Platinum Partners
Sustainability & Innovation: DEME’s Key Goals Throughout the Year

Sustainability & innovation always have been at the forefront of DEME’s corporate strategy. DEME aims to innovate in all aspects of its business. Therefore, 2016 was the year where DEME has made several key investments in its fleet. This demonstrates that the company is keen to take on a pioneering role when it comes to innovation, which in turn leads to a sustainable, greener world.

Much of DEME’s work addresses the major challenges faced in the world today – global warming, rising sea levels, coastal erosion, an increasing scarcity of resources, a growing population, rising demand for energy, the pollution of soils & waterways, and the transition to green and blue energy. DEME is only too well aware of these challenges and the need to consider all of its activities from a sustainable point of view.

Dual Fuel Vessels

One important investment the company made was in a new generation of trailing suction hopper dredgers (TSHD’s). With this new generation of TSHD’s, DEME is responding to the macroeconomic trend of maritime sand extraction at greater depths and further offshore. DEME’s bold decision to invest in these LNG vessels led to the company being honoured with the DPC Innovation Award in the ‘Dredger Design’ category. DEME was pleased to see that its efforts, where it focuses on vessels that can significantly increase efficiency, both in terms of productivity and environmental performance, is being appreciated by the industry. The dual fuel vessels represent a groundbreaking design for both coastal protection and for dredging hard soils. The engine, together with a hydrodynamic hull shape, minimise its CO₂ footprint and reduce fuel consumption dramatically. The vessels also minimise the turbidity generated by process water making it easier to dredge in environmentally vulnerable areas.

In 2016, DEME and shipbuilding company Royal IHC have launched the world’s first LNG-powered hopper ‘Minerva’ with a hopper volume of 3,500 m³. ‘Scheldt River’, the second dual fuel TSHD with a hopper volume of 8,400 m³, was launched at the beginning of 2017. The vessels have been equipped with some new innovations, driven by market developments and customer demand. They will both be delivered in the first quarter. Both dredgers are designed specifically for operations in European waters. In the future, DEME will also welcome dual fuel TSHD ‘Bonny River’ with a hopper volume of 15,000 m³.
Launch dual fuel TSHD ‘Scheldt River’

‘Living Stone’

The arrival of these special TSHD’s will be followed by the delivery of an equally impressive vessel – the ‘Living Stone’ - the world’s most advanced subsea cable installation & trenching vessel.

Equipped with the latest innovations, the vessel has two turntables below deck, each having a 5,000-tonne cable capacity. Together the turntables can carry and transport more than 200 km of cable. Furthermore, Living Stone can be equipped with a third carousel above deck with an additional load capacity of 2,000 tonnes and a 600-tonne crane. A system developed by DEME’s subsidiary Tideway enables the vessel to install cables faster and more efficiently in longer lengths, and with fewer offshore joints than any other cable installation vessel. The Living Stone also has dual fuel engines with LNG being its prime fuel. Due to arrive in Q2, she will head straight out for her first project at the Merkur offshore wind farm in Germany. She will also be deployed for the cable installation at the world’s largest offshore wind farm Hornsea Project One.

New Bremen Office

As well as investing in the fleet, DEME has added a new office in Bremen to its worldwide network. A leading hub for the marine and offshore wind industry in North Germany, Bremen was identified as the ideal base from which to strengthen DEME’s relationships with German customers and suppliers. The Bremen team is playing a major role in the construction of the offshore wind farms Merkur, Hohe See and Borkum Riffgrund 2.

And 2016 was no exception in terms of the variety of challenging projects DEME was tasked with in all corners of the globe and it has been granted a number of significant contracts for the coming few years. Here are just a few highlights.

Offshore Wind Projects

The increasing role of offshore wind for the world’s energy supply was highlighted by an important agreement formed with COSCO, the largest shipping company in the world, whereby DEME and COSCO will work closely on the development of offshore wind energy in China. The umbrella agreement was signed in the presence of Belgian Prime Minister Charles Michel and the Chinese Premier Li Keqiang demonstrating its significance.

In another strategic partnership leading to the further development of offshore wind, DEME Concessions Wind, the infrastructure investment arm of the DEME Group took a stake in Merkur, a construction-ready wind farm located in the German exclusive economic zone. DEME subsidiary GeoSea will be the turnkey contractor for the entire balance of plant.

Merkur Offshore wind farm will be one of Germany’s largest wind farms. A total capital investment of ca. € 1.6 billion was raised and close to € 500 million in equity was provided by a consortium of five sponsors including DEME Concessions Wind with 12.5 %

Early 2016 GeoSea has won the EPCI-contract for the foundations of the offshore windfarm Hohe See in Germany. With an installed capacity of 497 MW it will be the largest offshore windfarm in Germany. GeoSea also won a major contract for the Hornsea Project One in the UK and for the German windfarm Borkum Riffgrund 2. In Denmark a contract has been awarded for the 400 MW windfarm Horns Rev 3. GeoSea will also be involved in the construction of Merkur and Rentel.

Works have been completed in Germany for Nordsee One and in the UK at Race Bank.

Nordsee One in Germany

Despite challenging market conditions in the oil and gas industry, Tideway maintained a high level of activity with offshore wind projects. In Germany Tideway realised post- lay cable crossings for DolWin 3 and Veja Mate. At Nordsee One and Galloper Tideway was responsible for the scour protection. Rock placement works were executed for Godewind I and II in Germany.
World’s First Tidal Power Station

Tidal Renewable Energy is a new and challenging industry and here too, DEME is becoming a trendsetter for the industry. DEME Concessions also acquired a minority interest in the Scottish development company Tidal Power Scotland Limited (TPSL), which controls the planned MeyGen project, which is the world’s first tidal power station connected to the electricity grid. GeoSea was also awarded the installation contract. For Phase 1A of MeyGen GeoSea installed four gravity-based foundations and at least one of the scheduled four 1.5 MW tidal turbines. The installation included the connection of the foundations and the turbine to the export cables.

DEME is also involved in DEME Blue Energy and in cooperation with Nuhma it is also a partner in BluePower, another tidal energy development company.

Dredging and Land Reclamation: A High Level of Activity Across Regions

Traditionally, DEME has been very active on European projects, with maintenance dredging on several European rivers, including Scheldt, Weser, Elbe and Seine. Works also included the extension of the Europakai in Cuxhaven (Germany) and deepening, soil improvement and construction for the new Offshore Terminal in Rotterdam (the Netherlands).

The works for the Tuas Terminal Phase 1 mega-project in Singapore have now attained cruising speed and are seeing the deployment of innovative techniques and equipment. In Joint Venture with Daelim Industrial of South Korea, DEME will create 21 deep water berths. In total, these berths will have a combined container capacity of 20 million TEU per year. A first important project milestone took place in April 2016: the launch of the first of a total of 222 caissons. When fully placed, these caissons will form the frame of the quay wall.
DEME maintains a strong presence in Africa with dredging and reclamation projects across the continent. Significant contracts have been awarded for port extension projects in Sierra Leone, Mauritius and Guinea. In Nigeria, DEME continued works on EKO Atlantic City in Nigeria, as well as maintenance dredging works on the Bonny River.

