency of customs administrations. It is an ideal forum for the organization's 177 members, who collectively process over 98 percent of world trade, to exchange experiences and share best practices on a range of international customs and trade issues.
www.wcoomd.org



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.
www.impahq.org



ICHCA International speaks for cargo handling interests at an international level and consults, informs and advises its members accordingly. It has a worldwide membership and is a recognised Non-Governmental Organisation (NGO) with ILO, IMO, ISO and UNCTAD.
www.ichca.com



AIM is the global trade association for automatic identification and mobility technologies. 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) promotes safe, efficient and secure marine operations in port waters and represents the professional standing, interests and views of harbour masters internationally, regionally and nationally.
www.harbourmaster.org



PortEconomics is a web-based initiative aiming at generating and disseminating knowledge about seaports. It is developed and empowered by the members of the PortEconomics group, who are actively involved in academic and contract research in port economics, management, and policy. Since October 2012, Port Technology International and PortEconomics have been engaged in a partnership.
www.porteconomics.eu



The Coasts, Oceans, Ports and Rivers Institute (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 cooperation among more than 3,000 members, both domestic and abroad, and the industry as a whole by advancing members' careers, stimulating technological advancement and improving professional practice.
www.coprinstitute.org



CEDA 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.
www.dredging.org



The International Association of Dredging Companies (IADC) is a trade organization 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 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 Harbors (IAPH) is a worldwide association of port authorities, whose principle objective is to develop and foster good relations and cooperation by promoting greater efficiency of all ports and harbors through the exchange of information about new techniques and technology, relating to port development, organisation, administration and management.
www.iaphworldports.org



The Ports and Terminals Group (PTG) 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 organizations and governmental authorities worldwide to undertake port development and expansion on a build-operate-transfer or similar basis.

SUPPORTER COMPANIES

APM TERMINALS  Lifting Global Trade.



Port Technology International is supported by leading terminal operator networks, including APM Terminals and DP World.

APM Terminals is an independent business unit and operates a global port and terminal network of 50 facilities with 22,000 employees in 34 countries.

DP World is one of the largest marine terminal operators in the world, with 49 terminals across 31 countries.



TOC
CONTAINER
SUPPLY CHAIN
A S I A
www.toc-events.com

8-9 April 2014
 Marina Bay Sands Hotel
 Singapore

The pan-Asia conference for people who own, move and handle containerised cargo

- Container Supply Chain Conference
- Port Tour
- Technical Conference
- Networking
- Supplier Exhibit Area
- Social Programme



➤ Book your promotional package today

Part of 	Supported by 	Evening Reception Sponsor 	Sponsors 	Global Media Sponsor 	Media Partner
-------------	------------------	-------------------------------	--------------	--------------------------	-------------------

Contact us at www.tocevents-asia.com



Contents

- 1 INTRODUCTION
- 2 PARTNERS IN PUBLISHING
- 4 COVER STORY
Feasibility study: A critical step for life-long gains!
Logmarin Advisors, Genoa, Italy
- 8 NEWS DIGEST

- 11 GLOBAL ISSUES
- 12 **The challenges facing the global container terminal sector**
Neil Davidson, senior analyst - ports & terminals, Drewry Maritime Research (Drewry Shipping Consultants Ltd), London, United Kingdom
- 15 **LNG as a ship fuel: perspectives and challenges**
Siyuan Wang and Professor Theo Notteboom, ITMMA, University of Antwerp, Belgium
- 18 **Unleashing the rest of Latin America's potential**
Walter Kemmsies, chief economist, Moffatt & Nichol, New York, United States of America

- 20 PORT PLANNING, DESIGN AND CONSTRUCTION
- 21 **Valencia port efficiency boosted by a community system**
José García de la Guía, port community system manager, Valencia Port, Spain
- 25 **Reconstruction and deepening projects at Maydon Wharf**
João Martins, head of engineering, and Ernst Weber, senior project manager, sheet piling, ArcelorMittal, Esch-sur-Alzette, Grand Duchy of Luxembourg
- 27 **Considering the perspectives of port users**
Mary R Brooks, editor, Elsevier's Research in Transportation Business and Management, Halifax, Canada, and Thanos A Pallis, associate professor, Department of Shipping, Trade and Transport, University of the Aegean, Greece
- 29 **Ground improvement techniques allow flexibility for ports**
Jeffrey R. Hill, PE, senior engineer, Hayward Baker Inc., St Louis, Missouri, United States of America

Feasibility study: A critical step for life-long gains!

Decisions made at the project feasibility stage have a by far greater influence than those made at later project stages.

Logmarin Advisors, Genoa, Italy



Despite the global economic downturn and the depressed market of some commodities, the demand for electricity is still growing and the shipping market is changing under the influence of several aspects such as, the trend towards utilisation of larger vessels,

the new Panama Canal and increasing environmental awareness. Moreover, new mines are often located in remote locations with a lack of shore and maritime infrastructure, while a number of new power stations are also located in places affected by ailing infrastructure and shallow waters. Therefore, more than ever, both ends of supply chains are facing major challenges and risks which may lead to significant impacts on commodity competitiveness and ultimately on project feasibility and investment decisions.

A solid knowledge of the market and of the material to be handled, together with technical and operational know-how, is fundamental to producing a solution that delivers value to the client.

The importance of a global approach to the 'door to door' supply chain principle has been recognised by Logmarin advisors since the company was launched under the Italian classification society - RINA.

To determine the most efficient supply chain, it is necessary to undertake a comprehensive feasibility study leading to a business plan. This should be based on a variety of considerations such as: identification of commercial and operational needs; environmental impact; land availability and access to deep water sea; financial analysis; infrastructure planning; designing requirements; civil engineering; risks and ship market analysis.

The world's largest floating terminal ever built is strategically located in the Philippines. It was developed to overcome the Chinese ban preventing the Valemax to enter their ports. Logmarin was involved with all stages of the project from the feasibility study and site selection to the engineering, risk assessments, procedures and check-lists, and also provided assistance in commissioning.

To compete and succeed in today's economy; each supply chain needs to be considered as unique. Suppliers and industry players must understand the economic trade-offs of their decisions and act accordingly. To support clients in the decision-making process during the development of a new supply chain or the improvement of an existing one, Logmarin has customised a commercial software system to model and analyse the interaction between each link of the supply chain and to evaluate the impact of potential changes on the delivery cost of the commodity from the supplier to industry.

This allows each link's bottlenecks, (production, storage capacity, external traffic, weather conditions, port and river constraints, etc.) to be investigated and their interactions analysed and tested dynamically to ensure that they operate in an integrated and harmonious manner and achieve efficiency and effectiveness in the supply chain. In short, using this software - LOG.DES to simulate the entire supply chain in great detail, prevents the end-user from incurring unnecessary costs and helps to minimise the environmental impact while achieving the desired target.

In this competitive market it is not enough to work hard, it is necessary to work more smartly and with foresight. Any savings that can be made in the commodity supply chain costs reflects on the competitiveness of the supplier and consequently on the final product price. Logmarin's team concentrates all efforts, expertise, creativity and technology to manage the bottlenecks of its clients' commodity supply chain by providing customised solutions to bridge the logistical gap between suppliers and end users.



31 CONTAINER HANDLING

32 The case for automated RTG container handling

Thomas Gylling, head of port cranes process automation, Konecranes, Hyvinkää, Finland

38 Options and opportunities of container weight verification

Adrian Coventry, director of engineering, Strainstall Marine, Cowes, Isle of Wight, United Kingdom

42 Track and trace at Portsmouth International Port

Mark Phippen, distribution manager, MMD Shipping Services Ltd, Portsmouth, United Kingdom

45 Your wharf maybe stronger than you think

Erik Soderberg, vice president, Yoshi Oritatsu, structural designer and Michael Jordan, CEO, Liftech, Oakland, California, United States

48 Intelligent IT methods as a driver for terminal efficiency

Leif Meier, project manager, Realtime Business Solutions EMEA, Hamburg, Germany

50 DRY BULK AND SPECIALIST CARGO HANDLING

51 Analysing terminal facilities for biomass operations

Dr Mi-Rong Wu, consultant, TBA, Delft, The Netherlands

55 Trends in the bulk supply chain

Tim Borteel, commercial manager bulk, Euroports, Antwerp, Belgium

57 Loading chutes for versatile bulk material loading

Henrik Frandsen, general sales manager, Cimbria Bulk Equipment, Herning, Denmark

59 OIL, GAS & CHEMICAL HANDLING

60 Port of Fujairah putting itself on the map

Gert-Jan Roelevink, maritime project manager, MUC Engineering, Fujairah, United Arab Emirates

63 VTS, NAVIGATION, MOORING AND BERTHING

64 Simulation in Vessel Traffic Service training

Captain Terry Hughes, FNI FRIN, Founder, International Maritime Consultancy, Gloucestershire, United Kingdom

69 Microbiologically influenced corrosion of pilings

Brenda J. Little, senior scientist for marine molecular processes, Richard I. Ray, physical scientist and Jason S. Lee, materials engineer, Naval Research Laboratory, Mississippi, United States

72 Efficient selection and deployment of terminal tugs

Marinus Jansen, technical innovations manager, Rotortug, Rotterdam, The Netherlands

75 Improving operations while simplifying regulatory compliance reporting

Jason Tieman, director of maritime operations, PortVision, Houston, Texas, United States

78 **ENVIRONMENT AND SUSTAINABILITY**

79 **GREENCRANES: Testing the way to sustainability in ports**

José Andrés Giménez, research and development project manager, Valenciaport Foundation, Valencia

82 **Ports unite to propel liquefied natural gas technology**

The Antwerp Port Authority, Antwerp, Belgium

84 **Cavotec's shore power innovation hits new highs**

Luciano Corbetta, group market unit manager, Ports & Maritime, Cavotec, Milan, Italy

87 **Management as the engine of sustainability**

Wolfgang Hurtienne, managing director, Hamburg Port Authority, Hamburg, Germany

89 **CUSTOMS AND SECURITY**

90 **Multifocal sensor systems for port security**

Roland Meier, head of Panomera multifocal sensor systems, Dallmeier, Regensburg, Germany

93 **Crisis planning and preparation**

Andrew Taylor, chief executive officer, Bronzeze Group, London, United Kingdom



Advertisers Index

ABB AB Crane Systems	47	MARIN	67
AD Navigation AS	65	Orbita Ingeniera SL	35
Coaltrans USA	53	TMEIC	IFC
Elme Spreader AB	39	TOC Container Supply Chain: Asia	3
Igus GmbH	43	Transas Marine International	68
JW Fisher Mfg Inc.	23	Transport Events	10
Konecranes Finland Corporation	33	Vahle GmbH	41
KST BV	73	Valeport Ltd.	23
Liebherr Werk Nenzing GmbH	37	Van Oord	OBC
Logmarin Advisors SRL	FC & 4	Varian	IBC



DRIVE INBOUND MARKETING and lead generation with porttechnology.org

70% of all B2B business is conducted prior to any contact with the client (Forrester Research), meaning your clients are researching who they want to be in business with before contact is even made. B2B visitors are **digital natives** just like B2C. The barriers between your brand and any other brand is now simply **one click**.

- Porttechnology.org has more than 25,000 unique visitors every month;
- Porttechnology.org is ranked No.1 by Google for port related searches;
- Over 900 technical and white papers archived online;
- 5,000+ subscribers to our daily newsletter (73% use their company emails);
- Over 4,000 Twitter & 1,000 LinkedIn followers;
- Our Supplier Directory generates direct enquiries;
- Track visitors from your banners and website and remarket to them.

It's not just about advertising, it's about **Content in the right Context** which drives **"Inbound Marketing"** through all of your touch points for greater lead generation.

In a world of overwhelming and far too much random information which is unprocessed, often with little meaning and no value - **Porttechnology.org** remains Selective, Arranged and Measured 24/7/365.

Join our Preferred Partner/Supplier Initiative for 2014, we need partners who can handle the enquiries. Call James AA Khan | Commercial Director | +44 79462 14440 | jkh@porttechnology.org

Sailing to a sustainable future

The maritime industry's fundamental role

Linton Nightingale, editor, *Port Technology International*, London, United Kingdom

In September the shipping and port industry convened in London as the International Maritime Organisation (IMO) played host to its annual World Maritime Day. The principal theme was on the idea of sustainable development beyond Rio+20, last year's United Nations Conference on Sustainable Development, and with it the integral role that the maritime industry has to play not just in safeguarding its own future but the world as we know it.

Seaborne transportation represents approximately 90 percent of world trade and is the most cost-effective, energy efficient and emission efficient mode of transport. Affordable, relatively safe and secure, the world relies on the maritime industry for its energy, food and industrial

requirements. Therefore, maritime transport will be fundamental to sustain global economic growth as the two are intrinsically linked. These thoughts were propounded by IMO secretary general Koji Sekimizu on World Maritime Day who said that "it seems inevitable that shipping must be at the heart of sustainable development, and that shipping itself must ensure that its own development is also sustainable". To achieve this there must be an institutional framework to support the environmental, social and economic dimensions of maritime transport. Sekimizu sees the IMO as ideally placed to establish these multi-sectoral policies and provide a blueprint for countries to develop their maritime transport infrastructure in a safe, efficient and environmentally sound manner.

"It seems inevitable that shipping must be at the heart of sustainable development, and that shipping itself must, therefore, ensure that its own development is also sustainable."

Following Rio+20, the IMO Secretariat, in conjunction with a host of industry partners, developed a concept document for a Sustainable Maritime Transportation System (SMTS). The aim of the document, published to coincide with World Maritime Day - hence the theme - is threefold. First, and most importantly, it aims to highlight the importance of the maritime industry as a fundamental element of a more sustainable world. Second, it endeavours to provoke STMS discussion. The first example of this took place on World Maritime Day itself with the IMO hosting a symposium that invited the industry to converse and provide their initial thoughts on a global agenda for a sustainable maritime transportation system. Finally, the document seeks to identify the goals that are imperative to implementing the concept. The IMO lists a total of ten imperatives including safety culture and environmental stewardship, energy efficiency and ship-port interface, energy supply for ships, technology and innovation, maritime security and ocean governance. A qualified and flexible workforce is also a must.

However, the IMO make it clear that the SMTS needs to be coordinated.



Picture courtesy of the IMO

Koji Sekimizu, secretary general of the International Maritime Organisation.



Picture courtesy of the IMO

The International Maritime Organisation's headquarters, London, United Kingdom.

In Brief

In order to do this then the policies related to the components of the system must also be coordinated. Inevitably, as addressed by the secretary general, these policies will include shore-side entities related to the port sector but they will also need to be supported by a sound financial system given the cyclical nature of the shipping sector. Furthermore, if sustainable maritime development is to flourish then governments, national and international organisations, academic institutes, and every other stakeholder in the maritime transportation system, must be actively engaged so they can embrace both new technologies and new operational practices. Security is also a crucial element of the SMTS. The maritime sector will once again call for external assistance in the form of navy patrols, coast guards and customs, yet will have to ensure that it addresses its own security threats whether at sea or in port that have the potential to endanger crew and likewise cargo. The global distribution and availability of marine fuels is equally important to the SMTS, and more importantly ample access to clean energy and low-sulphur fuels to help meet the increasing demand from modern society for clean air and a greener environment. However, Sekimizu believes that the cost and burden of complying with the IMO's stringent emission control standards, due to be enforced in 2015, "should be shared equitably by society rather than pushed only onto the shipping industry".

This shared responsibility is the overriding theme of the STMS concept. If the concept is to prove successful then a collaborative effort is required from all concerned economically, socially and environmentally. The world's population of 7.1 billion is projected to increase by almost one billion come 2025, according to official UN figures, and to facilitate this rapid population growth the world will rely on shipping, without which it would simply be unable to function. With this in mind the importance of sustainable development within the maritime industry couldn't be more evident, yet everyone needs to get onboard quick sharp before it is too late and the proverbial ship sets sail. The IMO's call to action cannot be ignored.

ICTSI, PSA to build-operate Colombian container terminal

International Container Terminal Services, Inc. (ICTSI) and PSA International (PSA), through their respective subsidiaries, have agreed to jointly develop, construct and operate a new container terminal in Aguadulce Port, Colombia. ICTSI signed an agreement with Singapore's PSA wherein the latter would invest in Sociedad Puerto Industrial Aguadulce SA (SPIA), an indirect subsidiary of the Philippine-based operator, who holds the 30-year concession for the Aguadulce Port Project granted by the Agencia Nacional de Infraestructura of Colombia.

Conductix-Wampfler confirms Lasstec acquisition

The Conductix-Wampfler Group has announced the acquisition of Lasstec Sarl, headquartered in Sciez, France. Lasstec, with its Twistlock Load Sensing and Accident Prevention System, has a patented technology for the weighing of containers. This not only meets the needs of the stricter international requirements imposed by the IMO, says Conductix-Wampfler Group CEO Phillippe Lang, but is also the most "innovative solution" on the market. The contract, signed in September, included a mutual agreement to keep the purchase price confidential. Lasstec will be integrated into the Conductix-Wampfler Focus Market organisation.

Port Manatee & Pasha partner to serve Mexico-Florida auto trade

Port Manatee and the Pasha Group, a California-based global logistics firm, will join forces to create a new multi-purpose Ro/Ro terminal close to the entrance to Tampa Bay. Serving as a gateway to the burgeoning vehicle manufacturing industry in Mexico, the terminal will offer transit times one and a half days faster than routes calling the auto-handling ports on the Atlantic Coast. The project will include the construction of a vehicle processing facility and 30-acre terminal, with provisions in place for it to be expanded to 100 acres. Manatee's Berth 12, with its 40-foot draft, will be expanded to serve the proposed terminal.

Costa Concordia righted in 'perfect' operation

The Costa Concordia was successfully righted in September amid cheers from locals gathered on Giglio Island. Twenty months after the disaster, claiming 32 lives, it took just 19 hours to manoeuvre the vessel onto its keel. The operation to remove the stricken cruise ship was not only one of the most complex salvage procedures ever undertaken but one of the most expensive. The planning and execution of the operation cost more than €600 million. "It was a perfect operation," declared vice-president of Carnival Corporation, the ship's owner, Franco Porcellacchia. The Costa Concordia will be repaired so it can be towed away safely next year to be destroyed.

Van Oord and BAM International land \$460 million Moin contract

APM Terminals has appointed Dutch dredger Van Oord and BAM International to complete the first construction phase of its Moin Container Terminal in Costa Rica. The contract, worth US\$460 million, will be split on an almost equal basis with works scheduled to start during the first quarter of 2014 and expected to be completed within three years. The scope of work to be undertaken by Van Oord and BAM includes the build of a 1.5-kilometre reinforced shoreline and breakwater, a reclamation area covering 40 hectares, and the dredging of the access channel and turning basin. Van Oord will deploy a trailing suction hopper dredger, a cutter suction dredger and rock installation equipment to help realise the project, while BAM International will carry out soil improvements, construct the 650-metre quay, pavement and associated buildings and utilities.



For the latest news, and to register for our free daily news email service, visit

www.porttechnology.org



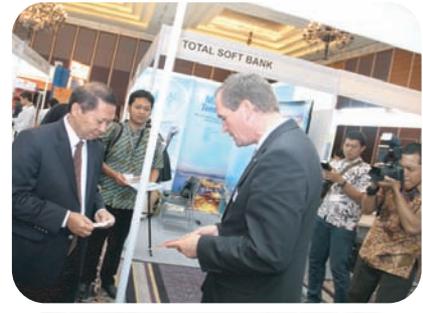
TRANSPORT EVENTS
www.transportevents.com

8th Southern Asia
 Ports, Logistics and Shipping 2013
 India

Wednesday 23 and Thursday 24 October 2013
 Supported by Jawaharlal Nehru Port Trust
 The Leela Kempinski Hotel Mumbai, India

11th Intermodal
AFRICA
 SOUTH 2013

Thursday 21 and Friday 22 November 2013
 Hosted by Transnet National Ports Authority
 The Boardwalk Convention Centre, Port Elizabeth, South Africa



8th INDIAN OCEAN
PORTS & LOGISTICS
 2014

Thursday 23 and Friday 24 January 2014
 Hosted by Mauritius Ports Authority
 Le Meridien Hotel, Mauritius

6th INTERMODAL ASIA
 2014

Thursday 27 and Friday 28 February 2014
 Supported by Port of Melbourne Corporation
 Intercontinental Melbourne The Rialto, Australia

12th Intermodal
AFRICA
 NORTH 2014

Thursday 27 and Friday 28 March 2014
 Hosted by Nigerian Ports Authority
 Lagos Oriental Hotel, Nigeria

2nd MED PORTS
 2014

Wednesday 23 and Thursday 24 April 2014
 Kenzi Farah Hotel, Marrakech, Morocco

10th TRANS Middle East
 DOHA 2014

Wednesday 21 and Thursday 22 May 2014
 InterContinental Doha The City, Qatar

12th ASEAN
PORTS & SHIPPING
 2014

Wednesday 11 and Thursday 12 June 2014
 Hosted by Indonesia Port Corporation I,II,III and IV
 JW Marriott, Jakarta, Indonesia



3RD BLACK SEA PORTS & SHIPPING
 2014

Wednesday 3 and Thursday 4 September 2014
 The Marmara Taksim Hotel, Istanbul, Turkey

12th Intermodal
AFRICA
 SOUTH 2014

Thursday 23 and Friday 24 October 2014
 International Convention Centre Durban, South Africa

9th Southern Asia
 Ports, Logistics and Shipping 2014
 India

Thursday 27 and Friday 28 November 2014
 Supported by Chennai Port Trust
 ITC Grand Chola Chennai, India



9th INDIAN OCEAN
PORTS & LOGISTICS
 2015

Thursday 29 and Friday 30 January 2015
 Hosted by Port Maputo
 Maputo, Mozambique

13th Intermodal
AFRICA
 NORTH 2015

Thursday 19 and Friday 20 March 2015
 Lagos, Nigeria

13th ASEAN
PORTS & SHIPPING
 2015

Wednesday 10 and Thursday 11 June 2015
 Hosted by Indonesia Port Corporation I,II,III and IV
 JW Marriott, Jakarta, Indonesia

13th Intermodal
AFRICA
 SOUTH 2015

Thursday 29 and Friday 30 October 2015
 Lusaka, Zambia





Global Issues



“The deployment of 18,000 TEU vessels on the Asia-Europe route means that a greater number of larger vessels will be cascaded onto other east-west routes, north-south trades and intra-regional trades. This is where the pain of growing ship sizes is likely to be more keenly felt by ports.”

‘The challenges facing the global container terminal sector’, page 12.

The challenges facing the global container terminal sector

Neil Davidson, *senior analyst - ports & terminals*,
Drewry Maritime Research (Drewry Shipping Consultants Ltd), London, United Kingdom

Drewry's latest analysis of the global container terminal sector shows that it remains dynamic and profitable, but that numerous challenges are looming.

PSA International, Hutchison Ports, APM Terminals and DP World remain the four big international players in equity twenty-foot equivalent units (TEU) and portfolio terms but with significantly varying levels of activity. DP World and APM Terminals are highly active in terms of acquisitions, divestments and greenfield developments; Hutchison is moderately active and PSA less so. ICTSI and Terminal Investment Limited (TIL) are also particularly active in terms of portfolio expansion. One thing is very clear – the focus of expanding global terminal operators, is on growth opportunities in emerging markets.

Major shipping lines meanwhile have

been selling stakes in terminals to raise cash. The deals involving CMA CGM's Terminal Link and MSC/TIL have been the most significant. Most carriers have seen little change in their terminal portfolios as a result, adopting a holding rather than expansion policy.

However, this is only one part of the story. There are a number of other significant players which are not yet classed by Drewry as global terminal operators, but they are growing fast and have a strong appetite for international expansion. These include GulfTainer, Bolloré, Yildirim, SAAM Ports and Ultramar for example and several large Chinese players, notably China Merchants Holdings International (CHMI) and Shanghai International Ports Group. These companies are challenging for inclusion in next year's Drewry league tables.

The top 10 global terminal operators

Drewry has developed a unique set of criteria for determining whether an operator should be classed as a global player for the purposes of its annual league tables. This is a deliberately exclusive club which allows focus on the activities and strategies of particular players.

In Figure 1, unless stated otherwise figures include total annual throughput for all terminals in which shareholdings are held as at 31st December 2012, adjusted according to the extent of equity held in each terminal. Figures do not include stevedoring operations at common user terminals and also exclude barge/river terminals. COSCO Group includes COSCO Pacific and COSCO Container Line, while PSA and HPH figures have been adjusted to account for

Ranking	OPERATOR	Million TEU	% share of world throughput
1	PSA International	50.9	8.2%
2	Hutchison Port Holdings	44.8	7.2%
3	APM Terminals	33.7	5.4%
4	DP World	33.4	5.4%
5	COSCO Group	17.0	2.7%
6	Terminal Investment Limited (TIL)	13.5	2.2%
7	China Shipping Terminal Development	8.6	1.4%
8	Hanjin	7.8	1.3%
9	Evergreen	7.5	1.2%
10	Eurogate	6.5	1.0%

Figure 1: Top 10 global terminal operators' equity based throughput, 2012. Source: Drewry Maritime Research.

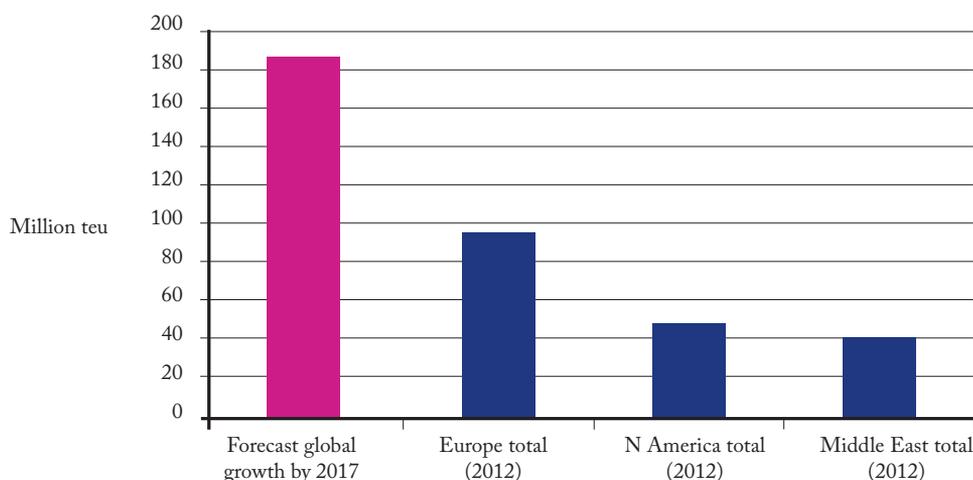


Figure 2: Forecast global container port demand growth in context. Source: Drewry Maritime Research.

PSA's 20 percent shareholding in HPH. Hutchison figures include HPH Trust volume. Please note that some of the figures are estimated.

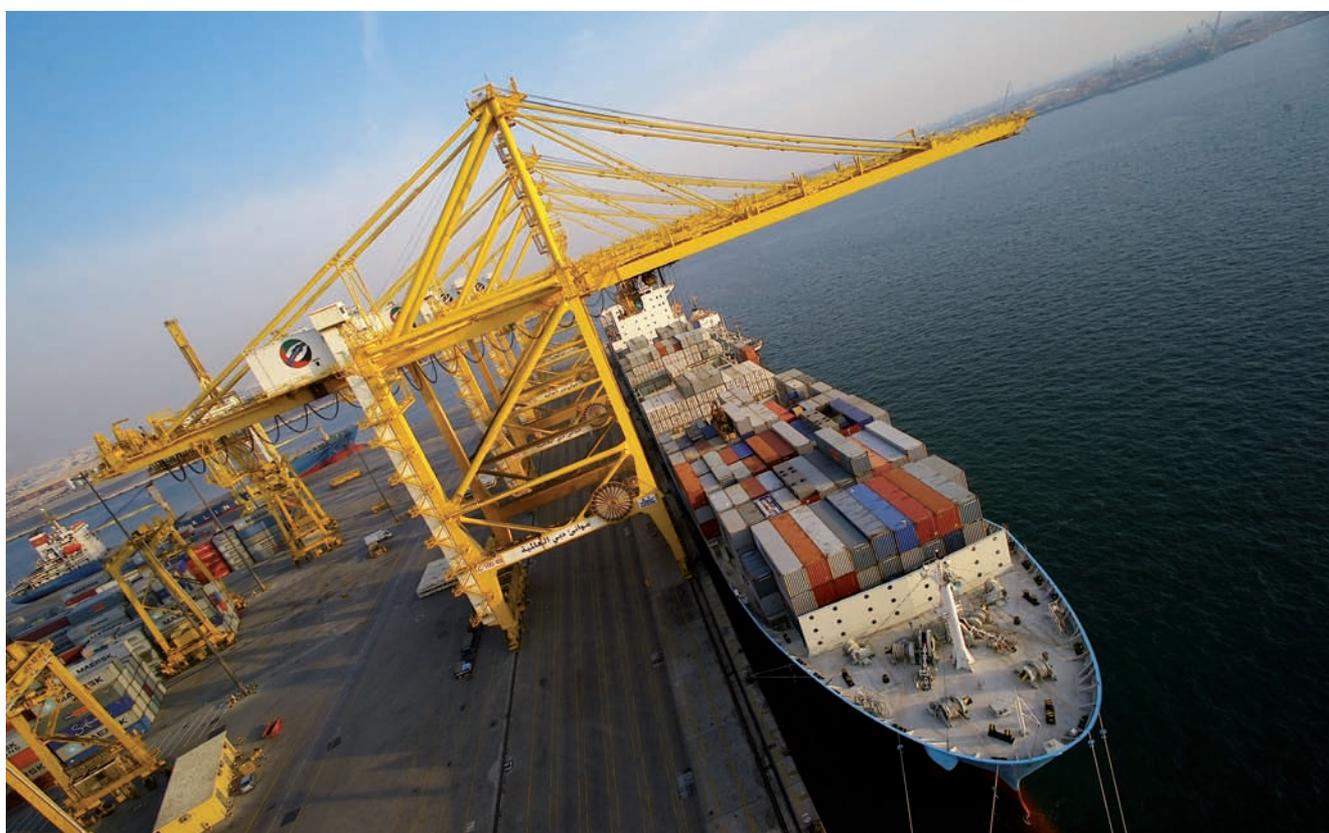
The big four global players (PSA International, Hutchison Ports, APM Terminals and DP World) had a combined share of the global market in 2012 of just over 26 percent. This was actually less than it was five years ago. Back then, they collectively held 29 percent. Several factors are behind this somewhat surprising statistic.

Firstly, container terminal ownership and operation remains an attractive business, so has attracted new players. The 2012 financial results of the existing main players showed another year of healthy profit margins and returns, and there are now plenty of other operators and investors fighting for a piece of the action. For example, outside of the top four players, the likes of COSCO Pacific, China Shipping Terminal Development and TIL have been growing rapidly.

Secondly, the big players are these days

equally happy to dispose of mature assets as they are to acquire new ones. They have adopted a portfolio management approach which is in contrast to the early days of the international terminals industry when it was almost a case of acquiring any asset, any place. Hence in the last few years, the likes of DP World and PSA have sold assets (or stakes in assets) in locations such as Hong Kong, Australia and the UK.

Thirdly, several major shipping lines have been selling stakes in terminals but



Picture courtesy of DP World

PSA International, Hutchison Ports, APM Terminals and DP World remain the four big international players in equity TEU and portfolio terms.

usually retaining majority control. Buyers have tended to be financial or emerging players rather than the big four terminal operators – perhaps because it is minority rather than majority stakes that are up for grabs. It seems inevitable given the financial pressures being experienced by a number of carriers, that there will be more disposals soon.

Looking at growth

On a more general level, container terminal operators and ports around the world face the challenge of growth on two fronts – growth in container demand and growth in ship sizes. While it is generally agreed that future container demand growth will not be as strong as the boom periods of the 1990s and 2000s, global container port demand is still forecast to exceed 800 million TEU per annum by 2017, growing by just over 5 percent per annum. However, percentage growth rates can be deceptive things. A compound annual growth rate of 5.4 percent per annum equates to an increase of 30 percent over 5 years. Add to this the fact that the global container port industry is now a huge business – with over 620 million TEU handled in 2012.

What this means is that based on Drewry's forecast, by 2017 the world's ports will be handling almost 190 million TEU more than today. To put this growth into context, this represents the equivalent of the entire throughput of all Chinese ports in 2012. Or to put it another way, it is more than the entire 2012 throughput of North America, Europe and the Middle East combined. This illustrates what a colossal industry the container port business has become – something that is often overlooked because it is geographically fragmented across nearly 1,300 terminals around the world and so the collective industry is somewhat under the radar.

Even modest demand growth now generates huge absolute increases in volumes. Drewry is forecasting 6.4 percent per annum growth for the Far East region over the next 5 years. This adds 89 million TEU to the market by 2017 (by far the biggest regional increase in absolute terms). At port level, the numbers are staggering. Even if Shanghai only performs at the world average of 5.4 percent per annum, it would add almost 10 million TEU to the port's total throughput by 2017. A figure of 10 million TEU is more than the entire container port throughput of the UK, India or Brazil.

Considering ship sizes

At the same time, container ship sizes are increasing dramatically. The largest

container ship in the world fleet has quadrupled in size since 1992, and in the Asia-Europe trade lane it has doubled in the last 10 years. The ever larger ships will strain the operational capability of ports, with a requirement to deliver faster handling speeds in order to maintain turnaround times. The fact that ships are not getting any longer is making this more challenging because simply deploying proportionately more cranes is not an option. In addition, handling such ships is not just about the quayside performance. The yard and landside also has to be able to keep up, including intermodal capacity.

At the same time, ever larger ships also continue the pressure for more alliances and cooperation between carriers in order to fill them, and so ports face the challenge of greater concentration of volume. Ship size growth has triggered for example most notably the P3 alliance between Maersk, MSC and CMA CGM.

Last but not least there will be greater cascading. The deployment of 18,000 TEU vessels on the Asia-Europe route means that a greater number of larger vessels will be cascaded onto other east-west routes, north-south trades and intra-regional trades. This is where the pain of growing ship sizes is likely to be more keenly felt by ports. The rampant and rapid cascading of larger ships into secondary trade lanes is likely to create more port problems and challenges than the 18,000 TEU monsters destined for the Asia-Europe trade lane and all ports and terminal operators have to rise to the challenge.

In conclusion

Drewry estimates that the world's container terminals had a turnover of around US\$45 billion in 2012 and taking a mid-range profitability margin, would have generated a global EBITDA of over US\$10 billion. However, while the industry is clearly consistently and satisfactorily profitable, it is one that requires substantial capital investment, and this requirement will remain highly significant in years to come. Using a ballpark benchmark investment cost of US\$350 million per million TEU of capacity (covering both terminal infrastructure and equipment), if the industry had to spend to accommodate all of the expected near 190 million TEU of volume growth, this would require an investment of the order of US\$65 billion over the next five years. Clearly this represents the upper end of the likely cost, as some of the growth will be accommodated in pre-existing capacity. Nevertheless, the required investment will be as colossal as the industry it will serve.

About the author



Neil Davidson has over 25 years experience in the port sector. He joined Drewry in 1997 and founded the company's ports practice. His current role is focused on Drewry's publications and new products in the ports and terminals sector. He has been closely involved as both contributor and editor of all of Drewry's annual and one-off port sector publications, and spoken at over 75 industry conferences and seminars worldwide. His previous consultancy experience included participation in port projects in global locations including Europe, Asia, the Americas, Africa and the Middle East. The work included buy and sell-side due diligence, privatisations, strategic advice, working for lenders as well as commercial and market analyses. Prior to joining Drewry he spent 8 years with the Port of Tilbury, London, specialising in business planning. He was closely involved in the successful management buy-out of the port in 1992, and its subsequent trade sale to Forth Ports plc in 1995. He also gained Freeport status for the port, acting as Freeport Manager for 2 years. A graduate of the Department of Maritime Studies, Cardiff University, his industry experience also includes working for Lloyd's of London and the Medway Ports Authority, Sheerness, UK.

About the company

Drewry is one of the world's leading international maritime consultancy and publishing organisations. Founded in 1970, the company has over 40 years' experience within the maritime sector, employing over 90 specialists across offices in London, India, Singapore and Shanghai. The company provides research reports and consultancy services with a brand renowned for its quality. Drewry reports are sold in more than 90 countries and consultancy services commissioned by clients from over 70 countries.

Enquiries

Neil Davidson
15-17 Christopher Street
London, EC2A 2BS
Tel: +44 (0) 20 7538 0191
Email: davidson@drewry.co.uk

LNG as a ship fuel: perspectives and challenges

Siyuan Wang and Professor Theo Notteboom, ITMMA, University of Antwerp, Belgium

The upcoming stringent environmental regulations enacted by the International Maritime Organisation (IMO), particularly at the level of the emission control areas (ECA), serve as a catalyst for exploring the use of Liquefied Natural Gas (LNG) as a marine fuel. LNG promises a good environmental performance compared to conventional ship fuels. It emits nearly no sulphur oxide (SOx) or particle matter (PM) emissions, 90 percent less nitrogen oxide (NOx) and 20-25 percent less carbon dioxide (CO2). Research into LNG as a marine fuel saw a strong growth in recent years, but no study has analysed in a structured way, the level of convergence among the findings presented in the wide range of studies conducted by research

centres, classification societies, ship engine manufacturers and consultancy firms. In order to fill this gap, we performed a systematic review to synthesise the findings of 33 published studies on the use of LNG as a ship fuel. The aim is to obtain a much broader understanding of the current perspectives and challenges for applying LNG as a bunker for ship propulsion.

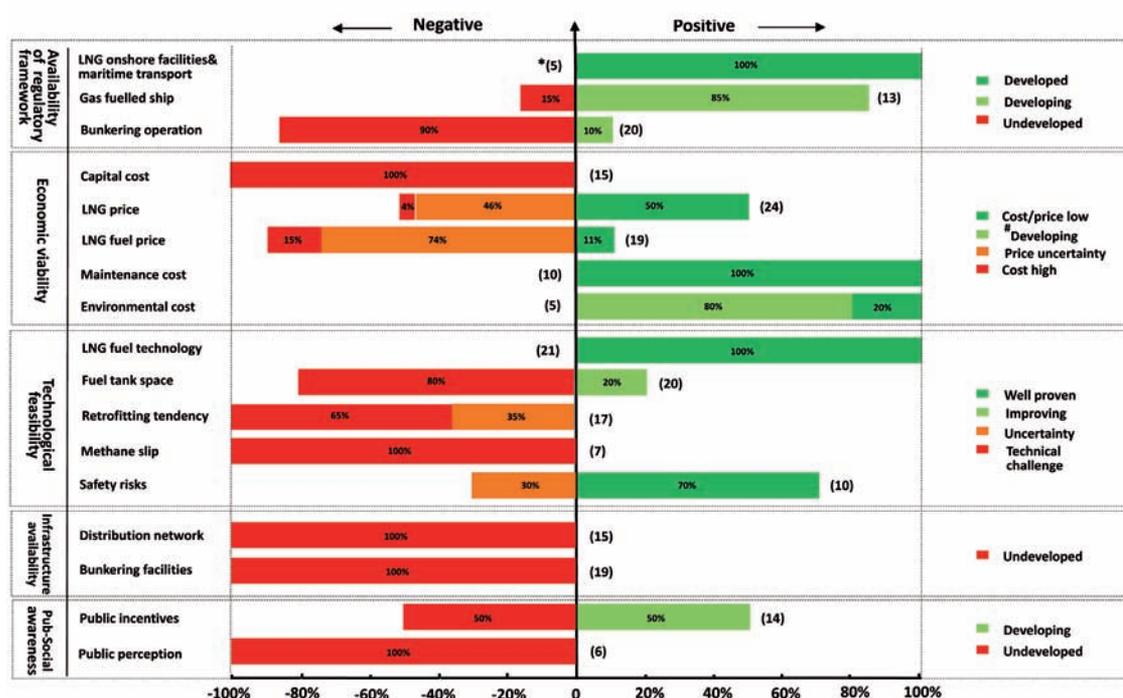
Factors supporting or obstructing the adoption of LNG

Figure 1 provides an evaluation for 17 factors affecting the large-scale adoption possibilities for LNG. Not all of the 33 studies considered refer to all 17 factors. The figure shows the consistency and/or divergence in existing literature. Some

divergence between earlier and later studies might be attributed to the ongoing technological innovation and economic and regulatory advances to support LNG as a ship fuel. Some of the most crucial challenges are discussed in the following sections.

Availability of a regulatory framework

There are some existing regulatory gaps regarding the application of LNG as a ship fuel. In recent years, the regulatory framework for onshore LNG installations and the maritime transport of LNG cargo have been established at international levels in line with the fast growth of the world LNG trade. These include the international



Notes: * the number in parenthesis means the number of studies where the relevant issue is discussed

Environmental cost is not yet established now except in Norway, but some studies expect that environmental cost will be developed in the future which can make LNG fuel more attractive

Figure 1: Positive and negative factors in the adoption of LNG as a ship fuel. The percentages refer to the share on a total of 33 studies.

code for the construction and equipment of ships carrying liquefied gases in bulk (IGC code); The Society of International Gas Tanker and Terminal operators (SIGTTO) and the Oil Companies International Marine Forum (OCIMF).

