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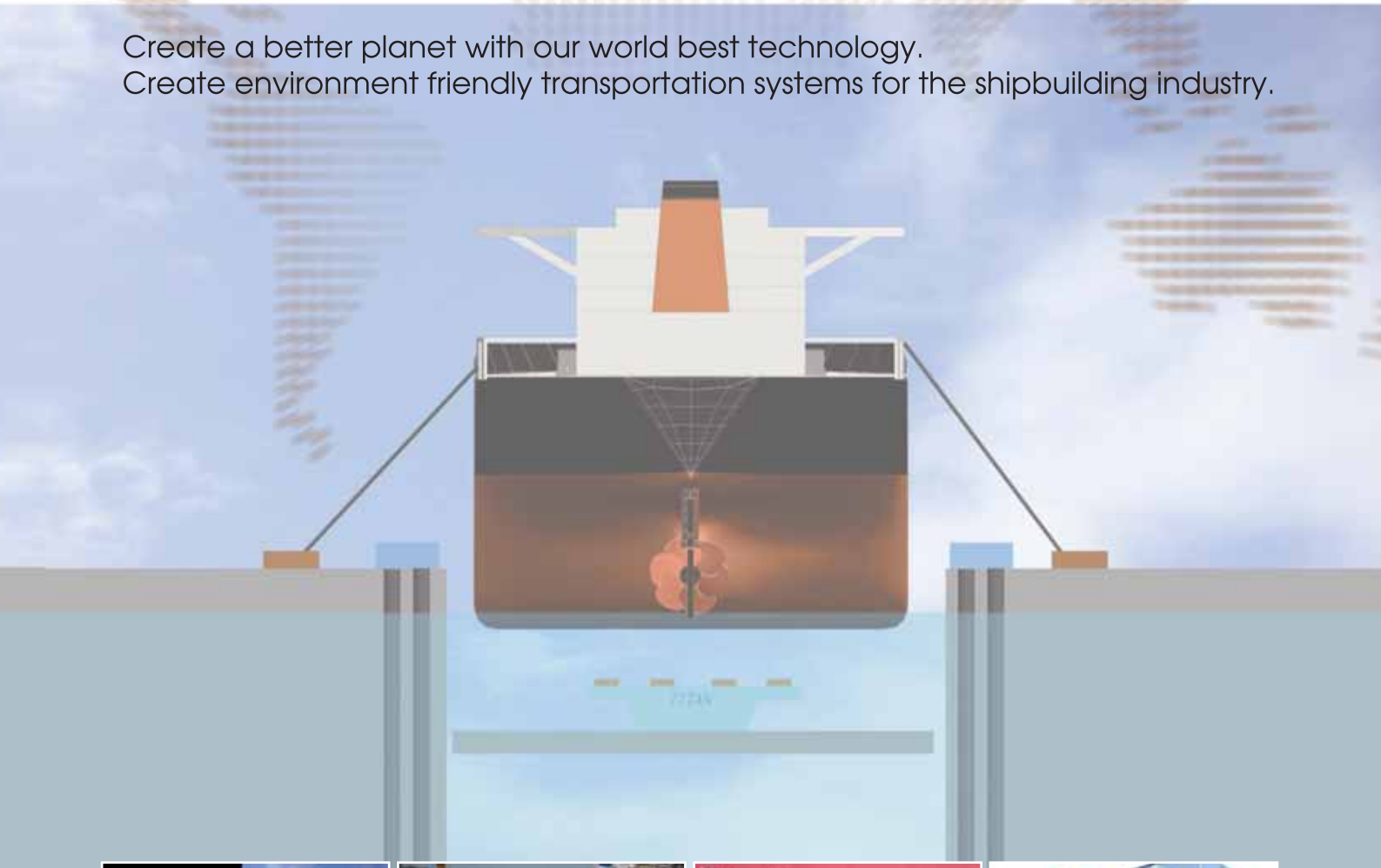

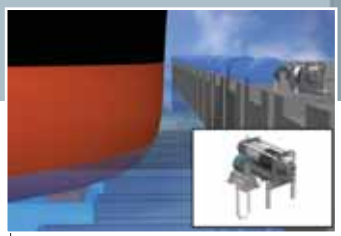

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SSME consecutively delivered 3 vessels

SSME announced on September 30 that it delivered 3 vessels in a row. These vessels are the Kamsarmax and Capesize class carriers, the sectors which saw a surge in new order placements and were dominated by SSME last year.

SSME delivered 82,000-ton cargo ship, the first unit out of 4 ordered in February last year from Tokyo-based Nisshin Shipping. The vessel was christened 'Bergen Trader' during the hand-over ceremony and the naming ceremony held at the same time, attended by officials such as Yayoi Fujii, President of Nisshin Shipping, Shinsuke Fujii, Managing Director of Nisshin Shipping, Ha Sung-yong, President of SSME, and others, who wished the successful construction of the remaining vessels. 'Bergen Trader' measures 229m in length, 32.3m in width and 20.2m in height with a maximum speed of 14.5 knots.

SSME celebrated the successful delivery of its first vessel ordered from Nisshin Shipping and consecutively delivered the last vessel among the 12 Capesize class bulk carriers ordered from Greece-based Enterprises, thus successfully finalizing the project. This vessel, which measures 292m in length, 45m in width, and 24.8m in height, has a carrying capacity of 180,000 tons and was named 'Taurus', one of the constellations of the zodiac.

Also, SSME delivered an 82,000-ton carrier ordered from Transocean at the beginning of last year and named 'Aeneas', a hero in both Greek and Roman mythology.