DEME’s presence in La Réunion will continue in 2017 for the construction of the ‘Nouvelle Route du Littoral’, a 13-km coastal road. DEME will execute dredging, gravel bed installation and backfilling works for 48 gravity base foundations of a 5.4 km maritime viaduct.

In Latin America, DEME returned to the iconic Panama Canal for deepening and widening of the Pacific Access Channel. Also in 2017, DEME will be dredging on the Panama Canal, near the Cocoli Locks.

DEME had a very busy year in Egypt, with works on the Suez Canal, the port of Alexandria, the Ras Al teen marine base and the Burullus Combined Cycle Power Project.

DEME continues to play a prominent role in India with the port extension project in Kamarajar and dredging works in the ports of Dhamra, Salaya and Kakinada. A land reclamation project also started in the Maldives at Emboodhoo Lagoon to build ten dream islands.

In the Middle East works on the La Mer Jumeirah Open Beach in Dubai and for the New Port project in Doha were completed successfully.

DEME will continue its strenuous efforts in 2017 and the years to come - making sure that each project is carried out as efficiently and sustainably as possible.
DREDGING AND MARITIME WORKS

Worldwide, Jan De Nul Group executes dredging and land reclamation projects from start to finish: design, development and maintenance of ports, deepening of channels, land reclamation and shore protection works, dredging in the most diverse conditions. Often, these dredging activities are part of a comprehensive port infrastructure project entrusted by the client to one contractor.

Jan De Nul Group owes its position as global leader above all to its technical know-how and very diverse fleet. By investing in its own installations, machines and vessels, the Group has today the world’s most modern dredging fleet at its disposal. Meanwhile, its employees continue to look for new opportunities.

EUROPE

In Belgium, Jan De Nul Group executed maintenance dredging works at the Belgian seaports of Antwerp, Zeebruges, Ostend, the marina of Nieuwpoort and their maritime access channels.

In the Netherlands, Jan De Nul Group participated in the Dutch Coastal Protection Programme by executing beach replenishment on different vulnerable locations along the coastline.

In the summer of 2016, Jan De Nul Group finalised the dredging and reclamation works for the port expansion in Cherbourg, France. A new terrain of 39 ha was constructed for the future port activities with regards to marine renewable energy infrastructures.

The main project in France is the extension of the port of Calais to allow the use of larger ferries for the Calais-Dover passage. This turnkey project, executed together with a number of partners, comprises the building of a 3.6-km long breakwater, the dredging of an entrance channel and turning basin to 10 m, reclamation works for new port areas, quay wall construction and revetment works, mooring and loading facilities for the ferries, important pavement works and all terminal buildings.

Next door to Calais, Jan De Nul widened and deepened the approaches to the container quays in the Western Port of Dunkirk. The access channel and turning basin in the inner port were extended, an existing dockyard was dismantled and a new embankment was constructed.

In Italy, the Group executed urgent replenishment of several beaches in the Emilia Romagna Region, using sand coming from a designated area offshore.

Jan De Nul Group continued maintenance dredging works in the sediment trap near the village Wedel in Germany for Hamburg Port Authority. This project started in 2015 and was extended in 2016. During the second half of the year the Group executed maintenance dredging works in the port of Hamburg itself.

During spring, the Group executed the second maintenance dredging campaign in the port of Landeyjahofn in Iceland, after which the dredger sailed to Siglufjordur in the north of the island for a small dredging and reclamation work during summer.
**MIDDLE EAST**

In Dubai, Jan De Nul Group executed dredging and reclamation works for the construction of a new container terminal (T4) at Jebel Ali Port. Two hopper dredgers and one cutter dredger were mobilised to execute the DP World project.

In South Kuwait, Jan De Nul Group delivered a small boat harbours project in March 2016. The objective of the project is to increase KOC (Kuwait Oil Company) marine facilities with the future aspect of increasing its oil production. The project was located at two locations, north and south harbour. The south harbour has been upgraded to meet the future harbour requirement. The north harbour has been developed partially as a duplicate in order to handle about 70-100% of the marine fleet.

**ASIA**

In 2016, Jan De Nul Group returned to the Arctic port of Sabetta, on the Yamal Peninsula in Russia, for the second last dredging campaign in the new seaport of Sabetta. Jan De Nul already worked in Sabetta in 2012 and 2013. It has now been assigned the contract to perform the last two capital dredging campaigns in 2016 and 2017. In June 2016, 18 dredging vessels and 4 support vessels of the Group set sail to the Arctic. The fleet widened the 50-km long sea channel stretching into the Ob Bay, and deepened and expanded the Sabetta LNG Port. The 2016 campaign was successfully completed in only three months.

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Jan De Nul Group continued the deepening and widening dredging works of the navigational channel and basin of Turkmenbashi Port, in Turkmenistan. The project was completed in the summer of 2016. This project turned the Turkmenbashi International Seaport into an important logistic hub between Europe and Asia, which will play a key role in the sustainable development and prosperity of the region.

In Kazakhstan, Jan De Nul executed capital dredging works for the access channel and port basin of the green port of Kuryk. The newly built port on the Caspian shore will be similar to Azerbaijan’s Baku International Sea Trade Port. Being located at 100 km from Aktau, Kuryk port’s main objective is the transportation of transit cargo from China to Iran, Turkmenistan, Azerbaijan, Turkey and further to Europe. The capacity of the port is expected to reach a total of 4 million tonnes of freight per year.

By order of the port of Kwangyang in South Korea, Jan De Nul dredged a third access channel and disposed the dredged sediments in a designated confined area. Furthermore, dredging was carried out at the port of Daesan.

In the port of Mailiao in Taiwan, the Group continued the maintenance works in the access channel to a design level of -24 m. In the port of Kaohsiung, 6 million m³ was dredged inside the port area and reclaimed as part of the Kaohsiung Port Expansion plan.

**AUSTRALIA**

In Australia, Jan De Nul Group executed the capital dredging works for the Amrun Project in Weipa, North Queensland. Rio Tinto is developing a new Bauxite mine and associated processing and port facilities. The dredging works executed were for the construction of a new export facility at Boyd Point and for two new roll-on/roll-off barge terminals in shallow water on the Embley River.

In Western Australia, Jan De Nul Group executed for the Pilbara Port Authority, for the fifth time running, the contract for the maintenance of the port of Port Hedland, the world’s largest export terminal for iron ore. The trailor Juan Sebastian de Elcano was mobilised and on completion in Port Hedland continued to work in Dampier and Cape Lambert for Rio Tinto. At both ports maintenance dredging was executed at the Iron Ore export facilities, including the berths and departure channels.

**AFRICA**

In the harbour of Takoradi in Ghana, Jan De Nul Group is creating a fully new harbour basin over a period of five years. The existing breakwater is being extended by 1.1 km, the harbour is to be deepened to -16 m, and a 600-m long and 16-m deep quay wall is being constructed. This project is scheduled to be completed in September 2017.
In December 2016, Jan De Nul Group delivered the reclamation project for the Dangote Lekki Refinery in Nigeria. The contract involved the creation of 2,500 hectares of new land for the construction of a future oil refinery and fertilizer plant, by pumping ashore 52 million m³ of sand.