There is no international rule recognising that LNG can be used as a marine fuel, apart from the IGC code which allows LNG carriers to use boil-off gas as a part of the ship's propulsion. In order to fill this gap, the IMO has started to draft the international code of safety for ships using gases or other low flashpoint fuels (IGF code) which will cover safety and operational issues for gas-fuelled seagoing vessels. The code is expected to be finalised by 2014. In addition, the lack of a set of comprehensive LNG bunkering regulations is one of the key barriers to the new application. So far, no international standards have been established which incorporate minimum requirements for the bunkering procedures, training and equipment necessary to ensure safe LNG handling for gas-fuelled ships via both shore-based and ship-to-ship bunkering operations.

In 2011, ISO established a working group to develop such international guidelines for harmonising LNG bunkering standards. This working group delivered its first draft in June 2013. At the time of writing, the document was being subjected to an international hearing round before it should be published as an ISO document by 2014. Another regulatory barrier is related to the use of LNG on inland vessels in Europe. In line with the relevant European agreement concerning inland shipping e.g. the international carriage of dangerous goods by inland waterways (ADN) and the Rhine vessel inspection regulations (RVIR); the regimes prohibit the installation on inland ships of combustion engines that use a fuel with a flashpoint below 55C. This means LNG is restricted to be used as a fuel since its flashpoint is -180C. To close this regulatory gap, the competent EU authority has started to establish a specific permit process for LNG-powered inland vessels and later may develop appendices under the existing regulatory framework.

Economic viability

Sophisticated LNG engines and the cryogenic double-walled fuel tanks require significant capital investments, certainly when compared to oil fuelled ships. The observed cost range is partly linked to the ship design, the engine type (dual-fuel or single LNG engine), and the size of fuel tank (i.e. dependent on the frequency of refilling) etc. Overall, the estimated cost for an LNG fuelled ship is between 20

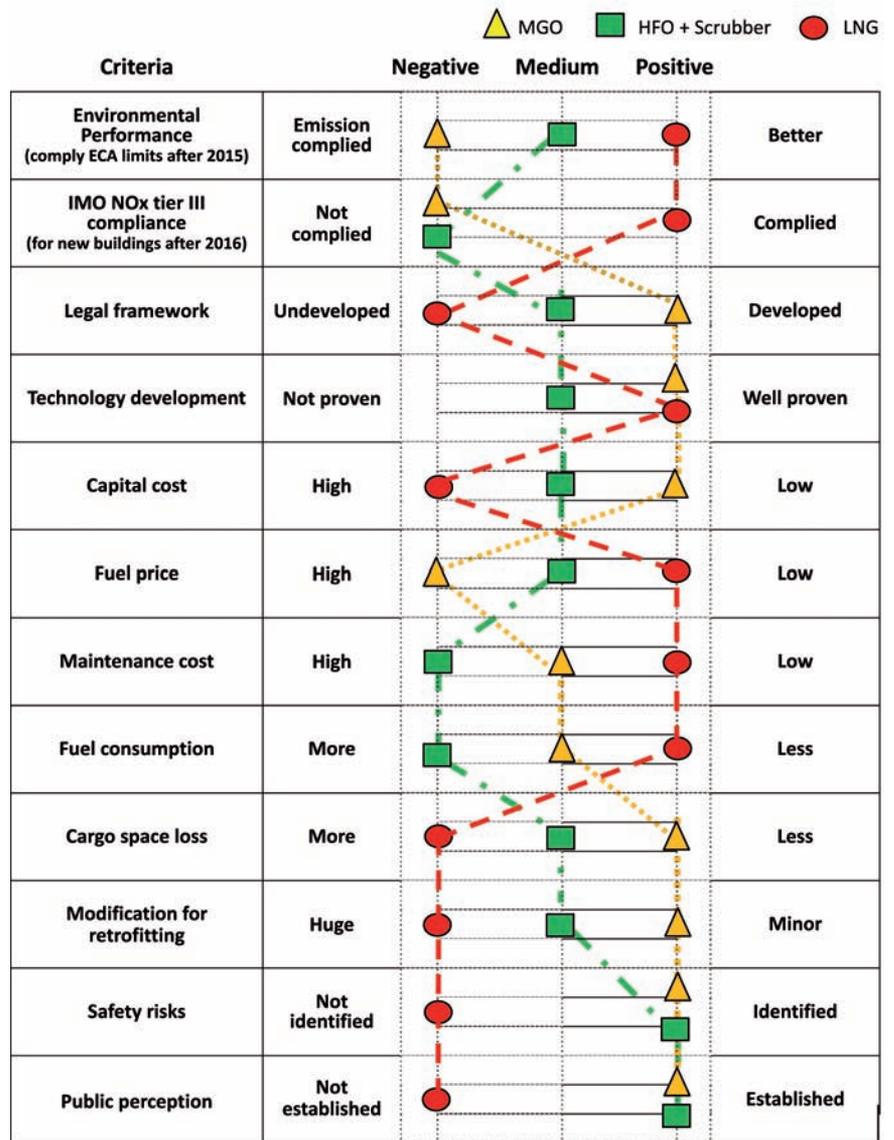


Figure 2: Comparison between three alternative solutions to meet IMO ECA regulations.

to 25 percent higher compared to an oil equivalent vessel. In addition, it is noted that the cost for a newly built LNG fuelled vessel is less than the cost to convert a similar existing vessel. LNG is therefore more feasible for new ships.

The LNG price lies at the core of the economic discussion on the use of LNG as a ship fuel. It is widely recognised that the current low natural gas price compared to the conventional oil fuel is a main economic driver for this new application. However, the various estimates of the future LNG price presented in the different studies make it hard to bring widely supported forecasts on the future energy prices. Moreover, the LNG bunker price to end users also includes the infrastructure cost of the LNG refuelling terminals, the distribution cost of LNG to the bunkering terminal and the cost of the bunkering operation. The current lack of LNG bunkering infrastructure and supply chain networks presents a far more

uncertain picture for the LNG fuel price. This leads to uncertainty for ship operators on whether they could benefit from the offset between fuel cost savings and large capital investments.

Nevertheless, LNG engine developments highlight the lower maintenance cost in comparison to oil engines due to a more clean and efficient system and a long lifetime of the machinery. Furthermore, the possible environmental cost (e.g. taxation or emission trading scheme) charged to shipping by governments will make the LNG cost savings more attractive than other options. To date, there is only a NOx taxation system in Norway, but it is believed that the environmental cost regime for marine transport will develop in many countries in the coming years.

Technological feasibility

The use of LNG as a ship fuel is not new. The technology is well-established as

LNG carrier operators can look back on 40 years of experience in powering their ships using LNG. Moreover, the technology has also been tested on some 35 non-LNG carrier gas-fuelled vessels mostly sailing in Northern Europe. The space-consuming LNG fuel tanks affect ship productivity and freight earnings. LNG has a 1.8 times larger volume than diesel oil, and of one includes the whole system of LNG engine and cylindrical-shaped fuel tank onboard, the space needed is even three to four times larger than the conventional oil system. Another technical challenge is the unburned methane (CH₄) emitted from LNG or dual-fuel engines, which reduces the overall environmental performance of LNG-fuelled ships. Considering the safety risks associated with the bunkering operation of LNG-powered vessels, it is necessary to establish common safety risk assessment approaches and risk acceptance criteria for LNG fuelled ships and bunkering procedures.

Infrastructure availability

Almost all reviewed studies show a consensus that a critical challenge to the development of LNG as a ship fuel is the current lack of established bunkering infrastructure and distribution networks for delivering LNG to the ships. This significant barrier currently represents a 'chicken-and-egg' problem. Bunker suppliers are unwilling to invest in the infrastructure necessary until there is sufficient demand to supply commercial shipping with LNG fuel. On the other hand, ship owners are unwilling to invest in LNG-fuelled ships if supplies of LNG bunkers are difficult to obtain. Currently, there are four LNG bunkering methods. They are truck-to-ship, ship-to-ship, terminal (loading arm)-to-ship and LNG portable tank. A minimal bunkering infrastructure is needed to kick-start the market development. The European Commission proposed that LNG refuelling stations should be installed in all maritime and inland ports of the trans-European core network by 2020 (2025 for inland ports). This aim includes a total of 139 ports which account for about 10 percent of all EU ports in number.

Public-social awareness

Many of the reviewed studies agree that the 'chicken-and-egg' dilemma can best be mitigated through government involvement. The approach for such involvement can be subsidies, funding or reduced taxes etc. The EU has started to develop financial instruments to support the introduction of LNG bunkering infrastructure, such as the funding from the Trans-European Transport Network

(TEN-T). In addition, some leading public port authorities in Europe, like Rotterdam and Antwerp, have already established port-specific emission regulations that give a discount in port dues to ship owners who use clean fuels for their vessels (i.e. the environmental ship index (ESI) programme). Another concern is the public acceptance of the use of LNG as a ship fuel. In order to increase public acceptance, better communication between the project developers, the authorities and the general public needs to be developed.

Options available to ship operators

In order to comply with the forthcoming ECA's SO_x limits in 2015 and NO_x Tier III standard in 2016 (may have five-year delay to 2021); ship operators have three compliance strategies standing out as realistic options. Apart from switching to LNG, they can change to low sulphur fuel oil e.g. marine gas oil (MGO), or use scrubbers. Figure 2 shows the current advantages and challenges with each of the three alternatives.

Using low sulphur fuels (e.g. MGO) is the most immediate compliant solution, due to minor modifications to ships with limited up-front costs and the established supply chain and bunkering facilities. Nevertheless, the growing demand for distillate oils would cause the fuel price to rise. The use of scrubbers is considered a viable method for removing sulphur and particulate matter from exhaust gas emissions. However, at present, ship owners lack confidence about this solution due to high uncertainty over its technical performance, e.g. system reliability, the risk of non-compliance, etc. Also, in order to remove NO_x to meet Tier III standards, the scrubber must be operated in conjunction with selective catalytic reduction (SCR), but the combination of these two technologies remains problematic.

LNG as a clear fuel can reach all environmental targets without any abatement technology. However, the current lack of bunkering infrastructure and operation standards imply that the use of LNG as a ship fuel is expected to first gain momentum in niche markets, like small ferry routes and regional liner traffic. In the longer run (perhaps from 2020) the adoption of LNG as a ship fuel on a global scale rests on three main factors: the price difference between LNG and low sulphur fuel oil; the global emission regulations e.g. the global SO_x limits enforced in 2020 or 2025; the availability of LNG bunkering facilities in a global context.

About the authors



Siyuan Wang joined ITMMA (an institute of the University of Antwerp) as a PhD student under the CONNEC scholarship programme of the European Commission in 2010. She holds an MSc in Transport and Maritime Management from ITMMA and a masters in Maritime Law from Shanghai Maritime University. Her research activities at ITMMA focus particularly on the LNG market.



Theo Notteboom is president of ITMMA, 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 publishes widely on port and maritime economics. He is also president of the International Association of Maritime Economists (IAME), chairman of the board of directors of the Belgian Institute of Transport Organisers (BITO - an institute of the Belgian Federal Government) and co-director of PortEconomics.eu.

About the organisation



PortEconomics is a web-based initiative aiming at generating and disseminating knowledge about seaports. It is developed and empowered by the members of the PortEconomics group, who are actively involved in academic and contract research in port economics, management, and policy. Since October 2012, Port Technology International and PortEconomics have been engaged in a partnership. www.porteconomics.eu.

Enquiries

ITMMA  niversity of Antwerp
Kipdorp 59, 2000 Antwerp, Belgium

Email: siyuan.wang@uantwerpen.be
or theo.notteboom@uantwerpen.be
Website: www.itmma.ua.ac.be

Unleashing the rest of Latin America's potential

Walter Kemmsies, *chief economist,*
Moffatt & Nichol, New York, United States of America

A rising tide lifts all boats, but if some of them have short anchor chains they will eventually sink as the water continues to rise. Latin American economies have benefitted significantly from strong economic growth in Asia, driven primarily by China. Those who have been able to develop infrastructure to support freight movement have benefitted more than others. However, further investment and development is needed, particularly in Brazil which has lagged behind other countries in terms of infrastructure and benefitting from growth in global trade. Ports will have to be able to handle larger ships and inland connectivity needs to improve. If these investments are made then Latin America, like Asia, could potentially see very strong economic growth.

Over the last two decades exports have generally increased the contribution of world trade to Latin America's economic growth (see Figure 1). Countries like Chile, Mexico and Ecuador have been in the lead. Chile began privatising its freight infrastructure in the early 1990s and has benefitted the most. Brazil has been the laggard.

Infrastructure investment

The list of needed infrastructure improvements in Latin America is substantial. Most freight is hauled inland by truck inland and by barge, given that the populations tend to be concentrated near the coasts. Roads are being improved with extra lanes and better drainage to make them more passable during the rainy season.

Major rail investment policies are also being deployed. However, progress on this front is slow. Key highways are still congested, particularly during peak season periods such as the soy harvests in Brazil. It could be argued that Mexico is in the lead, with substantial public and private funds having been invested in highways and railways. Mexico also deserves special recognition for the engineering prowess it deployed in constructing roads over mountain ranges that connect its Pacific Coast ports, such as Mazatlan, to major manufacturing centres such as Durango and Monterrey.

Although Brazilian ports have developed widely and have received private investment to reach international standards, the dwell time for containers in the more congested port areas is still 21 days, while internationally this would be two to four days. Truckers may also need to wait 12-24 hours outside of ports, leading to extra costs and negative effects for all cargo moving through the ports, including break-bulk and finished vehicles.

Most Latin American ports, and in particular those that handle containers, are located in cities that were founded centuries ago with narrow crowded streets. Improvements for truck access are sorely needed, as many of these ports will not be able to develop rail access very easily.

Cargo handling after it is discharged from the ship is not only impacted by poor surface transportation but also by customs clearance practices and inadequate inland storage. International distribution centres, for deconsolidating cargo, and warehouses appropriate for handling specific types of freight are not widely available in Latin America. This can stymie development of new ports or terminals.

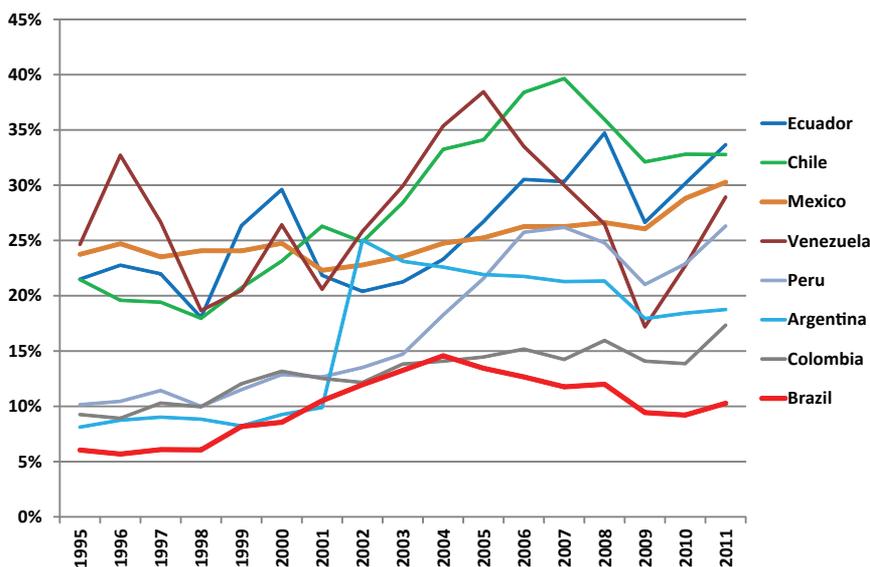


Figure 1: Exports as a percentage of GDP. (Source: UN Comtrade, IMF, Moffatt & Nichol)

The impact of inefficiency

One often hears at industry conferences that average wait time for vessels arriving in Latin American ports can vary, among the worst cases is Santos where a three-day wait is not uncommon. It can take about seven days to get shipments into and out of the terminals. However, this is set to change as new terminals are deployed and near-dock rail is developed.

Port productivity varies greatly across Latin America. There are many reasons for this, for example, whether the ports have sufficient landside gantry cranes with the capacity needed to handle the increasingly larger vessels that call at Latin American ports to customs-related delays. This can have negative impacts on equipment productivity.

Inefficiency in the freight movement supply chain causes congestion and therefore costs rise. Cost increases are eventually passed on to consumers and drive inflation. In order to avoid inflation, economic policymakers resort to increasing interest rates in order to slow the economy down. It is estimated that given its infrastructure, Brazil's economy cannot grow faster than three percent without inflation picking up. Inadequate infrastructure is thus an impediment to economic growth.

What is changing?

Latin American policymakers are aware of the importance of infrastructure's role in economic growth. Chile's example is being emulated in Peru and Colombia. Both countries are seeing substantial investments in port infrastructure. In the case of bulk commodities this often involves development of mine to port flow paths, usually including rail construction. Regulatory impediments are also being addressed. A good example of that is the new federal ports law in Brazil.

Brazil, which has been a laggard, is restructuring the road, rail, seaport and airport sectors. President Rousseff has announced a series of reforms, not just of the transportation sector but also energy, in order to lower the high cost of doing business in Brazil, popularly referred to as 'custo Brasil'. This is not a simple exercise. While more

investment and therefore competition is being encouraged, it cannot be done in a way that negatively impacts existing operators. If so it will be hard to encourage investors to enter this sector. However, a large number of new concessions are likely to be offered in the near term, and assuming that investors believe they will be able to make reasonable returns on their investments, there should be a significant increase in port capacity.

Across the region there is a lot of focus on dredging. Policymakers, port authorities and terminal operators are acutely aware that about half the global order book for container vessels is for those with a capacity to carry over 10,000 twenty-foot equivalent units (TEU). These ships require 50-feet of water depth.

Ports in Latin America that do not plan for larger vessels will not be able to benefit from the expansion of the Panama Canal. However, plans to take advantage of that do not always involve channel dredging. In Brazil's case this has also taken the form of supporting development or improvement of inland waterway terminals. Brazil is close to becoming the largest soy exporter in the world and is the largest source of China's imports. The soy is grown in the rural interior of the country and is trucked over difficult roads to ports in the south where it is loaded onto bulkers that travel to China via the Cape of Good Hope. The new plan is to develop terminals on rivers that feed into the Amazon River. The soy can be transhipped on the Amazon to large vessels that will be able to transit the Panama Canal.

In conclusion

Given insufficient capital and complex regulations, one can argue that Latin America has benefitted as much as it could have from the growth in world trade in the last few decades. However policymakers seem to have a much better awareness and grasp of the issues these days. This justifies optimism in regards to the outlook for the Latin American port industry and economy as a whole.

About the author



As Moffatt & Nichol's chief economist, Dr. Walter Kemmsies directs and oversees the firm's work related to

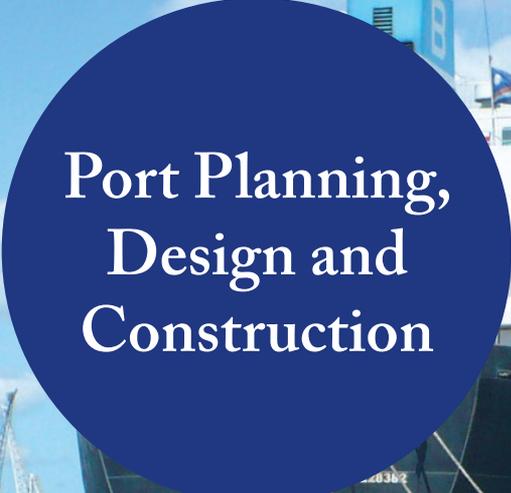
market studies, financial analysis, global trade and economic trend forecasts. He has led projects ranging from strategic development plans for ports to merger and acquisition transactions of port-related entities and terminal-operator expansion decisions. He is also an advisor to executives at various port authorities and major transportation and manufacturing companies. Dr. Kemmsies is a registered financial analyst with a strong background in industry analysis. He has presented his research at major industry conferences and international economic forums.

About the organisation

Moffatt & Nichol is a global infrastructure adviser specialising in the planning and design of facilities that shape our coastlines, harbours and rivers, as well as being an innovator in the transportation complexities associated with the movement of freight. Operating out of 30 offices around the world, the firm provides expertise in economics and cargo forecasting, project financing, and port and terminal planning and design. The firm also offers fully integrated planning and design services in maritime structures; urban waterfronts and marinas; coastal, environmental and water resources; transportation and intermodal infrastructure; energy; and inspection and rehabilitation, as well as state-of-the-art capabilities in modelling and simulation.

Enquiries

Moffatt & Nichol
Walter Kemmsies, PhD
Tel: +1 (212) 768 7454
Email: wkemmsies@moffattnichol.com
Website: www.moffattnichol.com



Port Planning, Design and Construction



“To protect the immersion zone, the design engineer opted for a cathodic protection with sacrificial anodes, which will be installed underwater on plates that are welded to the AZ sheet piles prior to driving.”

‘Reconstruction and deepening projects at Maydon Wharf’, page 25.

Valencia port efficiency boosted by a community system

José García de la Guía, *port community system manager, Valencia Port, Spain*

The Port Authority of Valencia (PAV) is a state-owned public entity in charge of the management of three ports located along 80 kilometres of the eastern border of the Spanish Mediterranean coastline in the Valencia Region: namely, the ports of Sagunto, Valencia and Gandia. It has had a vigorous growth rate over more than twenty years, from 12.9 million tonnes in 1992 to over 66 million tonnes in 2012.

The main traffic in Valencia Port is containerised cargo (78 percent). There are other types of cargo such as solid bulk, liquid bulk and general cargo, including roll on- roll off (ro-ro) cargo and car traffic. As the result of this growth, Valencia Port has had continuous growth of container traffic in the last two decades and it is now leading Spanish and Mediterranean container ports rankings, 5th in Europe and 30th in the world.

Challenges for ports

A strategic plan was defined to give an answer to the changing environment the ports are involved in. The 'container revolution' has made it necessary to re-convert the ports from just space for operation with some cranes, to specialised installations. Containers have made it much faster and simpler to move goods but have also generated the need to manage big amounts of information in very short periods of time. The increasing size of vessels is reducing the number of ports that they can operate in, and increasing the traffic gap between hub and feeder ports.

Additionally, the market itself has changed. Lower transit times and more reliable schedules are required by the customers. Much higher safety and security requirements come from the regulators. And the effect of globalisation has brought the traffic growth. There's a clear need to manage these complexities for ports.

Looking at the Valencia Port model

Valencia Port implements a mixed-hub model combining transshipment with local traffic. This model requires the technology and the infrastructure of a hub port and all the logistic complexity of an import-export port. The change in Valencia Port in the last ten years has been remarkable.

The number of vessels calling at the port has had a small reduction, but the number of TEU has been multiplied by three, the vessels' gross tonnage by 2.5. The average time to release an import container has been reduced from eight to two working days, which requires more and better synchronisation of operations.

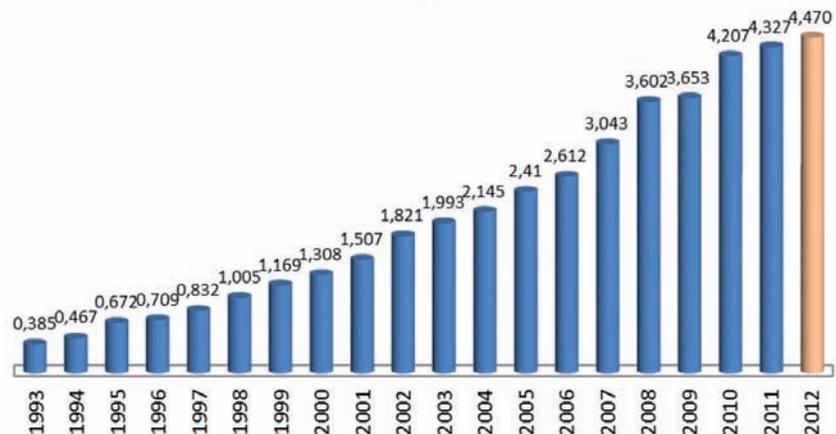


Figure 1: Valencia Port total container traffic (Thousand TEU) 1993 – 2012.

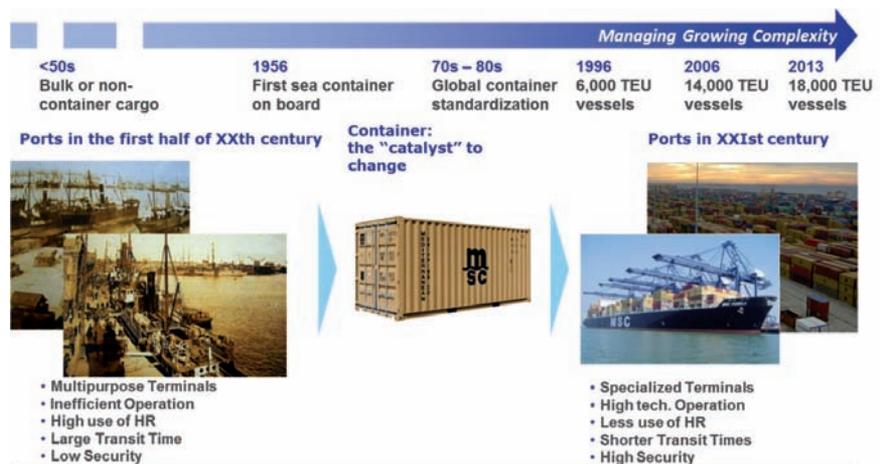


Figure 2: The timeline of growth complexity.

The continuous Valencia Port traffic growth has been possible due to the implementation of our strategic plan as defined in 2001. One of the four strategic axes was 'Efficiency of port services' including the initiative of the 'digital port'. Since the 1980s Valencia Port has pledged a bet on information and communication technology (ICT) to improve its efficiency.

The Port Community System

There are as many models of the Port Community System (PCS) as there are ports implementing one of them. To understand a PCS we have to take into account four main factors. Firstly, define the target user e.g. port operators, public authorities, shipping lines/agents, container depots. Secondly, look at the business model and define who the PCS owner is. We can have fully privately-owned PCS, mixed private-public or public-owed, where the owner can be the port authority, the city or the government. If it is publicly owned, it must be defined whether or not the users pay for using the PCS. Thirdly, look at the operational model. This is more an ICT issue - it can be operated by the owner, by an ICT company, or by an ad-hoc created company. And finally, consider the range of services needed. All PCSs are different at this point and the three previous factors have a deep influence in this one. We can find PCSs that are just an extension of terminal's operating system, others are just a single window to access port authority and/or customs and others offer a wide range of services including mixtures of business interfaces between business and government services.

Valencia Port's PCS, (valenciaportpcs.net), is a wide range PCS owned by the port authority. All the services we have implemented have been defined within the port community working groups under the umbrella of the Port of Valencia Quality Seal. The services are analysed not only from the functional and technical perspectives but also from the business one.

Our PCS philosophy is to have a 'Virtual Round Table' where all the port community shares electronic documents and information offering efficient services to the main customers of the port: the vessel and the cargo, both of them from the point of view of final actors in the logistic chain.

Valencia Port's PCS is the result of work carried out since the 1980s. We defined four phases which are needed for each port to implement a PCS. These are 'the isolated port' where ICT has to be implemented internally by the main players. Port authority, customs and terminals must have systems to manage information internally. In our case we decided to begin with electronic data interchanges (EDI) to

Valencia Port - 2002	Valencia Port - 2012
7,068 Vessel calls	6,935 Vessel Calls
96.4M Vessel G.T.	206.8M Vessel G.T.
1982 Container vessel calls	3146 Container vessel calls
1.8M TEU	4.47M TEU
1.35M I/E TEU	2.1M I/E TEU
900 000 Road gate operations	1.7 M Road gate operations
908 TEU / Vessel	1,421 TEU / Vessel
8-day, average time stay for import containers in port	48-hour, average time stay for import containers in port

Figure 3: Comparative figures for Valencia Port.

public administration and implemented the first system in 1992. The 'communicated port' phase was about speeding up the bureaucracy Valencia Port identified in the 1990s. Since 1995 different administrative documents such as call requests, summary declarations, dangerous goods declarations and customs declarations and the reception of the authorisations can be made via EDI in Valencia Port. Also, the 'Port Community' was defined. This was an idea that began in 1999 with our first business to business information exchanges using internet technology. Finally, the 'Worldwide Open Port Community' was developed out of a

strategic review in 2004 and we found some issues we had to solve in our systems. This led to building valenciaportpcs.net, with its first version in 2006.

The reasons for Valencia Port's approach

The main reasons for building Valencia Port's PCS were the need to provide connectivity outside of the port community because it doesn't work being isolated; add flexibility to the way the users connect to the PCS with more protocols, message formats and standards, more kind of devices and open technologies. And



Figure 4: Comparative vessel capacities.

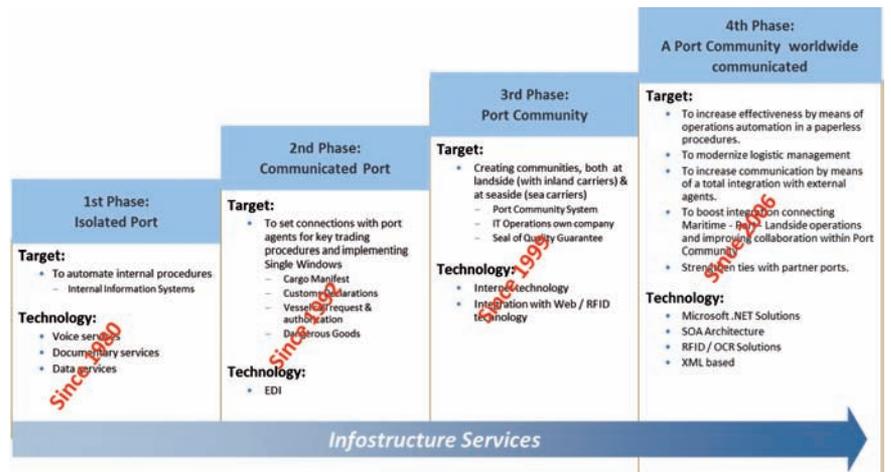


Figure 5: The phased approach.

VRS-20 Radar Level Sensor



Tide
Gauges

a new approach to tide and water level measurement

- Non-contact measurement of water level
- Direct interface to TideMaster tide gauge
- Use with own logger or PC via digital outputs
- Direct output via GPRS to internet



Tel: +44 (0) 1803 869292
sales@valeport.co.uk
www.valeport.co.uk



“Fishers underwater video cameras brave the **dangerous sites**, so you don’t have to”



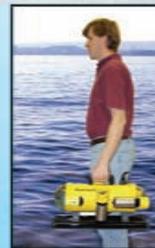
Jack Fisher,
President

SeaOtter-2 ROV

Only \$19,995



Control Box with
Built-in Monitor



Very Rugged
and Compact



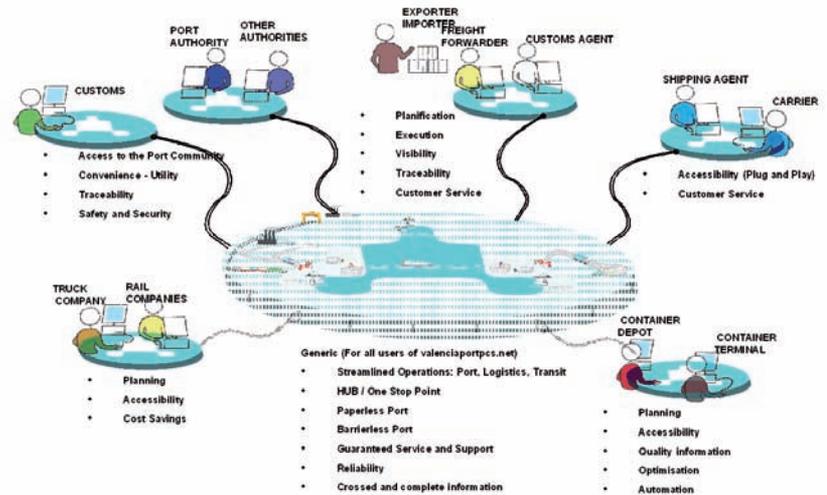
“Fishers underwater video products are cost effective tools for underwater search and inspection. The line includes low-cost mini cameras, dropped video systems, towed cameras, and powerful ROVs with scanning sonar onboard. Fishers has an underwater camera that will fit your application and your budget.”

Call for a free catalog or visit our web site: jwfishers.com





Figure 6 (top): The components of the PCS.
Figure 7(right): Valenciaportpcs.net - value proposition



also, not only to exchange information but to add value to the information from different sources, intelligence had to be added to the services.

Valenciaportpcs.net has provided all the port community members with the same integrated ICT environment, speaking the same data language. Our PCS is a wide range system including: Call request, which allows single-window access to the PAV, Merchant Navy and other authorities to exchange vessel operations requests and authorisations and connectivity to the Spanish Dangerous Goods Centre. It includes summary declarations, which allows single-window access to the PAV and customs for summary declarations for temporary storage and cargo manifests. Also, loading and discharge lists: through this service the operators give the vessel loading and discharge orders and receive terminal confirmations through valenciaportpcs.net for container and vehicle traffic. Paperless export clearance is part of it, with the shipping agents informing the customs authority of the goods that are to be loaded onto the vessels. Automated paperless import clearance is included. This service manages goods exits with automated customs controls through intelligent gates. Inland transport: 99 percent of container road transport in Valencia Port is managed through the PCSD. Rail freight documentation is also exchanged. Customs traceability: there's an online link with Spanish customs central system. Track and trace: users can track the status of their cargo or container through valenciaportpcs.net.

Adding value to the port

The use of valenciaportpcs.net since 1997 has grown exponentially and now 475 different companies work daily with the system. In 2012 more than 30 million messages were exchanged, more than 56 thousand load/unload cargo lists were sent containing more than 4.3 million

TEU, more than 1.1 million terminal gate movements were reported, more than 150 thousand dangerous goods declarations. The use of valenciaportpcs.net provides innumerable benefits to the port community, all the traditional ones of the business to business and the administrative single windows. You can see the summarised value proposition in Figure 7.

Some of the quick wins facilitated by valenciaportpcs.net in the last years are:

Paperless Road transport with queue-less automatic gates in the terminals. Before the PCS the average time of a truck at the terminal gate was 5 minutes, now it's just a few seconds in an automatic gate.

In conclusion

This system provides full automated vessel call, berth and anchorage management integrated with port authority, tugs, pilots, harbour masters, moorers and terminals. Real time information flows to all parties. Customs police check the PCS for the custom status of the export goods. It takes a few seconds to check a 5,000 movement vessel as opposed to four to five man hours before the PCS was installed. Unattended customs control at the port main gates and paperless checks of the trucks can now be done by getting the information through the PCS. There are now no queues for import goods and single window views with customs with an online connection. This provides every party in the field with real-time information about the customs status of goods.

Thus, valenciaportpcs.net has become an essential tool in the modernisation of logistics management for port community companies. Valenciaportpcs.net can be used to carry out information, commercial and operational transactions associated with goods transport, which gives users easy access to integrated logistics information, speeds up the contracting of logistics services and increases operational management efficiency.

About the author



Jose Garcia de la Guia is a telecom engineer with a Masters in business administration. He has held the role of

port community system manager at Valencia Port since 2007, and is also the vice president of Infoport Valencia. In building Valencia Port's PCS and EDI systems he has called on his full 20-year experience working for Infoport Valencia, the Valencia Port Foundation and Portel.

About the port

The Port Authority of Valencia (PAV), trading under the name of Valencia Port, is the public body responsible for running and managing three state-owned ports, Valencia, Sagunto and Gandia, along an 80-kilometre stretch of the Mediterranean coast in Eastern Spain. The Port of Valencia is the top Spanish, leading Mediterranean, fifth European and 30th in the world for container traffic, with 4.5 million TEU handled in 2012. Valencia Port, operating simultaneous import/export and transit traffic, is Southern Europe's gateway and distribution platform for MENA countries and West Africa, and a bridge between Asia and America.

Enquiries

Avda Muelle del Turia s/n
46024 Valencia, SPAIN
Email: jgarcia@valenciaport.com
www.valenciaport.com
www.valenciaportpcs.net

Reconstruction and deepening projects at Maydon Wharf

João Martins, head of engineering, and Ernst Weber, senior project manager, sheet piling, ArcelorMittal, Esch-sur-Alzette, Grand Duchy of Luxembourg

The Port of Durban is situated on the east coast of South Africa, in the KwaZulu-Natal Province. The port is the busiest on the African continent, and the biggest in terms of container capacity with 44 percent of South Africa's break-bulk cargo and 61 percent of all containerised cargo flowing through it. In 2010 alone, the port handled 2.5 million TEU.

The port has 57 berths and is protected by the north and south breakwaters, which are 335 metres and 700 metres long respectively. It was developed primarily for import cargo but over the years, cargo flows have changed significantly and exports have become more important. Over 4,000 commercial vessels now call at the port each year.

The Maydon Wharf terminal

The Maydon Wharf multi-purpose terminal (MPT) handles a variety of containerised, break-bulk and bulk cargo, and specialises in the handling of specific commodities. The terminal also handles both import and export containers, taking it to an average of 15,000 TEU. It has an annual throughput of more than one million tonnes of break-bulk and neo-bulk commodities. The Maydon Wharf area consists of 15 berths and the MPT operates principally between berths eight and 13.

Transnet National Ports Authority (TNPA) has initiated an extensive upgrade of the infrastructure at the port. One of the major projects is to rebuild and deepen seven of the 15 berths in the Maydon Wharf area. The new quays will be able to accommodate larger vessels and provide suitable load-carrying capacity for the handling of cargos over the berths.

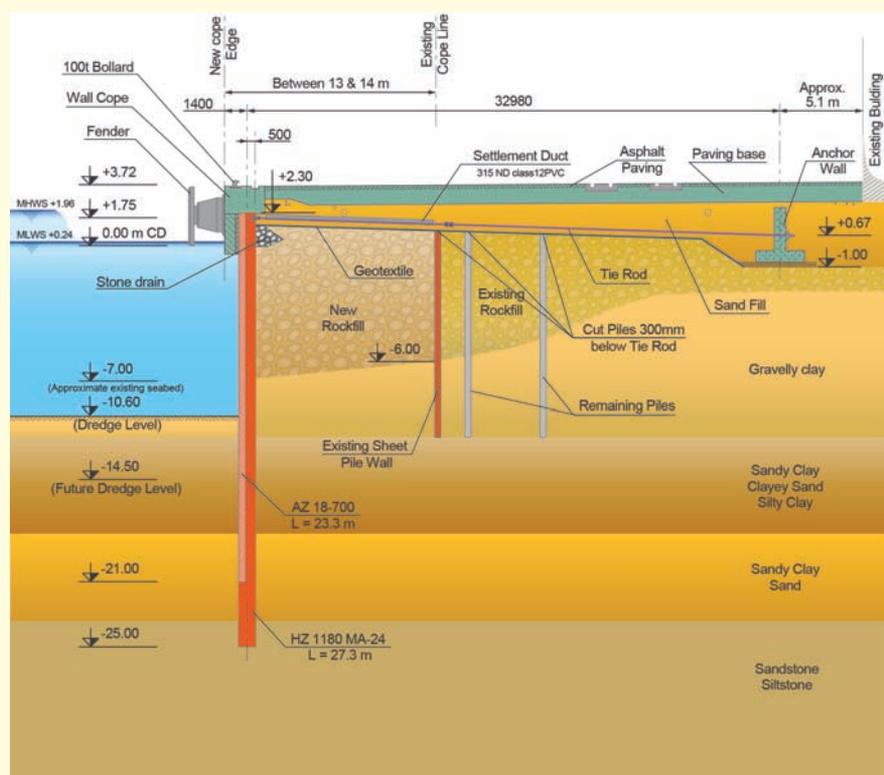
The reconstruction project

Berth 12 was the first reconstruction project to be launched. The quay wall is approximately 270 metres long, with a

return wall of 33 metres along Berth 11. The new front line of the wall lies 13 metres in front of the sheet pile wall of the existing berth. The quay wall has been built with the new HZM/AZ combined wall system: over 2,800 tonnes of HZ 1180M A-24 king piles and 440 tonnes of AZ 18-700 sheet pile pairs have been used as intermediary piles. A high strength steel grade has been chosen by the design engineer in order to optimise the steel quantities needed. The combi-wall system is anchored with tie-rods to a reinforced concrete anchor wall. The new quay wall and capping beam were designed to put up a future

front rail for a container gantry crane. The HZM king piles are 27.3 metres long, with a weight of 22.8 tonnes each, and were driven to depth with a free hanging vibratory hammer with variable frequency, suspended on the hydraulic crawler crane Kobelco CKE 1800, and an impact hammer.

A special two level template was used for the installation of the combi-wall. The HZM piles were driven during the first phase down to grade, guided into the correct position inside the template, before the infill sheets were installed. This standard installation procedure



Cross-section of the berth reconstruction project.



Berth 12, Maydon Wharf, Port of Durban.

ensures the verticality and correct position of the two components. The AZ infill sheets are shorter than the HZM, as their main function is to distribute the horizontal loads to the HZM king piles. The soil is quite heterogeneous, ranging from soft sandy clays to very compact sands. Part of the HZM king piles were driven into the siltstone/sandstone layer. Despite the hard soil conditions, the 123 HZM/AZ elements were installed in due time.