Meanwhile, SSME has delivered 115 vessels, including containerships, crude oil tankers, cargo carriers, etc, since it handed over its first ship to the owner in February 2007. This year, SSME received orders for shuttle tankers and FPSO (Floating, Production, Storage and Offloading) units, successfully making inroads into the offshore facility market. Furthermore, SSME was designated as defense contractor, thus drawing the attention across industries.

Kim Gyeong-jeon, the contract manager of SSME, and Kostas Zaran, the Enterprise Site manager, are shaking hands after signing on the delivery document for S1031, an 180,000-ton cargo carrier (clockwise).

DSME becomes Korea's first shipyard to export submarines

Daewoo Shipbuilding & Marine Engineering (DSME), which has the most extensive track record of building submarines, launched negotiation with the defense ministry and Navy of Indonesia to sign a submarine contract.

This submarine project worth KRW 120 trillion (approximately 1.1 billion) aims to build 3 units of 1,400-ton submarines, which is the largest defense export contract ever awarded to the nation's defense industry.

DSME and the Indonesian Ministry of Defense aim to seal a deal by November following negotiations in detail on technology and contract terms with regard to the submarines.

The aforesaid submarines are 1,400-ton submarines which DSME has developed indigenously for export since it built a 209 class (1,200-ton) submarine with technical assistance from Germany in early 1990s, and will be equipped with various torpedoes, mines, guided missiles, etc.

The construction of submarine requires highly advanced shipbuilding technology and expertise because of long construction time and use of many parts. Significantly, DSME prevailed as the preferred bidder for this project, beating off competition from France, Germany, Russia, etc, which dominate the global submarine markets. Although there is no technological gap among the competitors, DSME has been recognized to have competitive advantage in terms of price, quality, training, logistics support, technical collaboration on shipbuilding, etc.

Indonesian government's deep trust in DSME was also one of the significant factors. DSME successfully completed a project awarded from the Indonesian government to upgrade 2 units of Indonesian


209-class submarine

submarines (1,300 tons) and conduct the depot maintenance thereof, thus gaining the trust of Indonesian government in its shipbuilding technology.

In addition, this submarine project is said to have a very positive effect on the friendly and cooperative relationship between Korea and Indonesia which has made strides based on the deep trust between Korean President Lee Myung-bak and Indonesia's President Susilo Bambang Yudhoyono.

This submarine project is hailed as one of the examples wherein Korea beat other countries that dominate the global submarine market with concerted efforts of the nation's Ministry of Defense (MD), Ministry of Knowledge Economy (MKE), Ministry of Foreign Affairs and Trade (MFAT), Defense Acquisition Program Administration (DAPA), Korea Defense Industry Trade Support Center (KODITS), Navy, etc.

An official from DSME remarked, "Currently, major countries in South East Asia, such as Indonesia, Thailand, and Malaysia, are beefing up their Navy forces due to their particular geographical conditions. Importantly, this project will help establish a significant bridgehead in the submarine market of South East Asia, and we anticipate additional orders."

DSME, which is reportedly discussing export of submarines and surface ships with governments in Latin/Central America and South East Asia, has clinched orders for a total of 11 submarines so far (excluding this project). Furthermore, DSME carried out the upgrading and depot maintenance, which require a technological level similar to that of submarine construction - for 15 submarines in Korea and 2 units abroad, thus rising as a powerful player in the global submarine construction market.

POSCO inked a contract with Shell to supply steel plates over the long-term

POSCO entered into a Enterprise Framework Agreement on September 28 with the multinational oil giant Shell to exclusively supply offshore structural steel plates over the long-term.

Signing the Agreement, POSCO will supply a variety of offshore structural steel plates for all offshore plant projects awarded by Shell until 2016 and the term of the Agreement can be extended further by another 5 years based on performance.

This is an unprecedented case wherein any multinational oil company award an exclusive long-term supply contract to a specific company.

The steel materials used in offshore plants are required to meet rigorous safety and quality standards because they need to withstand rough marine environment. For that reason, the market for offshore structural steel materials has been dominated by a handful of European and Japanese steel manufacturers that have an advanced level of technology.

Among the key factors that led to the award of the long-term supply contract to POSCO are included its excellent technology and quality, price competitiveness, project handling ability, R&D capability, etc, which meet the global standard.

POSCO has supplied high strength steel plate that guarantees high performance of welded parts at -40°C based on relentless development of technology related to offshore structural steel materials. Additionally, POSCO plans to develop the products capable of guaranteeing high performance even at -60°C by the end of next year as part of effort to maintain its world's leading position in technology.

Along with that, POSCO is currently pressing ahead with the research into the application of new steel materials to offshore plants, which can be used in extremely cold marine environment and dramatically enhance the welding performance and anti-wear/anti-corrosion properties.

Through this Agreement, POSCO plans to position itself as a leader in the global market for steel plates used in offshore plants and develop the structural steel plates for application in energy sector as the company's 'World Best & World First' strategic product comparable to its current flagship products such as automotive steel plates, and is poised to evolve into a world's leading steel plate supplier.

KR and Daegwang Litech signed MOU to develop LED lighting system for ships

Korean Register of Shipping (KR) entered into a Memorandum of Understanding (MOU) with Daegwang Litech, a manufacturer of light-emitting diode (LED), in its Daejon headquarters on September 29 in relation to the development of LED lighting system for ships.

This technical collaboration as per the MOU will cover the joint R&D related to LED business, development/exchange of professional manpower in the related fields, international certification by KR for the newly developed LED products.