Also in 2016, Jan De Nul Group is dredging in Egypt, after the completion of the dredging works for the Suez Canal, the Group is now executing deepening and widening works for the channel approach of the Abi Qir Port. Moreover, the front of the berths will be deepened to -16 m.

In Congo, the CSD Ibn Battuta executed the second phase of the Eastern Extension of the Port of Pointe-Noire. Capital dredging works were executed and reclamation works were done for the future storage areas in the port.

Jan De Nul Group mobilised four vessels to Mozambique in order to deepen the main access channel to the Port of Maputo. The project will be completed in January 2017.

CENTRAL AND SOUTH AMERICA

Jan De Nul Group was present in a series of countries in Central America, for several dredging projects, but also for some very important civil construction works. The most well-known civil project for construction of the new locks in Panama was completed mid-2016. In June 2016, the new lock complexes were officially inaugurated by the client ACP. An extensive fleet of hoppers, cutters and backhoes of Jan De Nul Group carried out dredging works that were closely linked to the construction works. Both at the Atlantic and the Pacific Ocean, the access channels were dredged to ensure the necessary draught.

The dredging and civil construction works for the second phase of PSA Panama International Container Terminal at the Pacific Side started end 2015 and continued in 2016. The works include the dry earthmoving and soil remediation works to prepare for the subsequent wet expansion. After having removed existing structures, excavated the quay area, levelled the future port site and consolidated the site in 2015, Jan De Nul started in 2016 the dredging and earthmoving works, the development of a new port site of 27 acres and the construction of an 800-m long berth.
Dredging works for the opening of and civil construction of the new Panama Lock Complexes

At the Atlantic Side of the Canal, capital dredging works of the turning basin and berthing pocket for the LNG terminal of the Costa Norte Power Plant. Capital dredging was executed in the turning basin and navigation channel of the Manzanillo International Terminal (MIT). And at the end of 2016, a small maintenance campaign in the Port of Cristobal was executed.

Dredging works for expansion and/or maintenance of ports were also performed in Guatemala, Mexico, Belize, Guadeloupe, Cuba, the Dominican Republic and the Bahamas.

In 2016, Jan De Nul Group was also awarded a new important dredging contract in Jamaica for the first stage of the Kingston Container Terminal Development. These dredging works will include the realignment and deepening of the existing navigation channel, and the deepening of the Port of Bustamante, the internal channel and the East Channel.

In South America, Jan De Nul Group traditionally executed several maintenance dredging campaigns, mobilising trailing suction hopper dredgers, as well as cutter suction dredgers to ports in Colombia, Peru and Argentina.

Zooming in on Argentina, the Group continued the 26-year concession for the maintenance of the Río Paraná and Río de la Plata. In 2016 a fleet of 7 TSHDs and one large CSD maintained the sailing depth in the Río de la Plata and Río Paraná over a length of approx. 2,000 km. Due to the impact of el Niño, the yearly maintenance volume was unprecedented.

In the province of Buenos Aires, Jan De Nul Group executed maintenance campaigns in the port of Quequén. Further south, in the Port of Bahía Blanca, the inner access channel was deepened while in the outer channel and in front of the quay walls maintenance works were executed.

End 2016, a capital dredging project started in the Río Uruguay, in binational Argentinian and Uruguayan waters.

Delivery of the lock doors for the new Panama Lock Complexes

Cruise ship berth access channel dredging at Harvest Caye in Belize
OFFSHORE SERVICES

Jan De Nul Group offers a range of offshore services for the installation of submarine structures, cables and umbilicals for the oil, gas and renewable energy market. These services included: the preparation of the seabed, dredging of trenches, installation, rock placing for stabilising and ballasting of submarine pipelines, cables, umbilicals, foundations, platforms and complete wind farms. All these services are offered according to the specific needs and requirements of our respective clients including as a comprehensive Engineer-Procure-Construct (EPC) package.

In 2016 the offshore division of Jan De Nul Group was especially focused on projects related to the market of offshore renewables. In the United Kingdom we installed two export cables, including the pre-sweeping of sand waves and post-lay trenching activities. For this project Jan De Nul Group designed and constructed two trenching tools, ‘Sunfish’ and ‘Moonfish’ that weren’t available on the market yet.

In Belgium, Jan De Nul Group is constructing the offshore wind park Nobelwind with the jack-up installation vessel ‘Vole au vent’. A total of 51 monopiles and 50 3.3 MW Vestas wind turbines need to be installed. A part of the scour protection has already been installed by the rock installation vessel ‘Simon Stevin’. This new offshore wind power plant is being installed 46 km off the coast at Zeebruges. It will be connected to the Belgian power grid through an export cable previously installed by Jan De Nul Group in 2013 and will provide green power to 186,000 families.

In Finland, Jan De Nul Group started with the seabed preparation works for the Tahkoluoto offshore wind farm. Once completed, the Group will start with the installation of the foundations for the ten wind turbines. Also the installation of the turbines itself is part of the scope.

CIVIL WORKS

Civil engineering works, that’s where it all started for Jan De Nul Group. Even today, it is still an important part of the company activities, the focus having been shifted to complex projects. To this purpose, the Group has set up a structure that offers its clients an overall package to deliver projects. From design up to execution, all key activities are executed by our own employees and equipment, regardless whether it concerns the construction of locks, quay walls, bridges, tunnels, roads, buildings, water treatment plants, sewer systems or pipelines. Jan De Nul Group is also an expert in foundation and piling techniques through its subsidiary Soetaert-Soiltech, and a major player in the market of large PPP projects.

In the course of 2016, Jan De Nul Group was building a few important locks in Belgium. The construction of the Kieldrecht sea lock in the port of Antwerp was completed by mid-2016. In June, the lock was officially named and inaugurated. The construction of the lock in Ivoz-Ramet was completed in March and the works for the new lock in Harelbeke continued according to plan. Jan De Nul Group also started constructing new flood control dams in Kerkhove along the river Scheldt and in Aalst along the river Dender.

In the year 2016, Jan De Nul Group constructed new quay walls and bridges crossing waterways in Harchies, Liège, Genk, Bruges and Aalter.

Jan De Nul, as part of a consortium, was awarded its very first lock construction contract in the Netherlands. The Beatrix lock project includes the construction of a third lock alongside the two existing locks, the widening of the approaching Lek Canal and the construction of a 1,200-metre berth in the same Canal. The consortium started the works after award in 2016.
Construction of a third lock for the Beatrix lock complex

In Panama, the two new lock complexes, built by the Consortium GUpC of which Jan De Nul Group was part, were inaugurated in June. These locks double the Canal’s capacity, giving access to the Post-Panamax vessels up to 13,000 TEUs.

Also in Panama, Jan De Nul Group continued executing excavation, piling and construction works for an 800-metre quay wall extension by order of PSA Panama International.