Effective results

The service life of the structure is 50 years. To protect the immersion zone, the design engineer opted for a cathodic protection with sacrificial anodes, which will be installed underwater on plates that are welded to the AZ sheet piles prior to driving. The concrete capping beam reaches below low water level and protects the steel above this level. ArcelorMittal also supplied the tie-rods as part of the whole foundation solutions package. These are fixed with a specific T-connector to the HZM king pile, providing the advantage of keeping the installation simple without the requirement for any welding at the site.

About the author



João Martins is the head of engineering at ArcelorMittal's Luxembourg-based steel sheet piling department. He has been

involved in the design and execution of sheet pile structures around the world for more than 14 years.



Ernst Weber, a civil engineer, has been assisting ArcelorMittal's customers for the last decade on jobsites spanning all five continents.

He recently moved to the company's sales department and is in charge of a number of export markets including South Africa.

About the organisation

ArcelorMittal is the largest hot rolled steel sheet pile manufacturer worldwide. The company has more than 100 years of experience in sheet piling and is a major partner for design engineers, public authorities and investors who are looking for innovative and cost-effective foundation solutions. The sheet pile knowledge centre is located

in Luxembourg, and ArcelorMittal has offices in more than 60 countries with experienced sales and technical staff to assist customers during all project phases. The main task of the engineering department, who has been involved in thousands of projects, is to deliver design and installation recommendations, free of charge, based on the latest design standards and state-of-the-art installation technology. The R&D department dedicated exclusively to steel sheet piles has been playing a leading role in improving rolling techniques and developing new product ranges and new applications.

If you would like more information on steel sheet piling solutions, please visit www.arcelormittal.com/sheetpiling.

Enquiries

ArcelorMittal Commercial RPS S.à r.l. – Sheet Piling
66, rue de Luxembourg
L-4221 Esch-sur-Alzette
G.D. of Luxembourg

Tel : +352 5313 3105
Email : sheetpiling@arcelormittal.com

Considering the perspectives of port users

Mary R Brooks, *editor, Elsevier's Research in Transportation Business and Management, Halifax, Canada, and Thanos A Pallis, associate professor, Department of Shipping, Trade and Transport, University of the Aegean, Greece*

The quest for performance measurement has always been a key issue for ports. Port managers, whether port authorities or terminal operators, need to organise complex processes in an efficient and effective way in order to find the best ways to capture value for their customers and address the concerns of stakeholders.

For many, port performance has been associated with operational efficiency alone. Physical quantities of items used, levels of effort expended, scale or scope of activities, and the efficiency in converting resources into port services have always captured centre stage. Indicators like berth occupancy, revenue per tonne of cargo, capital equipment expenditure per tonne of cargo, vessel turn-around time and number of gangs employed have been used for decades as means to benchmark current performance against prior-year performance and against competitor performance, so as to deliver efficiency objectives.

However, improved efficiency does not necessarily lead to improved competitiveness, for competitiveness is also a product of effectiveness in delivering desired services to both customers and users. If a terminal operator wishes to improve its cargo-handling efficiency so as to improve berth utilisation through faster vessel turnaround, it may also improve its effectiveness as vessel time at berth decreases and the customer may be more satisfied with the shipping line's performance. However, if that terminal operator improves its asset utilisation by leaving more vessels at anchor so as to minimise its own downtime, its asset utilisation is improved but the customer's service expectations may not have been met. In this case, efficiency has come at the expense of effectiveness.

The importance of measuring perceptions

Stakeholders' perceptions of the ports they use are increasingly vital for correcting both

operational and governance flaws that the port's network might experience. Measuring users' perspectives helps managers to understand the current situation and eventually address issues so as to improve experiences with the port. Insight into what is most important to a port's users provides managers a two-pronged tool: firstly it assists ports in setting priorities, e.g. pointing out areas needing the greatest investment for improvement (against those where investments are less effective); and secondly, it identifies those areas where a port already delivers value, and therefore the port could benefit from marketing initiatives to raise awareness.

In the supply chain world, this is not an easy task. Effectiveness is related to the objectives of those users seeking it. Port user groups might rate a port's effectiveness in service delivery differently, i.e. a port that is rated highly by the shipping lines may score poorly when rated by cargo owners or its own supply chain partners, or vice versa.

Effectiveness measurement in practice

Not surprisingly, port authorities and others increasingly acknowledge the importance of measuring the effectiveness component of port performance in the supply chain. In recent times, on both sides of the Atlantic, we were invited to develop tools that will lead to such measurement.

In September 2013, European ports, via the European Sea Ports Association (ESPO), associations representing port users (shipowners, shippers and their agents), and port service providers (terminal operators, pilots, tug operators) joined academics to undertake a multi-year project that will develop and pilot test the measurement of port users' perceptions.

As part of a wider project targeting the monitoring of the European port sector called PORTOPIA, European ports

and port policy makers aim to identify evaluation criteria of port services that are most important to different groups of port users and to evaluate which of these criteria different user groups use to determine whether a port's performance is effective in meeting their needs. In the long-run, the actual measurement of how different users evaluate the port(s) they use will provide useful data on the performance of European ports as seen by user groups and the opportunity to interpret the data for performance management.

Lessons from North America

The process of finding the right user indicators for port effectiveness began in 2008. Following a pilot implementation that examined Canadian users of three Canadian and two US ports, the second pilot moved solely into US territory and examined service delivery effectiveness for American users. The final phase was implemented through the AAPA Customer Service Initiative, and collected user evaluations of the performance of seven North American container ports, each with more than 250,000 TEU in volume.

Participating ports supplied user lists for direct solicitation of users, and two surveys were developed, one for the East Coast with four East Coast ports listed and one for the West Coast with three ports listed. The team at Dalhousie University completed the work in December 2012, with the input of over 200 port users, 39 shipping companies and 48 supply chain partners and 119 cargo owners or their agents provided their insights based on their experiences with port service.

Each port participating in the study received (from the research team) a confidential report with the results for each of their user groups. Their individual results were framed in a Determinance / Importance-Performance Gap Space¹ to explain to ports (and in particular the

management team) the meaning of what respondents said in a way that is easily understood and provides actionable data for developing strategic plans for investment and marketing.

Presenting results in a simple framework (see Figure 1), meant that ports were informed of those features they need to invest in, which are important issues where there is a gap between importance and performance, issues of secondary attention or lowest priorities, which are of less importance. Beyond these, there are suggestions on cases where performance is such that it deserves to be marketed or it is of little importance to users and therefore there is no requirement for action.

This analytical framework has been presented at practitioners and related conferences, and has withstood the scrutiny of experts in port performance assessment. How each port chooses to use the best practice benchmarks and their own results will depend on the port's service goals. Based on the feedback from participating ports, non-participating ports would benefit from an opportunity to participate in a follow-up survey. The patterns of performance gaps identified in the AAPA Customer Service Initiative Reportⁱⁱ were different for each port.

In all cases, the initiative identified criteria for targeted improvement for each user group. Each port had a unique portfolio of factors to invest for improvement, and many ports found a usable 'market for awareness' opportunity. East and West Coast patterns were also noted. It is expected that the programme will be offered again in 2014.

Next steps

In North America, participating ports reported that the exercise provided a framework, which could be readily understood by their partners and staff, and on which they could hang improvement initiatives. The European exercise will focus on identifying which additional/different criteria will be useful for European ports and the pilot instrument will be developed in consultation with ESPO, as well as the associations representing port users, over the next several months. The PORTOPIA team will be working with European ports and will report progress on this initiative via the project website: www.portopia.eu and also via the PortEconomics initiative. The European exercise is not just for container ports however; the project will also consider whether this approach will work for bulk, ferry and cruise operations. In the long run, this will provide individual ports with a personalised effective performance report, but also a 'state of European ports report'. There are many reasons to stay tuned.

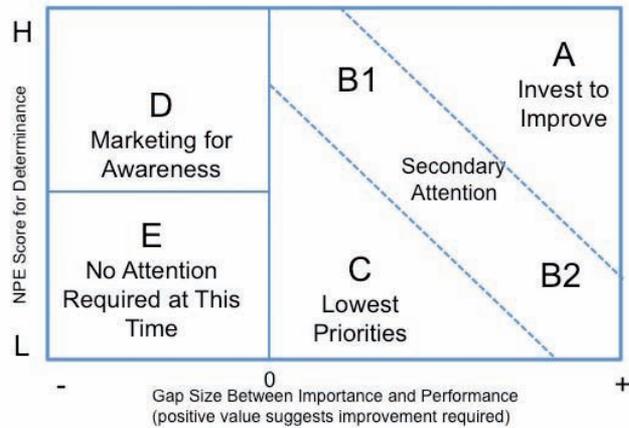


Figure 1: A simple framework for presenting survey results.ⁱ

References

ⁱFor more reading on the Determinance/Importance-Performance Gap Space and its use, check out Schellinck, Tony and Mary R. Brooks (2013). Improving Port Effectiveness Through Determinance/Performance Gap Analysis, Maritime Policy and Management, <http://dx.doi.org/10.1080/03088839.2013.809632>.

ⁱⁱFor more reading on the AAPA Customer Service Report, visit PortEconomics at: <http://www.porteconomics.eu/news/assoc-members-news/item/379-the-aapa-port-customer-service-initiative.html>

About the author



Mary R. Brooks, a member of the PortEconomics team, is with Stephen Ison as the editor of Elsevier's Research in Transportation Business and Management. Until 2013, she was the William A Black Chair of Commerce at Dalhousie University, Halifax, Canada. She has been actively engaged in the work of the Transportation Research Board (Washington DC) since 1993, and she was appointed to the Marine Board of the US National Academy of Sciences in 2008. She is the founder and chair of the Port Performance Research Network, a network of more than 50 scholars interested in port governance and port performance issues. Her latest book with Thanos Pallis, Classics in Port Policy and Management, was published by Edward Elgar in May 2012.



Thanos A Pallis is associate professor at the Department of Shipping, Trade and Transport, of the University of the Aegean, Greece (Jean Monnet in European Port Policy). He was a Fulbright Scholar at the Centre for Energy, Marine Transportation and Public Policy (CEMTPP), Columbia University, New York, US, and lectures at the University of Antwerp, ITMMA. A regular contributor at OECD, UNCTAD, IAPH, AIVP and ESPO discussions on port development, he has served as member of teams advising the European Commission, the Committee of the Regions, and national governments on port performance and development. He has been recently appointed secretary general of MedCruise, the association of cruise ports in the Mediterranean and its adjoining seas. Mr Pallis is a co-director of the PortEconomics initiative.

About the organisation



PortEconomics is a web-based initiative aiming at generating and disseminating knowledge about seaports. It is developed and empowered by the members of the PortEconomics group, who are actively involved in academic and contract research in port economics, management, and policy. Since October 2012, Port Technology International and PortEconomics have been engaged in a partnership.

Enquiries

Department of Shipping, Trade and Transport
 University of the Aegean, Greece, 2 Korai St, Chios 82100 Greece
 Email: apallis@aegean.gr or m.brooks@dal.ca, Website: www.porteconomics.eu

Ground improvement techniques allow flexibility for ports

Jeffrey R. Hill, PE, senior engineer,
Hayward Baker Inc., St Louis, Missouri, United States of America

Port facilities see an increase in demand on nearly a daily basis. This demand is fuelled by the constantly changing role of international shipping in the global economy. For example, new shale oil plays and tar sands in North America may lead to the export of energy from the US; ten years ago the idea of energy exports from the US was unimaginable. Another change in global shipping is the increase in use of intermodal transport. This article discusses a variety of ground improvement and specialty foundation solutions that can support bulkheads, heavy storage warehouses, grain silos, large-diameter tanks or any other port structure. These solutions are designed to efficiently provide a foundation-related maintenance-free operation for the design life of the structure, and are well-suited to the poor ground conditions often associated with port and shipping facilities.

Foundation solutions for difficult ground conditions

Some of the worst soil conditions are concentrated around navigable bodies of water. The Mississippi Delta and the US Gulf Coast are elementary cases of poor soil conditions in areas historically utilised for shipping. The ground conditions improve further up the Mississippi River; however, as the ground conditions become more suitable for building large heavy structures, the likelihood of a seismic event also increases. Today's ground improvement and specialty foundation solutions can be designed and constructed to overcome the difficulties of working in a delta bayou or the lateral loads associated with large scale seismic events.

As shipping facilities are redefined and capacity increases are needed, many of the world's ports have reached their practical limits of development. Therefore port designers and owners are challenged to find economical foundation options for the

facilities with poor subsurface conditions. In past years, foundation designers were given few simple options to support a variety of port facilities. In cases where the ground was less than favourable, a deep foundation consisting of driven piles was nearly always selected.

Another issue today is the reuse of sites near a port facility. Often these sites consist of poorly compacted fill, construction debris from previous operations at the port, or some other problematic soil condition. As the engineering community learns more about long-term settlement and reliability, the ways of yesterday are being re-evaluated. With modern ground improvement options at their disposal, the designers can increase reliability, increase loading capacity and decrease construction costs.

The storage tank example

Let's consider one critical port structure: large storage tanks. When a tank undergoes differential movement exceeding limits set by the American Petroleum Institute (API), the operator must make a choice about the tank's future. They could raise the tank by first lifting it and then placing sand beneath the floor to level it, but this is only a temporary solution, as the tank will eventually settle again and be out of service during the next repair cycle. Permanent solutions include specialty techniques like compaction and jet grouting which modify the ground conditions beneath existing tanks for a one-time fix. Alternatively micropiles can be installed to carry loads down to competent bearing elevations. These same techniques can be utilised should the owner want to increase the tank storage capacity by adding additional height to the tank. In this case, the ground conditions below the tank may already be supporting the maximum possible load. The tank has already gone through a cycle of primary settlement; increasing the

height of the tank will result in additional settlement. Grouting would eliminate the secondary settlement and provide support for the new loads. While this is a specific case history for a tank, the same repairs can be completed for dry storage facilities such as silos or warehouses.

Problem ground under planned structures

Ground conditions dictate which improvement methods are effective for planned structures. Because no two sites are the same, this presents a challenge for those trying to understand and remediate the world below our feet. One site may experience too much movement during a seismic event, while an adjacent site may be located near or on a slope, requiring design solutions for slope stability. An increasing number of technologies are available to provide solutions for any underground challenge. Through this vast array of innovative geotechnical tools, designers can now look past the problems they cannot see below ground and focus on building a viable structure. Following a thorough subsurface investigation the soils can be understood, allowing selection of the most cost-effective and technically appropriate ground improvement method.

Considering the options

Temporary fill material can be utilised to surcharge sites underlain by soft wet soil. This settlement may strengthen the soil enough to allow construction to proceed. However, the desired design capacity of the structure might not be attained for months or years depending on the soil properties. Installing wick drains, a cost-effective method also known as vertical drains or prefabricated vertical drains, into the soil accelerates the surcharge process. The wick drains are the lowest cost ground improvement method. Millions of feet of wick drains have been installed in port

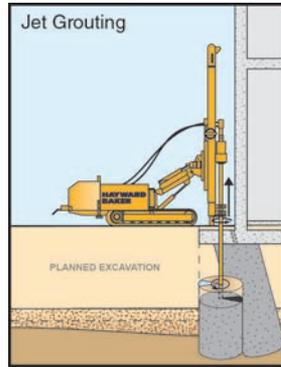
facilities around the globe. Capable of installation in harbours, wick drains may be designed to accelerate consolidation of material in the waterways and reduce the need for dredging. As with all ground improvement solutions, the soils must be appropriate for the technique.

If the proposed site is going to settle too much or won't support the structure's weight, rather than drive piles, consider increasing the soil's strength with ground improvement. Stone columns, Vibro Piers™ or aggregate piers can be highly effective for such sites. Well-researched and utilised for over 60 years, stone columns have improved bearing capacities and decreased settlement under structures and embankments around the world. In the proper soil conditions, stone columns also provide liquefaction mitigation. They are the next most cost-effective solution for reinforcing soils at your facility.

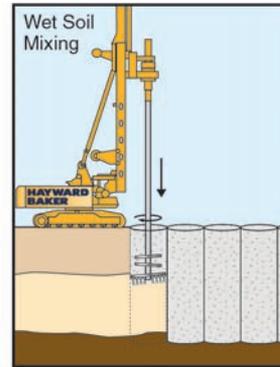
When stone columns do not provide sufficient reinforcement or improvement in capacity, soil mixing can be used. During this process, cement and other binders are mixed with the existing soil to strengthen it. This improved material supports significant loading, even in the worst soil conditions. Soil mixing can be completed as distinct columns or as mass soil mixing. Column mixing extends from the surface down to competent bearing stratum. Mass soil mixing treats nearly 100 percent of the poor soils to maximum depths of 20-feet. If the poor soils extend deeper, the two techniques can be combined effectively. Soil mixing is used at port facilities on a global scale. Soil mixing also has advantages over traditional backfill behind bulkhead walls. Sheet pile wall depths and thickness can often be reduced, thus making cost savings because the strengths of the soil mixed material is known from the design phase. One last consideration is the aging infrastructure at most of the world's port facilities. There is an economic need to get the most out of each bulkhead wall or other structure. Often ground improvement techniques such as jet grouting are utilised to reinforce these structures and/or add a few more years of design life to a failing structure.

In conclusion

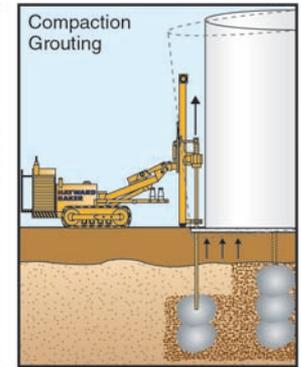
As your development expands, consider ground improvement to reduce cost. A variety of ground improvement solutions can be designed to meet the challenges faced by every port owner. Ground improvement techniques have proven track records of working well in port environments. As technology advances, poor ground conditions become less of a concern. If your ground is bad, don't live with it, improve it.



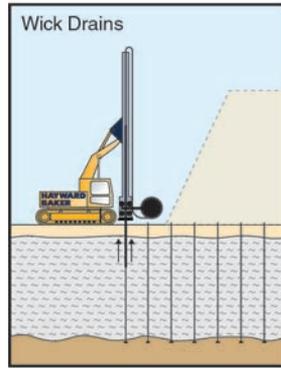
Jet grouting controls water and stabilizes existing structures.



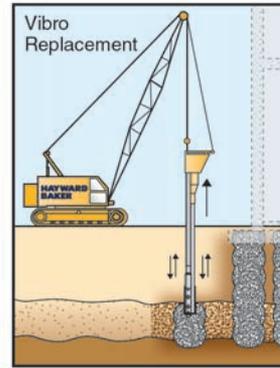
Soil mixing supports large new structures or dock walls.



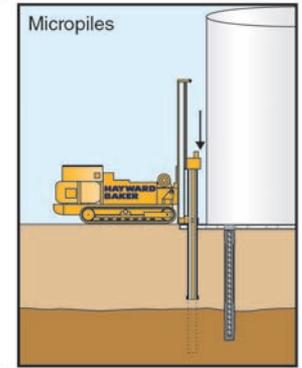
Compaction grouting remediates and lifts settled structures or improves fills.



Wick drains accelerate consolidation beneath large fill areas or port improvements.



Bottom feed vibro replacement stone columns support new structures.



Micropiles support settled structures, new loads on existing structures, and new structures in areas with limited access.

About the author



Jeffrey Hill has 14 years of experience in specialty geotechnical construction and engineering. Jeff is currently a senior engineer with HBI's Central Region where he is responsible for the development of specialty projects throughout the 20 states in the centre of the United States. He has experience in the structural and geotechnical design of micropiles, earth retaining structures, specialty grouting, including chemical and compaction grouting programs, and Vibro Improvement Programs. He has worked throughout North America on projects including heavy industrial, dams, bridges and roadways. Jeff has also consulted on HBI's parent company Keller on projects in Europe and Australia. Jeff is involved with ASCE's Geotechnical Committee as a founding member of the local Geo-Institute Section, ADSC, DFI, the Engineers Club of St Louis, AGC's St Louis Chapter, and AREMA Committee member Chapter 8, Foundations and Concrete Structures. Jeff received a BS in civil engineering from the University of Illinois at Urbana Champaign. Jeff is licensed as a PE in Missouri, Illinois and Arkansas.

About the organisation

Hayward Baker (HB) is North America's leader in geotechnical construction. Annually ranked by Engineering News-Record magazine as the #1 Excavation/Foundation Contractor, HB is the industry leader in ground modification, earth retention, structural support and grouting technologies with a 60-year record of experience. HB is part of the Keller Group of companies, a worldwide geotechnical construction organization. Don't let the ground dictate what you can build or the service life of your existing structures. Just Ask HB.

Enquiries

Jeffrey R. Hill, PE, Sr. Engineer
Hayward Baker Inc., 1530 S. Second, St Louis MO 63104
Tel: 314 802 2923, Email: jrhill@HaywardBaker.com
www.HaywardBaker.com

Container Handling



Section sponsored by:

LIEBHERR

The case for automated RTG container handling

Thomas Gylling, head of port cranes process automation, Konecranes, Hyvinkää, Finland

Automated container handling is a recognised megatrend in the container handling industry. It started back in the early 1990s, when the ECT Delta Terminal, Rotterdam, began to use unmanned rail mounted gantry cranes in their container yard, with considerable success. The industry noticed, and investment in new automated terminals grew. Automated container handling technology developed quickly, concentrating on the cranes handling the intermediate storage of containers in the yard.

The automated rail-mounted gantry (ARMG) crane was popular from the beginning for greenfield terminals where it was advantageous to build container blocks perpendicular to the quay, with exchange areas at the block ends. This is often called an 'end-loading' operation. A popular end-loading design uses two identical ARMG cranes in each container block, running on the same rail with the main operating areas (see Figure 1).

After the ECT Delta Terminal successfully pioneered the first ARMG yard, automated RMG operating models were taken into use at Thamesport in the UK, at Container Terminal Altenwerder in Germany, at Ohi Terminal in Japan, and at Evergreen in Taiwan. The ARMG operating model and technology were field-proven. An alternative ARMG operating concept was also developed, in which the exchange areas were moved from the block-ends to the block sides, along the full length of the block. Because the cranes need to reach over the truck lanes, larger rail-mounted gantry cranes with cantilevers (CARMG) are used for such 'side-loading' blocks. CARMG blocks are built parallel to the quay. This provides a typical CARMG container block layout (see Figure 2), which has been selected in locations with higher transshipment cargo flows.

RTG operating model gains ground

The ARMG and CARMG operating models have gained ground, but not at the expense of the rubber-tyred gantry (RTG) operating model, which has grown as well. The RTG operating model can offer important advantages for greenfield terminals, brownfield terminals and terminals undergoing conversion. The RTG operating model is suitable for container terminals with land use restricted by the surrounding

environment e.g. ports located in densely-built urban areas. The RTG operating model is especially suitable for terminals, now using reach stackers or straddle carriers, which want to move to a higher-density stacking operation for higher productivity.

The RTG operating model is very adaptable and flexible. It can also achieve a container stacking density approaching that of its 'stiffer big brothers', the ARMG and CARMG. See Figure 3 for a typical RTG container block.



Figure 1: ARMG block layout based on typical ARMG operating model.

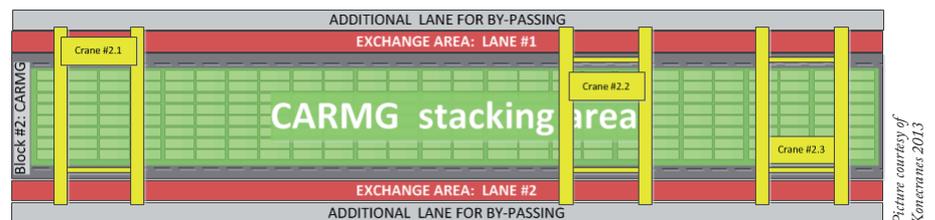


Figure 2: CARMG container block layout, based on typical CARMG operation.



Figure 3: RTG container block layout based on typical RTG operation.

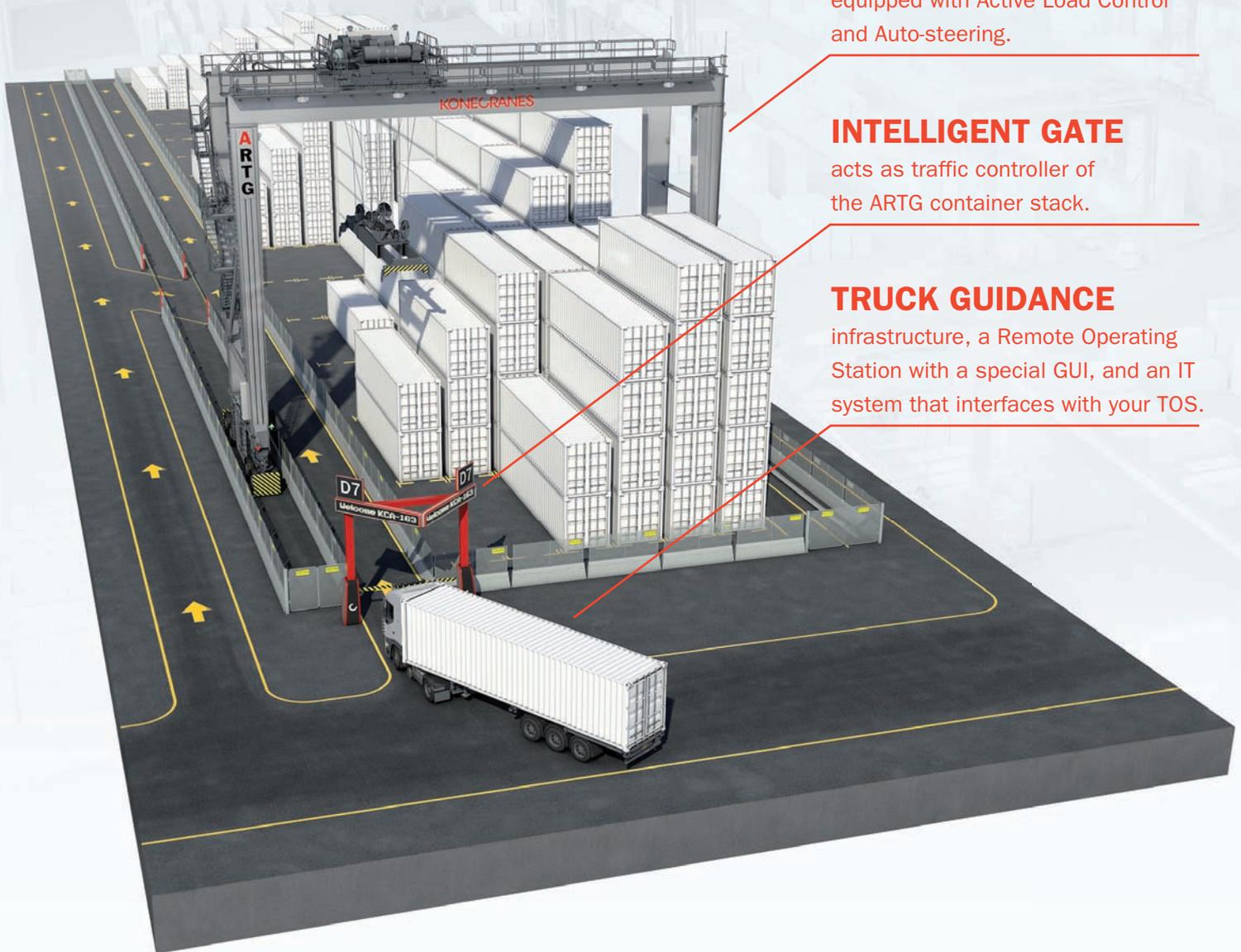


Figure 4: ARTG block layout, based on typical manned RTG operation.

KONECRANES ARTG SYSTEM

JOIN THE YARD

REVOLUTION



Based on our very popular **16-WHEEL RTG**, equipped with Active Load Control and Auto-steering.

INTELLIGENT GATE

acts as traffic controller of the ARTG container stack.

TRUCK GUIDANCE

infrastructure, a Remote Operating Station with a special GUI, and an IT system that interfaces with your TOS.

The **Konecranes Automated RTG System** gives you all the benefits of automation: operational cost savings, greater productivity, increased predictability and advanced safety features. You can build it in stages, using your current yard infrastructure. The future of your RTG-based container terminal operation is now brighter than ever.

Call us for **SMARTER WHERE IT MATTERS** container handling.
Tel. +358 204 2711, ask for Port Sales
Email: ports-info@konecranes.com
www.konecranes.com

KONECRANES[®]
Lifting Businesses[™]

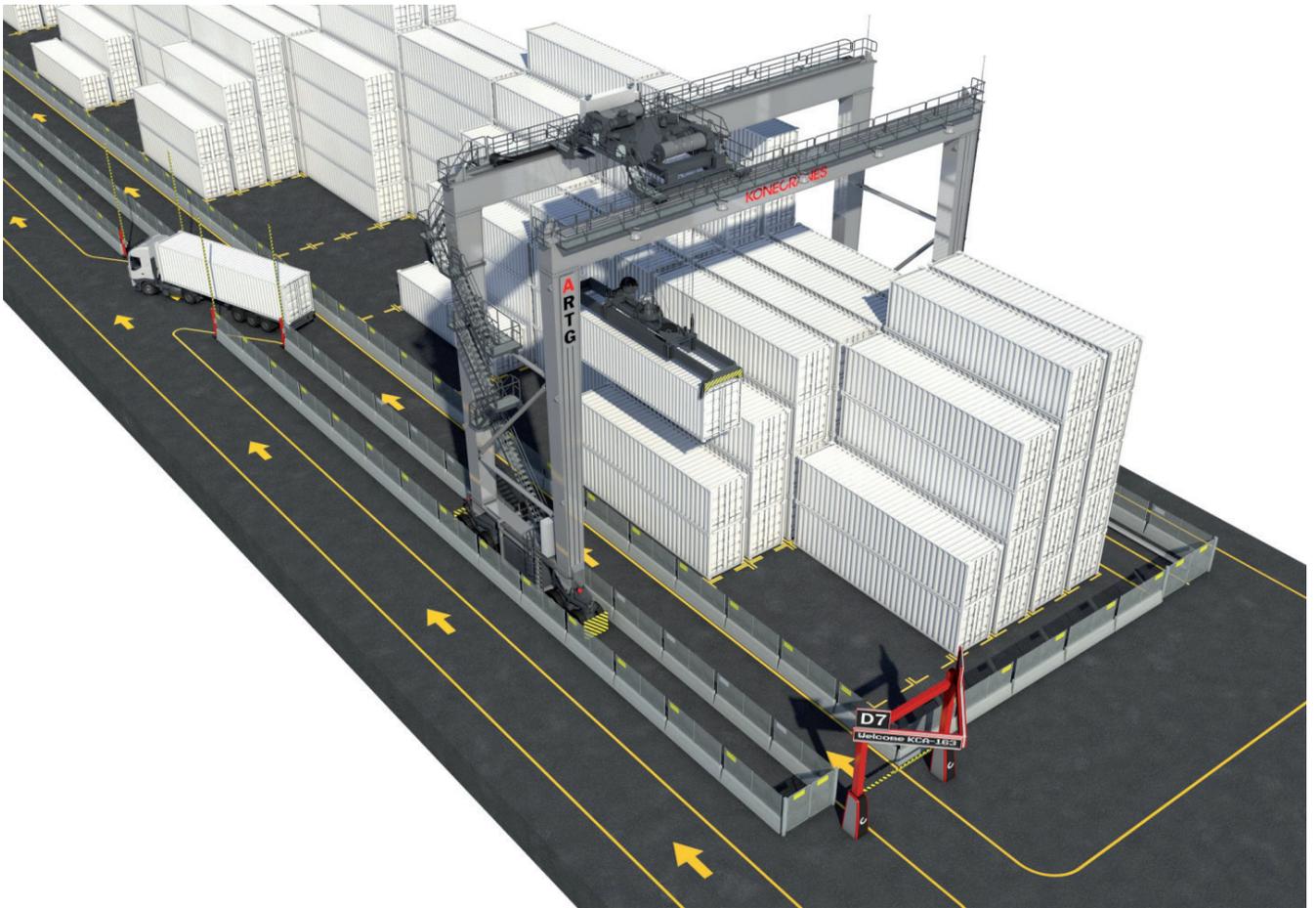


Figure 5: ARTG block layout example, brownfield layout derived from typical RTG block layout. Exchange area of one truck lane and truck by-pass lane between the blocks

When a truck 'by-pass' lane is added between the container blocks, the RTG operating model offers good truck access to the exchange area - practically as good as the CARMG operating model.

Automated RTG model: solving the process problems

Despite the strong evolution of container yard automation globally, there has been only one implementation of unmanned RTG cranes. This was at TCB Japan, where unmanned RTG operation was achieved in 2008.

Why has automated RTG operation not gained more commercial ground? Theoretically, building an automated RTG (ARTG) operation should not be that different from building an ARMG operation. In practice, however, an automation model based on rubber tyres is very different from an automation model based on rails.

Let's look more closely at the processes involved in building an ARTG operating model. Let's start with a typical manned RTG container block (see Figure 3). When this is converted directly with the same layout, the ARTG block would look like Figure 4.

When we compare the ARTG block layout with the field-proven ARMG and CARMG block layouts, the main difference in the ARTG layout is how the exchange area is integrated in the area of ARTG operation. In ARMG and CARMG blocks, the manned vehicles are kept separate from the automated cranes in the exchange areas. The separation is typically achieved using fences and truck driver booths. In manned RTG operations, 80 percent of the accidents in the RTG yard area are related to running over personnel.¹ A safety-first approach is vital for the ARTG operating model

A key process problem in the ARTG operating model is found in the areas where the truck is being loaded and unloaded by the unmanned crane. Safety must be ensured in the exchange area. Fencing can be the solution, following the model of the ARMG yard. The exchange area can be fenced off from the stacking area and the crane runway, creating a fenced truck lane. Block perimeter fencing can be added for additional security. This setup will have implications for the movement of truck traffic. Truck traffic pressure can be relieved by adding block exit points. Figure 5 shows this

basic setup at a typical brownfield RTG yard, with one additional exit point at the side of the block.

Handling of truck traffic is a major process change. The ARTG block in the example image has one truck lane that acts as the integrated exchange area, with end-loading. An additional exit point at the block side releases the truck traffic pressure through the block. Looking at this layout, we can see that truck traffic planning and control are essential in building a successful ARTG operating model.

Automated RTG model: solving the tolerance problems

From the crane design point of view, the ARTG operating environment poses a number of difficult technical problems related to 'the three deltas' of yard crane operation:

1. RTG crane runway tolerances
2. RTG stacking area tolerances
3. RTG rubber tyre tolerances

The three deltas of ARTG operation are much more difficult to handle than the three deltas of ARMG operation. The reasons why are found in the unevenness of typical RTG runway, and yard surfaces, contrasted with the



ORBITA
GateSuite



GateSuite®

Your access to advanced port container logistics

Make the most of our expertise in technological solutions for ports sector:

- Gate Automation
- Crane OCR systems
- Process engineering
- TOS integration

Visit now www.gatesuite.com and contact us at info@gatesuite.com

Picture courtesy of Konecranes 2013

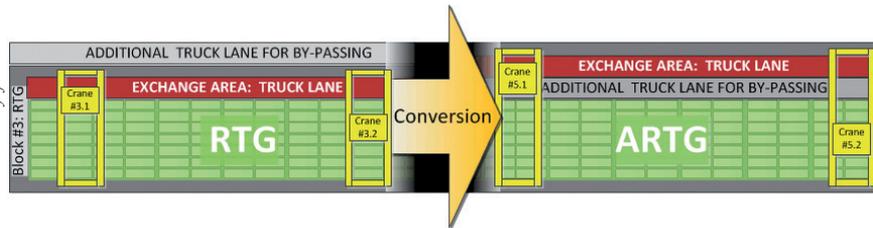


Figure 6: The ARTG system can be built up per block while retaining conventional RTG operation blocks. The new ARTG block here can cater for higher truck traffic flow thanks to the two truck lanes.

Picture courtesy of Konecranes 2013

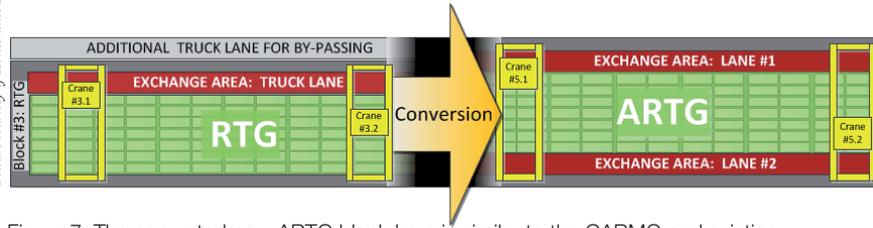


Figure 7: The converted new ARTG block here is similar to the CARMG and existing implementation which can separate the land side and water side horizontal traffic with the container stack between them.

straight rails and stacking areas of RMG yards, and how this affects container handling and stacking precision. All of the 'process and tolerance' problems have now been solved. The benefits of automation are now within reach for RTG-based terminals.

The benefits stack up

The well-known benefits of automation - greater productivity, greater safety, and cost savings - are now available for RTG-based container terminals. The ARTG offers stable and predictable productivity, around the clock. The machine never gets tired, it will operate without performance deviations. The container moves are executed automatically across planned usage patterns that treat the machine gently. Its lifetime can therefore be extended. The control system chooses the container moves instead of a human operator. This makes for a more predictable operation, and also ensures information exchange, keeping the terminal operating system up-to-date.

Whenever automation is implemented, the processes involved must be clarified, defined, streamlined and standardised. Done well, this will increase both productivity and safety. The ARTG operating model provides fundamental improvements in safety, since the horizontal traffic with manned vehicles is under much better control. Furthermore, the ARTG offers benefits that are unique to the RTG-based operating model. Compared to existing ASC systems consisting of either ARMG or CARMG, the investment cost is lower:

the ARTG system does not need rails. The rubber tyres of the ARTG run on virtual rails. It's very feasible to implement ARTG automation incrementally in the terminal, making the ARTG applicable for brownfields and greenfields alike. The ARTG operation can be built up in controlled phases, at reasonable cost, with minimal interruptions to terminal operations.

The terminal can retain its established RTG operating model, while gearing up for ARTG operation. The biggest strength of the ARTG is its adaptability to change. If the terminal is undergoing changes related to import/export and transshipment traffic, implementation of the ARTG system can be adapted to the new demand (see Figure 6). Such yard conversions enable a higher truck traffic flow thanks to the two truck lanes, thus catering for increased transshipment traffic. Alternatively, the conversion can adapt the CARMG thinking with two exchange area lanes on each side of the stack. This enables the separation of land side and water side horizontal transports (see Figure 7).

In conclusion

The benefits of ARTG operation are clear. The process and technical problems related to ARTG adoption have been solved by Konecranes. ARTG technology can be adopted now by RTG-based container terminals gearing up for greater traffic and productivity. The stage is set for the automation megatrend to grow even further in the container handling industry.

References

ⁱ Laurence Jones, TT Club/ICHCA Director Global Risk assessment, PEMA Equipment Technology Forum at TOC Europe 2013

About the author



Thomas Gylling has been heading the Konecranes port cranes process automation unit since 2011. He has held various positions at Konecranes over the last 10 years focusing on sales and project execution. He started his career with Konecranes by cooperating with the company on his Masters thesis, studying total cost of ownership of automated versus manned cranes. He continued as a project manager, delivering electrical overhead travelling cranes to the US market, then RTG cranes to the global market and then switching to container crane sales for Europe and South East Asia.

About the organisation

Konecranes is a world-leading group of Lifting Businesses™, serving a broad range of customers, including manufacturing and process industries, shipyards, ports and terminals. Konecranes provides productivity-enhancing lifting solutions as well as services for lifting equipment and machine tools of all makes. In 2012, group sales totalled €2,170 million. The group has 12,100 employees, at 626 locations in 48 countries. Konecranes is listed on NASDAQ OMX Helsinki (symbol: KCR1V).

Enquiries

Mr. Thomas Gylling
Manager, Head of Yard Process Automation
Konecranes Finland Corporation,
Port Cranes

Direct: +358 20 427 2219
Fax: +358 20 427 2599
Konecranes - Lifting Businesses:
www.konecranes.com

Company address: Konecranes, P.O.
Box 662, Koneenkatu 8, FI-05801
Hyvinkää, Finland

Experience the progress.



Liebherr-Werk Nenzing GmbH
Dr. Hans Liebherr Str. 1
6710 Nenzing/Austria
Tel.: +43 50809 41-725
mobile.harbour.crane@liebherr.com
facebook.com/LiebherrMaritime
www.liebherr.com

LIEBHERR

The Group

Options and opportunities of container weight verification

Adrian Coventry, director of engineering, Strainstall Marine, Cowes, Isle of Wight, United Kingdom

There can be little argument that the international cargo handling industry stands on the verge of one of the most significant changes since the advent of containerisation. Until now, cargoes have been shipped based on the container weights declared on the advance booking information provided by shippers. Vessel stowage plans and port operations are typically based on these pre-declared weights which can vary significantly from the actual mass of the cargo transported. The consequent risk to the health and safety of seafarers and port operatives is clearly apparent.