Gang Min-gyu, Chairman of Daegwang Litech, who attended the signing ceremony on the same day, said, "With our products being certified by the classification societies such as KR, we will be able to position our products for maximum competitive advantage in the global market."

Oh Gong-gyun, Chairman of KR, remarked, "LED, an eco-friendly lighting choice of the future, has great potentials for growth as the developed countries such as the United States, etc, are striving to establish international standard system. Based on this MOU, we will fully cooperate to help ensure the development of LED lighting system for marine application, which has the greatest competitive advantage and brand value, in a short period of time."

LED lighting, energy efficient compared to existing lighting system, is eco-friendly choice and has a wide range of applications ranging from raw materials used in the production of medicines, through medical equipment, to the cultivation of plants. LED lighting on board ships can reduce energy consumption by approximately 80% compared to existing lighting.

STX began the construction of diesel power plant in Iraq

STX Group began the diesel power plant construction project awarded by the Ministry of Electricity of Iraq in May.

STX held a ceremony at STX engine plant in Changwon, South Gyeongsang, on October 12 to mark the initial shipment of 24 units of 4MW diesel engine power sets that would be installed in the diesel power plants in Iraq, which was attended by Jung Dong-hak, President of STX Engine and STX Engine & Machinery Division of STX Heavy Industries, and Lee Chan-woo, President of Industrial Plant Division of STX Heavy Industries, and about 20 executives.

These diesel engine power sets were released from the plant on the same day were shipped out of Masan Port on October 20 and will arrive at the construction site in Iraq in November. STX plans to complete the delivery of remaining quantity by the end of this year in view of the overall construction period scheduled.

The construction of 900MW diesel power plant is the first phase in the project to build 2,500MW diesel power plants in Iraq. The 900MW plant will be built first in Diwaniyah, Karbala, and Missan in Iraq, the 3 regions with high electricity demand, and STX plans to complete the construction by June 2012.

Meanwhile, STX Heavy Industries received an order for 2,500MW diesel power plants worth KRW 3 trillion from the Ministry of Electricity of Iraq in May. Under this contract, STX Heavy Industries will construct 25 units of 100MW diesel power plants in all regions of Iraq which are plagued by constant electricity shortages and blackouts.

Jung Dong-hak, who is in charge of diesel engine power set production for this project, said, "With the shipment of engines which are the core parts of plants, STX has embarked on a project to build the diesel power plants in Iraq. We will redouble our efforts to win additional orders in the Middle East while successfully completing the project based on swift supply of engines and stable engineering technology."

The 1st diesel engine power set with an output of 4MW, released from Changwon plant of STX Engine

SSME increases its use of AVEVA Marine solution

AVEVA announced in late September that Sungdong Shipbuilding & Marine Engineering (SSME) extended its contract to push ahead with the design of commercial vessels.

The new licenses will be used in 4 shipyards located in Korea for the purpose of design and production of ships, including bulk carriers, containerships, and FSO (Floating Storage & Offloading).

SSME selected AVEVA as its key solution partner in recognition of its extensive expertise and experience in hull and outfitting solutions sectors, as well as the excellent overseas design of AVEVA solutions and suitability of production. Among other benefits are included SSME's legacy data protection and AVEVA's site engineering support team which is based in Busan. Through that, more responsive support will be available to customers.

An official from SSME mentioned, "AVEVA is a natural choice for any global company in carrying out shipbuilding and overseas projects like SSME. Our support for the design and production of commercial vessels has always been centered around AVEVA's solutions in our quest for growth. With SSME constantly expanding its business and increasing business efficiency, the expanded use of AVEVA Marine license will be pivotal in ensuring continued success of SSME."

Park Eun-joo, President of AVEVA Korea, remarked, "AVEVA Korea is a very important partner of SSME. AVEVA Korea is embracing the input of SSME to beef up our shipbuilding portfolio based on solid cooperative relationship. The integrated engineering and design of AVEVA enables interconnection of applications through object-centric system, improvement of project efficiency, and reduction of the engineering design and costs."

AVEVA Marine consists of unique engineering/design process for ships and overseas structures and integrated applications developed specifically for the generation of precise production information and design management.

FLIR Systems Korea held FLIR Customer Day 2011

FLIR Systems Korea announced that it successfully finalized 'FLIR Customer Day 2011' which was held at Spapia Hotel in Daejon on October 5.

FLIR Customer Day is an annual event that aims to present various practical examples applicable to industrial sites, allowing customers to enhance efficiency and save costs based on proactive maintenance and detection of defect.

In addition to the Infrared Training Center (ITC) of FLIR Systems, a series of practical examples were introduced throughout this event in relation to the application of thermal imaging in industry: thermal infrared imaging camera in the injection molding process at the Molding Technology Center of Korea Institute of Industrial Technology; fault diagnosis of electric power distribution/transmission facility at the Facility Diagnosis Center of Korea Electric Power Corporation (KEPCO); a study by the New Fashion Material Research Center of Seoul National University with regard to the far infrared clothes worn by human; the introduction of the stress measurement system using Dr. Pierre Bremond thermal imaging at FLIR Systems ATS; and the application of thermal imaging to the rail car fire at the Environment Friendly Technology Laboratory of Korea Railroad Research Institute.

'FLIR Customer Day 2011' of FLIR Systems Korea, held on October 5

This year, FLIR Customer Day 2011 attracted about 200 persons from related industries and research institutes, which reflects a growing interest in the thermal imaging camera.

HMD received Presidential Award in the 2011 Labor & Management Culture Award

Hyundai Mipo Dockyard (HMD) held a Presidential Awards ceremony, '2011 Labor & Management Culture Award', at Hanwoori Gymnasium at its Ulsan Headquarter on October 19.