ENVIRONMENTAL WORKS

Soil and groundwater remediation, environmental dredging and sediment treatment, treatment and valorisation of waste and brownfield development: through its subsidiaries Envisan and PSR Brownfield Developers, Jan De Nul Group can offer comprehensive experience in all environmental technology areas. It is actively working on the sustainable development of ports, harbours and waterways. Jan De Nul Group goes for an integrated approach, from design to execution, making maximum use of in-house equipment and its own network of geographically well-spread treatment centres.

Exploitation of treatment installation AMORAS in the Port of Antwerp

In 2016, the environmental subsidiary of Jan De Nul Group, Envisan, executed environmental dredging and sediment treatment projects in Belgium, its home market. In the port of Antwerp, its treatment installation AMORAS continued the processing of dredged sediments in the River Scheldt. In Ghent, the Siffer Lock was deepened and the dredged sediments were treated at Envisan’s treatment centres in Ghent and Moen. In Liège, maintenance dredging was executed in the Albert Canal and sediments were treated by Envisan’s floating mobile sediment treatment installation.

Envisan also executed two dredging projects in Scandinavia for the remediation of polluted port areas. In Norway, Envisan realised the project for the dredging and capping of contaminated sediments from the commercial port, ferry terminal and marina in the port of Trondheim. In Sweden, Envisan commenced the works in the port of Oskarshamn for the removal, dewatering and disposal of contaminated sediments, including the treatment of process water by means of an adapted water treatment plant.

Dredging and capping of contaminated sediments from the commercial port, ferry terminal and marina in the Port of Trondheim

In the south of France, Envisan exploits its soil and sediment treatment centre CPEM in La Seyne-sur-Mer, near Toulon. This centre, the very first of its kind in the Mediterranean region, was built to accept, treat, store and valorise polluted soils and sediments resulting from construction or dredging works. The centre was inaugurated in 2015, so in 2016 Envisan focused on making the centre fully operational. Also the first volumes of soils and sediments were accepted and treated.

Exploitation of the soil and sediment treatment centre CPEM in La Seyne-sur-Mer
Van Oord

Van Oord is a leading international contractor specialising in dredging, marine engineering and offshore projects (oil, gas and wind). Van Oord works closely with its clients to create innovative, sustainable solutions and safe working conditions.

Marine ingenuity is Van Oord’s signature and the foundation of its success. The knowledge and experience gained throughout Van Oord’s long history are sources of inspiration as it journeys into the future. Dedicated, and with a thirst for knowledge, Van Oord is happy to face our continuously changing surroundings. Ingenuity is the spark that lights the spirit of Van Oord’s professionals.

Vision

The growing world population needs more space. The demand for energy is rising constantly and society is demanding a transition to a renewable energy system. Increasing world trade requires more and better port facilities and climate change is threatening coastal areas.

It’s in our Nature to Care

As a family-owned business, established 150 years ago, Van Oord focuses on future generations and long-term business relations. Care for people is deeply rooted in our organisation. Working closely with our clients, with respect for one another and working together proactively on safety is a natural part of that.

Van Oord plays an active role in caring for the planet now and in the future by guarding the environment. We strive to minimise the potential negative impact of our work on the marine environment. Our smart engineers are continuously encouraged to develop more sustainable work methods and innovations.

Say YES to Safety

A simple, but powerful and positive message that indicates Van Oord is embracing safety: say YES to safety. This unique safety programme reflects Van Oord’s attitude towards safe working. Safety is part of our everyday work and all people working for Van Oord are expected to be proactive in meeting their responsibility to work safely.

DREDGING

Van Oord’s dredging talent translates into expertise, experience and ingenuity. It is carried out on complete marine engineering projects worldwide, such as the Palm in Dubai. These kind of projects contribute to the reputation as a Dutch centre of expertise in water management. Van Oord has global ambitions in the fields of dredging and marine engineering, ambitions that it is achieving by continually shifting the boundaries of technology. Examples of Van Oord’s innovative approach include water injection dredging, the Van Oord Guards (FaunaGuard, PlumeGuard and ReefGuard) and the Building with Nature programme.

Van Oord Signs € 300 Million Contract for Fehmarnbelt Project

On May 30, 2016, Femern A/S, a subsidiary of the Danish state-owned Sund & Bælt Holding A/S, and the Fehmarn Belt Contractors joint venture, consisting of Van Oord and Boskalis, signed the previously announced contract related to the construction of the Fehmarnbelt Fixed Link. Van Oord’s share of the contract is approximately € 300 million.

Van Oord Executes Various Beach Replenishments in Spain

In August 2016 Van Oord’s Spanish subsidiary Dravo SA, has been awarded a number of long-term beach maintenance contracts. These projects will contribute to both coastal defences as well the development of tourism. This year’s beach replenishments in Barcelona and La Pineda near
Tarragona have already been completed. Activities on the beach of Playa de Castillo on the Canary Island of Fuerteventura are in full swing.

**Impressive Ground Improvement Project in Kuwait Delivered**

Van Oord successfully executed the impressive ground improvement project for client Kuwait National Petroleum Company (KNPC). The project, which started in 2014, involved the reclamation of 65 million cubic metres of sand and extensive soil improvement. The reclamation area of 1,320 ha is intended for one of the largest oil refining plants in the Middle East.

**Dutch Dyke Reinforcement Project Awarded**

Hollands Noorderkwartier Regional Water Board (HHNK) has awarded the dike reinforcement project Den Oever in the north of the Netherlands to Van Oord in October 2016. The work will commence in 2017 and will continue until 2019. The project, part of the Dutch Flood Protection Programme, will encompass the design and the reinforcement of 900 metres of dyke.

**Innovation in Dyke Reinforcement: Van Oord and GMB Install Dyke Pin**

Van Oord and GMB use innovative dyke pins for the first time on a dike compartment between Hagestein and Opheusden in the Netherlands. The great advantage of this dyke reinforcement technique is that it can be used in places where working space is limited. The client, Rivierenland Water Board, is embracing this new method for use in the Hagestein-Opheusden Dyke Improvement Project.

**Van Oord to Reinforce Houtrib Dyke in the Netherlands**

December 21, 2016 – Van Oord announces that the Dutch Directorate General for Public Works and Water Management (Rijkswaterstaat) intends to award the contract for the reinforcement of the Houtrib dyke to Van Oord and its partner Boskalis. The contract carries a value of € 90 million of which Van Oord’s share amounts to € 45 million. The project entails the reinforcement of the Houtrib dyke on both sides with sand and rock over a distance of 25 kilometres. The activities will be carried out in the period 2017-2020. The dyke reinforcement project is part of the Dutch Flood Protection Programme, an alliance of Rijkswaterstaat and all district water boards aimed at reinforcing primary dikes in a more innovative and robust manner.

**OFFSHORE WIND**

As an EPC contractor Van Oord has completed several prominent offshore wind projects, being responsible for the engineering, procurement and construction. Projects include the Gemini Offshore Wind Park, one of the world’s largest offshore wind projects, and Eneco Luchterduinen wind park. Innovative solutions contribute to making this form of sustainable energy more competitive.