An imperative for change

As a result, the need for a robust system

of checking and verifying the weight of each container throughout its transit from shipper to receiver is now demanded by public and political opinion, and is almost universally accepted by the industry too. This consensus is extremely timely as recent technological developments mean that the accuracy and robustness of potential weight verification solutions is far better now than was previously the case. There are also very significant opportunities for the integration and automation of port, terminal and vessel stowage operations that may be facilitated through the implementation of container weight verification technology. The key outstanding questions however, are how to establish robust and meaningful

regulation and which technologies to implement in each port.

In order to inform discussion on both these questions, Strainstall published a white paper entitled: 'Taking the load off: technology options, costs and opportunities for the implementation of container weight verification'. This paper, which was launched at a meeting in London of the International Cargo Handling Coordination Association (ICHCA), is intended as an objective assessment of the opportunities and requirements of container weight verification implementation. It is now freely available to the global shipping industry and it is hoped, will add valuable insights to the ongoing debate on this subject.



Varying container weights are a risk to the health and safety of both seafarers and port operatives.

Why regulation must be technology-neutral

The concept of technology neutrality is a widely accepted principle of effective regulation. While there remains much debate on particular technologies and their respective benefits, it is crucial that regulators avoid the temptation to 'pick winners'. Instead, regulation should be expressed in a manner that specifies the outcomes required, such as measurement accuracy, repeatability, speed and acceptable calibration methods etc. as opposed to prescribing the precise means of achieving these objectives.

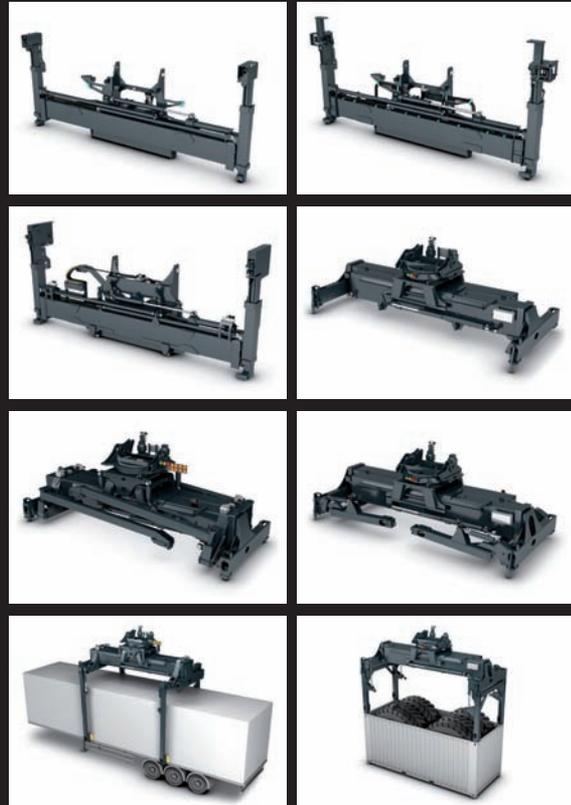
There are three key reasons why this is fundamentally important. Firstly, container weight verification technology is at a comparatively early stage of development, with many different systems offering complementary cost, benefit and return on investment profiles in different usage contexts. In short, it appears that there is no single 'silver bullet' technology that will be appropriate to every port and every cargo type. Secondly, regulating in a technology neutral manner will enable and facilitate future innovation by the load measurement industry as manufacturers will be free to develop new technological solutions that meet regulatory compliance while offering additional benefits of reduced cost or additional functionality. Finally, such an approach will enable port operators to select weight verification technology solutions that achieve regulatory compliance while also opening the way for the development of fundamentally new services and exploitation of process automation and integration opportunities beyond the immediate scope of weight verification.

Skills and investment considerations

The precise mix of existing capital equipment and operating processes is likely to be one of the primary considerations for port and terminal operators in achieving future container weight verification compliance. There is little chance of wholesale reinvestment in cargo handling equipment, so the compatibility of any technology solution with existing lifting equipment will be crucial. A further key issue is that of operator skills requirements, with many current mechanical handling roles being either low or semi-skilled. Whether the implementation of container weight verification influences the skills required of lifting equipment operators will depend heavily on the precise mode of implementation. Indeed, if smart port management systems are implemented in tandem with container weight verification, the change may be completely transparent and may not affect manual job functions.

Where to weigh?

Weighbridges located at the port gate are easy to implement, but present significant challenges in establishing the true tare weight of the vehicle and in differentiating the weights of multiple container loads. These indirect measurement systems might however find favour with shippers, allowing them to ensure that their declared weights are within tolerance prior to shipment to the port, thus avoiding the cost and disruption of mis-declaration penalties. Within the port, reach stackers and fork-lift trucks provide a relatively low cost path for indirect weight measurement to be integrated into vehicle systems e.g. inferred from hydraulic pressure. However, this is likely to be of lower accuracy than direct measurement systems and it is questionable whether it would deliver full compliance with any genuinely robust regulation. Rubber-tyred gantry cranes and straddle carriers provide a good opportunity for the implementation of direct weight measurement of individual containers within the port environment but before final vessel loading operations. Such systems may offer a highly flexible solution with minimal disruption to existing port operations and container logistics.



Trust and reliability

ELME's innovative modular spreader concept combined with design simplicity and market feedback is all characteristic of ELME. Our spreaders are supplied to lift trucks, reach stackers, straddle carriers, gantry, quayside and ship-to-shore container cranes worldwide.

ELME is well known for our historically reliable container solutions. Trust and reliability have made us the largest independent spreader manufacturer in the world. We simply offer the right spreader, for all applications, with any machine.

HEADOFFICE

ELME Spreader AB, Älmhult, Sweden
Phone +46 476 558 00 E-mail sales@elme.com

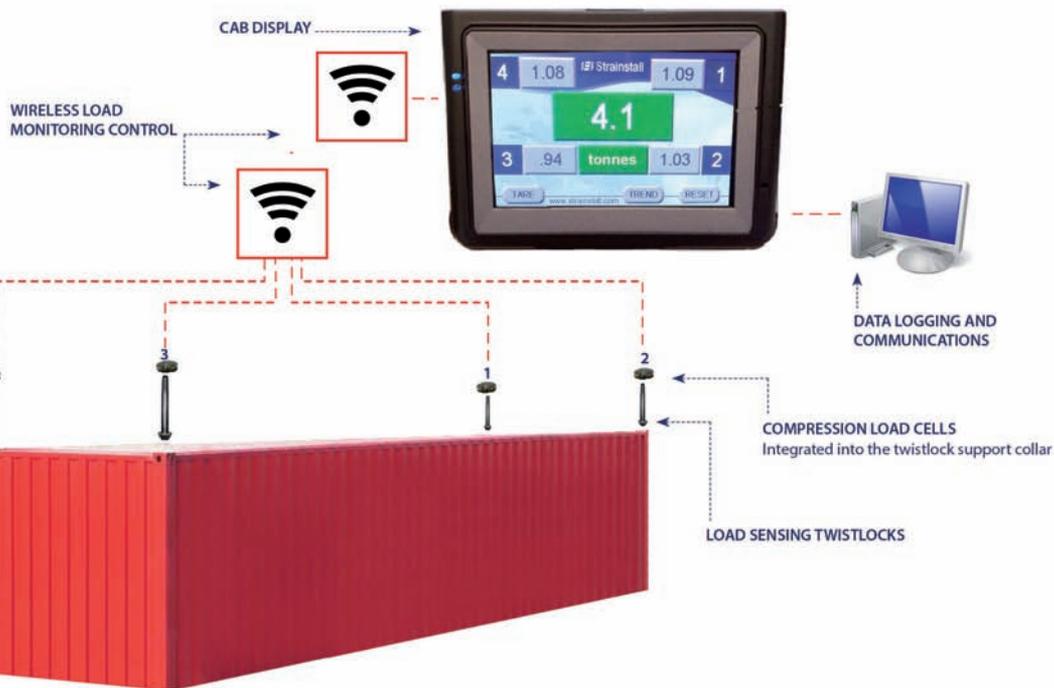
SALES AND SPARE PARTS

ELME Spreader Trading (Shanghai) Co. Ltd
Shanghai, P.R China
Phone +86 21 5169 8922 E-mail sales.cn@elme.cn

SPARE PARTS

ELME Americas Inc., Martin, Tennessee, USA
Phone +1 731 588 02 20 E-mail sales.us@elme.com

ELME SWEDISH
SPREADER
SYSTEMS



Strainstall's CWMS provides data on load at each twist lock location as well as overall mass.

	Technical description	Strengths and weaknesses	Nominal accuracy	Relative cost of implementation
Load cells and pins integrated at single point within lifting equipment	Strain gauges integrated into key load bearing components of the lifting equipment.	Simple to implement and extremely robust. Particularly effective for overload protection. Unable to distinguish individual containers on multiple lifts.	90 - 95%	Extremely cost-effective solution where additional accuracy and resolution of CoG is not required.
Strain gauged twist-locks	Strain gauges integrated into each of the spreader twist-locks (four for each container lifted).	Extremely robust but requires at least four sensors. Allows calculation of container CoG.	99 - 99.5%	Medium: life of strain gauges is limited to that of each twist-lock.
Fibre-optic systems incorporated into twist-locks	Fibre optics sensors integrated into each of the spreader twist-locks (four for each container lifted).	Requires at least four sensors. Allows calculation of container CoG. Potentially less robust and higher cost than strain gauged twist-locks.	99 - 99.5%	Medium-high: life of fibre-optic sensors limited to that of each twist-lock.
Strain gauged twist-lock collars	Strain gauges integrated into the collar of each of the twist-locks (four for each container lifted).	Extremely robust and cost effective. Allows calculation of container CoG.	99 - 99.5%	Low-medium: extended life of strain gauges as not directly integrated with consumable parts.

The ship-to-shore crane is a highly desirable location for weight verification, being the final point of departure and the first point of entry for imported containers. However, practical operational constraints will require that this process is one of confirmation for outgoing containers, as weights will need to have been verified at an earlier stage in port operations to avoid any disruption to loading and stowage planning. For incoming containers however, the ship-to-shore crane is an ideal location for

weight measurement, as any overweight container on an incoming ship is a problem that requires careful attention. In extreme circumstances it may be the case that a decision is made that a container cannot be unloaded safely, while in other more marginal cases it may be unloaded and segregated for handling as a non-compliant load (subject to appropriate additional processing fees). The aim of container weight verification is that an overweight container is never loaded onto a vessel in the first place;

the ship-to-shore crane is thus ultimately the ideal location for ensuring future regulatory compliance.

Technology options for direct measurement

There are two commonly applied categories of direct measurement technologies for container weight verification. Strain gauge technology is used almost universally in weighing applications ranging from load cells and pins through to twist-lock based

systems. The alternative fibre optic systems, tend to be used primarily on twist locks. Given good quality design, the accuracy of both measurement technologies is broadly similar. The accuracy, technical, and other characteristics of various technology options for direct measurement solutions are summarised in Figure 1.

Key considerations for implementation by ports

One of the key recommendations for the implementation of container weight verification technology must be that container weight should be measured as close as possible to the point of lifting; the twist-locks. In addition to enabling the precise verification of individual container weights, it will also enable automatic estimation of centre of gravity; something that will be extremely useful in improving the safety of stacking operations. In addition to ensuring that robust solutions are adopted, commensurate with the harsh environment of port operations, it is also recommended that those implementing solutions seek wherever possible to replicate or integrate with existing standard parts of the lifting system to which it is applied. Due consideration of the replacement cycles of equipment must be taken however, and this is an important reason for Strainstall's recent focus on the development of instrumented twist lock collars which have a service life well in excess of the twist lock.

In summary, within the context of genuinely technology-neutral regulation, implementation of container weight verification based on the approaches described in this article, and explained in greater detail in the recently published white paper, will not only provide a potentially much safer and more environmentally sustainable future for the shipping industry, but it will also act as a key enabler for a much higher level of process integration and automation.

About the author



Adrian Coventry joined Strainstall UK Ltd in 1990 as a field operations engineer. He gained extensive field experience across a wide range of industries including nuclear power, offshore oil and gas, marine and rail. In 2008 he was appointed to his current role as director of engineering, Strainstall Marine.

About the organisation

Strainstall Marine is a member of the James Fisher & Sons plc group. The company is a broad-based engineering business, specialising in load measurement and sensor-based safety technology. Based in Cowes, Isle of Wight, it has long been associated with the manufacture of standard and bespoke load cells, and has over 45 years' experience in assisting industries to operate safely by ensuring that structures, equipment and infrastructure are safe to use. Through continuous innovation and development, Strainstall has a range of world-class monitoring technologies that continuously monitor physical and performance parameters such as load, stress, temperature, acceleration, pressure and displacement for industries ranging from the global shipping and marine engineering sector to construction and renewable energy.

Enquiries

Jonathan Harris, sales manager
Container weighing systems
Strainstall UK Ltd
Tel: +44 (0)1983 203600
E-mail: Jonathan.Harris@strainstall.com



eRTG featuring fuel saver, cost saver, rapid power switcher.



VAHLE
ELECTRIFICATION SYSTEMS

WWW.VAHLE.COM

Track and trace at Portsmouth International Port

Mark Phippen, *distribution manager,*
MMD Shipping Services Ltd, Portsmouth, United Kingdom

Behind the simplicity of internet shopping lies a complex system of tracking software that allows customers to easily follow the whereabouts of their purchases. Managers at Portsmouth International Port wanted to deliver a similar experience to their customers who grow, ship and buy fruit all over the world.

Portsmouth International Port is the gateway for much of the fresh fruit eaten in the UK, with 60 percent of all bananas sold in the country having come through the port. Mainland Market Deliveries Ltd (MMD) is a specialist importer and handler based at Portsmouth. The company provides shippers with a fully integrated turnkey service, including stevedoring, ship and customs agency, handling, storage and onward distribution. MMD realised that new distribution software could bring big benefits to not only the company, but also its clients all over the world.

The development of a solution

In 2006 MMD made the decision to upgrade its distribution software. At that point it was using two systems - 'Manpack' for straightforward distribution of produce and 'Wizdom' for scanned pallet tracking. Following a selection process, MMD invited consultants Anglia Business Solutions to implement a new system, and their specialist 'LinkFresh' software was deployed.

'LinkFresh' is a bespoke adaptation of Microsoft's 'Dynamics NAV' software, combining scanned and non-scanned items into one system. Its arrival provided the foundation blocks for subsequent development, with MMD encouraging all customers to increase the amount of scanned items coming through the port. For the first time there was now full traceability throughout the supply, shipping, handling and delivery chain.

The next stage was to develop a web portal to allow customers to fully track their shipments.

The idea behind the system is simple. Barcodes are attached to products the moment they start to make the journey from field to supermarket, and are scanned at every new stage of the process. That means the fruit will be scanned at the port of origin, with shippers doing the same as it moves through warehouses, and onto and off cargo vessels. The web portal allows everyone involved in the supply chain to monitor the progress of each shipment.

Work on the development of the internet-based technology began in 2010, with the system fully released in 2012 after a year of testing. It allowed customers direct access to filtered data on the 'LinkFresh' system. Before this web portal became available a series of



Geest Line Benguela Stream.

international telephone calls had to be made or faxes of stock sheets sent. Now live data of stocks and dispatched loads could be viewed online from anywhere in the world; dramatically reducing the amount of time, cost and effort that had previously been required in getting the information.

Realising further benefits

The installation of the 'Linkfresh/Microsoft Dynamics NAV' system was initially very much a port-focused project. However, in early testing it soon became clear that the addition of the web portal brought major benefits to customers too.

Mark Phippen is the distribution manager at MMD Shipping Services Ltd. He explains the added value that clients have gained from the system: "The advantages are numerous, smoothing out the entire supply chain. The tracking system gives shippers real-time information about where their fruit is. This reduces waste by making sure the shipments can be collected at exactly the right time, helping to keep fresh produce in perfect condition. There is a reduction on wasted journeys, with HGVs only being dispatched when produce is ready for collection; this ultimately means a reduction in Co2. It also helps to ensure full advantage is made of empty space in trailers, reducing the overall number of lorries on the roads allowing the whole process to run more efficiently."

Mr Phippen continues: "There is also the benefit of traceability - something the industry now demands. The system gives growers the certainty that their fruit has left MMD and is travelling to the ripening centre, and it allows the supermarket to trace the fruit back to the farm of origin, which can be important if there is a problem with the produce."

Portsmouth International Port understands it is the only UK maritime destination for fresh fruit and vegetables to offer such a system. This is a major consideration for large global companies who rely on the efficient supply chain. All have been impressed when shown the live information available directly to them. As well as encouraging new business it has also helped MMD maintain current customers, attracted by the bespoke technology.

The system has been used by growers and companies shipping fruit from all over the planet. Whether it is grapes grown in Chile, oranges from South Africa or bananas from Central America and the Caribbean, practically every pallet that arrives at Portsmouth International Port now carries the barcode that allows full traceability throughout the

journey. The major suppliers to British supermarkets rely heavily on it, such as well-known companies Del Monte, Fyffes and Geest Line.

Sharing the experience

Mark Phippen believes the development of the system has been an entirely positive experience, one that he has been happy to share. Recently delegates from six countries in Europe came to the port to investigate the benefits it has brought. The 40-strong delegation was made up of members of Westflows (West and East Freight Flows). Westflows is an Interreg IVB North West Europe project funded by the European Regional Development Fund (ERDF) that aims to encourage a shift towards greener freight transport in the NWE region. As part of Westflows, Portsmouth

International Port received European match funding for the development of the track and trace technology, and at a conference held in Portsmouth, experiences gained from the implementation of the bespoke system were shared.

Mark feels this particular success story is unlikely to be the last: "We have several projects on the go at the moment. First is a new container control system which, like the portal, is web-based, accessible by all internal parties with the aim to eventually open this up to customers much like the current web portal. Customers will see all containers onsite, off site and loaded back to vessels. We are also working with customers, initially Del Monte, on a two way electronic exchange of orders. For instance, Del Monte will send a collection order directly to our system, pallets will

Moving energy made easy: by rol e-chains®



All media in one chain & from one source: power data hoses accessories. Corrosion-free and saltwater resistant. Long travel up to 800 m and high speed up to 100 m/min with 50% less drive force. Light and modular. Rol e-chains® by igus®.

visit us: [http://www.igus.com](#) / [http://www.igus.com](#) / [http://www.igus.com](#)

igus®-cranes.com

plastics for longer life®		igus® GmbH Spicher Str. 1a		D-51147 Cologne cranes@igus.com		phone 49 - 212 - 45 - 45 fax 49 - 212 - 45 - 45	
Austria	4 - 7 75-4 5-	France	-1-4 4 4 4	1 e ico	5 - 7 - 4 - 1 5	South Korea	- - 1 11
Belgium	- 1 - 144 1	Great Britain	44-1 4- 77 4	2 etherlan+s	1- 4 - 5	Spain	4- -47 5
Canada	55-11- 5 144 7	India	1- - 1 7	3olan+	4 - - 577	SE+en	4 -4 - 7
China	1- 5-7 44	Italy	- -5 -1	3ortugal	51- - 1	S5 it erlan+	41- - 7 7
Denmark	- 1-51 1	Japan	1- -5 1	Singapore	5- 4 71411	5ai5 an	-4- 5 1
	45- - 7	Malaysia	-7 5475	South Africa	7-11- 1 -1 4	7S	1-4 1-4



Top: NYKcool Crown Garnet calls Portsmouth's docks; Left to right, MMD Scanner, Fruit storage, Pallet loading at Portsmouth International Port.

be scanned onto the load on our system, and pallet/load details sent directly back to populate Del Monte's system. This cuts down on handling time and potential human error, and provides parallel real time information on customers' own systems. Thirdly we are developing a transport module to control the booking and flow of transport into and around the port, making more efficient use of time and space in the port. This will have a dramatic positive impact on waiting times and congestion."

The container control and electronic ordering systems are nearing completion, and should be available for testing and use towards the end of this year. The transport module is currently in the early stage of planning.

Lessons learned

Mark Phippen agrees that lessons are being learnt all the time through the development of new port technologies. He said: "We are driven by the needs of the customer, and

it is essential to involve them as soon as possible in the development of IT projects. This is because sometimes unexpected synergies and efficiencies can develop. An example of this happening in practice is the electronic ordering system, which developed organically from the web portal work with Del Monte. A clear goal is essential, but flexibility and adaptability is key too. Importantly, any IT project must benefit all parties and never be for the benefit of just the port or a customer alone."

Achieving that balance has always been the goal of the management team. The port is owned by the City Council and all expenditure has to demonstrate value not only to the end user, but also to local residents. They rely on the port for profits ploughed back into local services, as well as providing jobs in the area. There is confidence at the port that ongoing IT projects will deliver benefits that bring advantages to everyone who has a vested interest in the continued success of Portsmouth International Port.

About the author



Mark Phippen is the MMD Shipping Services Ltd, distribution manager, a commercial facing role, responsible

for handling customer's distribution needs, stocks control, outward cargo and container movements. Mark has been with MMD since January 2005. He was previously with Fyffes from 1993-2004, so has 20 years experience in the fruit business.

About the company

MMD (Shipping Services) Ltd is based at Portsmouth International Port on the south coast of England, providing cargo shippers with a fully-integrated turnkey service, including stevedoring, ship and customs agency, handling, storage and onward distribution. MMD's experience, expertise and state-of-the-art facilities allow them to handle a wide range of cargo. The specialist fruit and vegetable importing facility has secured Portsmouth as one of the largest fruit-handling ports in the UK, with produce from the Caribbean, Central and South America and Morocco.

Enquiries

dloader@mmdss.com
 MMD (Shipping Services) Ltd
 Flathouse Quay, Portsmouth
 Hants PO2 7SP
 Tel: 023 9289 0600
 Fax: 023 9281 1751

Your wharf may be stronger than you think

Erik Soderberg, *vice president, Yoshi Oritatsu, structural designer and Michael Jordan, CEO, Liftech, Oakland, California, United States*

Over time, vessel and crane sizes have increased dramatically. This continues as the maritime industry is experiencing another wave of larger vessels and cranes. The Panama Canal expansion and Triple-E class vessels are already impacting container terminals. Many terminals now face the challenge of accommodating larger vessels and cranes.

Often wharf owners find that they have insufficient crane girder rated capacity and only consider strengthening options. Before proceeding with expensive strengthening, owners should study the capacity of their existing crane girders. For a variety of reasons, crane girders are often stronger than their rated capacity due to early design methods and tools, cautious designers, or both. Using modern methods, engineers can often justify increased girder rated capacities without expensive strengthening upgrades.

Looking at methods of analysis

Various modern engineering methods are available to evaluate girder capacities. The most appropriate method depends on the nature of the structure, what controls the strength of the structure, and what capacity must be justified. Three of the more significant methods are presented here.

Three dimensional finite element analysis

Finite element analysis (FEA) is a relatively modern analysis tool not commonly used in design more than 30 years ago. Compared to earlier analysis methods, FEA provides a more accurate calculation of forces in the wharf structure, in particular when the structure supports the crane loading in multiple ways, eg. if the crane girders are integrated into a deck structure or have transverse beams. In these situations, a three dimensional FEA can often justify additional capacity.

Strut-and-tie model analysis

The strut-and-tie analysis method has only recently been integrated into US design codes by AASHTO in 1989 and ACI in 2002. This method involves considering the girder structure as a truss comprised of compression struts (concrete) and tension ties (steel reinforcing).

This method is most suitable when shear capacity controls the girder strength and when the controlling load is infrequent or extreme, where temporary or limited cracking can be tolerated. This method typically justifies much larger shear capacities than traditional methods.

Pile load testing

If the capacity of the wharf is limited by the estimated soil strength, there are several techniques that can be used to justify additional capacity. The easiest and initial method is to evaluate the pile driving data using modern methods. If driving data is not available or if more capacity must be justified, tests can be performed.

Two types of pile tests are most common, pile dynamic analysis (PDA) testing and load tests. PDA is used to estimate capacity by striking a pile with a hammer sending a compression wave down the pile, and measuring the pile response, including the

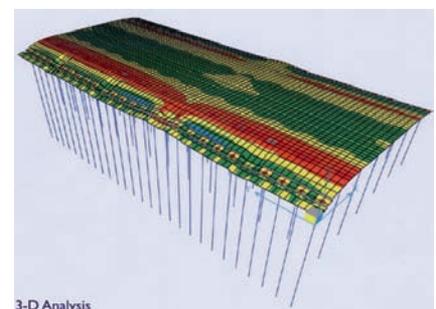


Figure 1 (top): Comparison of first container crane and modern container crane sizes; Figure 2 (right): Three dimensional crane girder finite element analysis results.

strains and accelerations at the top of the pile. An analytical analysis is made of the test data to estimate the pile capacity. The PDA provides a more accurate estimate of pile capacity than from pile driving data. Additionally, soil 'sets up' over time, providing more strength than during installation.

Piles can also be loaded to determine strengths. Load tests typically involve applying a load on the pile using one or more hydraulic jacks that push against the bottom of the girder and typically use the weight of the crane to help resist the loading.

In conclusion

Larger wharf capacities can be justified using modern engineering methods. The engineering cost has been a fraction of the cost of strengthening. An additional benefit is that there is no impact to terminal operations. If you need larger crane girder capacities, before proceeding with expensive strengthening work, try justifying additional capacity using modern engineering methods.

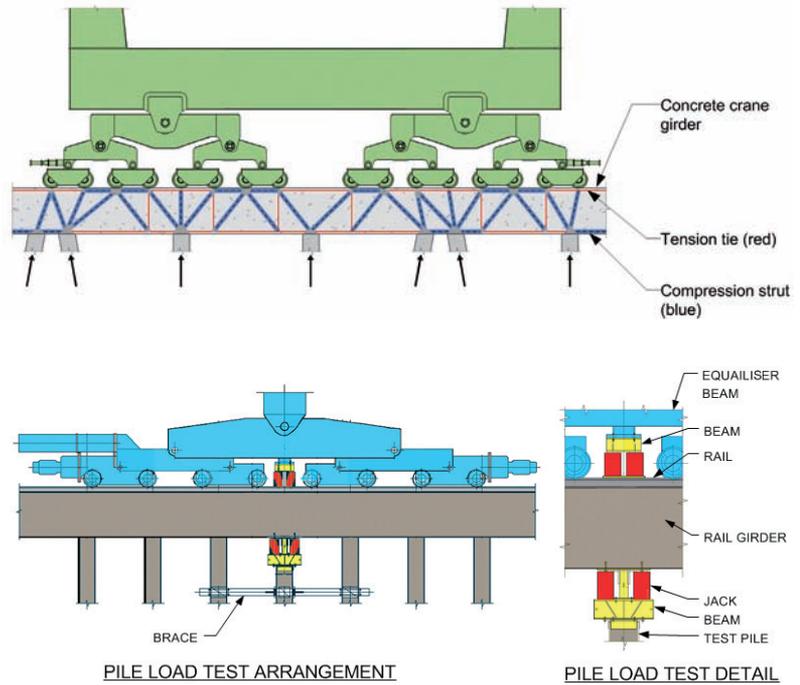


Figure 3 (top): Strut-and-tie model analysis;
Figure 4 (bottom): Pile load test arrangement and loading detail.

About the authors



Erik Soderberg is a Liftech structural engineer and vice president with nearly 20 years on the design, review, modification, and repair of a variety of structures, including over two dozen wharves, over 100 container cranes, and over a dozen bulk loader structures. Other structures include crane lift and transfer systems, and concrete and steel floats. He has participated in the design of over 1-1/2 miles of wharf and pier structures.



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



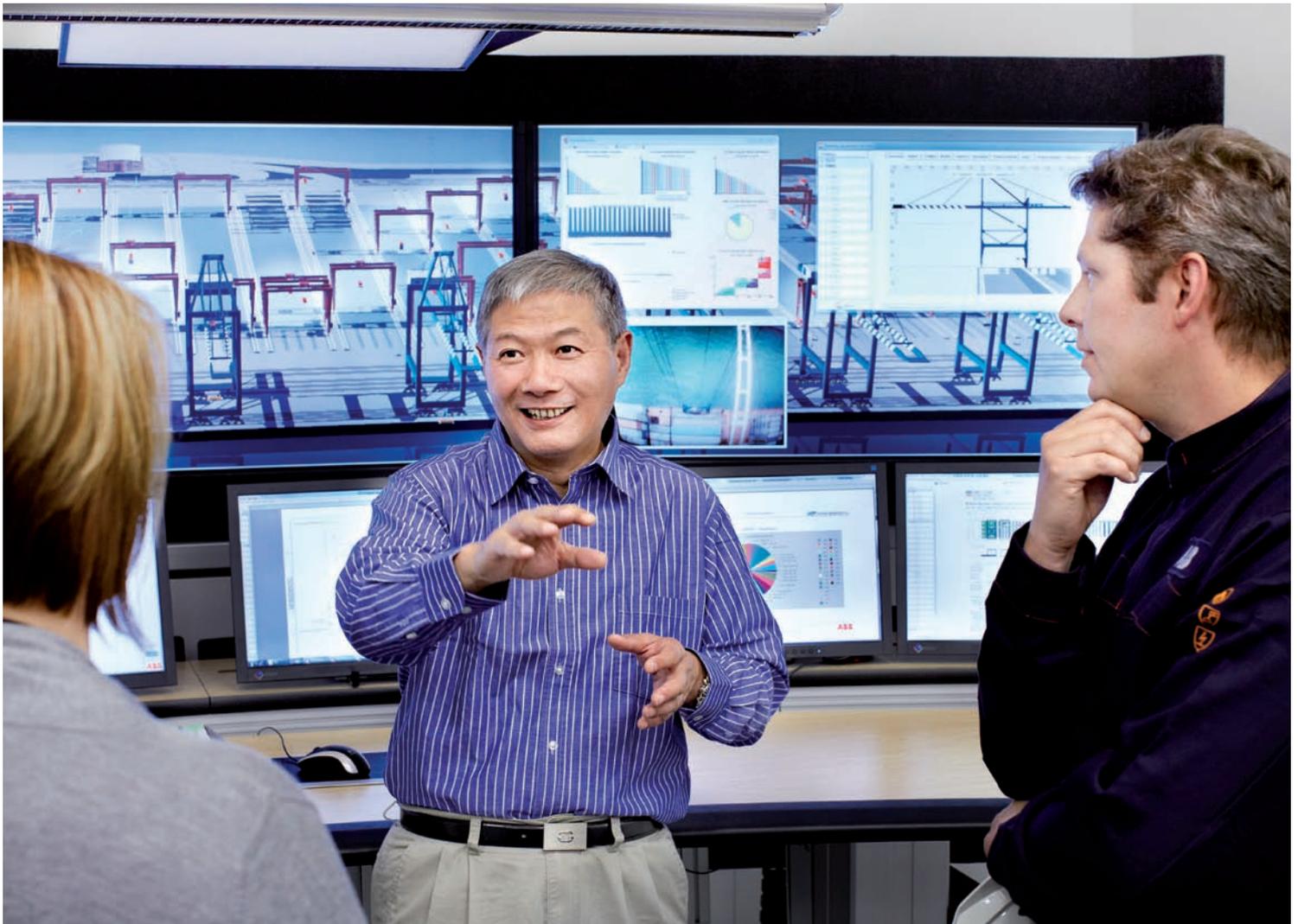
Michael Jordan is a Liftech structural engineer and CEO with over 50 years of experience. He is an internationally recognised expert in the container crane industry. He has been involved in the container industry evolution since participating in the structural design of the first container crane for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

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. Liftech's experience includes structural design for wharves and wharf structures, heavy lift structures, buildings, container yard structures, and container handling equipment. National and international clients include owners, engineers, operators, manufacturers, and riggers.

Enquiries

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



Intelligent Automation. Design your future crane operations today.

Mega-sized container ships, increasing container traffic and energy efficiency, set the ground rules for designing new container terminals. Responding to these challenges requires perfect planning and optimization of the processes. The solution is Intelligent Automation and collaboration. Intelligent Automation runs the processes, interacts with other systems, makes decisions based on real-time process information and adapts to changing conditions. People collaborate in teams to analyze improvement opportunities in order to ensure optimized performance of the terminal. Welcome to the terminal operations of the future – enabled by ABB's Intelligent Automation.

www.abb.com/cranes

ABB AB
Crane Systems
Tel. +46 21 32 50 00
Fax +46 21 34 02 90
E-mail: cranes.sales@se.abb.com

Power and productivity
for a better world™



Intelligent IT methods as a driver for terminal efficiency

Leif Meier, project manager, Realtime Business Solutions EMEA, Hamburg, Germany

Having the right information available at the right time for the right decision is a key issue that management and planning experts are facing day after day. This is especially true for the complex, dynamic and interacting processes at a container terminal. It is crucial for the planning team to be aware of the terminal operations with a full overview at any time, as any operational decision or change will have an impact on the efficiency of the terminal immediately - and therefore affect customers and shareholders.

As the terminal operating system (TOS)

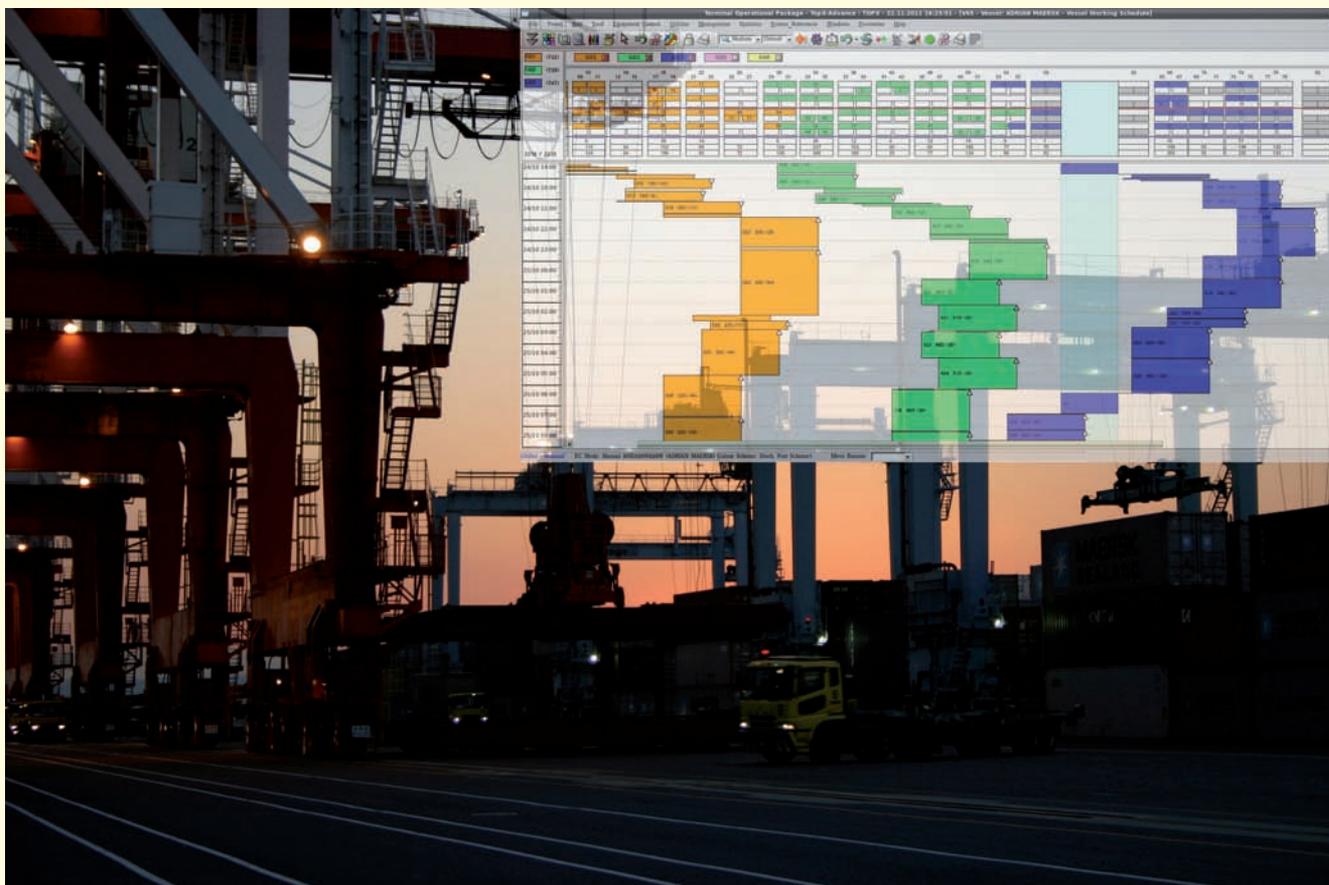
is managing all relevant information, the TOS is in a key position to drive terminal efficiency and success, playing a major part of the business profit model. New intelligent procedures based on methods from applied statistics and operation research benefit from TOS information in a smart way.

TOS-integrated solutions

Realtime Business Solutions (RBS) is working on TOS-integrated intelligent solutions for rubber-tyred gantry (RTG) dispatching and berth allocation. Being

TOS-integrated, smart algorithms make use of the high quality and information availability to support the planner with efficient solutions where necessary. Algorithms help to monitor any interacting changes in the system, keep the planner in focus of any upcoming issues based on defined thresholds and settings and are even able to propose smart solutions where required or take responsibility for chosen parts to free planners' time for more critical issues.

The RBS philosophy is providing the planner the right tools for decision-making



Main Image: A view of the Yokohama terminal, Japan. Insert: Quay crane assignment for vessel operations.



Tests for intelligent RTG dispatching as part of the RBS TOS show that it can reduce fuel consumption whilst increasing operational hours.

based on the best real-time information availability through the whole planning process. Tools and algorithms have been designed together with terminal business professionals, planning experts, management executives and optimisation experts to provide the best algorithms in a business relevant environment to drive the terminals performance with excellence. The RBS team and their partners were awarded the opportunity to present their ideas of this intelligent design of algorithms at the European Conference of Operational Research in Rome. Their outstanding results were presented to an audience of world's leading operations research specialists.

Tests for intelligent RTG dispatching as part of the RBS TOS have shown that it is able to reduce RTG idle times, RTG movements and is leading to a significant reduction in fuel consumption, together with an increase of operational hours. New berthing solutions allow increasing terminal performance due to optimised transport distances in operations and minimised vessel waiting times, helping to reduce complexity and uncertainty within the terminal processes.

Planning with uncertainty is a key cost driver in complex operations. As the forecast accuracy increases, expected

move times can be used for planning with additional positive direct impact on interacting planning areas eg. quality control operations and horizontal transport. Overall customer service is also improved by reducing turnaround times and costs in the operation, leading to increased profit for the terminal.

About the author



Leif Meier manages RBS TOS implementations, consults on optimising processes and trains key users. He acts as project manager and operational expert. A logistics expert, Leif has a PhD in logistics and quantitative optimisation from the faculty of Business Administration & Economics at the University of Göttingen, Germany. Leif has professional experience in logistics for container terminals, FMCG logistic management, risk management simulation and optimisation projects e.g. berth allocation and RTG dispatching for container ports, FMCG warehouse management, pattern recognition and forecasting for Bankin International Publications, workshop and conference participations, and academic referee work.

About the company

The strength of RBS EMEA lies in its focus, people and solutions. RBS EMEA focuses exclusively on ports and terminals. Every staff member gathered experience and expertise working on port and terminal projects worldwide. RBS EMEA sells, implements and services RBS Tops solutions. RBS EMEA delivers turn-key solutions assuming full responsibility for projects. RBS EMEA customers improve the service delivered to their customers in many aspects: from information availability, quality, performance, efficiency to accuracy and reliability. RBS EMEA implements port community systems, port management systems, tug management systems, general cargo management systems, dry bulk management systems and maintenance management applications.

Enquiries

RBS EMEA ug
Paul-Stritter-Weg 5
D-22297 Hamburg
Germany

Tel: +49 40 88 173-0,
Fax: +49 40 88 173-111
www.rbs-emea.com
Direct Contact: sales@rbs-emea.com

Dry Bulk and Specialist Cargo Handling



“The bulk industry prefers to do business with partners who can offer a one-stop-shop for the entire supply chain.”

‘Key trends in the bulk supply chain’, page 55.

Analysing terminal facilities for biomass operations

Dr Mi-Rong Wu, *consultant*,
TBA, Delft, The Netherlands

Introduction

The use of solid biomass (e.g. wood pellets) has been boosted by the recent development in bioenergy and EU directives. For instance, some power stations are in the process of a conversion to co-firing with sustainable biomass. The worldwide growing demand promotes the international biomass trade because the supply potential is unevenly spread out and shipping is and will continue to be the main method for transporting solid biomass.ⁱ Bulk terminals around the world have been dealing with solid biomass for some time on a small scale. However, with the expectation of the use of bioenergy growing (see Figure 1) and consequently the international solid biomass trade market. It is necessary to address comprehensive analyses of the terminal facilities for solid biomass operations.^{ii,iii}

Several ports already have appropriate handling facilities but the storage and inland transportation will require additional investment. Various aspects should be taken into account to provide a thorough picture of solid biomass operations: the significant material types for large-scale handling; the physical/flow properties of solid biomass; a comparison between handling of solid biomass and other common bulk material; and the effects caused by the stochastic parameters (e.g. vessel arrival patterns) to the storage capacity and storage time of solid biomass operations. These aspects are further discussed in the following sections.

Material type and properties

There are various kinds of solid biomass, but not every type is suitable for being transported over long distances and handled in dry bulk terminals. Selection criteria such as potential availability, the application preference/possibility by major users and logistical concerns were used to estimate which materials will

be commonly handled. Based on these criteria, the types of solid biomass to be expected by dry bulk terminals are: wood pellets, wood chips and torrefied pellets.