On the same day, HMD received the Presidential Award from Lee Jae-pil, Minister of Employment & Labor, after being selected as the winner in the Labor & Management Culture Award organized by the Ministry of Employment & Labor and Korea Labour Foundation in recognition of its unrivalled and exemplary labor & management culture.

The Awards ceremony was attended by many eminent officials such as Lee Jae-pil, Minister of Employment & Labor, Ahn Hyo-dae, a member of the National Assembly, Choi Il-hak, Chairman of Ulsan Chamber of Commerce & Industry, etc, as well as about 2,000 officers and employees including Choi Won-gil, President & CEO of HMD and Kim Won-base, Chairman of HMD's labor union. The event which was held in a very friendly atmosphere began with the Pledge of Allegiance to the flag of Korea and to the republic for which it stands, followed by the replay of videos related to the harmony between the labor and management, history and procedures of Labor & Management Awards, presentation of commendations and trophies to each prize winner, congratulatory speech and welcoming address, three cheers for the continued harmony between the labor and management.

Winning this Presidential Award, the labor and management of HMD made a vow to exert themselves to promote co-existential labor and management culture essential for overcoming the challenges arising from uncertain business environment and economic fluctuations both at home and abroad and spurring the growth of shipbuilding industry which remains key to boosting the nation's export.

HMD was selected among many companies well-known for excellent labor and management culture through multiple layers of strict review process involving academic circles and labor experts.

HMD, the winner of 2011 Labor & Management Culture Award, will be granted financial benefits, such as exemption from regular labor inspection for the next 3 years, deferment of tax audit, advantage in the eligibility processing of suppliers for the government procurement, and loans at favourable conditions and preferential interest rates, etc.

HMD received the Presidential Award as the winner of 2011 Labor & Management Culture Award. The photo shows Kim Byeong-oh, Managing Director, Choi Won-gil, President & CEO, Lee Jae-pil, Minister of Employment & Labor, Kim Won-base, Chairman of labor union, and Han Seung-chul, Executive Vice Chairman (from the left).

Rolls-Royce won first order for award-winning Environship

Rolls-Royce received its first order for vessels based on the Group's award-winning, highly efficient, Environship concept. Rolls-Royce will design and provide integrated power and propulsion systems for two technologically advanced cargo vessels, which were purchased by Norwegian transportation company, Nor Lines AS.

These highly efficient ships incorporate a striking wave piercing bow, world leading gas powered engines and an innovative Promas propulsion system, which combined, significantly improve the overall performance of the vessel - increasing fuel efficiency by up to 18%. It also provides numerous environmental benefits, including the virtual elimination of SOx and reduction of CO_2 emissions by more than 40% compared to similar conventional vessels.

The two Rolls-Royce NVC 405 cargo vessels will be built at the Tsuji Heavy Industries ship yard in Jiangsu, China. The vessels will enter service from October 2013, operating along the West Coast of Norway.

Toralf Ekrheim, Nor Lines, CEO said, "We have had a fruitful cooperation with Rolls-Royce for more than two years, developing vessels that are tailor made for our trade and incorporate the latest award-winning energy saving and emission reducing features."

Oddbjørn Eliassen, Rolls-Royce, President - Merchant said, "The Environship concept is a transformational development for merchant shipping, offering significant reductions in fuel burn and emissions, as well as enhanced performance at sea.

"This order demonstrates that customers are embracing more environmentally friendly ship designs and technology.

Rolls-Royce is best placed to provide ship designs and integrated power and propulsion systems that deliver tangible improvements in operational efficiency and ship performance, along with a significant reduction in environmental impact."

The contract is for two ships, and includes options to build an additional two vessels of the same design. Rolls-Royce is already using the Environship concept to develop a wide range of other efficient ship designs, including passenger ferries, chemical tankers, gas tankers, bulk carriers, and superyachts.

Core elements of Environship are as follows:

-The Rolls-Royce Environship concept, received the prestigious Next Generation Ship Award at this year's NorShipping event in Oslo, Norway.

-The Rolls-Royce Bergen B-Series lean burn gas engines, as used in the Environship, emit around 17 per cent less CO_2 (per unit of power) than a diesel engine.

-The use of gas fuelled engines means that NOx emissions are reduced by about 90 per cent while SOx emissions are negligible.

-These emissions are already within the limits of IMO Tier III environmental legislation, due to come into force in 2016.

-The Rolls-Royce Promas propulsion system is an integrated rudder and propeller, which alone improves efficiency of the vessel by 5 to 8 percent.

-The new innovative bow shape and hull form, designed by Rolls-Royce, also reduce resistance by up to 8 percent, therefore reducing fuel burn and emissions further.

-The vertical bow shape enables the vessel to maintain speed even in rough seas enabling operators to achieve demanding shipping schedules without the need to burn additional fuel to make up lost time.

HHI accelerates into offshore market with its HiMSEN engine

Hyundai Heavy Industries (HHI) is making inroads into the offshore facility market with its HiMSEN engine after entering the markets for engines used for the propulsion of ships and onshore power generation.

HHI announced on October 19 that it successfully completed the Type Approval Test of high output HiMSEN engine (model name: 16H32/40V) which ran at an inclination of 25 degrees in the presence of officials from the Norwegian classification society DNV at the Engine Technology Center of its Ulsan headquarters.