**E.ON Awards Contract Arkona Offshore Wind Project to Van Oord**

On April 25, 2016 energy supplier E.ON has awarded the contract for the transport and installation of foundations at the Arkona offshore wind project in the German Baltic Sea to Van Oord. Van Oord will install the project’s 60 monopiles and transition piece foundations.
Van Oord and Highland Group Holdings Ltd. Will Cooperate on the Deutsche Bucht Offshore Wind Farm

Van Oord and Highland Group Holdings Ltd. have signed a cooperation agreement for the development, financing and construction of the offshore wind farm Deutsche Bucht in Germany. The wind farm is located in the German Bight, approximately 90 km from shore and will have a rated power of 252 MW. Van Oord will execute the Balance of Plant for the project. The latter consists of the engineering, procurement and construction of the foundations, inter array cables and the offshore substation.

Van Oord Completed Burbo Bank Extension Offshore Wind Project for Dong Energy

Van Oord’s heavy lift installation vessel Svanen successfully completed the last of the 32 foundations at Dong Energy’s Burbo Bank Extension project in July 2016. With a total of 32 Vestas wind turbines of 8 MW each to be installed, the offshore wind farm will have a total capacity of 258 MW. The offshore wind farm will provide electricity to 230,000 homes and is expected to be operational early 2017.

Van Oord Completes Installation of Gemini Offshore Wind Park

On August 23, 2016, Van Oord’s offshore installation vessel Aeolus installed the final wind turbine at the Gemini Offshore Wind Park, which means that the installation of all 150 wind turbines is now complete. This milestone brings the supply of sustainable energy to 1.5 million people in the Netherlands a step closer.

Consortium Excited with Winning Tender for Borssele III & IV

The consortium of Eneco, Diamond Generating Europe (100% subsidiary of Mitsubishi Corporation), Shell and Van Oord is pleased and honoured to have won the tender for the construction and operation of Dutch offshore windfarms Borssele III & IV. The preferred supplier for the wind turbines is MHI Vestas Offshore Wind. Wind farms Borssele III & IV are expected to generate more than 3,200 GWh per annum, the equivalent of the electricity used by approximately 825,000 households. The wind farms are located 22 kilometres out of the coast of Zeeland in the Netherlands.

Van Oord to Build Belgium’s Largest Offshore Wind Project

Van Oord has signed a contract with Norther for the Balance of Plant works for the Norther offshore wind farm, located 23 km off the Zeebrugge coast in Belgium. With a maximal capacity of 370 MW, Norther is set to become Belgium’s largest offshore wind project. After completion it will deliver renewable energy to 400,000 households.
OFFSHORE OIL AND GAS

The growth of the global economy and the expanding world population are generating an increasing demand for energy worldwide. To meet this global demand, oil and gas are being extracted from isolated fields and transported over long distances. Van Oord has evolved into a world-renowned Engineering, Procurement and Construction (EPC) contractor. Van Oord’s fully integrated EPC services encompass detailed design and verification, procurement of materials and associated services, and installation and commissioning services—all delivered in one complete package.

Special Norwegian Offshore Project Delivered

Off the west coast of Norway, Van Oord has successfully stabilised the wreck of a World War II submarine in July 2016. The Norwegian Coastal Administration awarded the contract to Van Oord at the end of 2015. The wreck, containing toxic mercury, was located at the top of a steep slope in the seabed. This slope was stabilised to guarantee the stability of the wreck. Van Oord deployed its flexible fallpipe vessel Stornes.

Two Offshore Contracts in Egypt for Van Oord

On November 3, 2016, Van Oord was awarded two contracts by international contractor Subsea 7. The assignments include the construction of a landfall and the execution of subsea rock installation works in Egypt. The projects are part of the West Nile Delta project, which comprises the development of a series of gas fields, located 65 km off the northern coast of Egypt. Final client is oil and gas company BP.

OTHER NEWS

Van Oord Has Been Awarded the 2016 Leonardo da Vinci Prize

The 2016 Leonardo da Vinci prize has been awarded to Van Oord. Mr A. Aboutaleb, the Mayor of Rotterdam, presented the prestigious international prize for family businesses to CEO Pieter van Oord. Willem van Eeghen, Chair of Les Hénokiens, explains the selection of Van Oord. “We award this prize to businesses that are continuously adjusting to market circumstances while taking into account long-term developments, which show respect for the environment in which they work and ensure a living legacy. Van Oord, which is now being managed by the fourth generation, has expanded into an international organisation with 5,000 employees. The company, which offers solutions to global maritime challenges, is involved in many activities and programmes focusing on innovation and research, such as the Building with Nature knowledge programme.”

Business Community Calls on Government to Introduce Climate Legislation

On October 25, 2016, the Dutch business community announced that it has embraced the Paris climate objectives for 2050 and is calling on the government to prioritise the acceleration of the energy transition. Thirty-nine (39) players, including initiators Siemens, Van Oord, Eneco, Shell, and Rotterdam Port Authority, have joined forces in a Transition Coalition to request the government to draw up climate legislation to implement the agreements reached at the Paris summit.

Van Oord Joins Water Management Partnership Rotterdam – Jakarta

Rotterdam and Jakarta will be exchanging knowledge about urban water management and the effects of climate change for another three years. Today, during Prime Minister Rutte’s economic mission to Indonesia, the partners signed a new partnership agreement. Just as is the case in our own low-lying country, protecting the coast in the region of Jakarta has been a point of major concern. Rotterdam and Jakarta are both delta cities, and there is much they can learn from one another. That is why the two cities began an exchange programme with various partners in September 2014.

Winner of TenneT Contractor Safety Award

Van Oord has won TenneT’s Contractor Safety Award 2016. This is TenneT’s first ever safety award given in recognition of the best safety performance by a contractor. Van Oord was selected from a total of 30 entries because of the verifiable measures taken with its ‘say YES to safety’ programme to encourage safe work practices.
BERTHING 2.0

Berthing velocities have not been measured since the 1970s. The berthing velocities of container ships have never been determined. The Rotterdam Port Authority has changed this in recent years. The berthing velocities have been surveyed by means of a large-scale study and the construction of the berthing dolphins has also been reviewed. The outcome? Much more can be done.

In Rotterdam, seagoing vessels are berthed particularly carefully. This is due to the absence of a strong tidal flow combined with the skill and expertise of pilots in conjunction with boatmen and towage services. “The strain on berthing structures is much lower than that for which they were designed”, says Alfred Roubos, Project Engineer at Port of Rotterdam. “Thanks to the surveys, we not only know that vessels can be berthed quicker, but more importantly, the quay and jetties can facilitate larger vessels. Naturally, the latter depends on the depth and berthing configuration onshore, but in any case it offers possibilities.”

Fenders

Roubos and his team came to this realisation following a comprehensive study of the Port of Rotterdam. For example, mobile lasers were used to take measurements during a storm season on the Maasvlakte. In addition to this, the information from the towage service’s Portable Pilot Units was gathered and data from the large oil terminals was analysed. Quite a job, but with a useful outcome. The measurements showed that it is possible to allow larger vessels to berth at the existing fender systems (i.e. a fender/buffer to protect berthing vessels and the berthing structure against damage). Roubos: “The nautical sector in Rotterdam is to be commended for the berthing policy and creating opportunities for optimising the use of our port infrastructure.”