It is essential to understand the material properties of these selected solid biomass types, in order to know how to handle and store them properly. Selection and design of handling and storage equipment for solid biomass types strongly depends on their physical material properties/flow properties. Furthermore, the flow properties may also affect the operational process.

Although some handling properties of wood pellets and wood chips have been obtained by various studies, a completely range of their flow properties was not very clear. As a newly developed material, there is no information available yet for the flow behaviour of torrefied pellets. Various experiments such as density testing, large-scale linear annular shear testing, and linear wall friction tests were performed recently to determine the handling characteristics of wood pellets, wood chips and torrefied pellets.^v (see Figures 2, 3 & 4) For a better understanding regarding equipment it is important to make further interpretations: to compare these solid biomass properties with other bulk materials that have been handled and

studied frequently, such as coal. Table 1 shows an overview of the flow properties of some solid biomass types and coal.

Comparison between biomass and coal

The following points can be made on the similarities and differences between the selected solid biomass and coal (see Table 1):

- Wood pellets have better flow-ability among the selected solid biomass materials and coal. The flow behaviour of torrefied pellets is more resembling to the flow behaviour of coal. Wood chips have the poorest flow ability among these materials.
- Values of bulk density and lower heating value (LHV) together show that up to eight times more volume of solid biomass is required for the same energy input.
- Similar to coal, solid biomass properties vary in a wide range. Equipment designed for the handling solid biomass should take this fact into account.

In terms of handling and storage equipment, the following conclusions can be made for solid biomass:

- Sensitive towards material degradation. Therefore the storage

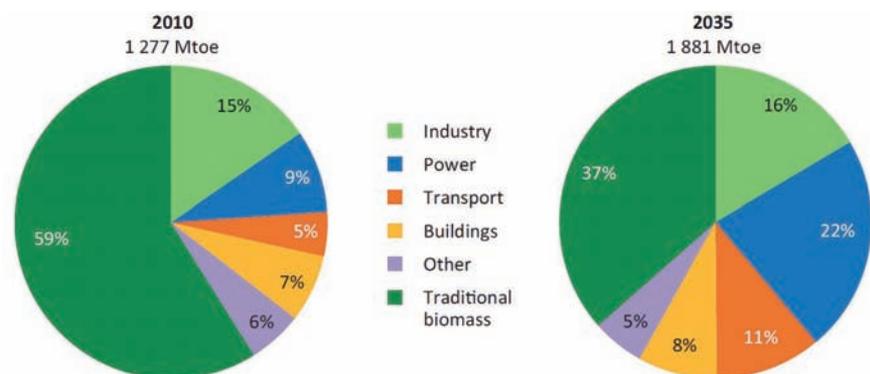


Figure 1: World bioenergy use by sector in the New Policies Scenario, 2010 and 2035.^{iv}



Figure 2: Wood pellets - 6 mm (left), Figure 3: Wood chips - 0-100 mm (top right), Figure 4: Torrefied pellets - 6 mm (bottom right).

- time should be shorter than for coal.
- Equipment designed for coal can be used for solid biomass. However, the number or capacity of equipment has to increase (three to four times more due to bulk density) for same tonnage performance requirement.
- Enclosed or covered equipment is required (e.g. flat storage, covered belt conveyors).
- Handling methods should be adjusted to cope with biomass material properties for un-wanted effects (e.g. against self-heating).

Storage facilities and time

Storage facilities for solid biomass require large areas as a result of their low bulk density and energy content (see Table 2), and such provisions can be realised either

at the waterside terminals or more inland, at the premises of the power station (end user). To have the same energy output as coal, up to eight times more volume of solid biomass is required. A common demand figure for a power station unit will be about three million tonnes of wood pellets per year and when the choice comes to wood chips even 4-4.5 million tonnes may be required. Due to the low bulk density, the lower energy content, and the need for an uninterrupted supply, power stations typically ask for storage capacities of about 100,000 tonnes which requires a covered storage around 200,000 cubic metres (wood pellets). In addition, because of their lower bulk density, more volume of solid biomass needs to be stored. With the same stacking method, 1.3 times more land is needed (lower volumetric performances for biomass).

Supply chain characteristics e.g. vessel sizes, strategic decisions, reliability, and availability of inland transportation and costs will determine which location should be preferred to realise a large-scale storage facility. The stochastic nature of supply chains, for example arrivals/departures of incoming and outgoing material flows, size composition of vessels/inland transportation, and the number of influencing parameters for example supply seasonality, make it difficult to simply calculate the best alternative. That's why simulations are increasingly applied to analyse the biomass supply chain, including a sensitivity analysis for parameters difficult to estimate over a long period of time (terminal operation disruptions such as rainfall, changes in vessel charter policies), see Figure 5 for an example.

		Torrefied pellets	Wood pellets	Wood chips	Coal
Physical properties	Particle Density (kg/m ³)	1225 - 1251	1174 - 1820	N/A	1100 - 1800
	Bulk Density (kg/m ³)	633 - 651	506 - 629	223 - 263	640 - 920
	Moisture Content (%)	4	8 - 11	42 - 49	15 - 65
	Effective angle of internal friction (°)	48	40 - 43	48 - 53	55
	Angle of repose (°)	38 - 44	34 - 40	43 - 47	27 - 38
Equipment in contact with biomass: wall friction angle	PE (°)	12	9 - 11	15 - 19	10 - 15
	Concrete (°)	29	29 - 32	32 - 36	30
	Mild Steel (°)	15	16 - 17	25 - 29	24 - 34
	Stainless Steel (°)	26	17 - 19	29 - 30	25 - 35

Table 1: Summary of the experimental results.^v

	Torrefied pellets	Wood pellets	Wood chips	Coal
Lower heating value (LHV) (GJ/ton)	8 - 21	16 - 18	14 - 17	30

Table 2: Comparison of lower heating value between solid biomass and coal.

Coaltrans Conferences presents

14th Annual

Coaltrans USA

February 6 - 7, 2014

JW Marriott Marquis | Miami | Florida | USA

www.coaltrans.com/usa



Coaltrans
Conferences

Speakers include

Kevin Crutchfield
Chairman and CEO
Alpha Natural Resources

J. Brett Harvey
Chairman & CEO
CONSOL Energy

Ernie Thrasher
President
Xcoal Energy and Resources

Cyril Martinand
Division Manager –
Procurement – Solid Fuels
ArcelorMittal USA LLC

Mark S. Fraley
Manager, Transportation,
Procurement – Fuels
Department
FirstEnergy Solutions

Jose Simon Buela
Director Gas Procurement,
Coal and Carbon
Iberdrola



At the conference in 2014:

- Key market players discuss thermal coal price outlook and current cost/price nexus
- Hear directly from over ten end-users in the European and domestic US market
- Where are today's opportunities? Assessing risk and M&A appetite
- Network with over 350 fellow coal producers, traders and buyers and join discussion both on and off the conference platform

Platinum Sponsor



Gold Sponsor

STIFEL

Silver Sponsor

United Bulk Terminals

Bronze Sponsors

McKinsey & Company



Register by
December 13,
2013 and save
US\$300

"The ability to
hear from so
many industry
experts at one
event is
priceless!"

Grant McHenry,
LogiCamms
(Previous Coaltrans Delegate)



+44 20 7779 7222



www.coaltrans.com/usa



coaltrans@euromoneyplc.com

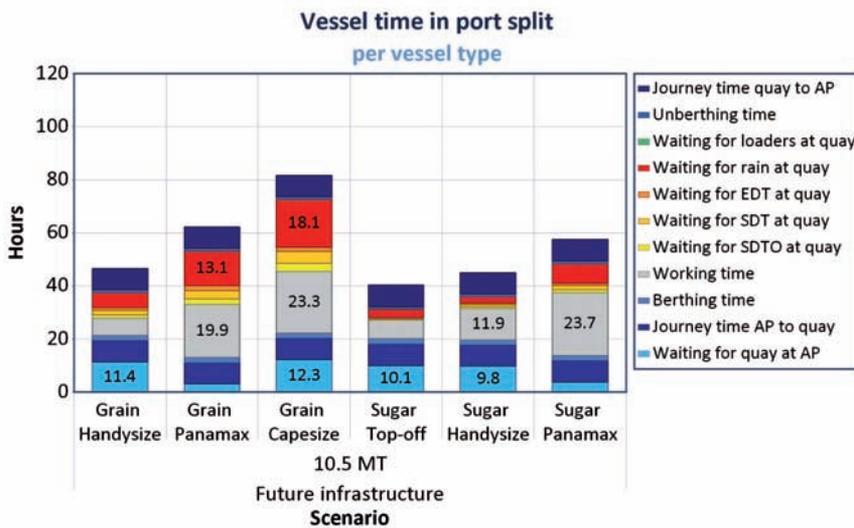


Figure 5: An example of vessel handling time in detailed status.

Several enclosed/covered storage options can be used to store solid biomass. Some power stations/bulk terminals have selected silos (ensuring a first-in/first-out material flow); others chose wide sheds or domes (with a circular stacking/reclaiming system). The following recommendations apply to all storage options:

- Measures against dry matter loss and material degradation, such as a good ventilation system and pre-drying before storage, should be applied.
- Measures against self-heating should be applied. Such measures can be

having homogeneous storage piles (in terms of material particle size distribution), taking the geometry of storage piles into account, avoiding compacted storage piles etc.

- The storage time of solid biomass should be controlled. Depending on the moisture content of the material, the recommended storage time varies from three weeks (for fresh wood chips) to three months (wood pellets).
- Both storage capacity and storage time are sensitive to arrival and departure patterns. Good logistic control is required.

In conclusion

The international biomass trade market is expected to have a significant increase for the predicted future growth in the use of bio-energy fuels. Among the large variety of biomass wood chips, wood pellets, and torrefied pellets are identified to be the most preferable and possible materials.

The material characteristics of solid biomass imply that volumetric performance is the recommended main benchmark rather than tonnage performance. The number of equipment increases for equal tonnage performance requirements (three to four times more, due to bulk density). Equipment designed for coal can be used for handling solid biomass. However, storage methods, storage time and handling processes should cope with solid biomass material properties (e.g. enclosed storage).

The low bulk density of solid biomass results in the requirement for a larger storage land size and faster stock turnaround time. An analysis with the help of a simulation model is recommended as it allows investigating the impact of stochastic events (e.g. material arrival and departure patterns, operational disruptions) and will result in a better terminal design in terms of berth capacity, equipment utilisation, storage capacity and storage time.

References

ⁱD Bradley, F Diesenreiter, M Wild and E Tromborg, 'World Biofuel Maritime Shipping Study for IEA Task 40,' IEA Bioenergy Task 40, July 2009.

ⁱⁱA Faaij et al, 'Opportunities and barriers for sustainable international bio-energy trade: towards a strategic advice of IEA Task 40', 14th European Biomass Conference and Exhibition. Biomass for Energy, Industry and Climate Protection, Paris, France, 17-21 October 2005.

ⁱⁱⁱJ. Heinimö et al, 'International Bioenergy Trade - scenario study on international biomass market in 2020,' Lappeenranta University of Technology, Department of Industrial Engineering and Management, research report 181, ISBN 978-952-214-354-9, February 2007.

^{iv}International Energy Agency and Organisation for Economic Co-operation and Development, OECD/IEA, 'World energy outlook 2012 renewable energy outlook,' 2012.

^vM R Wu, 'A large-scale biomass bulk terminal', Delft University of Technology, 2012. ISBN 978-94-6186-076-7.

About the author



Dr Mi-Rong Wu is a consultant for TBA, a leading terminal design and simulation company in The Netherlands. Her primary responsibility is managing projects for design and performance assessment in the bulk sector. She has five years' bulk sector research experience focused on subjects such as bulk terminal design, bulk material handling, and the development of a simulation model for bulk terminal design. Dr Mi-Rong Wu holds a PhD titled: 'A large-scale biomass bulk terminal' from Delft University of Technology. The research explores the possibility of a large-scale bulk terminal in West Europe dedicated to handle solid and liquid biomass materials.

About the organisation

Netherlands-based TBA is a leading international provider of consultancy and software. Its product and service portfolio concentrates on marine terminals and intermodal container terminals. TBA's clients include all major terminal operators worldwide and many local port operators. TBA has completed over 200 terminal projects with varied scope; from design review to complete master planning. TBA supports a terminal operator during all stages from concept to realisation and thereafter in operations. TBA is specialised in ensuring that the planning is realised and targeted performance levels are achieved.

Enquiries

Capt. Kaushik Jadhao, Bulk handling project manager
 Ir Martijn Coeveld, CEO
 Tel: +31 (0) 15 3805775, Fax: +31 (0) 15 3805763, Email: Kaushik.Jadhao@tba.nl

Trends in the bulk supply chain

Tim Borteel, *commercial manager bulk, Euroports, Antwerp, Belgium*

As terminal operators and providers of maritime supply chain solutions to the bulk industry, Euroports is not only uniquely positioned to evaluate market and trade tendencies in the fertilisers and minerals bulk market but also perfectly organised to offer answers to the industries' ever-changing supply chain requirements.

Shifting from traders to producers

In today's bulk supply chain, we can observe four major trends. The first is a shift in who defines the supply chain requirements, from traders to producers. A key example of this tendency is shown in the fertiliser industry. Around 2009, commodities became speculative and a considerable number of companies had to write off lost stock values. This meant that there was limited access to capital, resulting in reduced cargo and

lot sizes. As a consequence, shipment and vessel sizes were preferred to be as small as possible. On top of that, fertilisers are a seasonal commodity, peaking more due to changing weather conditions. Changes to vessel size and this seasonality required increased flexibility and a reaction from the logistics service provider in speed to market and flexible transport solutions. Intermediary players did not have the financial means to support these changes.

On the other hand, the producers have the financial power to absorb the speculation on the product, and were therefore forced to take on part of the intermediary role. In the period that followed between 2009 and 2013, we saw an ongoing wave of acquisitions in the industry and producers started to play a more active role in trading

activities. Producers felt the need to show their brand to the end user in spite of intermediary involvement (distributors, wholesale, and traders). These reasons made the producer the definer of the supply chain requirement rather than the traders. The producers in-sourced a part of the commercial supply chain.

Changing roles of logistics partners

The second trend is directly related to logistics service providers like Euroports. They can create a win-win situation by servicing customers' full transportation needs on a European scale. Looking at the case of Euroports, the first development and consolidation in the fertiliser and mineral market changed our reality, meaning dealing with bigger groups (producers) and more complex

Bulk stuffing in container



Picture courtesy of Euroports



Direct transshipment

logistics flows. As this increase in complexity in the physical supply chain is not part of the industrial clients' core business, the supply chain is not part of their traditional comfort zone. This, combined with the further push towards globalisation in the markets has led to logistical partners such as Euroports changing their roles in the customers' supply chains. They are now adding a consulting role, meaning advising on the best means of transport for each lot (eg. container or bulk vessel). Additionally, the bulk producers are looking for logistical partners that have the ability and competences to grow with them. They need to be able to think locally and act globally.

The bulk industry prefers to do business with partners who can offer a one-stop-shop for the entire supply chain. By doing so, the supply chain complexity is moved from themselves to their logistical partner allowing the bulk industry to focus on their core business. The logistical supplier on the other hand does what they do best: optimise the flow of goods and the modes of transports used. Euroports' service offering has grown by not only focusing on terminal operations, but also offering a wide range of transport services to their customers such as road carriage, inland navigation, ship agency and customs clearance, freight forwarding and contract logistics. Euroports' logistics engineers are well equipped to build the tailor-made supply chain for each specific customer, combining the different required services.

Optimising and adding value

A third trend relates to the requirement for superior value added service (VAS) activities and the impact of containerisation. The previously mentioned shift to smaller shipments and the request for an increase in speed to market, combined with producers becoming traders, has pushed many producers to ship lots in containers. For the logistics service providers it is key that

they have the infrastructure not only to load or discharge the containers but also to advise on and execute the stuffing of the product in bulk or in bags. Bagging and other services for container transport and freight forwarding should be included in the logistic partners' offerings. The strong logistics partner is especially able to deal with the challenge by advising the customer on a lot by lot basis. This would consider issues such as whether they should use bulk shipments, put bulk in a container using the container as the packaging unit, or put the product in bags and stuff those into a container for shipment by seagoing vessel. Needless to say optimising this flow is not only creating value for the industrial client and for the logistics partner, it also allows the producers to offer flexibility to their clients regarding delivery method.

Enhanced relationships improving efficiency

Lastly, a fourth trend results directly from the increased focus of the industry on their core activities. The increased attention on flow optimisation and cost efficiency is resulting in a requirement for onsite contract logistics service offerings. This trend allows a logistics partner to be involved in developing the supply chain of the customer. The logistics partner is given the ability to organise logistics, terminal and VAS services on the bulk customer's premises (or other location) both for inbound and outbound flows. This trend towards a deeper relationship between logistics partner and industrial client very often requires joint investment and is quickly becoming a more frequent reality. Euroports, as an international player with multiple terminal locations and a strong network of logistics services in Europe and China, is in a position to offer their bulk customers the extended portfolio of contract logistics operations. The bulk customer has the significant advantage to deal with a single partner that can meet their changing expectations at an international level.

About the author



Tim joined Euroports in 2007 after working for several years as a sales executive for key players in the industry.

Tim holds a Masters degree in communication sciences at the University of Brussels. He has been instrumental in further developing and building out Manuport and later Euroports' portfolio of dry bulk hubs in Antwerpen, Gent and around Liege. Today, as commercial manager bulk, he and his team are responsible for growing Euroports' dry bulk business in Benelux and France, including two large-scale renovation projects in Antwerp and Gent. Tim, along with his girlfriend and three-year old son, resides in Belgium.

About the company

Through a series of acquisitions (between 2007-2010), Euroports' portfolio has been growing steadily to the network of terminals, contract logistics, transport services and freight forwarding offices as it is today. Euroports is one of the largest port operators in continental Europe and handles in total some 52 million tonnes annually with a strong focus on general cargo and dry bulk. We have 22 port terminal operations in Europe plus two in China and also operate on behalf of our industrial customers at a further 10 sites. All Euroports entities in the group are now fully working under the Euroports' brand name and are expanding still. We aim to be your partner of choice in maritime supply chain solutions.

Enquiries

Tim Borteel
Vosseschijnstraat 51 BB -2030
Antwerp, Belgium

Tel: +32 3 204 93 32,
Email: tim.borteel@euroports.com

Loading chutes for versatile bulk material loading

Henrik Frandsen, *general sales manager,*
Cimbria Bulk Equipment, Herning, Denmark

For many years, loading chutes have been used for loading dry bulk products into different vessels, such as tankers, open trucks, ships and barges. The strong points of using loading chutes have always been the flexibility and versatility of being able to load all kinds of dry bulk materials, under virtually all conditions, and in nearly all known applications, eg. in ports, refineries, cement and power plants, and grain terminals.

For 25 years, Cimbria has produced and installed more than 13,000 Moduflex branded loading chutes worldwide. The chutes are being used for loading anything from cobber concentrate over fly ash and cement to fertiliser, grain and food stuff. They are used for loading ships and barges, flatbed trucks and dumper trucks, stockpiling, tanker trucks and boats as well

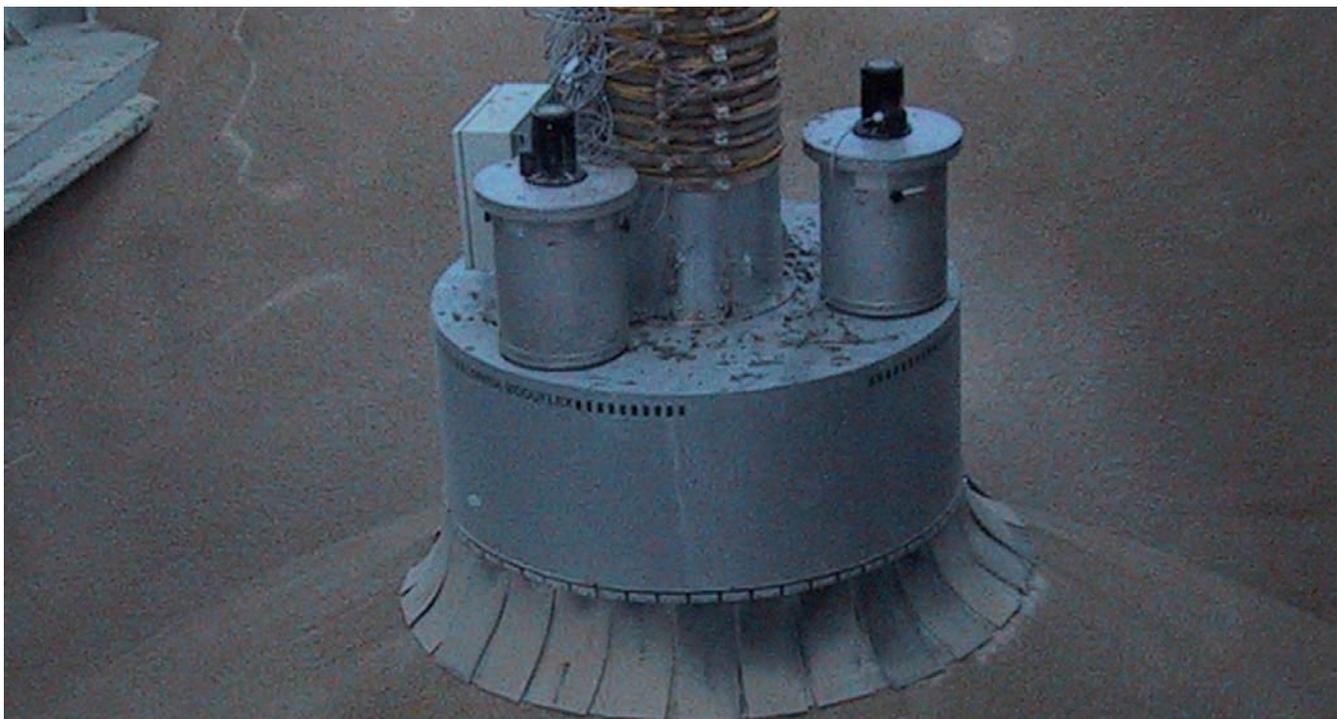
as train wagons. In many cases, the chutes are loading not only one specific product, but many products through the same chutes or instance in port terminals.

Effective chute construction

This level of variety of use can only be supplied due to the versatility of the loading chute itself which is due to its general construction. The Moduflex loading chutes are designed with a unique modular construction, which means that the chute can be adapted to suit 99 percent of all known applications within the dry bulk industry, although the parts being used are standard components. This ensures that the operators know that the loading chutes are based on well-founded, recognised technology that provides the user with quick access to

standard spare parts, if a breakdown occurs, so down times are kept to a minimum. On top of this, the Moduflex loading chutes can cater for capacities up 4000 tonnes per hour in the standard configuration, and a drop of more than 25 metres. This flexibility can only be achieved using a loading chute.

The Moduflex loading chutes can of course be used in light-duty industries for loading grain, bran, food stuff etc. but also in the heavy-duty industries for loading cement, limestone, fly ash, clinker, minerals etc. This versatility is founded on the ability to construct the various parts of the chute in high density polyamides, abrasive resistant steel, stainless steel, and with liners in vauitid and/or ceramic compound materials. Furthermore, loading of products with larger particle sizes or very low



A heavy duty dust skirt encapsulates the dust arising from the product falling onto the peak of the product pile during the outloading process



Dust free outloading of bulk materials into tanker trucks

densities and little structure are completely impossible to load, except through a loading chute. No other loading system can offer the same degree of adaption to specific needs of the users or the same safety and durability in one piece of equipment.

The proof of this point becomes even more evident when looking at toxic products, or products that need to be loaded in a closed system (food and chemicals), as this again is for hygienic reasons only possible using a loading chute. The demands of food safety and cleanliness within the chemical industry make it impossible to load products like sugar for instance, with any open system that exists on the market. The risk of contamination of loading any product for human consumption and almost any chemical base materials in non-sealed systems is unacceptable and in some cases dangerous to health. In order to avoid contamination, a closed system with a closing device at the outlet that ensures an active seal during loading and plugging when the chute is not in use, is required.

Environmental considerations

Looking at it from a different point of view, the overall purpose of the loading chute is to ensure a dust-free loading of products. The environmental authorities across more and more countries are imposing strict legislation on environmental protection and enforcing these laws vigorously. This means that the duties of loading involve: protecting the natural environment; protecting the surrounding environment and the working environment. There is no argument against the fact that only loading chutes are able to fulfil all these tasks and truly provide a dust-

free situation. Although other systems claim to do so, dust and particles will inevitably escape in the space between the outlet of the material provider (a silo or similar) and the inlet of the chute e.g. hopper or hose. Any dust needs to be confined and dealt with in a safe and efficient way, as spillage and waste of product not only means a nuisance to the environment, but also means loss of profit. This objective can only be secured in a well aspirated loading chute, which is either connected to a separate filter or provided with an integral filter.

A further aspect of modern loading is the varied environments where loading takes place. In some cases the loading does take place inside in enclosed surroundings, but the vast majority of loadings are done outside, where wind, sun and humidity affects the material being loaded and the loading equipment. For example if loading is done through a hopper system, the wind will seriously affect the free falling product, creating dust problems, and if loading is done using a simple hose or bag, the humidity in the product will affect the flow and cause disruptions in the loading procedure.

In conclusion

It can be seen that loading chutes are, for now and for years to come, the only system where you can combine flexibility and versatility with efficient loading, and at the same time adhere to the environmental legislation and work safety requirements placed on companies today. Alternative systems have such a limited usage, that they can only be justified in very few applications where the conditions and the product are so homogenous that they will work to the satisfaction of the users.

About the author



Mr. Henrik Frandsen is the General Sales Manager of Cimbria Bulk Equipment. He resides and works in Herring, Denmark, where he has been responsible for the sales of the company's conveying equipment for more than 13 years. Furthermore, he is business area manager for the conveying area within the Cimbria Group of Companies.

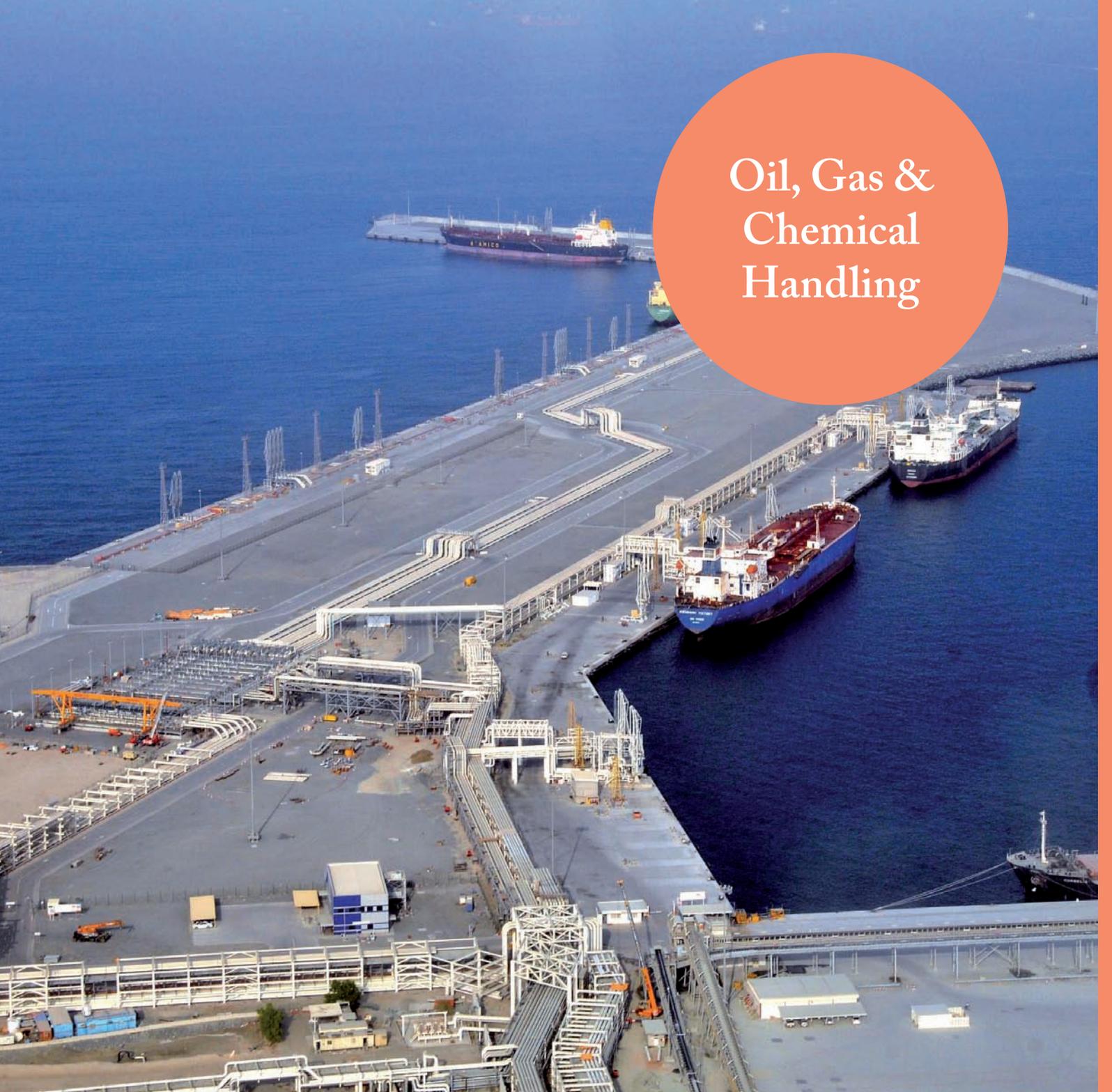
About the company

The Moduflex loading chute is designed and sold by Cimbria Bulk Equipment A/S, a part of the Cimbria group of companies. Cimbria was established in 1947 and is today an international organisation with 600 employees in 15 companies throughout the world. Cimbria offers equipment and processing plants for the grain and seed industry, and transport and conveying equipment for bulk handling.

Enquiries

Industrivej Syd 1a
DK-7400 Herring
Denmark

Tel: +45 72 42 24 00
Fax: +45 72 42 24 99
Email: cbe@cimbria.com
Website: www.cimbria.com



Oil, Gas & Chemical Handling



“While dedicated oil tanker berths are typically dolphin berth structures with loading platforms on piles, the Port of Fujairah has decided to build continuous quay walls in OT1 and OT2. This allows flexible usage of the berths.”

‘Port of Fujairah putting itself on the map’, page 60.

Port of Fujairah putting itself on the map

Gert-Jan Roelevink, *maritime project manager,*
MUC Engineering, Fujairah, United Arab Emirates

The Port of Fujairah was built in the early 1980s as part of the economic development of the United Arab Emirates. Fujairah is situated on the East Coast, just outside the Strait of Hormuz, and with its port being a secure portal to the Gulf; it has seen steady growth over the years. Due to its convenient location along one of the world's major shipping routes, the port has emerged into a major oil and logistic hub.

A mild wave climate, easy access due to its deep water relatively close to the shore, and the fact that Fujairah is piracy-free, have all contributed to the port's success. The mild wave climate allows open sea terminal operations and bunker trade in particular has played a key role in its growth; the port is now ranked alongside Singapore and Rotterdam in size.

Moreover, the importance of the port is increasingly recognised, with several national strategic projects being developed. One of these is the 1.5 million barrels per day (bpd) 'Fujairah Habshan Oil Pipeline', with its main oil terminal in Fujairah and the 250,000 bpd refinery which is planned for completion in 2016. Additionally, an LNG terminal is being constructed north of the Port of Fujairah.

To strengthen the private sector and support companies in the oil industry, a special zone for oil companies has been established in the area north of the port. This Fujairah oil industry zone (FOIZ) aims at developing the strategy for investment in the region and regulating the petroleum and hydrocarbon industries.

Fujairah oil tanker terminal

While the Port of Fujairah, being a multi-purpose port, offers a wide variety of services such as container handling, general cargo, break bulk, project and maritime logistical supply especially its oil tanker terminals have expanded rapidly in recent years. In 1996, the Van Ommeren

tank terminal (currently Vopak Horizon Fujairah Ltd., VHFL) became operational with an onshore oil storage facility and offshore jetty operating independently. In 2004 a dedicated oil terminal (OT1) inside the Port of Fujairah was completed with three berths for handy size tankers and bunker barges. This facility mainly serves the Fujairah refinery just north of the port.

Forward projections of the increasing importance of Fujairah as a strategic oil hub, have resulted in the conception and planning of a second oil terminal (OT2), developed jointly with MUC Engineering. OT2 is being created around a new harbour basin, north of the existing port which is dredged to -18 metres. The new terminal is completely dedicated to handling oil tankers.

The first four berths of OT2 were commissioned in 2010 and currently accommodate tankers up to 200,000 deadweight tonnes (DWT). These berths have been realised as a 1,500 metre long quay wall. As a response to the increasing demand for more berths, the port has decided to continue the construction and is currently developing two further berths, which will be able to handle partly-loaded very large crude carriers (VLCC). These berths are planned to be finalised in early 2014. With these two new berths, the number of oil tanker berths in the Port of Fujairah totals nine, with six berths being able to handle tankers up to 180,000 DWT.

Additionally, in May 2013, the construction of the three-kilometre northern breakwater started. This breakwater shall enclose the northern harbour basin to protect OT2 against swells, and will serve as a causeway to a new VLCC berthing facility. This VLCC berth is planned to be built on the seaward end of the northern breakwater at a water depth of -26 metres and is



scheduled to be operational in mid-2016. Furthermore, a number of dedicated berths for bunker barges and chemical tankers are at the drawing board.

Independent oil storage terminals

Only VHFL runs a self-owned jetty and all other commercial storage terminals in the FOIZ use the Port of Fujairah facilities for marine loading and unloading operations. Fujairah continues to attract new companies that commit to building storage tanks in Fujairah. In addition, existing tank farms all undertake new expansion projects to upgrade their



M.U.C. Engineering 

Main image: Fujairah's second oil terminal (OT2); Bottom right: Maiden call at OT2 in May 2010.

terminals. As a result, the total capacity of all commercial storage terminals is increasing and is expected to reach 8 million cubic metres by the end of 2014. Consequently, the anticipated throughput through the Fujairah oil tanker terminal could reach an annual 70 million tonnes at the end of 2014. This is exclusive of the crude which is being exported through the Abu Dhabi Crude Oil Pipeline (ADCOP). With the six berths on its jetty being fully occupied, VHFL has also started the construction of pipelines connecting its terminal to the Port of

Fujairah, in order to use the berths in the Fujairah oil tanker terminal.

The flexible oil terminal

During the planning of the Fujairah oil tanker terminal, there has been an emphasis on flexible usage of berthing facilities in general and flexible connectivity in particular. Flexibility was considered to be an essential precondition for the success of the system as a whole. The port understood that dedicated berths for each terminal would result in a large number of jetties





The Fujairah oil industry zone.

that would quickly congest the available waterfront space. Hence a system was adopted where all tank terminals are connected to all berths through two large matrix manifolds. The berths and the matrix manifold are being operated by the Port of Fujairah.

Matrix manifold

The first matrix manifold (MM1) is fully integrated and connected to oil tanker berths two to nine. MM1 is able to receive 62 pipelines serving 10 to 11 oil storage terminals. A second matrix manifold (MM2) has been planned at the north side of OT2 and is able to receive an additional 60 pipelines from the storage terminals north of the port. MM1 and MM2 will be fully connected and integrated to enable connectivity between all tank terminals and all present and future oil tanker berths.

Flexible berth system

While dedicated oil tanker berths are typically dolphin berth structures with loading platforms on piles, the Port of Fujairah has decided to build continuous quay walls in OT1 and OT2. This allows flexible usage of the berths. Practically, it means that each berth can either be used for handling one big tanker with two central loading arms, or it can be used for handling two small tankers at the same time with two smaller loading arms. This system has proven to be convenient given the large number of small tankers which are used in the bunker trade. These small tankers can now be served two at a time if the berth is not occupied.

Future projections

Fujairah seems to be commonly recognised as an important strategic oil logistics hub and the number of companies that have an interest in establishing their business in Fujairah is increasing. With OT2, the Port of Fujairah has created the basic infrastructure for a marine oil terminal

that has the potential to be expanded beyond 24 berths for large tankers up to VLCC class. The Port of Fujairah has shown dedication in providing the required marine loading and unloading capacity of terminals in Fujairah and has the capacity to accommodate more growth in the future.

About the author



Gert-Jan Roelevink is maritime project manager at MUC Engineering. He has a background in hydraulic engineering, where he specialises in the design of coastal protection and port infrastructure and port master planning. As maritime project manager his responsibilities are the management of port infrastructure design projects. He is also a key part of the design and engineering division at MUC, which consists of around 30 structural, geotechnical and hydraulic engineers, master planners and project managers.

About the organisation

MUC Engineering is an independent advisory engineering and consultancy company based in the Middle East. MUC Engineering has supported the Port of Fujairah with the development of the Fujairah OT2 master plan and has carried out the design and project supervision for the OT2 infrastructure. Furthermore, MUC acts as project management consultant for a number of the commercial oil storage terminals in the FOIZ.

Enquiries

Capt. Mousa Building, Ground Floor
Hamad Bin Abdulla Rd Fujairah
P.O. Box 7718 Fujairah, UAE

Phone: +971 92239954
Fax: +971 92232006
Email : roelevink@muc.ae
Website: www.muc.ae



VTS,
Navigation,
Mooring and
Berthing



“To underpin the continuous global development of the maritime transport industry, VTS personnel, being non-seagoing professionals, are a key element in the safety of shipping and must be trained and educated, especially in the developing world.”

‘Simulation in Vessel Traffic Service training’, page 64.

Simulation in Vessel Traffic Service training

Captain Terry Hughes, FNI FRIN, Founder,
International Maritime Consultancy, Gloucestershire, United Kingdom

In September the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) organised their first ever seminar on simulation in vessel traffic service (VTS) training in Wageningen, The Netherlands. The seminar was kindly sponsored by MARIN, NNVO and the Port of Rotterdam and was attended by 50 delegates representing 20 countries. The primary aim of the seminar was to provide guidance to training organisations and their simulation staff in organising and developing VTS simulator training courses. It was intended for, not only those who already have experience, but also for those who have no experience whatsoever in VTS simulation.

Developing an effective training programme

The IALA has already produced all the internationally recognised model training courses for VTS personnel (V103 series) in which VTS simulation plays a vital role and provides a means for assessing the competence of VTS personnel. Training organisations face many challenges as they integrate simulation tools into their training programme. In order to take full advantage of these tools, an approach should be chosen that allows for relevant, effective training in a reasonable time period. Any existing training programme needs to be carefully scrutinised and amended in conformity with the new approach.

The IALA V103/1 VTSO training model course consists of eight modules and simulated training can be used in each one. The simulation itself can take many forms from a simple table-top format with models, to the more sophisticated form of computerised technology, and can successfully complement the classroom training. In fact, after initial training, the final assessment should be carried

out on a VTS simulator. This is where all the pieces of jigsaw are put together - communications and the management of vessel traffic. Simulation can also provide a very useful asset for on-the-job training (OJT) and many VTS authorities now incorporate simulators as part of their main VTS systems and use for both OJT and refresher training.

The importance and role of simulator instructors

Simulator instructors, while being knowledgeable and appropriately qualified, need to be imaginative, not only in exercise creation but also with respect to configuring the system being used. Depending on their complexity, simulator exercises can take several days to make. They need to be credible to be believable. Mathematical models need to be realistic but, unlike the needs of a bridge simulator, interaction between other vessels and the seabed for example, is nice to have but not really necessary.

Debriefing is a key element of an exercise and is probably the most important part of the learning process. Debriefing is where the participants are able to review their performance, evaluate whether they have met the training objectives and whether any action taken was appropriate. The creation of a 'no blame' culture is crucial to learning. The great thing about simulation is that exercises can be repeated several times. Interestingly, no matter how many times an exercise is repeated, the results are quite different. The human element plays a big part in this and even in real life people react quite differently when faced with the same situation.

Different types of simulator systems

One of the most popular questions being asked today by countries new to VTS is: how can a country not versed in simulator

training commence? Most accredited training organisations that have approval for standards of training, certification and watch keeping for seafarers (STCW) officer training have a Radar/ARPA simulator. This type of simulator can be used very successfully for all aspects of VTS training. Bridge simulators, although non-mandatory, can also be used for VTS training especially as they have the added advantage of visual cues. Full mission VTS simulators can be very sophisticated and generally their design depends on budget. A VTS simulator can be used in conjunction with both a bridge simulator and Radar/ARPA simulator. Probably the main disadvantage with any simulator is equipment fidelity. However, this can be overcome with extra time being allocated for equipment familiarisation.

Two topic areas eagerly discussed at the seminar were portable simulators and serious gaming, both on and offline. Several countries are now using portable VTS simulators as an inexpensive way of mobile training. This form of simulation will be of particular interest to those countries currently unable to afford full mission simulators. However, with any form of computerised technology, the human and machine partnership may not be an easy one. You can have the best simulator in the world but unless you have the right person operating it, the simulator output is worthless.