This engine is high output model ranging from 6,000kW to 10,000kW, fitted to offshore facilities such as drillship semi-submersible rig, etc. HHI invited the officials of major shipyards to the demonstration session held at its headquarters upon completion off the aforesaid Inclination Type Approval Test.

Particularly, this Inclination Type Approval Test verified the durability and operability of engine parts at a steep inclination of 25 degrees in view of the high tide and harsh marine environment, unlike the test of engines - used for the propulsion of ships and onshore power generation - which is usually performed at an horizontal angle.

HHI independently designed entire processes for parts development and auxiliary equipments to ensure normal operation of engine even in extreme environments like the North Sea where the pounding waves as high as 20m make work extremely difficult.

An official from HHI said, "With the successful completion of this Inclination Type Approval Test, HiMSEN engine proved its reliability and will play a key part in our winning orders for offshore projects."

So far, engines fitted to offshore facilities such as drillship had to meet stricter quality requirements compared to those mounted on commercial ships. Therefore, the market for marine facility engines was dominated by MDT of Germany, Wartsila of Finland, and Caterpillar of the United States.

This year, HHI has shown strong performance in the global offshore facility market, winning orders for 104 units of HiMSEN engines which will be installed on board the drillships of global drilling companies such as the U.S.A-based Diamond Offshore Drilling, Noble Drilling, etc.

HiMSEN engine is the nation's first indigenous engine developed by HHI in 2000. HHI has exported approximately 6,700 units of engines - used for the propulsion of ships and onshore power generation - and auxiliary engines to about 40 countries worldwide, and gained reputation for its excellence in technology.

HHI successfully completed the Inclination Type Approval Test at the Engine Technology Center of its Ulsan headquarters recently.

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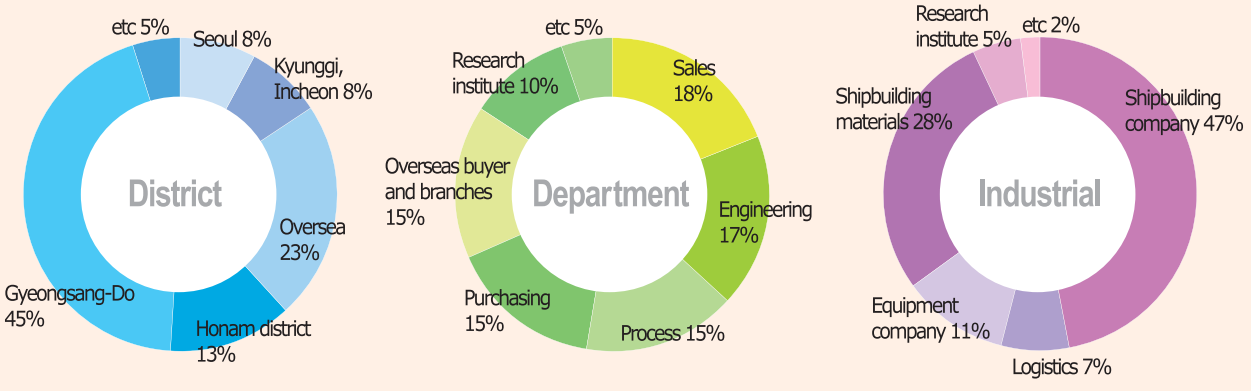
Detailed area breakdown



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Oil tanker market to recover in 2015

Shipbuilding industry is showing strong performance on the back of robust growth in the market for LNG carriers and offshore facilities. However, other sectors such as oil tanker, product carrier, bulk carrier, etc, are still struggling. The underlying cause is the overcapacity created from 2007 onwards.
Among others, the overcapacity glut in the market for oil tankers, the vessel transporting the crude oil, is expected to worsen as a massive quantity of newbuilds are scheduled for delivery to shipping companies by 2013. The industry speculates that the oil tanker market will recover from 2015 when the demand for oil is expected to rise in emerging economies.
Recently, Yang Jong-seo, a researcher at Korea EXIM Bank Overseas Economic Research Institute, published a report based on the trend of the oil tanker, shipping, and shipbuilding markets and the data released recently by IEA and BP, which provides an insight into current conditions of the oil tanker market and mid and long-term changes for the years to come.

Photo: Maersk

The market for oil tanker, a type of vessel transporting crude oil, is staying weak amid declining demand for oil worldwide. International Energy Agency (IEA) forecast in its report on a long-term outlook that the demand for oil would be diminished in view of the demand for renewable energies. Accordingly, the shrinking demand for oil is expected to have an impact on the shipping industry.

Trend and outlook of oil market

According to BP's estimate, global consumption of oil dramatically increased in 3 years as a result of economic recovery in 2010 and base effect on the global economy which remained mired in a deep recession in 2009. The global oil consumption increased 3.1% year-on-year to 4.03 billion tons in 2010, and the oil consumption growth remained vigorous

Table 1. Growth in the oil consumption among major countries between 2009 and 2010

(Unit: %)

	2009	2010
U.S.A.	-4.9	2.0
U.K.	-4.3	-1.0
Germany	-4.0	-1.0
France	-4.5	-4.7
Japan	-10.7	1.5
China	6.7	10.4

Source: BP

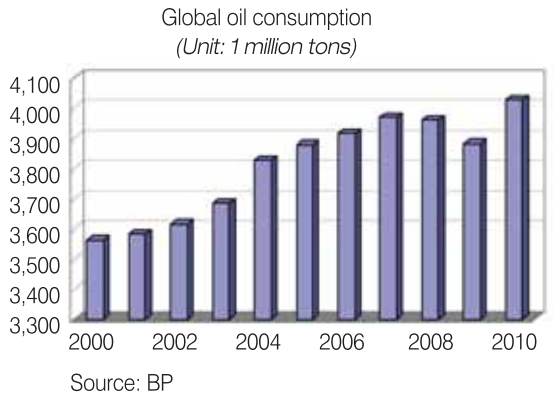


Fig. 1 Trends in global oil consumption

in several developed countries in sharp contrast to previous years.