Flexible Dolphins

A practical study of the dolphins in the Port of Rotterdam was conducted concurrently and this also delivered concrete results. “The design codes differ from the actual capacity by a factor of two. They are therefore capable of handling a much greater capacity. Consequently, we have now been able to extend the maximum draught at one berth alongside the dolphins in the Calandkanaal by two metres.” Another finding is that by reducing the dolphin diameter and making the steel thicker, the dolphins have become much more sturdy, while fifteen percent less material is needed. “These giants can easily take a 1.5-metre deformation at the pile head, thus absorbing the berthing energy. It is not without good reason that we call them flexible dolphins”, adds Roubos.

Unexploded Bombs

The study of the dolphins included examining the ‘transmission’ of vibrations that are released when the dolphins are vibration driven into the harbour floor. However, that transmission turned out better than expected. Based on that, the area, which, prior to installing new dolphins, will have to be checked for unexploded bombs from WWII that may still explode because of the vibrations, can be reduced by 75 percent. Roubos: “Together with the saving on materials, that really makes a big difference in terms of time and costs and that, again, is favourable for the Port Authority’s customers.”

Dolphins at the Calandkanaal
(Freek van Arkel)
In 2016, around 20 million cubic metres of sludge was dredged from the port of Rotterdam. That quantity will increase substantially in 2018. In addition to the regular maintenance, the Rotterdam Port Authority and the State will in fact be making the Nieuwe Waterweg and the Botlek area deeper. This will enhance Rotterdam’s already favourable position with no locks and tidal limitations, enabling vessels to reach their destinations yet more easily.

More than 15,000 seagoing vessels sail along the Nieuwe Waterweg annually. The Nieuwe Waterweg has to be made 1.5 m deeper, spanning a length of 25 kilometres. On average, the waterway will be 16.30 metres deep from Hoek van Holland up to the Benelux Tunnel. The project will strengthen Port of Rotterdam’s position and ensure that nautical access to the Botlek is in keeping with the times. “Simply put, it means deeper draught, more freight”, says Edwin Hupkes, project manager at the Port of Rotterdam. “And more freight means more revenue for our customers.”

Panama Canal

The deepening will extend into the Botlek area; one of the largest (petro)chemical complexes in Europe encompassing a cluster of oil refineries, chemical companies and warehousing firms. Companies specialising in fuels and oil products in particular will therefore stand to benefit. “Ship owners are opting for vessels that can serve several ports. We now see that the Panama Canal has been deepened. That additional depth has become a criterion for these ship owners when building new vessels. The Port of Rotterdam has responded to this by implementing the deepening.

The trend for transporting more fuels rather than crude oil is also in line with this. Once the deepening is complete, Aframax tankers, which are mostly used for transporting fuels, will be able to access the Botlek easily.”

Stone Depot

The entire deepening of the Nieuwe Waterweg will take less than six months to complete, plus another six months for the port basins in the Botlek. A great deal of consideration has also been given to the possible risks that may ensue. The environmental impact report shows that the impact on, for example, the salinity, the groundwater and the riverbed can be limited or easily managed by taking targeted measures. For instance, the freshwater supply may be adversely affected because of more salt water penetrating the west of the Netherlands on account of the deepening. Appropriate measures will be taken at various locations to guarantee continued freshwater supply. Hupkes: “Another example is that the deepening may cause the currents in the Delta rivers to change direction. If this causes a dam to become unstable, one of the Port Authority’s stone depots can be deployed immediately in case of acute safety issues.”

Monitoring

Finally, the Rotterdam Port Authority is devising a programme for monitoring the salinity, the groundwater and the changes in the riverbed. To this end, the content of salt and the riverbed will be determined several times a year. This will clearly highlight the impact of the deepening and measures may be taken.
DYNAMIC DRAUGHT IN SAVINGS

Static minimum depths have been published for every square metre in the Port of Rotterdam. This provides a safe margin for vessels to enter and leave the port unhindered, any time of the day, 365 days a year. The conditions, however, are not static, but vary depending on the tides, day by day, minute by minute. This is where Dynamic Nautical Accessibility Rotterdam (DYNAR) comes in. The online tool provides ship owners with current dynamic information, so that vessels can be safely, but more heavily, loaded. That saves money.

“In many cases, vessels entering and leaving the port may carry more freight than is currently the case”, says Pieter Nordbeck, Nautical Advisor, Rotterdam Port Authority, Harbour Master Division. “This not only means that the capacity of our waterways can be used more wisely and increase the efficiency of the port, but it also ensures additional revenue for ship owners. For example, for an average tanker, 10 centimetres extra draught means 900 tonnes more freight per vessel.”

Water Column

The crux of this clever tool does not lie in a revolutionary new measuring methodology. It is a result of a big data application that combines the data from knowledge institutions like the KNMI and the Port Authority. The water column within ports can be calculated and predicted based on current dynamic information. This makes it possible to indicate tidal windows within which vessels with a deeper draught can enter and leave the port. “For instance, in the case of tidal windows during spring tide, it is now possible to enter and leave the port with a few decimetres additional draught.”

Pilot

The tool, which is being further developed within the Rotterdam Logistics Lab, is now available to the pilot participants such as Shell, Koole Terminals and Vopak Agencies. Nordbeck: “We are currently testing whether the additional draught, which has been demonstrated on paper, is also feasible in practice. The focus is on the Botlek/Vondelingenplaat area and we are concentrating on companies that transport wet and dry bulk cargo.”

Hydro-Meteo

The results of the pilot will determine whether DYNAR is suitable for all companies operating in the port and, for example, the container sector. “Follow-up steps that we nevertheless want to take, is that we want to use the tool to give companies more insight into other dynamic hydro-meteo aspects that play a role in optimising the ship’s voyage”, continues Nordbeck. “For example, tidal windows, dynamic wind information and visibility information. All building blocks are available and the related preparations have already been made. Naturally, it would be ideal if DYNAR can also provide port-to-port advice in the future.”
The first monopiles from the brand new Sif plant on the Maasvlakte were placed on board a jack-up vessel in January 2017. A milestone for the offshore developments in the Port of Rotterdam, but not by any means the last one. “We want to become the frontrunner in this race.”

The share of energy generated from sustainable sources in Europe is expected to increase significantly in the coming years. Energy generated at sea is therefore the most important source for countries bordering the North Sea. The conditions on the North Sea are extremely favourable for offshore wind. A relatively high number of windy days spread throughout the year, sound foundation possibilities and many consumers of the generated wind energy in the vicinity. According to Joost Eenhuizen, Business Manager Maritime and Offshore Industry, Rotterdam Port Authority, the Port of Rotterdam is a logical location for establishing the offshore wind industry. “We are literally and figuratively situated directly along the North Sea and the Sif terminal is the first proof of competence completed by the Port Authority to incorporate the offshore industry at the newly constructed Maasvlakte 2. With a guaranteed water depth of more than 16 metres, the largest offshore vessels currently operating can berth along the Sif quay. Moreover, all conventional jack-ups can stand 8 metres from the quay. With the increased weight, this is a huge competitive advantage. These are just some of the trump cards that Rotterdam holds to facilitate the construction of the planned five large wind farms, each 700 megawatts, off the coast of Holland and the coast of Zeeland.”