In the world of serious gaming, a number of gaming software companies have produced some credible simulation games: Flight Simulator from Microsoft, VSTEP's Ship Simulator Extremes and X-Plane by Laminar Research being three prime examples. There are also a number of air traffic control (ATC) simulation games on the market but none currently for VTS. There is no suggestion that this type of simulation would take over from the recognised training simulators but

The Most Accurate Portable Pilot Unit

EXTREME RELIABILITY - SAFE, ACCURATE, EFFICIENT



ADX XR

- Totally Wireless PPU system, operational within a few minutes
- Independent of any ship equipment
- Seamlessly tracking GPS+GLONASS (17-20 satellites in view)
- 1-2 cm Positioning of Bow and Stern
- 0.02 kn speed control of Bow and Stern

Since 2005, AD Navigation has been supplying PPU systems to demanding pilots worldwide. The new State-of-the-art ADX XR technology is the perfect PPU tool for the pilot that wants to be 100% independent of the ship instruments and crew. Unmatched performance makes ideal for applications such as:

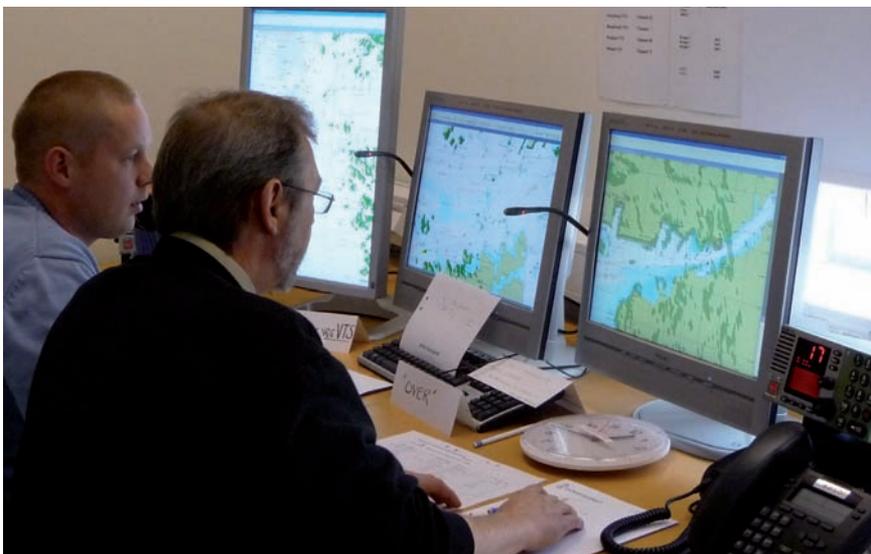
Maneuvering in confined waters - Docking - Lock/Dock approach - Rig Move - Ship to Ship Docking

 **AD NAVIGATION**

SPECIALISTS IN PRECISE GNSS NAVIGATION
A SAAB Defence and Security Company

www.adnav.com

AD Navigation AS
Reservatveien 8, N-3118 Tønsberg, Norway
Tel: +47 69 25 33 00 info@adnav.com



Students working with a VTS simulator.

they do make excellent building blocks for those who wish to gain further knowledge on the subject or perhaps to practice everyday skills.

Levels and system applications

In 2012 the International Maritime Organization (IMO) published an excellent model course called 'Train the Simulator Trainer and Assessor', in which they have four classifications for a simulator.

1. Full mission simulator - capable of simulating a total shipboard bridge operation situation, including capability for advanced manoeuvring in restricted waterways;
2. Multi-task simulator - capable of simulating a total shipboard bridge operation situation, but excluding capability for advanced manoeuvring in restricted waterways;
3. Limited-task simulator - capable of simulating a shipboard bridge operation situation for limited (instrumentation or blind) navigation and collision avoidance training and;
4. Desktop simulator - capable of simulating operation and / or maintenance of particular bridge instruments and / or defined navigation / manoeuvring scenarios.

Simulators can be used for aptitude testing, initial training, assessment, refresher/updating, case studying as well as for continued professional development (CPD). The following requirements are stipulated for STCW simulator training but can also be applied to non STCW training:

- suitable for training and/or assessment objectives;
- physical realism appropriate to training and/or assessment objectives;
- sufficient behavioural realism;
- capable of producing a variety of

conditions (operating environment);

- the trainee should be able to interact and;
- the instructor/assessor should be able to control/monitor/record exercises.

The 2010 Manila amendments to the STCW Convention included a requirement to realistically simulate VTS communication procedures between ship and shore. Whilst this is a start to improving the VTS awareness of navigating officers, the IALA would like these officers to have a greater depth of knowledge of VTS and the types of services provided. This knowledge can be included in all types of Radar/ARPA, bridge simulator and classroom training.

The importance of regulatory requirements

Simulation has long been used as a safe and effective means of providing realistic training to ship-based personnel. The use of simulation to complement other training methods for VTS personnel is therefore a logical step and a recommended course of action. The need for consistent, quality training of VTS personnel is of primary importance in ensuring the effectiveness of the service provided. A commitment to training results in professional reliable services being offered which leads to confidence in, and support for, the service itself.

All accredited training organisations involved in VTS training, should have approval in compliance with the IALA Guideline 1014 on accreditation and approval process for VTS training. Currently only 16 countries are registered with the IALA World-Wide Academy. Considering the number of countries providing VTS to vessel traffic around the world, this list is surprisingly short in numbers.

In September, for World Maritime Day, the IMO published a lengthy document 'A Concept of a Sustainable Maritime Transportation System'. This states that "Maritime transport is the backbone of world trade and globalisation. Twenty-four hours a day and all year round, ships carry cargoes to all corners of the globe. To underpin the continuous, global development of the maritime transport industry, non-seagoing maritime professionals must also be trained and educated, especially in the developing world. As ships do not operate independently from shore-based entities in the Maritime Transportation System, efficiency must extend beyond the ships themselves to shore-based entities. These include ports, which must deliver an efficient service and provide the essential maritime infrastructure. In more crowded seas, with greater traffic density and larger ships, shipping routes will need to be supported by better and clearer information systems (including through meteorological, oceanographic and hydrographic services, aids to navigation, lights houses and technology such as vessel traffic services."

Ensuring proper training where needed

To underpin the continuous global development of the maritime transport industry, VTS personnel, being non-seagoing professionals, are a key element in the safety of shipping and must be trained and educated, especially in the developing world. In MSC Circ1065 on IALA Standards for Training and Certification of VTS Personnel, member governments were invited to bring the IALA model courses to the attention of their VTS authorities, training institutes responsible for the training of VTS personnel and any other parties concerned. This training includes the use of simulation, which is a key to successful education. IALA Guideline 1027 on simulation in VTS training, although in the process of being updated, provides useful guidance for those involved in VTS training.

It is very important for all countries that have a VTS, to ensure that their personnel are properly trained. It is ironic that although STCW training is mandatory for shipboard personnel, training is not yet universally mandatory for VTS personnel. It is up to the various national competent authorities to ensure this happens.

Recommendations

The IALA Simulation in VTS Training seminar produced a number of recommendations amongst which were:

Is your operator the next trainee...



...to make shipping safer and quicker?

For more than 80 years MARIN has been serving the maritime industry with high-grade technology. The experience of our hydrodynamic research is incorporated in our nautical services, consultancy and training.

MARIN's nautical centre MSCN provides Nautical VTS training in compliance with the IALA V103 Recommendations and Guidelines:

- VTS Operator (Basics)
- VTS Supervisor (Advanced)
- VTS Refresher
- VTS Train the Trainer

Other training courses:

- VTS Introduction
- (VTS) Communications for Nautical Operators
- Assessment Nautical Personnel



Photo courtesy of the Port of London Authority (PLA)



An example of a real VTS centre operated by the Port of London Authority (PLA).

1. That the principles of simulation used in Air Traffic Control be considered with a view to providing input to the development of guidance for simulation in VTS training;
2. Training organisations are encouraged to consider the use of portable/mobile/on-line simulation in VTS training;
3. Competent / VTS authorities are encouraged to adopt IALA Recommendation V-103 and associated model courses as the basis for mandatory training;
4. That Competent Authorities are encouraged to actively cooperate with the IALA World-Wide Academy in terms of registering accredited training organisations and approval of VTS training;
5. That Competent Authorities and accredited training organisations are encouraged to promote reciprocal arrangements for approved VTS training internationally and;
6. That training organisations providing STCW training are encouraged to include a comprehensive VTS training module utilising IALA Guideline 1089 on the Provision of Vessel Traffic Services (INS, TOS & NAS).

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. After twelve years as chairman of the personnel and training WG in the IALA VTS Committee he has stood down and is now an accredited VTS expert with IALA's World Wide Academy.

About the organisation

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). 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: terryh2014@gmail.com
 Web: www.maritime-vts.co.uk

Transas Integrated Port Management Solutions



Port Management Information System

Flexible and customer tailored solution to:

- improve port operations and related planning
- utilise port's resources efficiently
- increase port's performance through trend monitoring of the quality of services
- manage HR and infrastructure using simple tools
- handle billing and document trail
- bolt on to existing PMIS and port systems



Vessel Traffic Management Solutions

- turnkey solutions for small ports and large harbours
- comprehensive range of VTMS services

A must-have for ports looking to enhance their decision-making tools within a safer environment.

3D VTS

3-dimensional view of the navigational situation in the VTS area: enhanced situation awareness.

Search & Rescue

Straightforward control of SAR missions and SAR resources.

Microbiologically influenced corrosion of pilings

Brenda J. Little, *senior scientist for marine molecular processes*,
Richard I. Ray, *physical scientist* and Jason S. Lee, *materials engineer*,
Naval Research Laboratory, Mississippi, United States

Sheet piles, used as retaining walls, wharfs, and piers, are typically made of unprotected carbon steel (CS). This type is affordable and the general corrosion rate (wastage) is predictable. Despite the long and successful use of CS sheet pilings, there are reports of localised corrosion of CS pilings that have been identified as microbiologically influenced corrosion (MIC) i.e. corrosion that is a result of the presence and activities of microorganisms. Microorganisms can produce localised attack including pitting, enhanced erosion corrosion, enhanced galvanic corrosion, stress corrosion cracking, and hydrogen embrittlement of CS. Microorganisms do not produce a unique corrosion morphology in CS that could not be produced abiotically.ⁱ

Corrosion of pilings in marine and estuarine environments

Accelerated low water corrosion (ALWC) is a particularly aggressive form of localised corrosion that has become a high profile problem, associated with unusually high corrosion rates of unprotected or inadequately protected CS pilings in marine and estuarine waters. The UK Institution of Civil Engineers described ALWC as “a matter of national importance”.ⁱⁱ

ALWC is a global phenomenon having been reported in all climatic conditions on unprotected steel pilings in contact with saline water (i.e. seawater and brackish water) that is subject to tidal influences.ⁱⁱⁱ A survey of port and harbour authorities in five Western European countries concluded that at least 13 percent of the ports were affected by ALWC.^{iv}

The term ALWC does not define a corrosion mechanism. Instead the term denotes the precise location of the corrosion on the exposed pilings (see

Figure 1). Average corrosion rates in the range of 0.3 to 1.2 millimetres per year have been reported. ALWC has a distinct appearance, patches of lightly adherent, bright orange and black (iron sulphide rich) deposits over a clean, shiny and pitted steel surface.^v

As pits deepen and become more numerous, they overlap, producing terraced holes. Corrosion products contain magnetite, iron sulphides, and green rust (an unstable iron oxy-hydroxide sulphate complex).

Mechanisms and mitigation

A report by Gehrke and Sand concluded that ALWC was due to the combination of sulphate-reducing bacteria (SRB) and sulphur oxidising bacteria (SOB) in the fouling layers on the pilings.^{vi} The organisms co-populate the same spatial regions on the pilings. At low tide the biofouling layer is oxygenated whereas at high tide anaerobic areas develop. Sulphides produced by SRB are converted to sulfuric acid by SOB, creating an extremely corrosive environment. (see Figure 2a).

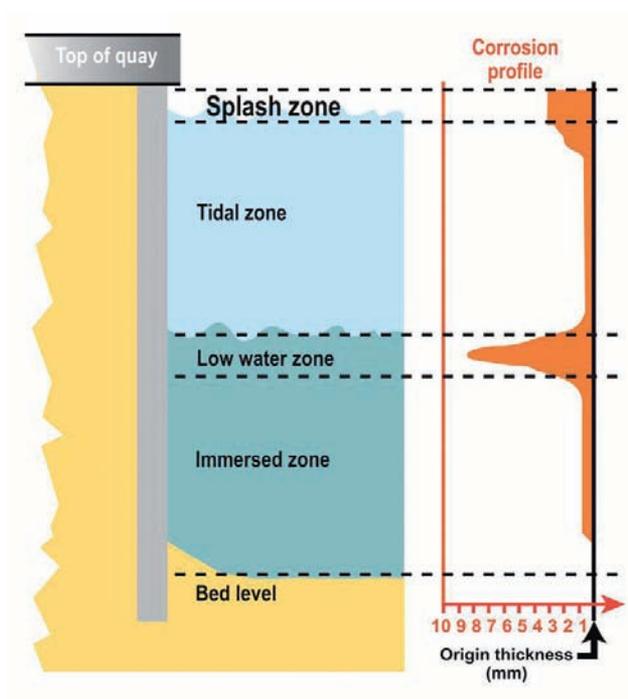


Figure 1: Schematic of ALWC illustrating relationship of water level and degree of corrosion. Taken from Kopczynski (PTI 2010).

Melchers and Jeffrey found: “The increased occurrence of ALWC reported in recent years is most likely the result of elevated levels of water pollution in the waters to which the steel piling has been exposed over its lifetime, irrespective of whether water pollution is currently decreasing.”^{vii}

A later review of data from a 27-year period related to ALWC concluded that the severity of ALWC correlated with the concentration of dissolved inorganic nitrogen (DIN), “a critical nutrient for microbiological (bacterial) activity in seawater.” It is suggested that this observation could be used to predict the long-term risk of ALWC.^{viii} It has also been reported that protective coatings, sacrificial anodes or impressed current cathodic protection were effective in mitigating ALWC.^{ix}

Corrosion of pilings in freshwater environments

Accelerated corrosion has been reported for CS pilings in the Duluth-Superior Harbour (DSH), Minnesota, a fresh water estuary.^x DSH pilings that are over 30 years old are either completely or partially perforated by localised corrosion (see Figure 2b). The corrosion extends from the air/water interface to a depth of about 3 metres, but with decreased attack from 1.2 to 3 metres. The position of the air/water interface is not significantly influenced by tides. Below 3 metres where zebra mussel attachment begins there is little corrosion. Corroded DSH pilings have an orange rusty appearance characterised by tubercles, dense mounds of corrosion products (see Figure 3). The average pit depth, a measure of localised corrosion, in a three-year study ranged between 670 micrometres to 788 micrometres, 7-8 percent of the total thickness of the coupons. Pit depth varied with location and increase in pit depth was not linear over the three-year exposure.

Mechanisms and mitigation

A 2009 study has demonstrated that corrosion of carbon steel pilings in DSH was due to deposition of copper under tubercles of iron-oxidising bacteria (IOB). IOB oxidise iron and produce dense deposits of intact and/or partly degraded remains of bacterial cells mixed with amorphous hydrous ferric oxides. A galvanic couple was established between the copper layer and the iron substratum. In laboratory experiments, the galvanic current depended on the concentration of dissolved copper in the lake water.^{xi} A recent study used genetic techniques to quantify the abundance of IOB at multiple sites in the DSH over multiple



Photograph courtesy Ivanna Betch, University of Oklahoma



Photograph courtesy of Gene Clark, UW Sea Grant Institute

Figure 2a: (Left) Piling deterioration due to ALWC. Figure 2b: (Right) Corrosion of piling in Duluth Superior Harbour.

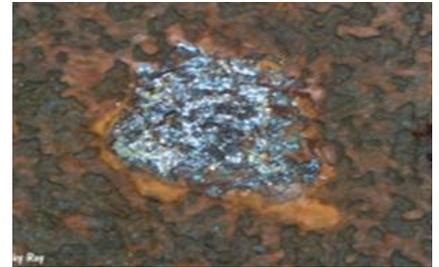


Figure 3: Tubercle on carbon steel exposed in Duluth Superior Harbour before (left) and after (right) removal of tubercle.

years. They demonstrated that tubercles in the DSH were enriched with IOB compared to the biofilm on adjacent surfaces. However, long-term corrosion was not related to IOB abundance or dissolved copper concentration.^{xii} Both studies concluded that a combination

of microbiological and chemical factors influenced the rate of corrosion. An additional report evaluated coatings for DSH pilings over a four-year period. Some of the coatings provided an effective barrier that prevented tubercle formation and MIC.

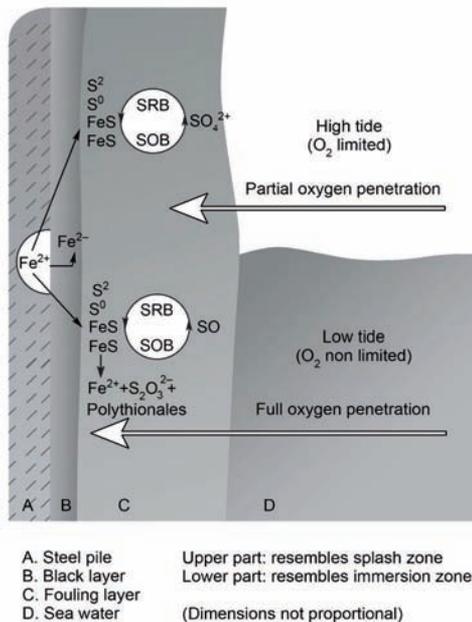


Figure 4: Schematic representation of the chemistry and reactions associated with ALWC. Reproduced with permission from NACE International, Houston TX. All rights reserved. Copyright NACE International 2003.

Diagnosing MIC in harbours

The involvement of microorganisms in the corrosion of CS pilings cannot be surmised by evaluating the morphology of the localised corrosion. Furthermore quantification of bacterial types does not provide a predictive capability. The following are required for an accurate diagnosis of MIC: a sample of the corrosion product or affected surface that has not been altered by collection or storage, identification of a corrosion mechanism, identification of microorganisms capable of growth and maintenance of the corrosion mechanism in the particular environment, and demonstration of an association of the microorganisms with the observed corrosion.

In summary

Corrosion rates for ALWC and corrosion in DSH are similar ie. 0.3 millimetres

per-year and higher. However, there are obvious differences in the observations in DSH and reports of ALWC (see Figure 4). ALWC is in the low water zone, just below the tidal zone, in saline waters containing gram per litre quantities of sulphate. DSH is a fresh water harbour with milligram per litre concentrations of sulphate. Corrosion in DSH is localised to the top 3 metres below the surface of the water and water depth is not significantly influenced by tides. Despite these differences both ALWC corrosion and corrosion in DSH have been attributed to MIC. In both cases, a combination of biological, chemical and physical events contribute to the corrosion. The specificity of metal/microbe/electrolyte interactions makes it difficult to predict the likelihood and rate of MIC in harbours. MIC on CS pilings can be prevented.

References

- ⁱLittle BJ, Lee JS. 2007. Microbiologically Influenced Corrosion. Hoboken, New Jersey: John Wiley and Sons, Inc.
- ⁱⁱBreakell JE, Foster K, Siegwart M. 2005. Management of Accelerated Low Water Corrosion in Steel Maritime Structures: C634. London: Construction Industry Research & Information Association (CIRIA)
- ⁱⁱⁱJohnson D, Moulin JM, Karius R, Resiak B, Confete M, Chao WT. 1994. Low water corrosion on steel piles in marine waters. EUR 17868
- ^{iv}Kopczynski B. 2010. Accelerated low-water corrosion in harbours. Port Technology International. 46:116-118
- ^vCheung CWS, Walsh FC, Campbell SA, Chao WT, Beech IB. 1994. Microbial Contributions to the Marine Corrosion of Steel Piling. Int Biodeter Biodegr. 34(3-4):259-274
- ^{vi}Gehrke T, Sand W. 2003. Interactions between microorganisms and physicochemical factors cause MIC of steel pilings in harbours (ALWC). Paper presented at: CORROSION / 2003, San Diego, CA.
- ^{vii}Melchers RE, Jeffrey R. 2010. Corrosion of vertical steel strips exposed in the marine tidal zone and implications for ALWC. Paper presented at: CORROSION / 2010, San Antonio, TX.
- ^{viii}Melchers RE. 2013. Influence of Dissolved Inorganic Nitrogen on Accelerated Low Water Corrosion of Marine Steel Piling. Corrosion. 69(1)
- ^{ix}Kumar A, Stephenson LD. 2005. Accelerated Low Water Corrosion of Steel Pilings in Seawater. Paper presented at: CORROSION / 2005, Houston, TX.
- ^xMarsh CP, Beitelman AD, Buchheit RG, Little BJ. 2005. Freshwater Corrosion in the Duluth-Superior Harbour, Summary of Initial Workshop Findings. ERDC/CERL SR-05-03.
- ^{xi}Ray RI, Lee JS, Little BJ. 2009. Factors contributing to corrosion of steel pilings in Duluth-Superior Harbour. Corrosion. 65(11):707-717.
- ^{xii}Hicks RE, Oster RJ. 2012. Developing a Risk Assessment Tool to Predict the Risk of Accelerated Corrosion to Port Infrastructure, Finla Report. Great Lakes Maritime Research Institute.

About the author



Brenda J. Little is senior scientist for marine molecular processes at the Naval Research Laboratory. Dr Little has worked in the field of microbiologically influenced corrosion for 30 years. She serves on the editorial board for Biofouling and is a NACE International Fellow.



Richard I. Ray is a physical scientist at the Naval Research Laboratory. Mr Ray has worked in the field of microscopy for 20 years and has developed protocols for imaging biofilms and biological materials.



Jason S. Lee is a materials engineer at the Naval Research Laboratory. Dr Lee has worked in the field of corrosion for 14 years.

About the organisation

Naval Research Laboratory (NRL) is the corporate research laboratory for the US Navy and Marine Corps and conducts a broad program of scientific research, technology and advanced development. NRL has served the navy and the nation for over 85 years and continues to meet the complex technological challenges of today's world. NRL publication NRL/JA/7303 -13-1810. Funding provided by ONR (Dr L. Chrisey).

Enquiries

Brenda J. Little
Naval Research Laboratory
Code 7303, Stennis Space Centre
MS 39529, US
Tel: +1 (228) 688 4494
Email: brenda.little@nrlssc.navy.mil

Efficient selection and deployment of terminal tugs

Marinus Jansen, technical innovations manager, Rotortug, Rotterdam, The Netherlands

Introduction

When sea-going vessels slow down to enter port, their rudder effectiveness and manoeuvrability become restricted by the loss of water flow or water speed across their rudder. The paradox of slowing down to enable safe navigation of high-risk areas, while losing effective steering control at the same time is what drives the demand for tugs.

At the zero speed condition a ship's control ability can be boosted with bow and stern thrusters, but the effectiveness of these drops dramatically if a ship gains a little speed and a pilot is not always sure how effective a ship's transverse thrusters will be.

At medium speeds tugs apply steering and braking forces supplementary to a ship's own steering system and at higher speeds we refer to this type of assist as 'escorting'. There is however a sliding scale between escorting and ship-handling and modern tugs are generally required to provide assistance over the full 10-0 knots speed range, creating an overlap in the existing definitions.

This is why modern day terminal tugs are required to feature both suitable escort capabilities and superior manoeuvrability during ship-handling operations. In effect, one could state that terminal tugs cover a somewhat intermediate position between escort tugs and ship-handling tugs as far as operating speed (not maximum sailing speed) is concerned. This issue focuses on the working principles of modern terminal tugs and how tugs generate maximum towline forces during escort duties and rapid vector response when ship-handling in confined spaces.

Escorting duties

Escorting and associated technologies are like the extreme sports of towage industries. High towline forces are generated by manoeuvring the tug under an oblique angle to the sailing direction. The hydrodynamic hull forces (lift and drag) generated in this

manner create the high towline and steering forces on the assisted ship (see Figure 2). Because of the indirect power generation, we generally refer to this manoeuvre as operating indirect or in an indirect mode. The same working principle applies at lower speeds too and at about 6-4 knots tugs generally shift between the so-called indirect mode and direct mode wherein they pull using direct thruster power only.

To maximise the indirect steering forces, naval architects increase the lateral surface area of escort tugs by adding skegs

- The application of skegs in tug designs limits manoeuvrability when providing ship-handling services
- Generated steering forces deteriorate more than 40 percent when the assisted vessel reduces speed (because the hydrodynamic lift and drag forces deteriorate in turn by a power of two.)

The tugs' supplementary steering forces deteriorate as the ship slows down, while the ship's own steering system becomes less effective too. Where tugs should mitigate the navigational risks, they actually become less effective due to their working principle. This paradox in ship design required a new tug concept providing steering and braking forces

over the full range of speeds of ships with hydrodynamic forces being part of, but not the only power generating force.

The triple Z-drive or Rotortug® displayed in figures 3 and 4 uses a combination of the hydrodynamic and direct thruster forces to generate effective steering and braking forces at the same time. The combination of indirect and direct thruster forces enables enhanced ship control for the pilot over the full 10-0 knots speed range. The Rotortug® generates the forces without increasing lateral surface area of the hull and is therefore easier to manoeuvre during the ship-handling phase.

- The combination arrest mode (see Figure 4) offers enhanced safety for a tugboat's crew because the towline is lined up with the tug's hull creating only limited heeling angles

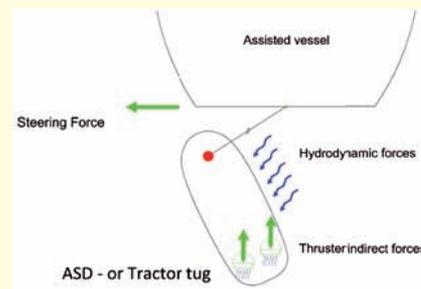


Figure 1: Hydrodynamic forces - indirect mode.

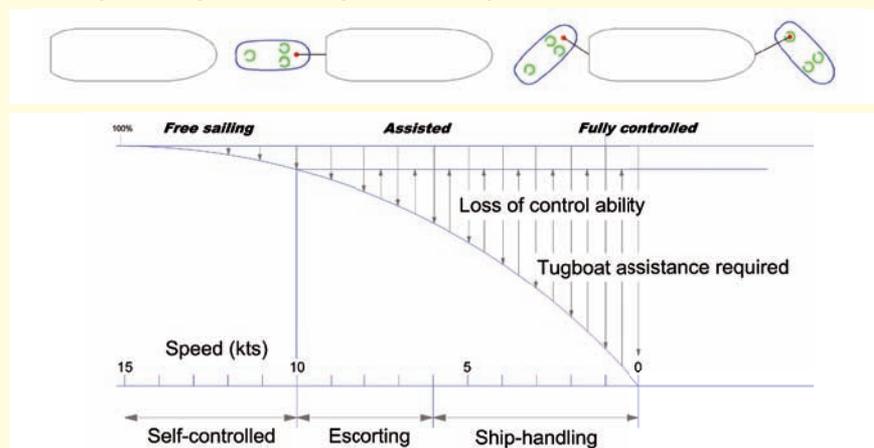


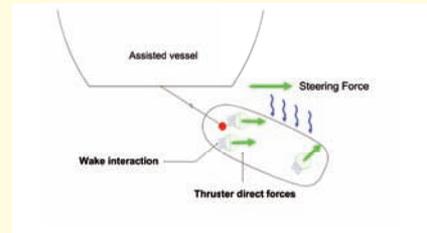
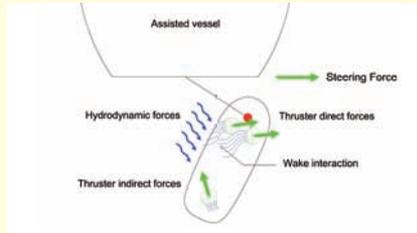
Figure 2: Tugboat requirements.

(5-7 degrees heeling).

- Switching between the indirect and direct or combi mode is a simple and safe manoeuvre. The Rotortug's double-ended control ability increases vector response to assisted ships.
- Smart application of a ship's own steering systems and pre-deployed tugs can further increase a ship's manoeuvrability in restricted waters.
- The ability to deploy your tugs in multiple configurations extends the pilot's options to adapt to all circumstances.

So what level of supplementary steering forces can we expect from these Rotortugs when deployed on the stern tug position in addition to a ship's own steering systems? The bottom line answer to this is displayed in figure 5.

Figure 5 displays the generated steering forces over the entire speed range for both the triple Z-drive Rotortug® and conventional escort tugs relying on hydrodynamic forces to generate steering forces. Another interesting feature is this 'rotoring' or indirect towing at low speeds. This enables full control ability while operating within the beam of a ship while transiting bridges or entering docks.



Figures 3 and 4: Generating steering forces with a Rotortug®.

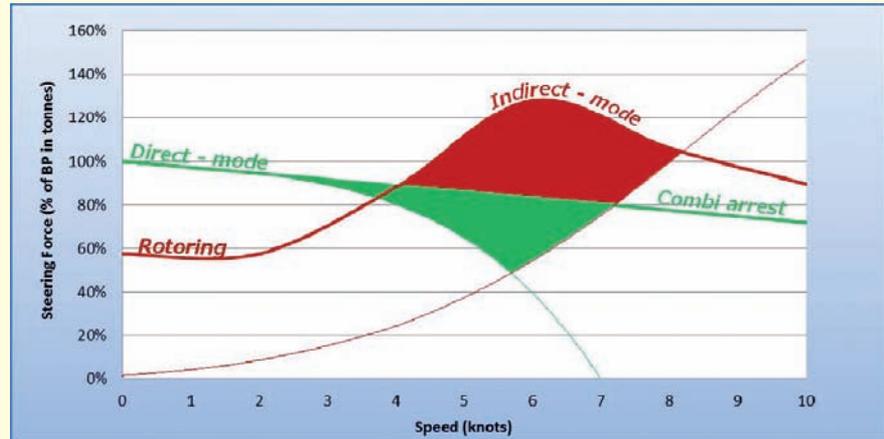


Figure 5: Steering forces by speed.

Ship-handling

All ships slow down eventually as they make their final approach to their berth. These manoeuvres are generally referred to as ship-handling (with tugs) and involve

three basic manoeuvres: to navigate a narrow approach (channels, bridges, locks or otherwise); turning a ship; and berthing the ship. Being in control requires an understanding of how ships are

ROTOR TUG

Changing the game? Definitely!



ART 80-32

ROTORTUG.COM

Visit our website to learn about escorting and ship-handling with the Rotor®tug

moved by the assisting tugboats and how vectors interact with each other. What type of forces are involved and how the deployment of the right tug for the right application extends a pilot's options.

Navigating approaches

Navigating confined spaces, such as bridge transits and docking operations provides additional challenges to port operations. Figure 1 indicates that the required tugboat assistance is greatest in these circumstances, but due to the restricted space, twin-drive tugs cannot reposition themselves effectively.

Twin drive tugs (Voith tractor, Z-drive tractor, ASD, conventional) always need to have their towing point aligned with their propulsion units. This requires them to reposition before applying a vector force, but the large hull appendages and lateral underwater surface areas, beneficial when working in indirect mode, handicaps manoeuvrability during ship-handling.

At the same time slow speed 'rotoring' (see also Figure 5) enables the triple Z-drive Rotortug® to continue providing steering forces when navigating a narrow approach (see Figure 7). Where twin-drive alternatives lose control for a brief window during their passage, the Rotortug® provides full control along the entire approach.

- The ability to remain within a ship's beam while providing transverse forces increases a ship's control ability during bridge or lock transits, but also when docking large ships like VLCC, capesize bulkers and VLGCs.
- The absence of large hull appendages further benefits the manoeuvrability when operating in close quarters for the triple Z-drive Rotortug®;
- These Rotortugs were initially developed for use in the confined port area of Bremerhaven in 1999. Over 32 Rotortugs currently operate with six operators in Bremerhaven, Castellon, Hamburg, Rotterdam, Port Hedland and Zeebrugge offering a proven tug concept.

Berthing

The very same 'rotoring' feature can also be used when bring ships alongside a quay. In order to achieve this, the tugboats bring the assisted vessel alongside and keep her stationary until a safe shore connection is established. Figure 8 displays a berthing manoeuvre using this feature of the Rotortug®. Control of the assisted vessel's transverse speed is critical when berthing and the Rotortug® provides 60 percent bollard pull while remaining within the beam of the ship. Tugs offer a supplementary service

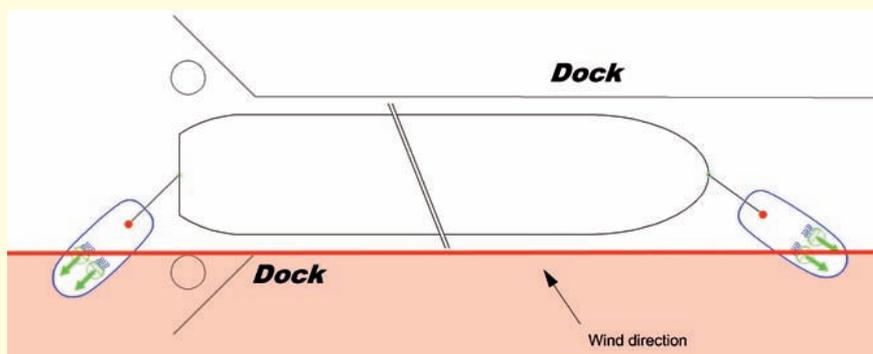


Figure 6: Navigating narrow approaches with twin-drive tugs.

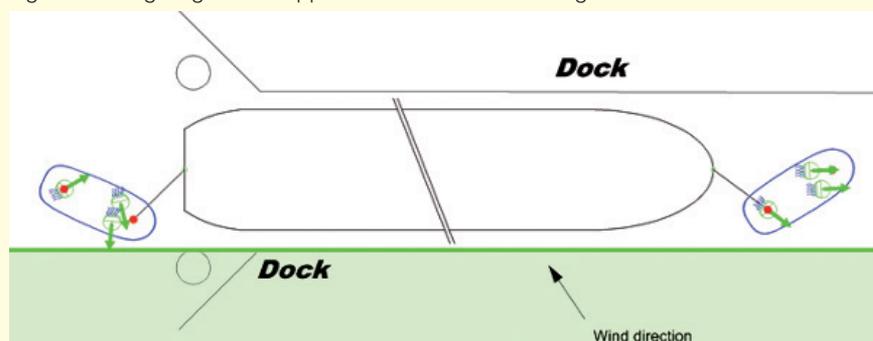


Figure 7: Navigating approaches with Rotortugs®.

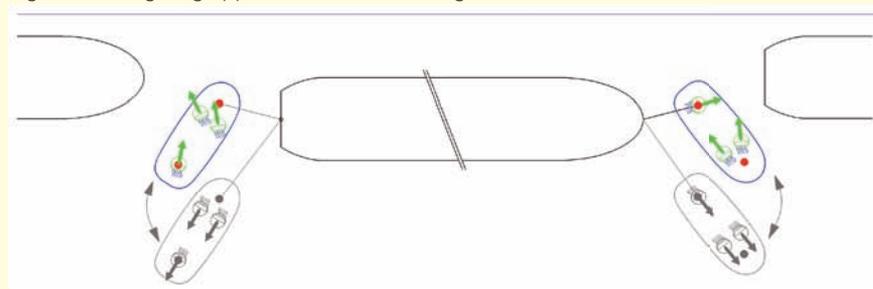


Figure 8: Ship berthing with 'rotoring'.

in addition to a ship's own steering systems and bow thrusters, not as a full replacement of those systems. At the same time deploying fewer, but stronger tugs achieves major savings on operating costs and fuel consumptions for local towage operators. Savings which in turn enable a lower cost port operation with better safety levels during narrow approaches and passageways.

In conclusion

Tugs offer a supplementary service to ships mitigating their reduced control ability when slowing down near ports and terminals. Terminal tugs especially should focus on a good overall performance across a wide range of speeds. The old escort tugs' methods of providing steering forces needs to be reconsidered in the mid speed range. In this view the triple Z-drive Rotortugs add direct thruster forces into the mix, providing a 100 percent increase in steering forces between 4-6 knots ship speed. At the same time this new generation of terminal tugs increases ship control in confined spaces and enables operational cost savings in the majority of ship calls.

By continuously reviewing your operations,

tug deployment and types of tugs, you gain a higher degree of efficiency and control at your ports and terminals. Rotortug happily shares its experience in terminal operations with interested parties.

About the author

Marinus Jansen Msc. is a technical innovations manager at Rotortug. He studied marine engineering at the University of Technology in Delft, the Netherlands, before joining Rotterdam-based Rotortug in 2010.

About the organisation

Rotortug is a development company dedicated to innovative technologies and a systems-based approach to ship-handling with tugs. Rotortug believes you can always improve your operation by optimising how tugs are deployed and what type of tugs you deploy to safeguard your assets.

Enquiries

ROTORTUG (KST B.V.)
Boompjeskade 123
3011 XE Rotterdam
The Netherlands
Tel: +31 102010 045
Website: www.rotortug.com

Improving operations while simplifying regulatory compliance reporting

Jason Tieman, *director of maritime operations, PortVision, Houston, Texas, United States*

Efficiency, cost control, and enhanced visibility are more important than ever in today's increasingly complex terminal environment. At the same time, marine terminal operators must function in a challenging regulatory climate and support new and more rigorous expectations for industry best practices. There are two key requirements for meeting these objectives. The first is to have instant access to vessel information, including both current and historical locations and events. The second is that this information be more than simply 'points on a map' so that operators can use the data for business intelligence and analysis, and to improve operational efficiency, decision-making and reporting.

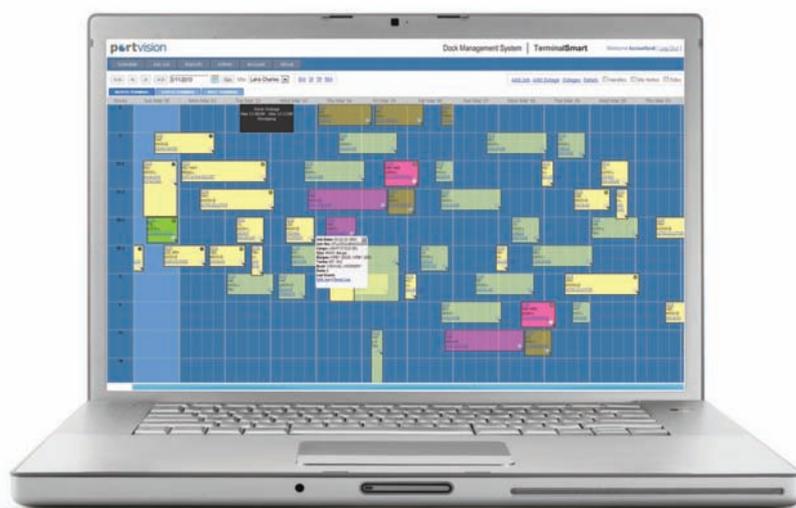
Today's enterprise-class terminal management offerings make this possible by delivering access to both real-time and historical vessel tracking information,

and combining this data with integrated reporting, analysis and dock management tools. These systems can also be used to automate and enhance dock scheduling and activity logging, as well as other key processes and functions, while enabling operators to combine multiple, independent systems into a single, comprehensive and fully integrated solution.

Considering stakeholders' needs

Integrated marine terminal management systems deliver benefits up and down the chain of command, from the dock operators and supervisors through to senior corporate management. Each stakeholder has specific needs. For instance, at the corporate office, IT teams must ensure system compliance with security and risk mitigation practices. Chartering managers and schedules

must connect with traders and identify available vessels while maintaining reliable schedules. Marine technical departments, superintendents and port captains also need the right data with which to investigate incidents and improve safety and security. Furthermore, marine transportation and operations management personnel are challenged with optimising logistics and loss control/prevention, while validating and minimising demurrage claims and streamlining analyses related to the root causes of delays. Meanwhile, dock operators need to know where all vessels are and resolve upcoming conflicts while maintaining an accurate record of dock activities. The business optimisation group needs to reduce costs and improve efficiency. Elsewhere, plant and operational management need to maximise resource availability while



The PortVision TerminalSmart Dock Management allows collaborative job scheduling, activity logging and back-end reporting.

managing the budget and ensuring safety.

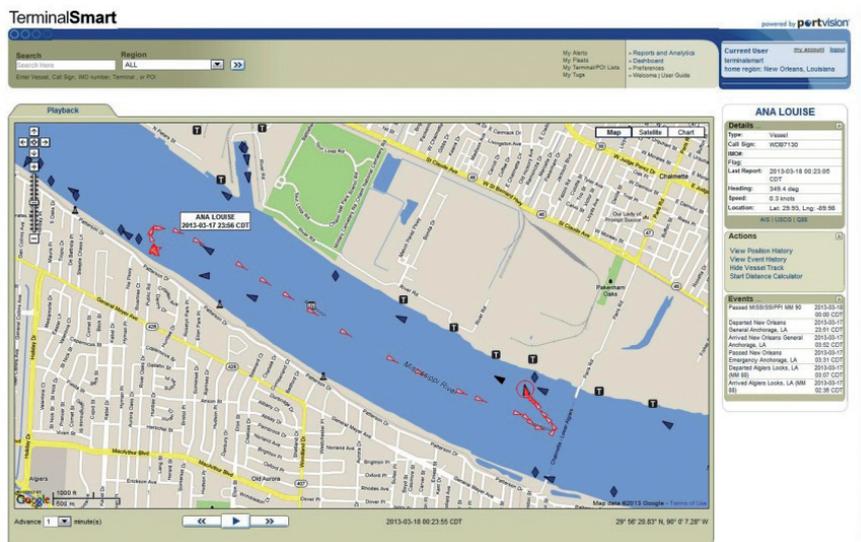
For optimum efficiency and accuracy, all of these tasks must be integrated into a single comprehensive dashboard that combines vessel tracking capabilities with enterprise-class process automation and analytical tools. Vessel tracking capabilities must extend to each automatic identification system (AIS) enabled vessel in the region of interest, which requires a service that can process tens of millions of daily AIS-based ship location reports and provide access to billions of records about historical arrivals, departures and individual movements. The service should also provide detailed visibility into commercial port arrivals and departures as well as ship movements on the open sea, all in a single display screen.