Despite the remarkable growth in oil consumption in 2010, the global oil consumption grew by an annual average of only 0.5 to 1.1%. BP predicted that the oil consumption would decrease by an annual average of 0.3 to 0.8% in the North America and 0.08 to 0.6% in Europe by 2030. Asia and Middle East are expected to see an increase in oil consumption by approximately 1.4 to 2% over the long-term and become the epicenter of the growth in global oil demand and the largest oil consumers in the period ahead.

In the World Energy Outlook (WEO) published in November 2010, IEA predicted that the oil consumption growth would slow down over the long-term. Based on the existing neutral scenario, global oil consumption was predicted to grow by an annual average of 0.8%. The new scenario, which reflects the G-20 countries' recent policy on renewable energies, estimates that the oil consumption would grow by an annual average of 0.5% over the long-term.

Current shipping market conditions for oil tankers

The global import of oil increased 10% year-on-year in 2010 (from 2.6064 billion tons in 2009 to 2.6335 billion tons in 2010). The oil import has shrunken only in Europe (665.3 million to 596.3 million, a decrease by 10.3%), while oil import has climbed both in the United States (from 564.9 million tons to 577.1 million tons, an increase by 2.2%) and Japan (from 211.8 million tons to 225.7 million tons, an increase by 6.6%).

According to the Clarkson's Oil & Tank Trade Outlook, the global oil import is expected to rise by approximately 3% in 2011 compared to the previous year, and resultantly, demand for oil tankers is expected to grow by about 2.7%.

The oil tanker freight rates remain low due to the overcapacity. The Worldscale (WS) index, representing the levels of freight rates, shows that the rates in 3 segments of VLCC, Suezmax, and Aframax class show similar trends and rose in 2010 before plummeting in the second half of 2011.

Table 2. BP's outlook of annual increase in oil consumption over the long-term

(Unit: %)

	2010-2015	2015-2020	2020-2025	2025-2030
North America	0.024	-0.361	-0.495	-0.707
S&C America	2.016	1.886	1.490	1.324
Europe & Eurasia	0.006	0.082	0.147	0.632
Middle East	2.494	2.032	1.639	1.005
Africa	1.625	1.717	1.767	1.815
Asia Pacific	2.150	1.884	1.659	1.453
World	**1.126**	**0.931**	**0.795**	**0.551**

Source: BP, BP Energy Outlook 2030

In July 2011, the freight rates for VLCC between Saudi Arabia and South Korea fell by 14.3% compared to the same period of previous year, while the freight rates for Suezmax class oil tanker between Nigeria and Eastern part of United States decreased by 15.2%. Meanwhile, the freight rates for Aframax class oil tanker between Egypt and France declined by 25.2% compared to the corresponding period of previous year.

Mid and long-term outlook of oil tanker market

Outlook of VLCC market

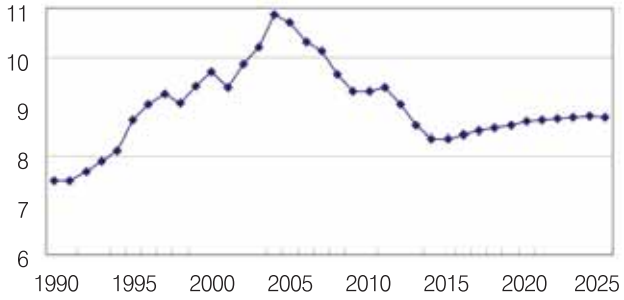
The shipping market is faltering amid the massive deliveries of newbuilds ordered during the boom years.

The global oil cargo volume is expected to climb by about 2.7% in 2011, but is likely to slow down amid uncertainty in the economic outlook of the United States and Europe. As a large quantity of newbuilds are being added to the existing tanker fleets, the growth in the capacity of VLCC fleets and Suezmax class tankers is expected to climb by an annual average of 6.3% and 9.2%, respectively, which is much faster than the growth in the cargo traffic volume. The capacity of Aframax class tanker is expected to increase by an annual average of 3.1% during the same period, which does not surpass the capacity growth rates of large vessels. The growth in capacity, however, has outpaced the growth in maritime cargo volumes, which will weaken the shipping market. Furthermore, it will be difficult to artificially improve the market conditions as the phaseout scheme for tankers - based on the scrapping or remodelling as per the dual hulled tanker regulations - has been almost completed.

The cargo traffic volume-capacity ratio is expected to be aggravated by 2014 and it will be difficult to anticipate an improvement for the time being. The overcapacity is expected to be aggravated until early 2014 as the orders are scheduled for delivery by 2013. The overcapacity may be alleviated from 2014 on the assumption that the newbuilding orders remain flat by 2012.

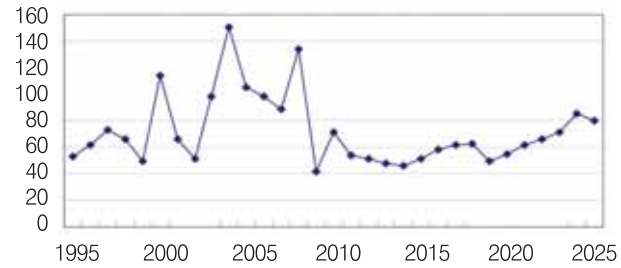
The shipping market is not expected to rebound fast due to the orders scheduled for delivery, constraint in the growth of oil cargo traffic, and few number of ships to be scrapped, even if the cargo traffic volume-capacity ratio improves after 2014.