**Decommissioning**

The Port Authority’s ambitions, however, extend beyond the promising wind market. Eenhuizen: “The Maasvlakte 2 offers us many possibilities. We are working on bringing together a number of offshore markets like oil, gas, wind and decommissioning. For example, in a multi-user offshore centre with various uses. This not only provides a future-proof model with room for mutual exchange and shared innovation, but also stimulates the existing cluster, which, for example, includes Huisman, van Oord, Mammoet, Franklin Offshore, Gusto MSC and Boskalis.” It comes as no surprise that, according to research firm Wood Mackenzie, with a $160 billion market for removing offshore platforms within fifteen years, the emphasis specifically focuses on decommissioning. “That is an interesting market for us for several reasons. Employment opportunities, the ripple effect to other companies, not to mention that we are well equipped for this new discipline here in Rotterdam. We already demolish industrial facilities and have the necessary expertise to remove asbestos, clean and dismantle contaminated pipelines and recycle scrap. We already undertake all that kind of work here in Rotterdam.”
2016 saw the shipping industry reach a crossroads in its evolution. Traditionally so conservative, we can no longer ignore the advances of technology. In a subdued industry that is looking for ways to remain competitive, taking practical steps towards digitalisation now will reap rewards in future.

In practice, this means looking towards process automation to reduce human error and refine scheduling, as well as finding opportunities to capture data and build robust datasets. This does not necessarily have to mean huge technological investment: much of this data can be gathered from processes and equipment that are already in place. It’s about gaining insight into how efficiently the port ecosystem is running, and then identifying areas for improvement. There’s no reason not to start that process now.

Key to success will be taking small steps in specific areas, with the support of trusted partners who have the data enabled products, technologies and infrastructure to enhance specific port operations for maximum efficiency.

Becoming a trusted partner in these areas has been a primary focus for PIANC Platinum Partner, Trelleborg’s marine systems operation, throughout 2016. The company has committed to evolving its business model and offering to effectively incubate and support the Ports of the Future. It has begun by building on its current core competencies, which span from vessel approach, through docking, mooring, transfer and departure.

The company has seen the significant progress made in automating ‘landside’ processes, such as loading and unloading, and sees huge opportunities for efficiency improvements within port approach and vessel turnaround.

As such, Trelleborg is focusing heavily on systems integration and data: the two key components that it believes will empower the most progressive port owners and operators in the future.

**Supporting the Port of the Future**

In 2016, Trelleborg carried out an industry wide survey to understand the current level of market maturity in terms of digitisation and automation. Calling on the views of global port, terminal and shipping stakeholders, Trelleborg explored the evolution of digital technologies in ports, and stakeholder perspectives on whether the industry is doing enough to prepare for the Port of the Future, and importantly, the capture, storage and sharing of data that will enable it.

This Smarter Approach to port and terminal efficiency, and drive towards data-driven technologies, started in 2015, when Trelleborg acquired Marimatech A/S, a Danish company that designs and manufactures advanced marine positioning and piloting systems, specialising in the development of software used for docking and mooring ships offshore and in ports.

Trelleborg saw an opportunity in Marimatech’s navigation and ship positioning product line, which utilises innovative ‘smart’ technology that could be applied within other assets. This technology is already being integrated with Trelleborg’s existing product range, as the company look to extend the automation that is becoming increasingly well-established on the land side, to the jetty side too.

**Raising the Bar for Fenders**

Trelleborg’s Smarter Approach philosophy extends far beyond Port of the Future thinking: it is a principle applied to every product line and includes the company’s ongoing commitment to smarter materials science. As part of this initiative, 2016 saw Trelleborg launch a new interactive whitepaper...
and on-demand webinar detailing a new, industry-leading approach to the design and manufacture of foam fenders, and recommending testing method to ensure the best possible quality and performance.

Continuing with the fender systems product line, Trelleborg also launched an ISO17357-1:2014 compliant, high performance pneumatic fender, designed to address the evolving needs of ports, terminals and offshore ship-to-ship transfer applications.

This quality assured fender features a thinner, lighter body for easier transportation and handling, as well as improved netting and hemispherical ends, which are designed to offer superior functional performance and enhanced continuity of end fittings, for optimum deflection capability.

Other manufacturers use synthetic tire cords for just the body of the fender and chafer fabric at both hemispherical ends. However, Trelleborg uses 100% synthetic tire cord for the construction of the entire fender. This directly enhances the operational ability of the product because synthetic tire-cord has a higher tensile strength than chafer fabric. By incorporating the synthetic tire cord throughout the entire fender, its stability, longevity, and shape retention are all significantly enhanced.

A Smarter Approach to Fender Selection

The fender selection and specification process is traditionally full of complexity, which is why 2016 also saw Trelleborg undertake a project designed to simplify it. The initiative resulted in the launch of Trelleborg’s online Fender Selection Tool, which enables specifiers to determine the optimum fenders for their project needs in just a few clicks. Almost completely digitising the fender selection process, this saves consultants the huge amounts of time normally spent carrying out complex manual calculations. The tool is also intended to help the industry as a whole take steps towards a standardised engineering process, reducing subjectivity in the design process and helping to shape consistent industry best practices.
Work with PIANC

Trelleborg sees huge value in nurturing young talent within the industry and remains committed to supporting PIANC’s Young Person initiatives. As such, 2016 saw Trelleborg sponsor PIANC’s Young Professionals-Com (YP) Seminars in both the Philippines and Singapore.

Trelleborg’s technical expert, Mishra Kumar, discussed a range of key trends and issues affecting fender development, including the importance of rubber compound composition, the manufacturing process and the use of modulus as an innovative and robust way of measuring fender performance.

Notable Contracts

2016 has been a successful year for Trelleborg, with a number of contracts secured globally. One premium project required the supply of one of the most complex fender solutions Trelleborg offers: a pre-assembled ‘Slide In, Slide-Out’ (SISO) fender system, to a gas plant in Australia.

The innovative SISO solution features sliding front panels, significantly reducing the time and effort required to complete a fender wear pad change-out. For this project specifically, pre-assembly of the systems ensured zero downtime during installation, meaning no disruption to scheduling and a significant reduction in cost for the terminal.

Trelleborg also sponsored the 9th PIANC-COPEDEC conference in Rio de Janeiro, Brazil, at which Regional Director, Marco Gaal, presented the company’s latest thinking on materials science and equipment engineering.

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Trelleborg also supplied over 300 of its SCN 1600 fenders to one of the largest harbor development projects in Egypt. The project aims to double the throughput of one of the world’s most important maritime transit links. This will see the expansion and rehabilitation of the port, and the construction of a container terminal capable of handling an increased volume of general cargo traffic.

Another notable contract saw Trelleborg supply SafePilot Portable Pilot Units (PPUs) and a Port System server solution to the Association of Maryland Pilots, facilitating consistent, real-time information sharing between almost 70 pilots.

The Association of Maryland Pilots serves the Chesapeake Bay, the longest pilotage route on the East Coast of the United States, with nearly 200 miles of waters. The scale of the waters put particular demands on the operational battery time the piloting equipment requires. Trelleborg was able to develop a specific navigation sensor to meet this need and fully integrate it with the port system and PPUs supplied.