Streamlining information

In addition to providing vessel information, terminal management systems should also automate scheduling tasks for just-in-time deployment based on a combination of current vessel locations, dock availability and in-transit traffic conditions. This enables terminal operators to streamline vendor and resource management, and incorporate vessel information into their current traffic scheduling dispatch and management practices. For optimal effectiveness, users should be able to define their own customised filters, views and fleets. They should also be able to receive and share e-mail and text message alerts about fleet movements. The system should be able to automatically time stamp and capture data about arrivals (including sea buoy arrivals), departures, and other vessel events, and allow users to add their own documents and information about dockside events for each vessel call.

Task-oriented modules should be available for such specialised functions as dock management, giving organisations the option to replace paper and spreadsheet systems with an end-to-end, collaborative job scheduling, activity logging and back-end reporting tool. With this kind of fully integrated solution, users can view and manage vessel activities until dock arrival, and then maintain dock activities, demurrage data, and other information pertinent to the vessel call's Statement of Fact (SOF) information.

Viewing and managing real-time activities is only half of the puzzle. Equally important is the ability to review historical vessel movements, and incorporate this information directly into the supply chain model. For instance, this



Vessel incident replay

makes it possible to perform integrated demurrage reporting and analysis within a single, integrated dashboard environment. Or, the historical data could be used to identify the root cause of costly incidents and property damage.

Putting systems to use

One of the largest US refineries has used both real-time and historical vessel tracking data to streamline activities ranging from job scheduling and real-time operations to activity logging and demurrage management. In the past, each transaction required a dozen or more hand-generated documents derived from manually created spreadsheets. The error-prone process consumed considerable staff time. Once the company moved these processes to an enterprise-class terminal management platform, it was able to significantly reduce both costs and labour requirements, while also simplifying vendor and resource management, and automating scheduling, dispatch and traffic management. The company has also integrated all demurrage reporting and analysis functions, and can now automatically compile all necessary data required to track, validate and report demurrage information for all fleet routes and berth calls. This detailed information is also used to produce documentation required to support or dispute demurrage claims, with savings estimated at more than US\$1 million per year at a single site.

Additional applications

Many terminal operators also use management systems to manage all aspects of on-water incidents or events. Today's refineries face the potential for millions of dollars in damages when

vessel wakes impact piers, ships and other resources at docking facilities. These wakes also cause serious and even fatal injuries, especially in the case of dock-related construction projects where personnel and equipment are at risk. With an effective terminal management system, operators can view real-time vessel traffic in a single, convenient display, gain access to every aspect of an actively managed incident in user-defined safety zones, and share real-time information and reporting with remote participants and other operation centres to drive compliance and create incident reports. These systems also can be configured to automatically notify construction staff anytime a vessel is transiting at high speed toward specific locations, so they can initiate safety measures including securing equipment and pulling people out of harm's way. In other cases, the damage may have already been done, but terminal management systems can be used in a forensic capacity to identify responsible parties. Terminal management systems can provide not only real-time information about every commercial vessel on the waterway, but also up to five years of historical data with which to investigate incidents and prepare cases for compensatory damage claims.

Finally, terminal management systems can also be used to help operators comply with industry best practices recommendations, such as the recently established Oil Companies International Marine Forum (OCIMF) Marine Terminal Management and Self-Assessment (MTMSA) guidelines. These guidelines define standardised Key Performance Indicators (KPIs) and best practices for assessing the effectiveness of management systems

used in berth operations and the ship-to-shore interface. Major oil companies are using these guidelines to evaluate their own terminals and those of prospective third party operators and other service providers. Among the most challenging MTMSA elements are those concerned with vessels, their movements and their contracted personnel. Also challenging are KPIs related to the safety and efficiency of the dock's layout and various dock operations including scheduling, liquid cargo transfer activities, and communication and information sharing both inside the organisation and between the dock team and various port and harbour entities. The latest terminal management systems make it easier to perform to these KPIs related to MTMSA vessel and dock processes.

In conclusion

Marine terminal operators must enhance a variety of complex and interrelated operations in an increasingly challenging and competitive environment. By combining vessel tracking services with enterprise-class analytics, reporting and process-improvement tools, today's terminal management systems improve visibility while reducing costs and enhancing overall efficiency, safety and security.

About the author



Jason's diverse maritime experience has been critical in the development and implementation of the PortVision service line, and spans a 17-year career serving on tankers, supply vessels and research vessels as well as operating harbour tugs along the Texas Gulf Coast. In 2000, Jason accepted a Coast Guard commission and served seven years of active duty in marine safety operations prior to transitioning to reserve status. He has held various Gulf Coast Marine Safety leadership roles including chief of port safety and security, chief of marine environmental protection, and senior investigating officer.

About the company

PortVision's web-based enterprise software and services give oil companies, marine terminal operators, fleet owners/operators, and other maritime users comprehensive tools for improving business operations through instant, continuous access to critical information about vessel and terminal activities. PortVision's enterprise software solutions leverage the PortVision vessel-tracking service to deliver integrated reporting, analysis and collaborative real-time management capabilities across all levels of the operational chain of command. These capabilities can be used to enhance operations, reduce costs, and improve safety and security. Founded in 2006, PortVision is a service of AIRSIS, Inc., an Energy and Transportation Solutions Company. For more information visit www.portvision.com.

Enquiries

PortVision
 723 Main St. #1004, Houston, TX 77002, USA
 Jason Tieman: Tel. +01 (713) 337-3737 ext. 202.
 For PortVision sales, ask for ext. 201
 Website: www.portvision.com

PORT TECHNOLOGY SUPPLIER DIRECTORY



YOU'VE READ ABOUT THE PRODUCTS IN THE JOURNAL

NOW SOURCE THEM IN OUR ONLINE DIRECTORY

Compare technical specifications, watch video coverage of the products in action, read company news and contact suppliers direct through our online enquiry service

Download technical papers published by the company in the PTI journal



Watch informational videos of the products in action



WWW.PORTTECHNOLOGY.ORG/DIRECTORY

To add a multimedia entry for your organisation, contact James AA Khan
 E: jkhan@porttechnology.org | T: +44 (0)20 7871 0123

Environment and Sustainability

STENA HOLLANDICA
HOEK VAN HOLLAND



“While shore power is frequently championed as an effective way for the ports industry to reduce its environmental impact, the economic case for shore power has, in the past at least, tended to be less clear. Rising fuel prices are however, creating conditions where the economic benefits of shore power are becoming increasingly apparent.”

‘Cavotec’s shore power innovation hits new highs’, page 84.

GREENCRANES: Testing the way to sustainability in ports

José Andrés Giménez, *research and development project manager, Valenciaport Foundation, Valencia*

One of the main strategic guidelines established by the European Commission about energy efficiency is related to assuring an effective transition towards the use of energy sources with lower environmental impact in terms of greenhouse gas (GHG) emissions.

Such evolution should be sustainable in the mid to long term from different points of view, including the economic-financial, environmental and social perspectives.

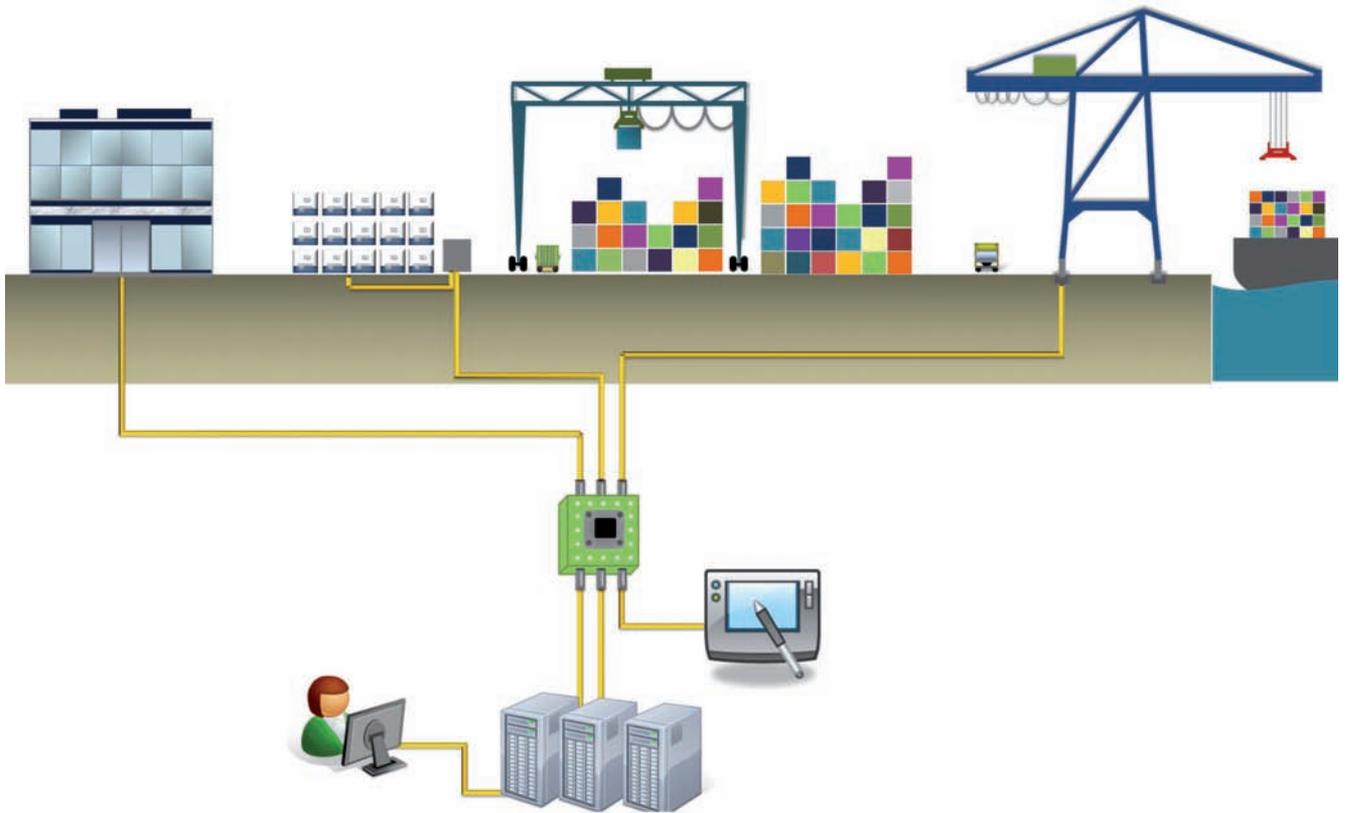
In recent years the integration of renewable energy and alternative fuels within the industrial and transport sector has been greatly encouraged. However, despite important efforts, the total share of such greener alternatives remains modest considering the production and consumption energy mix on a European level. In January 2013 the European Commission launched a communication titled: 'Clean Power for Transport: a

European Alternative Fuels Strategy' which reflects upon the important dependency of oil and its sub-products within the European transport sector. Moreover, high economic costs as well as environmental impact are addressed as significant barriers for the fulfilment of the 20/20/20 objectives established by the Commission.

The maritime transport and port-logistic sectors are strongly affected



LNG tractor and mobile supply station.



Energy consumption monitoring concept.

by this situation, due to their strategic importance as key drivers of international trade and transport of goods. However, it is worth mentioning that energy efficiency has not been considered as an important improvement field in this sector until recent years. Fortunately, this situation is changing quickly thanks to the major awareness of the industrial sector and the innovation developed by research teams and port machinery manufacturers.

The GREENCRANES TEN-T project

Within this context, the project 'Green Technologies and Eco-Efficient Alternatives for Cranes and Operations at Port Container Terminals' (GREENCRANES) aims to be an innovative action which contributes to the improvement of energy efficiency of port container terminals. GREENCRANES was awarded European funds through the Trans-European Transport Network (TEN-T). The project started in August 2012 and will end in May 2014. The participants in the GREENCRANES project are the Valenciaport Foundation (acting as coordinator); the Port Authority of Valencia; Noatum; Konecranes; ABB; Port of Koper and the Italian Ministry of Infrastructure and

Transport. The implementing bodies are Autorità Portuale Livorno; RINA SpA; Global Service Srl; Scuola Superiore Sant'Anna - Perceptual Robotics Laboratory.

The main mission of the project is to provide tools to port container terminal decision-makers which increase energy efficiency of equipment and machinery. GREENCRANES proposes the development of different actions including:

- To characterise the energy profiles of port container terminals, thus quantifying the amount of energy consumed and its location.
- To analyse the feasibility of several eco-efficient alternatives able to produce a significant reduction of the environmental impact of these facilities without affecting productivity.
- To develop pilot tests of those alternatives with higher implementation potential and significant reduction of GHG emissions.
- To provide recommendations and guidelines to the port industry, port container operators, public authorities, etc. derived from the results obtained in the project.
- To communicate and disseminate

these results and good practices among the European port sector and the public in general.

Integral energy consumption diagnosis

GREENCRANES is structured into three key activities oriented towards the achievement of their described objectives. The first activity consisted of an integral energy consumption diagnosis of the participant terminals in the project: Noatum Container Terminal Valencia (Spain), Livorno Darsena Toscana (Italy) and Koper Container Terminal (Slovenia).

This study concluded that 80 percent of electrical consumption is produced by reefer containers connected at the yard (43 percent) and ship-to-shore cranes (37 percent) in charge of loading and unloading containers to and from vessels. With regard to fuel consumption, the study found that 90 percent of the total consumption is distributed between rubber-tyred gantry (RTG) cranes (58 percent) and terminal tractors in charge of the horizontal transport (32 percent). In absolute figures, in 2012, the three studied container terminals consumed more than 30 GWh of electricity, which equals to the annual consumption of 3,000 Spanish homes on average. In the same manner, the amount of fuel

consumed almost reached 7 million litres. The associated carbon footprint generated was calculated as 11.7 kilogrammes of carbon dioxide (CO₂) equivalent per twenty-foot equivalent unit (TEU).

Evaluation of eco-efficient alternatives

The second activity of GREENCRANES consisted of the development of studies focused on evaluating financial, technical and environmental feasibility of a selected group of eco-efficient alternatives which may allow the reduction of GHG emissions.

The use of liquefied natural gas (LNG) in terminal tractors

The feasibility study for this alternative option concluded that it is affordable from the financial, technical and environmental perspectives, assuming the current gap of price between LNG and diesel fuels. The study was conducted for the Noatum Container Terminal Valencia (NCTV) business case and shows that a minimum fleet of 19 new terminal tractors would be needed to ensure the critical mass which provide an internal rate of return (IRR) of 10 percent (the minimum profitability threshold established by the company).

Reach stacker retrofitting with dual fuel technology

This alternative was also considered as feasible, taking into account that emissions reduction would be greater considering a full LNG solution, but the high power requirements of this machine when lifting up and down containers make it more suitable as an intermediate solution in order to fulfil operative performance.

Electrification of RTG cranes

Electrification is a viable solution for greenfield terminals, although in existing facilities a detailed study must be carried out for each specific case. It is the alternative with a higher degree of environmental local benefits, as CO₂ emissions reduction could reach 90 percent. Moreover it provides significant savings in energy cost due to the use of electricity instead of fossil fuels.

Optimisation of RTG cranes by generator power adjustment

Tests carried out in GREENCRANES show that old RTG cranes are equipped with oversized generators, thus providing much more power than the needed to perform port operations. In this manner,

it is possible to adjust the real power requirements by means of substituting old systems with smaller new units able to reduce fuel consumption and emissions.

Development of market-sided pilots

Activity three of GREENCRANES is to develop market-sided innovation by means of the demonstration of pilot projects in the ports of Valencia, Livorno and Koper.

Within the framework of the project, the first European prototype of a 100 percent LNG propelled terminal tractor has been developed. The prototype is currently being tested at NCTV, jointly with a last generation diesel (stage IV) terminal tractor in order to compare operative performances of both machines. The results of the pilot will be used as decision criteria to progressively replace the fleet of 90 terminal tractors of NCTV by new LNG units.

Another pilot consists of the dual fuel technology implementation in a reach stacker vehicle. The pilot will be conducted at the Darsena Toscana Terminal in the Port of Livorno, thus demonstrating the feasibility for the adoption of alternative fuels in heavy-duty port vehicles.

The final pilot and demonstration will be based on the implementation of a real-time energy consumption monitoring system at the Port of Koper Container Terminal, with the aim of preparing the terminal for a future certification with the ISO 50001 standard.

It is a pleasure for us to invite readers of Port Technology International to attend the real live demonstrations taking place on December 2nd in Valencia, where the LNG powered terminal tractor and retrofitted eco-RTG will be presented. For more information and to register for these Demo Days, please visit: www.greencranes.eu <<http://www.greencranes.eu/>> .

About the author



José Andrés Giménez qualified as an industrial engineer at the Polytechnic University of Valencia in Spain. He is research and development project manager at the Valenciaport Foundation and has 10 years' experience in managing and developing innovation and research projects in the port-logistic and maritime transport sectors, with special focus on energy efficiency, security and safety. His work is focused on R&D projects financed by the European Commission through innovation, research and cooperation programmes like TEN-T and VII Framework Programme among others. He is also the technical manager for the GREENCRANES project.

About the organisation

The Valenciaport Foundation for Research, Promotion and Commercial Studies of the Valencian region (Valenciaport Foundation) is a non-profit private entity. It has been conceived to expand the reach of the logistics-ports community by serving as a research, training and cooperation centre of excellence. The Valenciaport Foundation manifests an initiative of the Port Authority of Valencia, in collaboration with various other associations, companies and institutions. The Valenciaport Foundation is presently active in numerous cooperation and internationalisation projects in over 20 countries, principally located in Europe, the Far East and Latin America.

Enquiries

Valenciaport Foundation
Av. Muelle del Turia s/n
Port Authority of Valencia
Phase III
46024 Valencia
Spain

Tel. +34 96 393 9400
Email: jagimenez@fundacion.valenciaport.com

Ports unite to propel liquefied natural gas technology

The Antwerp Port Authority, Antwerp, Belgium

At its 2011 conference in Busan, the International Association of Ports and Harbours (IAPH) identified the need to reduce toxic emissions, improve air quality and provide a platform that could work on long-term solutions to make a substantial difference to the environmental impact of ports.

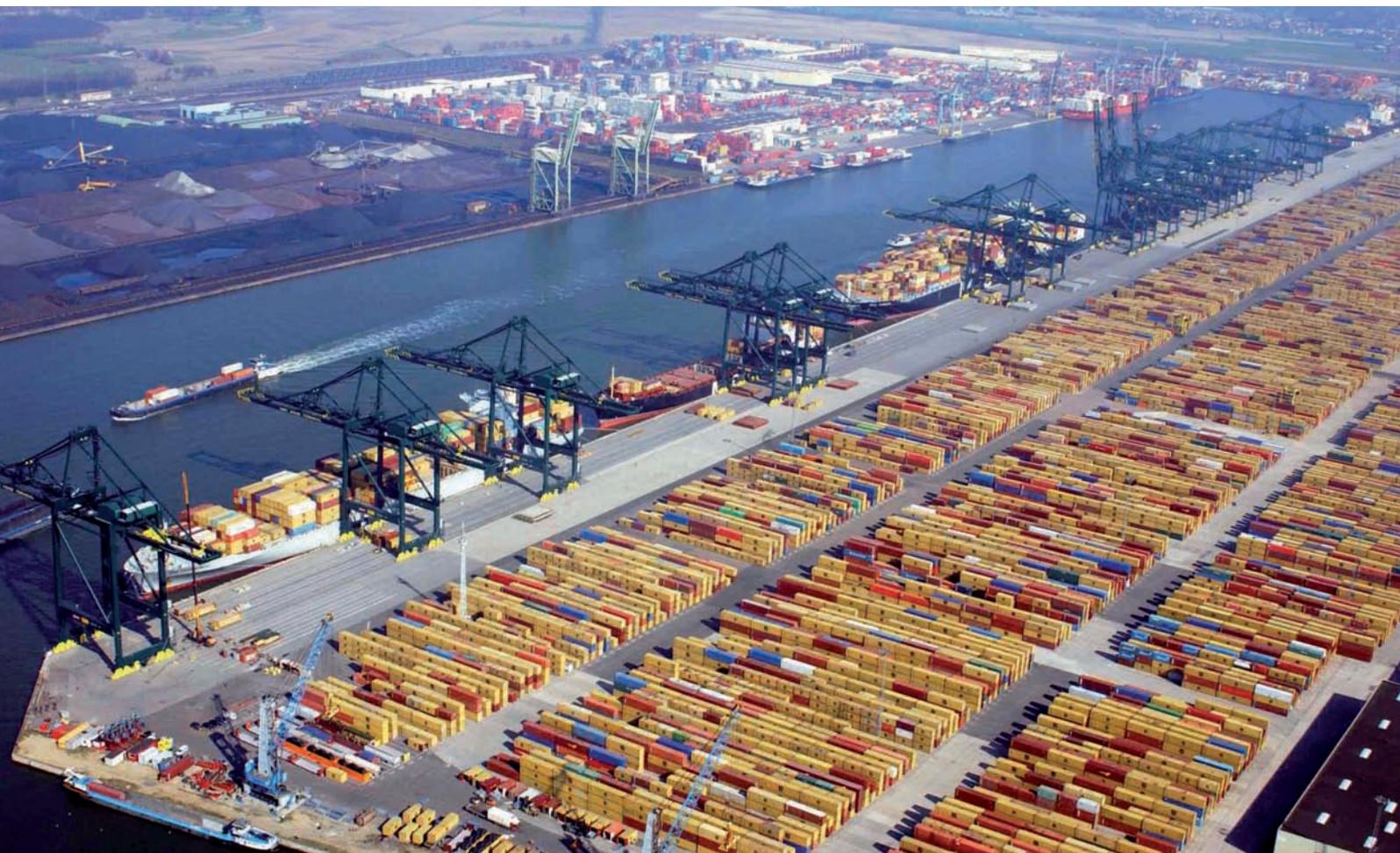
The solution in liquefied natural gas

To be able to answer the International Maritime Organisation's (IMO) call to

reduce emissions of sulphur oxide, carbon dioxide and nitrogen oxide, the shipping industry is slowly but steadily pushing liquefied natural gas (LNG) as the preferred fuel of the future for vessels.

LNG has been identified as the primary medium-term solution as it offers substantial environmental benefits in comparison to conventional fuels. Sulphur and particle emissions would be reduced to almost zero, nitrogen oxide emissions by 85-90 percent and net greenhouse gases by 15-20 percent.

According to a recent study by the Danish Maritime Authority, the current use of natural gas within the Sulphur Emission Control Area (SECA-zone), is expected to increase by 140 percent by 2020, due to the use of LNG as a shipping fuel and also its usage on land by trucks and buses. By 2015 a number of progressive shipping lines want to lead by example and feature LNG-powered vessels in their fleet. Several vessels today are already LNG-powered and more are on order.





A leading global think-tank

Many of the world's leading ports joined forces in the LNG fuelled vessels working group, established under the auspices of the World Ports Climate Initiative (WPCI), to successfully implement the technology around the world.

The switch from conventional fuel to LNG presents several challenges for the shipping industry, and ports in particular. The costs associated with switching technologies and a lack of direction on issues like bunkering options have hindered progress on LNG-fuelled shipping. That's where the LNG fuelled vessels working group comes in. In the working group many of the world's leading ports work together to oversee the implementation of LNG as a marine fuel and tackle all the challenges that lie ahead. It is a think-tank tasked with finding solutions in terms of safety, infrastructure and regulations and developing guidelines on safety procedures for LNG bunkering operations.

The goal is to provide an implementation guideline to help ports around the world in their bid to provide safe storage and bunkering of LNG for shipping lines in or near their port areas. In addition, the working group is tasked with raising awareness about LNG as a sustainable technology and source of fuel. The Port of Antwerp is pushing the boat out in the working group, chairing the initiative. It is joined by representatives of the ports of Amsterdam, Bremerhaven, Brunsbüttel, Gothenburg, Hamburg, Le Havre,

Los Angeles, Long Beach, Rotterdam, Stockholm and Zeebrugge. The working group maintains close contacts with industry stakeholders currently using and/or handling LNG, as well as government agencies, to get a feel for what the industry demands and validate the results of the working group's findings.

Further considerations of the group

The group consists of three sub-groups that tackle individual domains like safety regulations or public awareness. Industry experts are also invited to be active contributors and share their expertise. The Port of Antwerp took the initiative to come up with safe bunkering procedures, a process which will be finalised near the end of 2014. The port believes that the schedule should allow for plenty of time to take ISO recommendations and stakeholder feedback into account. The port wants to focus on coming up with a definitive standard, rather than rushing out a solution.

A switch to a completely new fuel type like LNG requires sizeable changes in infrastructure and the supply chain. The Port of Antwerp also plays a leading role in truck-to-ship bunkering solutions, having implemented the procedure as early as November 2012 and has subsequently built up its expertise on rules and requirements. In December last year, the first LNG truck-to-ship bunkering took place in the Belgian port.

The sub-working group focusing on public awareness has its job cut out to

promote the use and the benefits of LNG. The Port of Antwerp plays its part through the European Clean North Sea Shipping project. The project serves to scientifically illustrate all the environmental benefits of LNG and compare the impact on emissions and feasibility of different clean technologies. The port also supports LNG pioneers such as the BlueCargo project, which is developing LNG as a suitable fuel type for trucks.

About the organisation

The 1,650 employees of the Antwerp Port Authority ensure the efficient and safe day-to-day operation of the port. In view of their wide-ranging responsibilities the jobs of all these colleagues varies strongly: from lock keeper to accounting, from quay supervisor to promotional employee and from tug boat captain to crane operator. Together they work on a sustainable future of the Port of Antwerp.

Enquiries

Antwerp Port Authority

Port House
Entrepotkaai 1
2000 Antwerp

T.+32 (0)3 205 20 11

Cavotec's shore power innovation hits new highs

Luciano Corbetta, *group market unit manager, Ports & Maritime, Cavotec, Milan, Italy*

With the global ports industry taking substantive steps to operate more sustainably and cost-effectively, leading shore power expert with the Cavotec engineering group, Luciano Corbetta, describes how shore power, or 'cold ironing' systems are increasingly being adopted, and adapted for port authorities, shipping lines and ship owners.

"We're increasingly adapting our alternative maritime power (AMP) systems, be they on shore, ship-based, fixed or mobile, low or medium voltage, for all types of customers," says Corbetta.

Working closely with engineering partners, shipping lines and port authorities, Cavotec has developed shore power technologies since the 1980s. The group designs and manufactures a variety of shore power systems with varying voltages, including ship-based units, land-based vault systems and mobile units. Shore power systems enable ships in port to switch off their engines and connect to shore-side electrical power supply, thus reducing emissions in ports and surrounding communities.

"Shore power is increasingly seen as an effective way to operate more sustainably, and as fuel prices rise, also a way to reduce costs in the long-term," says Corbetta.

Indeed, in many countries, the ports industry is being left with little choice but to introduce shore power systems. It is operating in an increasingly demanding legislative framework when it comes to emissions, both nationally and internationally.

Increasing adoption of new systems

In California for example, by 2014, all ships calling at the state's ports must be fitted with shore power connection systems. And by 2020, 80 percent of the power used by docked ships will have to come from shore power.¹

Today, there are more than 400 Cavotec AMP units installed, or currently being installed on ships; while ports such as Los Angeles, Long Beach, Oakland, Prince Rupert, and Tacoma in North America, as well as Antwerp, Goteborg, Stockholm and other ports across Europe use the technology.

The majority of Cavotec's existing AMP systems are installed at container or bulk handling applications, and passenger ferry and cruise ship berths. Cavotec's shore power interface equipment primarily consists of cable management systems and connectors installed in or on the quayside, or on board ships that connect grid-generated electrical power from shore to ship.

A world-first for shore power

Cavotec is constantly innovating and adapting its shore power systems. During

the summer, the group announced a uniquely innovative project that will integrate AMP with its automated mooring technology MoorMaster™ into a single system at two passenger ferry berths in Norway. The units will be installed at the Lavik and Oppedal passenger ferry berths, in the Norwegian fjords, and used by another world first: a fully battery powered, catamaran-hulled ferry, run by Norwegian ferry operator Norled. The system will first moor and then connect the ferry to electrical power to charge its batteries.

"These are the first systems anywhere in the world that integrate automated mooring and automated AMP. This demonstrates our capacity for innovation, and our ability to offer integrated systems that maximise efficiency gains



A Cavotec AMP cable management system at the Port of Ystad, Sweden.

and environmental performance,” says Sofus Gedde-Dahl, managing director of Cavotec Norway.

The 80 metre long vessel will have capacity for around 120 cars and 360 passengers, and will make 17 crossings of the Sogne Fjord daily. It is scheduled to

enter service in 2015.

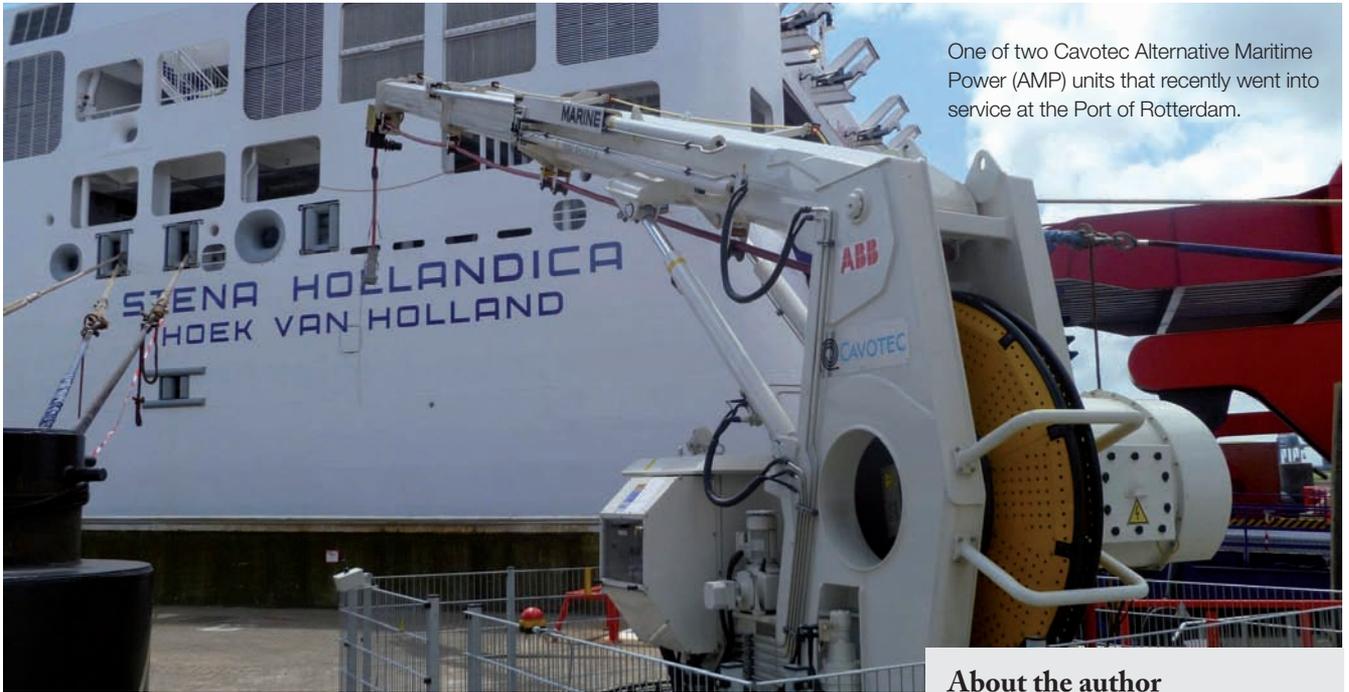
The MoorMaster™ units will be operated by Cavotec hand-held radio remote controls by the ship’s captain from the bridge of the vessel. The mooring system will signal to the AMP unit when the ship is secure, and sensors will then

guide the AMP connector to a hatch in the side of the vessel, connect to the ship’s battery and start charging.

By using MoorMaster™ the ferry’s propeller system can be switched off for nine minutes during each 10 minute boarding process, giving more than



A ship-board AMP system at the Port of Long Beach, USA.



One of two Cavotec Alternative Maritime Power (AMP) units that recently went into service at the Port of Rotterdam.

sufficient time to connect to the Cavotec AMP system and charge the on-board batteries.

With around 6,000 port calls made annually on the Lavik-Oppedal route, the air quality improvement and fuel cost savings compared to using conventional mooring and power systems is considerable. At present, the diesel-powered ferry that operates on this route needs to run its engines to hold the vessel in position on the berth, thereby generating emissions, increasing fuel costs, and causing noise pollution.

MoorMaster™ is a vacuum-based system that eliminates the need for conventional mooring lines. Remote controlled vacuum pads recessed in, or mounted on the quayside, moor and release vessels in seconds.

Airport know-how takes flight in the ports sector

In another example of the extent to which shore power systems are being innovated, Cavotec is currently delivering a large number of 'easy lift' access covers and shore power outlet connection boxes for four separate container terminals at several ports in California and other locations worldwide.

The Port of Los Angeles, one of the largest ports in the US, already uses AMP at several berths, and has a Cavotec AMP Mobile unit that can be deployed as required throughout the cruise terminal.

Cavotec's 'easy lift' access covers are safer for personnel to operate than many existing alternatives. This product is an example of the effective cross-implementation of technology between

Cavotec market units as these systems were first developed for use at airports and other aviation-related applications.

The units avoid operator stress and injury by reducing lift weights to a minimum. They are built into the quayside to enable vessels to connect to grid-generated electrical power quickly and easily.

The economic case for shore power

While shore power is frequently championed as an effective way for the ports industry to reduce its environmental impact, the economic case for shore power has, in the past at least, tended to be less clear. Rising fuel prices are however, creating conditions where the economic benefits of shore power are becoming increasingly apparent.

"Willingness to reduce fuel costs are making shore power an increasingly attractive option on a cost basis, not simply an environmental one," explains Corbetta.

Looking forward

Given the degree to which shore power systems are adapting to new levels of technical sophistication demanded by customers, it seems that shore power is set to continue to deliver the operational and environmental gains that ports and shipping lines are seeking to make.

References

The Electric Generation, 'Electrification Moves to the Seas', Rémi Paccou, September 25, 2013.

About the author



Luciano Corbetta is Cavotec's group market unit manager, ports & maritime. He holds an MSc in mechanical engineering from Politecnico di Milano. He has worked as a mechanical engineer at TTR Srl. and as a sales manager at Brevetti Stendalto SpA. Corbetta has been responsible for the development of advanced maritime power supply solutions, and has been involved in a large number of high voltage shore-to-ship projects. He is also actively involved in the ongoing standardisation process of shore power equipment.

About the organisation

Cavotec is a global engineering group that manufactures power transmission, distribution and control technologies that form the link between fixed and mobile equipment in the ports and maritime, airports, mining and tunnelling and general industry sectors. In addition to AMP and MoorMaster™, Cavotec's range of technologies for the ports sector includes Panzerbelt cable protection systems, crane controllers, marine propulsion slip rings, power chains and connectors, radio remote controls and motorised and spring driven cable reels.

Enquiries

Email: info@cavotec.com
 Website: www.cavotec.com

Management as the engine of sustainability

Wolfgang Hurtienne, *managing director,
Hamburg Port Authority, Hamburg, Germany*

The Port of Hamburg is the backbone of the economy in Hamburg. It provides employment, income security and growth in the region. The entire German economy benefits from the port, the numbers speak for themselves: jobs supported by the Port of Hamburg employ about 261,000 people in all of Germany.

At the same time it is a landmark of the city and makes Hamburg the proverbial gateway to the world. To make this gateway greener and more prosperous is a challenge the Hamburg Port Authority (HPA) is happy to face. The vast majority of the land within the port area belongs to the HPA. It concludes long-term lease contracts with the port operators with a maximum maturity of 30 years.

Looking at strategy

Recently, the HPA has presented its first sustainability report titled 'Greening the Gateway to the World'. The report describes numerous economic, ecological, and social projects that were realised in the 2011/2012 reporting period and simultaneously outlines future developments. The certification to the standards of the Global Reporting Initiative (GRI) was accompanied by Deloitte & Touche, an audit firm. The sustainability report is a first step towards documenting HPA's commitment. At the same time it motivates HPA to improve and refine the sustainability strategy. The reporting forms part of a broader process initiated to define the sustainable strategy of the HPA, implement action plans and assess results. The HPA plans to issue a sustainability report every other year to document the development process and the results in a transparent way.

Sustainability and the responsibility of business towards society and the environment are increasingly important competitive criteria for a port. The HPA aspires to enhance its image as a

sustainable port by developing workable ideas and innovative technologies to improve the competitiveness of the Port of Hamburg in Germany.

In its role as manager and infrastructure provider of the Port of Hamburg, the HPA is responsible for the strategic development of the port to ensure that it stays competitive. One of its main tasks is to provide, operate and maintain the public infrastructure for the benefit of Hamburg and Germany as a whole. This includes the maintenance of the port's waters and the Hamburg-managed section of the River Elbe as a federal waterway. Port management for the HPA involves advancing the macroeconomic interests of the city and the metropolitan region as part of its duty to provide public services. At the same time, it safeguards its own commercial interests and acts for the benefit of its customers and the port community while also ensuring that environmental and social issues are adequately addressed.

Effective environmental and sustainable building projects

The HPA has prepared a climate protection concept that contains protection objectives, areas of action, activities to reduce emissions and suggestions on how to monitor and evaluate currently planned measures. The HPA's climate protection objectives are based on the regulations of the Free and Hanseatic City of Hamburg, which foresee a 40 percent reduction in carbon emissions by 2020 and an 80 percent reduction by 2050, based on 1990 as reference year. To ensure the continuous reduction of adverse impacts on the environment, a systematic environmental management system in line with the criteria of the international environmental management standard ISO 14001 was introduced in 2011.

The relevant impacts on the

environment are analysed and quantified in order to be able to identify and specify further areas of action and develop appropriate measures. When building on port land, the HPA makes a point of deploying sustainable construction techniques. In July, the port railway, a division of HPA, moved into an office building located on the river island of Spreehafeninsel. The building is Hamburg's first office building that meets the low-energy standards of a Passivhaus. The reinforced concrete skeleton frame structure with exterior insulation and finishing system (EIFS) houses technical rooms as well as office and common rooms for the port railway.

A new HPA building on the Peute site was awarded the preliminary certificate in silver by the German Sustainable Building Council (DGNB). The institution recognises buildings that meet high environmental and sustainability standards after completion. The refurbishment of existing buildings to make them more energy-efficient and reduce their energy requirements has a firm place on the HPA's environmental agenda. The consolidation of physical servers based on green IT criteria had the same purpose and created energy-efficient and highly available IT infrastructure. By standardising, consolidating and virtualising physical servers, 194 hardware units could be dispensed with, which significantly reduced energy consumption. Furthermore, the HPA demonstrated its active commitment to the environment by taking part in the ÖKOPROFIT® (EcoProfit) project. Strict separation of waste at the HPA's headquarters in Speicher P for example, has increased the recycling rate from 30 percent to 80 percent. The use of water flow restrictors lowered water consumption by about 25 percent. Since 2011, the HPA has been involved in pilot projects that use

Picture courtesy of Hamburg Port Authority



Top: HPA's port railway moved into Hamburg's first Passivhaus-Standard (low-energy-standard) office building; Right: Wind turbines in Hamburg-Altenwerder



Picture courtesy of Hamburg Port Authority

recovered materials in road building. All this helps save money as resources decline and raw materials costs rise. In addition, the HPA is carrying out various material tests to develop effective recycling strategies. From 2013 onwards, the HPA will be supplied with natural gas which contains 1.8 percent of resource-saving biomethane and the percentage of the HPA's energy consumption derived from renewable energy sources will increase from 92.5 percent to 97 percent.

Our aim: more clean energy

Not only the Port of Hamburg but ports worldwide have realised that the offshore wind energy industry is offering enormous value-adding potential to their development. Events like the accident in the nuclear power plant of Fukushima in Japan in 2011 created new dynamics in the debate on energy politics and the production of renewable energy. Europe currently has the largest offshore wind energy market and the region has demonstrated how suitable ports are to act as a production location as well as a base or service port for wind energy. The International Association of Ports and Harbours (IAPH) has a port planning and development committee (PP&D), which has put together a report on demand and requirements for the offshore wind industry concerning ports worldwide. The project was championed by the HPA. In May 2013 as chair of the PP&D committee, I presented the report at the IAPH conference in Los Angeles. The PP&D committee has now been studying the specialised port infrastructure required

to install and accommodate offshore wind farms for two years.