The freight rates are expected to decrease until 2014. The worsening overcapacity will result in declining freight rates



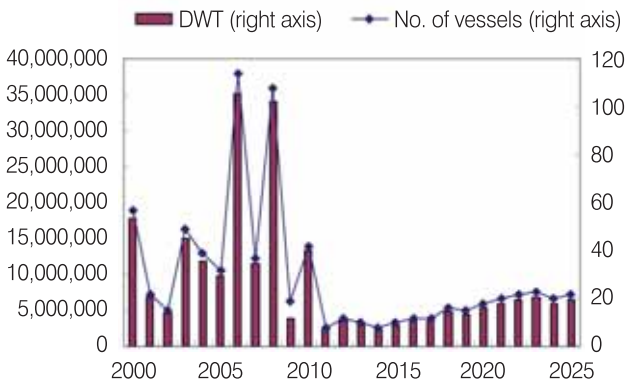
Source: Estimation of the Industrial Investment Survey Dept. of Korea EXIM Bank Overseas Economic Research Institute

Fig. 2 Trend and outlook of cargo traffic volume-capacity ratio for VLCCs



Source: Estimation of the Industrial Investment Survey Dept. of Korea EXIM Bank Overseas Economic Research Institute
Note: Based on 260K WS between Saudi Arabia and Ulsan

Fig. 3 WS trend and outlook of VLCCs



Source: The past data is based on Clarkson's data, and the forecast is based on the estimation of the Industrial Investment Survey Dept. of Korea EXIM Bank Overseas Economic Research Institute

Fig. 4 Outlook of new orders for VLCCs

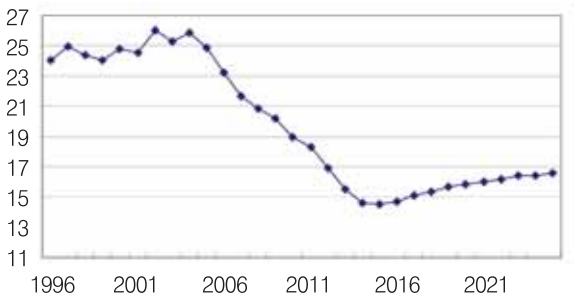
until 2012. Thereafter, the freight rates will recover only at a slow pace.

The global new orders for VLCC, which have fallen steeply since 2011, are expected to remain flat for several years to come. The newbuilding orders are likely to stagnate for a long time ahead before the overcapacity glut in the oil tanker market - where the cargo traffic volume growth is outpaced by the capacity growth - is resolved. It will be difficult to anticipate orders for more than 20 ships yearly before 2020. However, the overcapacity may worsen and the market will be victimized as a consequence if overseas shipping companies or Chinese shipping companies backed with the Chinese government support for Chinese shipyards place a massive quantity of orders.

Outlook of Suezmax class market

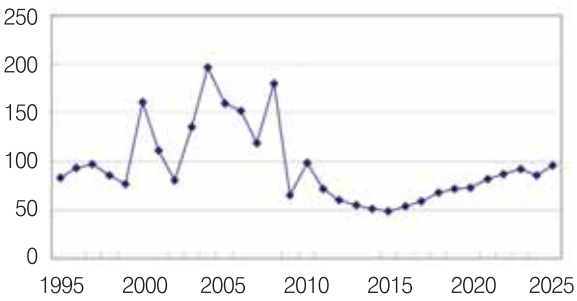
The current market conditions for Suezmax class tankers are not different very much compared to those for VLCCs. The market for Suezmax class tankers are expected to show signs of bottoming out in 2014 or 2015, but will not rebound fast unlike the market for VLCCs. As the orders have begun to be delivered in large quantity since 2009 and the deliveries will continue into 2013, the overcapacity will loom larger.

The cargo traffic volume and capacity of Suezmax class tankers will show a trend similar to that of VLCCs. The market for Suezmax class tankers is expected to recover, albeit slowly, after 2015. The key factor may be the extent of order can-



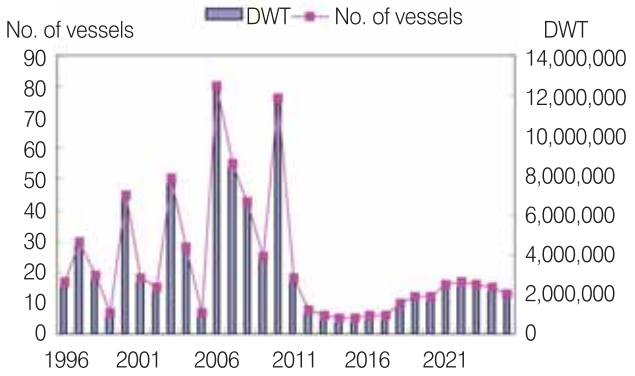
Source: Estimation of the Industrial Investment Survey Dept. of Korea EXIM Bank Overseas Economic Research Institute

Fig. 5 Trend and outlook of cargo traffic volume-capacity ratio for Suezmax class



Source: Estimation of the Industrial Investment Survey Dept. of Korea EXIM Bank Overseas Economic Research Institute
Note: Based on 130K WS between West Africa and eastern part of United States

Fig. 6 WS trend and outlook of Suezmax class



Source: The past data is based on Clarkson's data, and the forecast is based on the estimation of the Industrial Investment Survey Dept. of Korea EXIM Bank Overseas Economic Research Institute

Fig. 7 Outlook for new orders for Suezmax class oil tankers

cellations or delay in delivery because the overcapacity is the underlying cause of the worsening balance between the supply and demand, rather than the sluggish growth in cargo traffic.