The SafePilot solutions supplied to the Association of Maryland Pilots are part of Trelleborg’s evolving, data-driven product offering. This evolution took a huge step forward in late 2016 with the establishment of Trelleborg SmartPort.
A Smart Solution for the Port of the Future

Arising from Trelleborg’s view that digitisation has a huge role to play in powering and optimising vessel turnaround, Trelleborg SmartPort is the company’s offer to support ports and terminals in revolutionising operations through automation and data, and bolstering efficiency, safety and productivity.

Trelleborg SmartPort is a collection of data powered marine technology (MarinTech) product applications that operate standalone, or can be integrated, to start to move facilities towards a Port of the Future vision. Product architecture powered by the SmartPort Engine is open, scalable and securely hosted within Amazon Web Services (AWS) cloud architecture.

Ultimately, Trelleborg SmartPort is a technology platform that will connect disparate port operations. This holistic oversight will allow users to analyse the performance of their assets and identify areas for optimisation, to enable efficiency gains. Real-time information will enable better day-to-day decision making, and as data sets accumulate and become more comprehensive over time, this longitudinal data will empower long-term operational improvements too.

2016 was a hugely exciting year for Trelleborg’s marine operation. With PIANC continuing to set best practice guidance for the industry, Trelleborg looks forward to further strengthening its relationship with the organisation and working collaboratively to share best practice as our sector accelerates its journey towards the Port of the Future ideal.
Since its foundation in 1908, TOA CORPORATION has engaged in reclamation and marine construction works through various projects all over the world. Among them are reclamation works for industrial areas and offshore airports; port and harbour facilities, such as wharves and breakwaters; transportation facilities, such as coastal roads and bridges; and recreational facilities, such as marinas.

In order to complete those projects safely and successfully, TOA has developed various construction methods, working vessels, and equipment to overcome severe natural conditions on and under the sea. In addition, as lifecycle management of infrastructures, environmental sustainability, and protection from natural disasters are becoming of greater concern to society, TOA has developed new technologies for renewal and reinforcement of structures, environmental assessment and pollution control, sub-surface and sub-ground survey, disaster prevention, and so on.

With these work achievements, advanced technologies and accumulated expertise, TOA has earned a reputation for more than a century as a reliable contractor of maritime construction and engineering. TOA will make all possible efforts to improve technologies and cultivate human resources in order to respond to growing engineering requirements and emerging concerns, and strive for the prosperity of society and sustainability of the natural environment.

**Jebel Ali Container Terminal (Design and Construction) (UAE)**

A new container terminal has been completed in the United Arab Emirates city of Dubai. For this construction project, an existing general cargo berth was redesigned and renovated as a state-of-the-art container terminal.

Jebel Ali Port is the largest marine terminal in the Middle East and also has the largest man-made harbour in the world. With the completion of the new container terminal, Port Jebel Ali has become able to handle 19 million TEU containers a year.

- **Client:** DP World
- **Construction period:** June 2012 to March 2015
- **Project outline**

This project involves renovating the existing 1,860-metre berth at the Jebel Ali Free Zone Area (JAFZA), which is located in the United Arab Emirates and operated by DP World. Improvements will be made to the existing berth (the quay has a depth of 11 metres) by constructing a container berth (1,860 metres) with a depth of 18 metres.

The work calls for the design and construction of container terminal including a 75-ha container yard behind the berth, building and MEP works.

- **Main scope of works**
  - Dredging: approx. 2,400,000 m$^3$
  - Quay wall: 1,860 m
  - Diaphragm wall: 1,900 m
  - RMG crane rail: 17,500 m
  - Pavement: 715,000 m$^2$
  - MEP: 1 LS
  - Building (total floor area): 8,700 m$^2$

- **Project site**
  - Dubai in the United Arab Emirates

**Minami-Honmoku Container Terminal (Japan)**

The Minami-Honmoku Pier is located at the Port of Yokohama, which is one of the ports in Keihin Port, a designated strategic international container port. With the aim of strengthening its international competitiveness, work is currently underway to make improvements to the facilities at the Minami-Honmoku Pier to transform it into an international container terminal capable of enabling large-scale container ships to come alongside the
quay. Columns measuring 32 metres high with a diameter of 24.5 metres constructed of steel sheet structure cellular were employed in the work to construct the earthquake-resistant quay’s foundation. The quay will, in the future, have a façade that is sunk to a depth of 20 metres. The project was started in the 2007 fiscal year and completed in the 2014 fiscal year.

Sakhalin II LNG Project (Russia)

The Russian Government invited foreign investments to develop the natural gas and oil fields offshore of Sakhalin Island in the Russian Far East in the Sea of Okhotsk. For the Sakhalin II project, TOA was awarded contracts in 2003 to construct a LNG loading facility for the natural gas processing and liquefying plant, the foundations for the oil export terminal, and to provide ready-mixed concrete for the entire project.

TOA overcame various difficulties that hampered the smooth execution of the construction work, such as the severe weather conditions that prevented offshore work throughout the winter and oftentimes other seasons as well, the strict environmental regulations to protect fish, other marine creatures, and their habitats around the worksite, and completed the project in 2008 on schedule.

Saigon Premier Container Terminal (Vietnam)

The Saigon Premier Container Terminal, located in the south part of Ho Chi Minh City, was constructed in the largest port in the city. This facility has a 500-metre wharf and a 23-ha container yard with a storage capacity of 16,000 TEU (20-foot equivalent container units), giving it the capability of handling containers totalling 930,000 TEU a year.

Making use of its many years of experience in construction work in the Mekong Delta region in southern Vietnam, TOA took part in the construction of this facility by undertaking measures to reinforce the soft ground in the delta region. TOA employed the cement deep mixing (CDM) method, a technology for ground improvement developed by TOA, earning high praise from the client.

The construction of such port and harbour facilities is seen as being a part of the port and harbour development projects promoted by the government of Vietnam. It is anticipated that this facility will make it possible to increase the volume of containers handled in the southern part of Vietnam.

Pasir Panjang Container Terminal (Singapore)

The Port of Singapore, which is connected to 600 ports in 123 countries, is one of the largest container hub ports in the world. The Pasir Panjang Container Terminal, located in the southwest part of Singapore Island, will have a total of 26 berths at the completion of Phase I and II of the project. All container berths have been designed to have a depth of 15 metres and be equipped with gantry cranes capable of reaching out across 18 rows of containers, making it possible to accommodate Post-Panamax class container ships.
Since 2005, TOA Corporation has been awarded 6 separate contracts to construct 14 container berths with a total quay length of 4,330 metres and a carry ferry terminal. The last 4 berths, with a total quay length of 1,300 metres, were completed in October 2009.

**Introduction of ‘Pile Driver Ship’**

TOA has constructed the ‘Kakuryu’ large-scale multiple angle swinging pile driving vessel with a 600 t hoisting capacity and superior work efficiency to accommodate the increasing trend towards scaling up of diameter of steel pipe piles for the larger scaling of port facilities both in Japan and overseas.