Wind energy is also one of the core issues of the smartPORT Energy project. In 2012, the HPA initiated the project together with the state Ministry of Urban Development and Environment (BSU) and the state Ministry of Economic Affairs, Transport and Innovation (BWVI). The declared aim is to extend the Port of Hamburg's green-energy strategy beyond the HPA's scope of action by:

- Making the port a 'flagship port' for renewable energy, in particular wind energy
- Making the port less dependent on conventionally generated energy by increasing the share of energy derived from renewable sources and providing renewable energies in line with demand as well as by installing and expanding storage capacities
- Lowering energy consumption and emissions by increasing energy efficiency and providing intelligent infrastructures
- Promoting innovative and eco-friendly mobility to reduce sulphur oxide, nitrogen oxide, carbon dioxide and particulate matter emissions

The HPA is responsible for planning and implementing the sub-project 'Shore power facility to supply cruise ships while they are berthing' at the cruise ship terminal in Altona. In cooperation with business partners and local approval authorities the topic of the availability of liquefied natural gas (LNG) as fuel in the port, could be advanced as a sub-project under the smartPORT Energy project.

About the author



A graduate from the Technology University of Braunschweig in 1981, Wolfgang Hurtienne has over thirty years of experience in the maritime industry. After several positions related to port planning and port projects, Mr. Hurtienne joined the HPA as director of port development in 1994. He became a member of the HPA's executive committee in 2008 before becoming the organisation's strategy director a year later, when he began his tenure as the managing director of the HPA.

About the organisation

Since 2005 the Hamburg Port Authority (HPA) has been providing future-oriented management of port infrastructure. As an institution under public law, the HPA is in charge of paving the way for the efficient, resource-friendly and sustainable implementation of infrastructure projects in the port. The HPA is the contact point for all kinds of questions concerning the waterside and the landside infrastructure, the navigational safety of vessel traffic, port railway facilities, port property management and the economic conditions within the port area. The HPA ensures the provision of land as required, carries out all statutory duties placed on it and provides port industry services.

Enquiries

Hamburg Port Authority AöR
 Neuer Wandrahm 4
 20457 Hamburg/Germany
 Tel: +49 40 42847-0
 Email: info@hpa.hamburg.de
 Web: www.hamburg-port-authority.de



Customs and Security



“It would seem sensible to assume that all ports have a formulated crisis/ disaster recovery plan in place; however this is not the case.”

‘Crisis planning and preparation’, page 93.

Multifocal sensor systems for port security

Roland Meier, head of Panomera multifocal sensor systems, Dallmeier, Regensburg, Germany

The technological advances that have been made in the field of network-based surveillance in the last few years are astounding. High definition (HD) and megapixel (MP) cameras were introduced onto the market and the question arose: Which are more suitable for professional video surveillance of ports, HD or megapixel cameras? But since then, even that discussion is already outdated. A new technology, known as multifocal sensor technology, has taken the market by storm and is paving the way for a whole range of previously inconceivable surveillance and analysis capabilities.

When the first HD and megapixel cameras were launched onto the market a few years ago, they were clearly superior to the predecessor standard definition cameras, with much higher resolutions. HD cameras are impressive because of a technology that is derived from the field of video that is to say relating to moving images. On the other hand, the

roots of megapixel technology are in the field of static photography, even though they can reach higher pixel values than are possible with HD cameras. But before any discussions begin as to whether HD or megapixel cameras are more suitable for modern surveillance tasks, one point must be considered: resolution on its own is not everything. In order to be able to use the images from surveillance cameras efficiently and analyse them successfully, other dimensions besides resolution are important, such as effective image breakdown, recording of the overall image or analysis in the past. Whereas both HD and megapixel cameras very soon reach the limits of their capabilities in these areas, a new technology, multifocal sensor technology, performs flawlessly.

Unlike HD and megapixel cameras, which are equipped with a single lens, the multifocal sensor systems work with several lenses, each of which has a different focal length. Thanks to this new sensor

concept, the camera can be adapted optimally to the area for surveillance, so details are still clearly visible, not only close up but also at very long distances, and individuals can be recognised. However, that is not the only way it stands apart from conventional cameras.

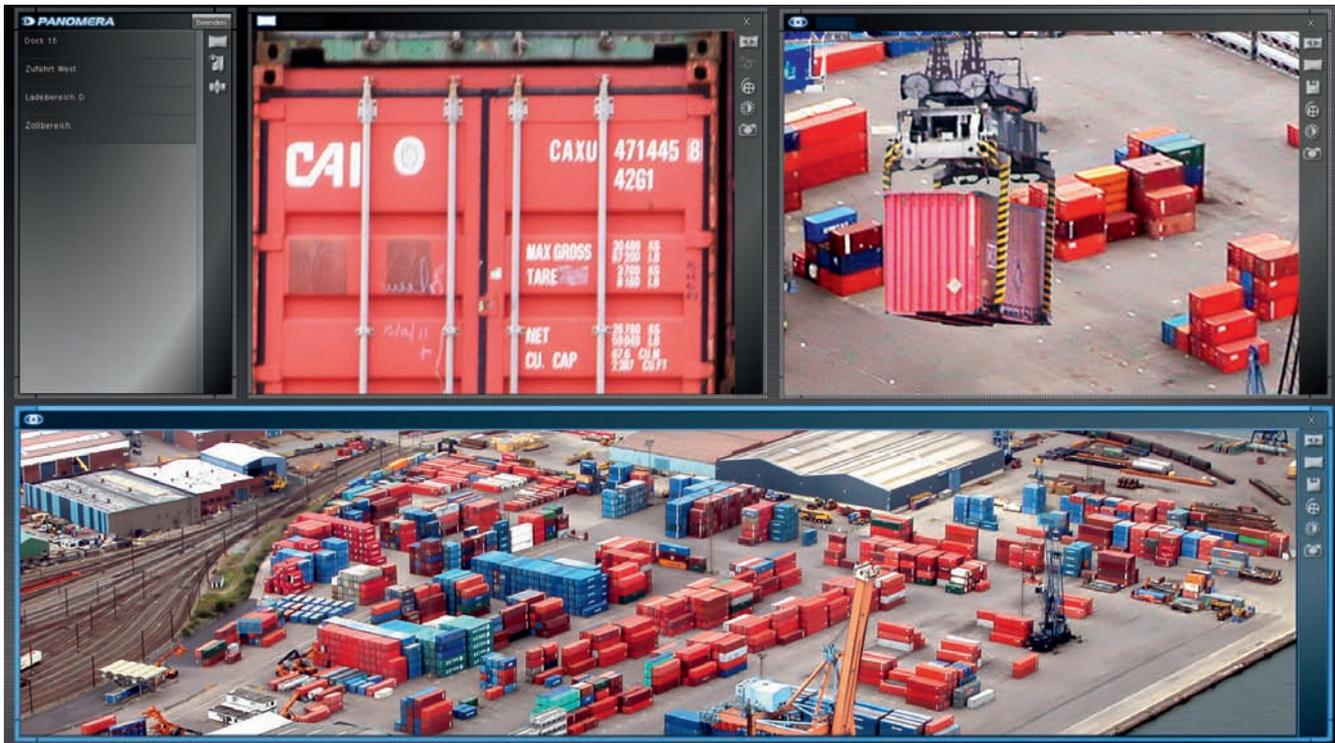
Efficient image breakdown

One of the main arguments advanced by the defenders of high definition cameras is that HD uses the widescreen format with an aspect ratio of 16:9 compared with the 4:3 format of the megapixel cameras. This corresponds more closely to the human field of vision, and makes it possible to record yet more information laterally as well.

But real scenes seldom correspond to either of these two formats. However, in order to cover all areas of interest, it is often accepted that unimportant expanses, such as the sky, will be captured as well. In this case, pixels and the recording and storage capacity they take up are all



Panomera® is a patented multifocal sensor system, opening up completely new possibilities for the video surveillance of ports.



With multifocal sensor systems all PTZ functions like panning and zooming are even available subsequently in the recording.

wasted needlessly. But there is a more elegant solution: instead of forcing a scene for surveillance into a given format, with multifocal sensor systems there are no rigid, pre-set aspect ratios. They adapt the pixel ratio to the situation at hand. The image is split efficiently without being locked into specific aspect ratios such as 16:9 or 4:3. Thus for example aspect ratios like 5:1, 10:1 or 3:4 can be used without any difficulty.

Constant resolution over the entire object space

It is true that HD and megapixel cameras use progressive resolution options, but they quickly reach their limits precisely when it is important to be able to recognise details even at long distances. "Movies or television programmes like CSI often suggest to viewers that even blurry pictures can be transformed into high quality police wanted posters with just a few clicks", explains Roland Meier, team leader, Panomera® Multifocal Sensor Systems at Dallmeier. "But pixels are still just pixels: if there is no additional image information present, for example because an HD or MP camera only represents a person at a distance of 50 metres with a collection of coarse blocks, this information cannot be conjured out of thin air afterwards. So you are aware that something is happening here, but it is completely impossible to even recognise, much less identify a person. And that is precisely the objective of a professional video system."

So in order to obtain the desired information in the past, multiple cameras had to be installed at different locations. But this in turn involves higher costs. The appropriate cabling for power supply and data transmission is needed at every individual installation site, so the infrastructure costs and subsequent maintenance costs for multiple camera sites are enormous.

This is where the new multifocal sensor technology can help, since the resolution it offers is currently equivalent to about 32 times greater than a conventional HD camera. It can be used from just a single installation point to provide surveillance of a huge area. Roland Meier says: "With conventional cameras, the resolution drops off as distance increases. Or to put it another way, the further a person or object is away from the camera location, the poorer the resolution there is, so you are able to make out fewer details. In contrast, a multifocal sensor system uses different lenses, so constant resolution can be guaranteed over the entire area under surveillance. So the resolution at 100 metres is exactly as good as it is at 20 metres. This makes it possible to recognise people for example even from 160 metres".

Permanent recording of the total picture in highest resolution

Those who have no desire to install multiple conventional cameras over the area in question, as described previously, can use 'PTZ' cameras. As their name suggests, these cameras can 'pan, tilt and

zoom'. So in theory it would be possible to use these cameras to watch over a relatively large area and to pan or zoom to a location of interest if the need arises. But PTZ cameras do have one critical disadvantage, they only ever record what the operator is currently seeing live. So if the user zooms in on a certain scene, it is only this scene that will be recorded. Any additional incidents in the viewing range of the PTZ camera are lost and cannot be analysed or proven subsequently. Accordingly, the surveillance system is only as good as the user who is operating it.

In contrast, a multifocal sensor system always delivers total performance, since the whole picture is constantly recorded in its highest resolution. "Those are three important points straight away: the whole picture is recorded so no areas are lost, even if the operator is currently concentrating on a smaller inset. This total picture is recorded all the time, so there are no gaps in time. And finally, the recording takes place in the highest resolution, so no details are lost in the recording," says Roland Meier.

He continues: "Moreover, unlike PTZ cameras, multifocal sensor systems do not have any mechanical parts so there is no wear which extends the equipment's operating life significantly. And there is another advantage, whereas with PTZ cameras only one operator can have control over the camera at a time, with the multifocal sensor system any number of users can connect to the camera and select their entirely individual views."

Analysis in the past

Seeing live images from the surveillance cameras is one thing but with professional video security systems, most analyses take place in the past. This means that the video system runs, and if an incident should occur at a given time, the recordings are searched later in order to reconstruct the course of events and identify the individuals responsible.

Consequently, it is an essential requirement of modern surveillance systems that they are also able to zoom or pan even in the recordings. With conventional HD or MP equipment, this is not possible. "Even with PTZ cameras, these functions are only possible in live mode, not subsequently, in the recording. And if the operator is concentrating live on another area in the surveillance scene at the precise time, the entire incident will not be seen on the video images," states Roland Meier.

Here too, the solution is available with multifocal sensor systems, because all PTZ functions are fully available even in the past, even as the system continues recording images live. Roland Meier explains: "Since the overall image was recorded at the highest possible resolution, it is also possible to move within the image and to zoom in on pertinent details. This opens up a wide range of analysis options, which were simply not possible with the prior technology."

About the author



After his studies of micro electronical, mechanical and optical systems (MEMOS), Roland Meier has been working as the project leader at an international engineering company. He has been working with Dallmeier for over six years and was, amongst others, responsible for realising the world's largest IP video surveillance solution at the City of Dreams casino in Macau. As head of Panomera multifocal sensor systems he is now responsible for the project handling and sales of the Panomera technology.

About the company

Dallmeier is one of the world leading providers of products for network-based video surveillance and has more than 25 years of experience in the development and manufacture of high quality components and complete solutions for the CCTV/IP sector. Whether its cameras, recorders, intelligent video analysis, software or video management: Dallmeier offers complete systems with perfectly integrated components from a single source. All products are developed and manufactured on Dallmeier's own production sites in Germany, and meet the highest requirements concerning quality and reliability, which is confirmed again and again by independent international test centres, through numerous certifications and awards.

Enquiries

Dallmeier electronic GmbH & Co.KG
 Cranachweg 1
 93051 Regensburg
 Germany
 Tel: +49 941 8700-0
 Fax: +49 941 8700-180
 Email: info@dallmeier.com
 www.dallmeier.com & www.panomera.com



WWW.PORT-DIRECTORY.COM



UPGRADE YOUR FREE LISTING

- ▶ Recently re-launched with significantly improved search functionality
- ▶ Users can now search across a combination of location, facilities and berth depth
- ▶ New tool allows users to browse an interactive map of port locations

Contact **James AA Khan** if you would like to add or amend your free port listing:

T: +44 (0)20 7871 0123
 E: jkhan@porttechnology.org



Crisis planning and preparation

Andrew Taylor, *chief executive officer,*
Bronze Group, London, United Kingdom

Ports and airports are national assets. Usually high profile and expected to be resilient, they are also inherently dangerous places. This combination of factors ensures that any accident or event is likely to be picked up by the media quickly. Whether the story stays as local news or escalates to the national and international media is obviously dependent on many factors, often completely outside of the control of those who have to deal with it. Nevertheless, the way in which an event is managed from the outset has the potential to adversely affect business continuity for years to come. In addition to the endemic high risk within a port and because of their high profile, ports can expect to attract the attention of terrorists looking for publicity and organised criminals looking for opportunities. This 'threat mixture' demands a sophisticated and intelligent plan to mitigate risk and to drive response when an event occurs.

As with all things injurious, prevention is far simpler and much cheaper than treatment and cure. Unfortunately for CEOs and boards, who are always mindful of costs, that fact may only become obvious with hindsight. In addition, company executives and managers are increasingly considered to be criminally liable for negligence on the part of their companies. Events are statistically inevitable. Yet our experience at Bronze Group is that our advice and training is often sought in response to an event rather than to help plan and prepare for such a probability.

The US Federal Emergency Management Agency (FEMA) sums up the challenges faced in this area: "The emergency management community faces increasing complexity and decreasing predictability in its operating environment. Complexity will take the form of more incidents, new and unfamiliar threats, more information to analyse (possibly with less time to process it), new players and participants, sophisticated technologies, and exceedingly high public expectations. This combination will create a vastly different landscape for risk assessment and

operational planning. Pressure to perform in this environment will be extraordinary."

The Deepwater Horizon example

The BP/Deepwater Horizon oil spill in April 2010 involved large corporations with a global presence – BP, Anadarko, Halliburton and Transocean were all key stakeholders. They got into collective trouble over their poor handling of something which they might reasonably have expected to be a possibility, and should therefore have prepared for. The underlying cause of the event may have been an attempt to reduce operating costs, but poor crisis management reversed any savings. In May 2010, BP CEO Tony Hayward commented: "I would like my life back" in a television interview which caused outrage at the time, this came in the middle of an event which turned into a disaster and swiftly, a fiasco.

Deepwater Horizon was operating in 1,500 metres of water 50 miles off of the Louisiana coast – a hostile environment dealing with a volatile substance. Just like ports, oil rigs are home to risk and threats. This particular event ultimately cost the companies involved (and their insurers) billions of dollars and will continue to do so for the foreseeable future – legal experts talk of a 20-year legal horizon. At this stage, a compensation fund set up by BP had paid out over \$US12.6 billion in compensation. The disaster ultimately cost Hayward his job too – his poorly chosen comment shows how important it is that those who face the press on behalf of companies must be properly briefed and prepared.

The parties involved in this incident should have had a combined crisis management plan and their teams should have been working together. This seems not to have been the case, and the result was significantly detrimental to business continuity. It is possible to assume two things: firstly, that the crisis management teams at each of the companies were unlikely to have trained and practiced together and secondly, that a credible,

coordinated, mutually beneficial crisis response was not produced when needed.

Learning lessons

In the case of the Deepwater Horizon disaster, it seems that everything that could have gone wrong did go wrong. Thankfully, few of us are likely to face such a catastrophic event. But it's not only major events that can cause critical problems for business continuity. Small events can quickly spiral out of control when poorly managed. That is why we have to plan for the worst and hope for the best. In the Deepwater Horizon example, instead of a co-ordinated and well-rehearsed damage limitation exercise, we saw BP become the news story. Both the media and the public have a preference for bad news. Allegations of incompetence and criminal negligence quickly followed, the results spiraled until the American public began to boycott then blockade BP filling stations.

Media management and communication must be part of a crisis management plan. If the media is allowed to get into a mindset that there is culpability, they will dig into that story. It is not enough to merely issue press statements or hope that your staff are saying the right thing on their respective social media outlets. Systematic, proactive handling of the situation in combination with effective management of the underlying incident is the only answer.

Deepwater Horizon provided us with a very clear demonstration of what can happen when the crisis management ball is dropped. If the right personnel are not in place, if they are not adequately trained and prepared, they will always struggle to deal with the handling of an incident, even a simple one.

Spot the problem and resolve to solve it

Smoking kills one person in every two of those who participate in the habit. But if two smokers were chatting during a smoke break, each would likely assume that the

other one would be the unlucky one, not him/herself. Sadly, it seems that many businesses follow a similar logic when formulating crisis/disaster planning into their corporate plan.

In the event of an emergency, critical support from local and national agencies may not be forthcoming - their assets are finite and they will be prioritising their response accordingly. Governments generally require businesses to take care of their own incident response planning and preparation. Some do. But often this preparedness is honoured more in the breach than in the observance. The facts are sobering on this but there are many companies ☒ and this includes some major names - which treat this as a box-ticking exercise. Many CEOs see this requirement as a chore at best and low-priority at worst and some simply don't bother at all. It is estimated that as many as 80 percent of businesses will habitually fail to conduct an appropriate level of disaster/crisis planning and preparation into their business routine. That means that up to 80 percent of businesses have a potentially fatal flaw built into the fabric of whatever they do. Furthermore, resilience considerations should also include business partners, service providers and equipment providers. It is vital for businesses to consider if they could survive if one, some, or all of those elements were removed.

Some businesses will rely on the proactive promises of third party providers. This ticks the boxes and resolves some of the problems on the surface. It can work too, but only if the company proactively supervises/manages the relationship and the training includes these providers. Vigilance can wane with time and you can be sure that it is when focus is at its lowest, a mishap will occur.

A good example of where this type of arrangement went wrong is the 2012 Olympics. The UK government awarded the security contract for the games to Group4 (G4S). Their bid was low but G4S did not provide the required service level and the UK government was forced to deploy thousands of troops to fill the security gap. Unsurprisingly this company's competence continues to be questioned by the media ☒ as it has also bid for a similar role for the Commonwealth Games to be held in Scotland in 2014. The event caused major problems for the UK government, whose crisis management efforts were constantly playing catch-up with the media.

Looking at ports

Ports are complex organisms. There are countless things which can go wrong. Special legal requirements frequently



Picture courtesy of JPM Terminals

apply to ensure the efficient operation of the facilities and to deal with the peculiar issues of each of them. A plethora of functions often creates a tangled overlay of activities requiring a complex control matrix. If one link fails, other areas of the port will be adversely impacted.

Most ports will be on the national security grid but this is not to protect the interests of the business, but only of the nation. Close support from policing and security agencies will be in place. Nowadays however, ports are expected to make sure that they maintain strict vigilance on their own account ☒ and they are businesses which would be expected to be resilient despite the occasional crisis. Local agencies should not be relied upon as an efficient failsafe. In these austere times, manpower pressures and financial restrictions can conspire to downgrade any formal support from official security agencies to the point where it is non-existent or useless.

It would seem sensible to assume that all ports have a formulated crisis/disaster recovery plan in place; however this is not the case. Very often, they will have something written down somewhere, and there may even be a manager who has the crisis and emergency planner role - but there it often ends. In these organisations one only has to approach a random member of the staff and ask a few questions for it to be clear that employees are often unaware of the crisis management plan, all too often because there isn't one.

So, what do we do?

This is not only about having a plan. This is about having a robust plan, supervised

by competent managers with a team who have been properly trained and tested on a regular basis. There are many different crisis management models available but the key rule is 'keep it simple'. The most important thing to recognise is that crisis management is essential. In our modern world the health and safety (H&S) requirements insert a further level of potential strain, but an effective H&S regime can help as a partial monitor for crisis management.

It is important to really encourage the formulation of a positive crisis management approach. Many countries have now enacted laws which formerly hold company executives and management individually criminally liable under 'duty of care' obligations, many people do not realise this. Both the US and EU for example, have enacted laws which could put a CEO in jail in the event that the cause of an incident, or the company's response to it, was found to be negligent. Remember, ignorance is no defence in law.

Make an action plan

Consider reviewing the current crisis management arrangements that you may already have in place. Revisit your assessment of what crisis management you believe you need. This should be centred on the identification and prioritisation of the various risks and threats. Following this, the formation of a crisis management team (CMT) and the production of a corporate crisis response plan (CCRP) are the first crucial steps. Without either of these, any other planning is likely to fail at its first test.

The identification of likely risks and threats is a critical process. This process

allows businesses the opportunity to plan ahead and prepare resources to limit impact. No organisation can ever plan for every eventuality. But a good team, properly trained, exercised, and led by an effective manager, will in most circumstances be able to deal with whatever is placed in front of them. This is one reason why the military place so much emphasis on training. Training improves response times and capability, builds teams that can work together during times of high stress; it builds resilience and stress acclimatisation. When an event occurs, it is good to know that your team will respond in a predictably calm and efficient manner. As the Duke of Wellington said, "No man fears to do that which he knows he does well."

There is a strong correlation between how individuals react to stress and how businesses react to a crisis. During periods of stress, the heart rate increases and it becomes more difficult to carry out simple tasks. Corporately, businesses often react in a similar way. Without planning and preparation, the net effect can be something which might be described as corporate panic. In the absence of firm and experienced leadership and a team who know their tasks and each other well, the result is often poor decisions, delayed response and a crisis management approach which could worsen the situation.

Important features to include

A good CMT is worth its weight in gold. It can also act as an excellent intelligence filter for company executives. But this is not just about the management of crises. A good CMT and an effective CCRP will on many occasions enable problems to be foreseen and avoided. When the entire workforce knows what to look for and what to do when they see it, a company is more likely to remain incident-free. A formalised, systematic reporting chain through which staff can raise safety and security concerns - possibly supported by an employee reward scheme - acts as an effective interdiction filter system.

Teamwork is critical to crisis planning. Small things can upset even the best company. Indeed, it is often the small things which act as a catalyst towards bigger events. Remove any single element of service provision and the situation can swiftly and adversely impact resilience. For example, striking teachers could close the schools resulting in a significant number of employees being absent - until they find alternative childcare at least. Not a huge problem for any business in the short term. But, what if this was to coincide with a major event? A seemingly simple event can deliver unforeseen impact on your business continuity. This is equally so where

suppliers and other supporting services will be suffering the same problems, which will further impact your business.

A systematic communications plan is a crucial component of any crisis response. The ability to provide a structured response from an individual who is trained and experienced enough to stand in front of a camera and answer questions is invaluable. Preparation is the key. Whoever has that responsibility must be equipped with core messages to follow during interviews. Thorough preparation enables the spokesperson to respond to questions with reactive answers which keep to the narrative.

Engaging with the media

The media will be looking for an 'angle'. If you do not occupy them, they will occupy themselves and could target any line of enquiry they choose. Employees, families, subcontractors, customers, suppliers could all be scrutinised and the media will monitor and use social media too.

It's important to engage with the press. Make friends with them. This will at least ensure that when an event occurs, you already have open communications and will help you to keep the press informed in a systematic way. Avoiding them will only make matters worse. If they can't get hold of you, they will get hold of someone else. It is not about controlling the story in a restrictive way. It is about making sure that your narrative is front and centre. There is always someone else with something to say. If you don't control them, you run the risk of the story being misrepresented. Your CMT might then end up having to unwind this rather than dealing effectively with the event.

Lastly, make sure your website is up to date and use it. Put relevant documents about the event into the public domain wherever possible.

Food for thought

Ports are complex organisms with endless moving parts, laws, rules and regulations, vulnerabilities and lots of coming and going. Quite apart from the general risks that are associated with day-to-day activities, the facilities are also at risk of malicious or terrorist attack. A recent terrorist alert with its focus in Yemen caused the US to close almost 30 diplomatic missions across the region. The terrorists also planned to take over an oil terminal and were prepared to spend days fighting it out with security forces whilst they did as much damage as they could to the terminal. Recent events in Mumbai, Algeria and Nairobi have demonstrated what mayhem a handful of committed terrorists can create in a relatively contained incident. Elsewhere,

terrorists have actively targeted ships in the Suez Canal. It is clear that there are always people on the lookout for further high value, high profile targets.

In conclusion

If a ship was to sink at the entrance to your port, or if someone was to hack into your computer system and effectively close your port by disabling some of your control systems, are you prepared to deal with the results? The next opportunity that you have, look at your port and consider the 'what if' scenarios: What is most likely to happen? How will that impact upon operations, business, safety and security? How will it be managed, by whom and what are the likely outcomes?

Prevention is always more cost effective and efficient than cure. And the solution is simpler than you might imagine. You may not be able to avoid the incident, but your management of subsequent events will affect the longer-term impact on your company's business continuity and resilience.

About the author

Andrew Taylor is the CEO of Bronzeye Group. He served 26 years in the British Army in Military Intelligence in various locations around the world. Subsequently, he worked for several years with investment banks in London where he set up and successfully ran an intelligence process to exploit open source intelligence on 'Event Driven' trading. For the last four years he has been involved in providing, with his partners, intelligence support and advice globally to companies operating in the financial and commodity markets.

About the organisation

Bronzeye Group offers a discrete service to clients in the areas of Crisis Management and Commercial Intelligence. The team, which has wide experience in intelligence and financial services in many parts of the world, brings a tailored, discrete, innovative and successful solution to clients who operate in markets where it has to be got right. Bronzeye Group has a global reach.

Enquiries

info@bronzeye.com

SUBSCRIBE TO PORT TECHNOLOGY INTERNATIONAL

- ▶ The quarterly technology journal for ports, harbours and terminals
- ▶ Exclusive analysis on emerging technologies from leading industry experts
- ▶ Online access to over 700 technical articles from the journal archives

Simply complete and return the form below by fax or post, email us at info@porttechnology.org or subscribe online at www.porttechnology.org/subscription

- 1- Fax this form: +44 (0) 20 7871 0101
 2- Post this form: Port Technology International, 5 Prescot Street, London, E1 8PA, UK
 3- Telephone: +44 (0) 20 7871 0123
 4- Email: info@porttechnology.org

I would like to receive the following copies of Port Technology International

4 editions (1 year):	USD \$250 <input type="checkbox"/>	EUR €200 <input type="checkbox"/>	GBP £150 <input type="checkbox"/>
8 editions (2 years):	USD \$450 <input type="checkbox"/>	EUR €360 <input type="checkbox"/>	GBP £270 <input type="checkbox"/>

Back issues can be ordered for USD \$55 / EUR €45 / GBP £35 per issue. Please call or email for more details.

Your details / delivery address

Name: _____ Job Title: _____
 Company/Port/Organisation: _____
 Full Address: _____

 Zip/Post Code: _____ Country: _____
 Telephone Number: _____ Fax Number: _____
 E-mail: _____ Web URL: _____

For the purposes of our circulation audit, please write the last two letters of your father's first name: _____
 (For example if your father's first name is William, the answer is 'am')

Payment details

Payment enclosed (please make International money order/cheques payable to Maritime Information Services Ltd.)

Bank transfer completed

Account Name: Maritime Information Services Limited; Account Number: 40765155; Sort Code: 20-39-53;
 Swift Code: BARC GB 22; IBAN Number: GB 78 BARC 203953 40765155;
 Bank: Barclays Bank Plc, 10 Hart Street, Henley-on-Thames, Oxon, RG9 2AX.

Please charge my credit card

Visa Amex Mastercard



Card holder's name: _____
 Card number: _____
 Last 3 digits on the back of the card: _____
 Expiry date: _____
 Card holder's full postal address: _____

If you do NOT want to receive our free weekly e-newsletter tick here
 If you do NOT want to receive our free daily email news alerts tick here

Signature _____ **Date** _____

Reconstruction and deepening projects at Maydon Wharf

João Martins, head of engineering, and Ernst Weber, senior project manager, sheet piling, ArcelorMittal, Esch-sur-Alzette, Grand Duchy of Luxembourg

The Port of Durban is situated on the east coast of South Africa, in the KwaZulu-Natal Province. The port is the busiest on the African continent, and the biggest in terms of container capacity with 44 percent of South Africa's break-bulk cargo and 61 percent of all containerised cargo flowing through it. In 2010 alone, the port handled 2.5 million TEU.

The port has 57 berths and is protected by the north and south breakwaters, which are 335 metres and 700 metres long respectively. It was developed primarily for import cargo but over the years, cargo flows have changed significantly and exports have become more important. Over 4,000 commercial vessels now call at the port each year.

The Maydon Wharf terminal

The Maydon Wharf multi-purpose terminal (MPT) handles a variety of containerised, break-bulk and bulk cargo, and specialises in the handling of specific commodities. The terminal also handles both import and export containers, taking it to an average of 15,000 TEU. It has an annual throughput of more than one million tonnes of break-bulk and neo-bulk commodities. The Maydon Wharf area consists of 15 berths and the MPT operates principally between berths eight and 13.

Transnet National Ports Authority (TNPA) has initiated an extensive upgrade of the infrastructure at the port. One of the major projects is to rebuild and deepen seven of the 15 berths in the Maydon Wharf area. The new quays will be able to accommodate larger vessels and provide suitable load-carrying capacity for the handling of cargos over the berths.

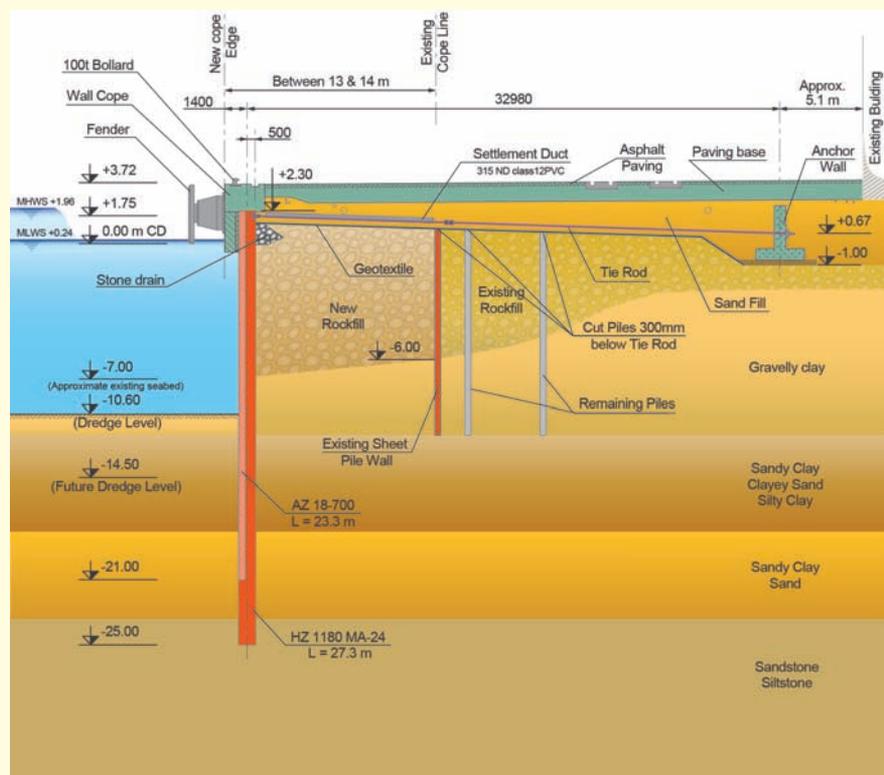
The reconstruction project

Berth 12 was the first reconstruction project to be launched. The quay wall is approximately 270 metres long, with a

return wall of 33 metres along Berth 11. The new front line of the wall lies 13 metres in front of the sheet pile wall of the existing berth. The quay wall has been built with the new HZM/AZ combined wall system: over 2,800 tonnes of HZ 1180M A-24 king piles and 440 tonnes of AZ 18-700 sheet pile pairs have been used as intermediary piles. A high strength steel grade has been chosen by the design engineer in order to optimise the steel quantities needed. The combi-wall system is anchored with tie-rods to a reinforced concrete anchor wall. The new quay wall and capping beam were designed to put up a future

front rail for a container gantry crane. The HZM king piles are 27.3 metres long, with a weight of 22.8 tonnes each, and were driven to depth with a free hanging vibratory hammer with variable frequency, suspended on the hydraulic crawler crane Kobelco CKE 1800, and an impact hammer.

A special two level template was used for the installation of the combi-wall. The HZM piles were driven during the first phase down to grade, guided into the correct position inside the template, before the infill sheets were installed. This standard installation procedure



Cross-section of the berth reconstruction project.



Berth 12, Maydon Wharf, Port of Durban.

ensures the verticality and correct position of the two components. The AZ infill sheets are shorter than the HZM, as their main function is to distribute the horizontal loads to the HZM king piles. The soil is quite heterogeneous, ranging from soft sandy clays to very compact sands. Part of the HZM king piles were driven into the siltstone/sandstone layer. Despite the hard soil conditions, the 123 HZM/AZ elements were installed in due time.

Effective results

The service life of the structure is 50 years. To protect the immersion zone, the design engineer opted for a cathodic protection with sacrificial anodes, which will be installed underwater on plates that are welded to the AZ sheet piles prior to driving. The concrete capping beam reaches below low water level and protects the steel above this level. ArcelorMittal also supplied the tie-rods as part of the whole foundation solutions package. These are fixed with a specific T-connector to the HZM king pile, providing the advantage of keeping the installation simple without the requirement for any welding at the site.

About the author



João Martins is the head of engineering at ArcelorMittal's Luxembourg-based steel sheet piling department. He has been

involved in the design and execution of sheet pile structures around the world for more than 14 years.



Ernst Weber, a civil engineer, has been assisting ArcelorMittal's customers for the last decade on jobsites spanning all five continents.

He recently moved to the company's sales department and is in charge of a number of export markets including South Africa.

About the organisation

ArcelorMittal is the largest hot rolled steel sheet pile manufacturer worldwide. The company has more than 100 years of experience in sheet piling and is a major partner for design engineers, public authorities and investors who are looking for innovative and cost-effective foundation solutions. The sheet pile knowledge centre is located

in Luxembourg, and ArcelorMittal has offices in more than 60 countries with experienced sales and technical staff to assist customers during all project phases. The main task of the engineering department, who has been involved in thousands of projects, is to deliver design and installation recommendations, free of charge, based on the latest design standards and state-of-the-art installation technology. The R&D department dedicated exclusively to steel sheet piles has been playing a leading role in improving rolling techniques and developing new product ranges and new applications.

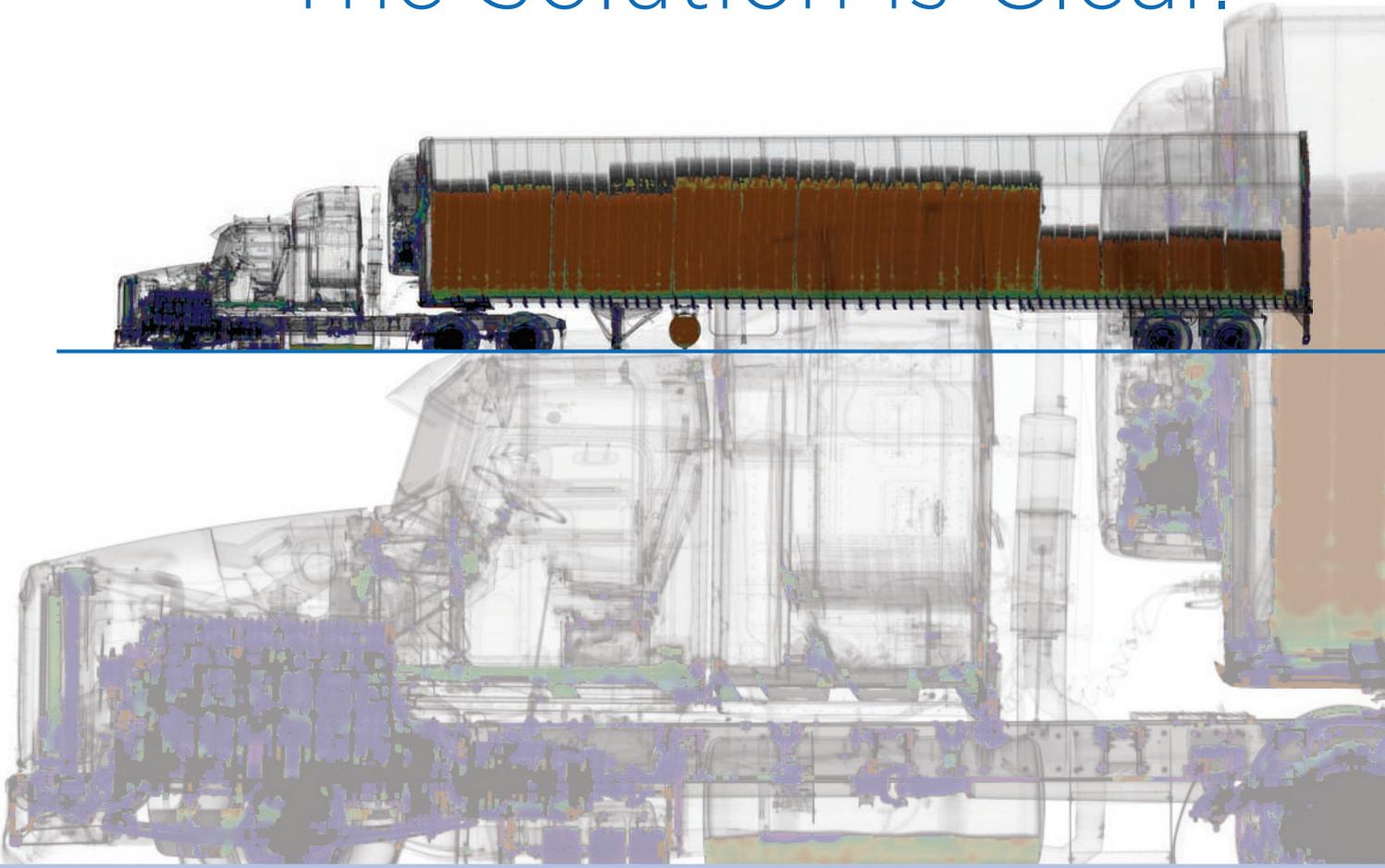
If you would like more information on steel sheet piling solutions, please visit www.arcelormittal.com/sheetpiling.

Enquiries

ArcelorMittal Commercial RPS S.à r.l. – Sheet Piling
66, rue de Luxembourg
L-4221 Esch-sur-Alzette
G.D. of Luxembourg

Tel : +352 5313 3105
Email : sheetpiling@arcelormittal.com

The Risk is Hidden. The Solution is Clear.



Leading cargo security system providers have selected Varian Security and Inspection Products to offer unparalleled performance, reliability and safety in the most demanding environments.

VARIAN
medical systems

A partner for **life**

SECURITY & INSPECTION PRODUCTS

tel: 702.938.4859

fax: 702.938.4833

e-mail: sjp@varian.com

To learn more visit our website at www.varian.com/sjp

Marine ingenuity



Get more info with

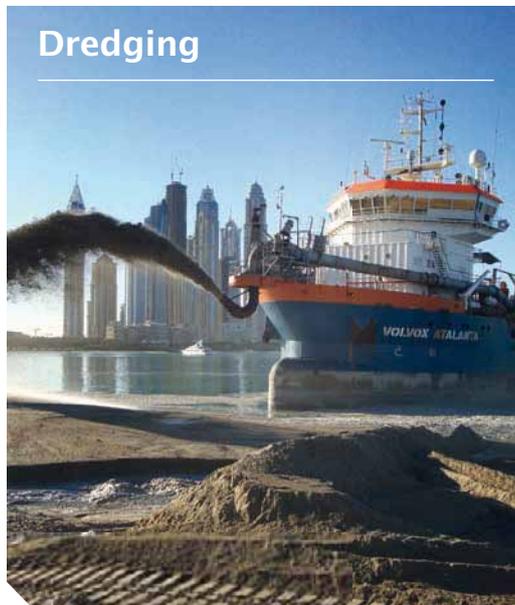


Offshore Wind Projects

In just two words, marine ingenuity, we express that we are passionate dredging and marine contractors with a worldwide innovative approach to meet your challenges. Our people - who manage a versatile fleet - specialise in dredging, marine engineering and offshore projects (oil, gas and wind).

www.vanoord.com

Dredging



Offshore Oil & Gas