The freight rates will begin to recover from 2015, but any sharp increase is unlikely. The freight rates for Suezmax class tankers will rise only slowly after 2015 like those for VLCCs, and remain low until 2025.

As new order volumes for Suezmax class tankers are expected to show a pattern similar to those for VLCCs, about 15 Suezmax class tankers are likely to be ordered yearly over the long-term. Global new orders for Suezmax class tankers are not expected to exceed 10 units until 2017. However, the demand for Suezmax class product carriers is rising recently, and therefore new orders for product carriers are expected to climb despite the order drought in the oil tanker market.

Outlook of Aframax class market

The market for Aframax class tankers is worsening due to the problems similar to those faced by the aforesaid 2 types of large vessels, and is expected to bottom out between 2014 and 2015. With the supply in the Aframax class tanker market being expected to shift downward sharply in 2013, the Aframax class tanker market is likely to resolve the issue of overcapacity faster than the markets for large oil tankers. For that, the uncertainty in the European market is the key factor as a number of countries in Europe are large importers of crude oil shipped in Aframax tankers. However, the declining demand for oil in Europe will make the prospect of a quick recovery in the shipping market even less probable, even if the European economy recovers.

The cargo traffic volume-capacity ratio for Aframax class tankers is expected to improve slowly after the Aframax class tanker market experiences a prolonged period of sluggishness. The balance between the supply and demand will improve during the period between 2013 and 2015, but the market is likely to recover only slowly due to the falling cargo traffic volumes.

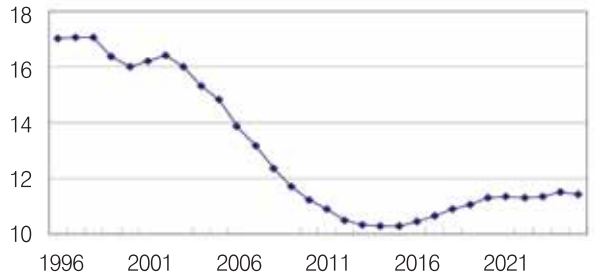
The freight rates remain flat, just like in other markets, and is expected to recover slowly from 2014.

Global new orders for Aframax class tankers are also expected to stagnate for several years to come, like other types of tankers, and about 20 Aframax class tankers are expected to be placed worldwide only after 2018. However, new orders for Aframax product carriers are likely exceed those for Aframax oil tankers.

Conclusion

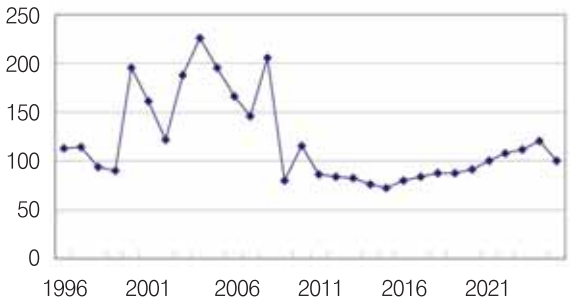
The shipping market for oil tankers is expected to experience a prolonged period of stagnation as a result of the long-lasting sluggishness in the growth of cargo traffic volumes and excessive number of orders placed over several recent years, and will recover from around 2015.

The cargo traffic volume is unlikely to climb fast even when the market begins to recover. Furthermore, the recovery will



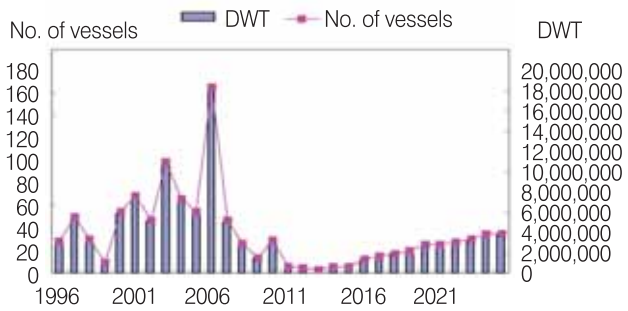
Source: Estimation of the Industrial Investment Survey Dept. of Korea EXIM Bank Overseas Economic Research Institute

Fig. 8 Trend and outlook of cargo traffic volume-capacity ratio for Aframax class



Source: Estimation of the Industrial Investment Survey Dept. of Korea EXIM Bank Overseas Economic Research Institute
Note: Based on 80K WS between Egypt and France

Fig. 9 WS trend and outlook of Aframax class



Source: The past data is based on Clarkson's data, and the forecast is based on the estimation of the Industrial Investment Survey Dept. of Korea EXIM Bank Overseas Economic Research Institute

Fig. 10 Trend and outlook of new orders for Aframax class oil tankers

be slow because the average age of ships which has become younger over the last few years makes it difficult to adjust the balance between the supply and demand.

The market for tankers below the Suezmax class - which can be remodelled into or used as product carriers - holds a prospect for an improvement in conjunction with the conditions of oil refining or chemical and other industries. However, somewhat careful approach is necessary to be taken in making investment in large tankers such as VLCCs.

The market may recover from around 2015 on the assumption that only a minimum quantity of vessels is ordered until 2014. However, the market conditions may worsen if Chinese shipping companies place a large quantity of orders in the period ahead. The bulk carrier market is plagued by overcapacity glut created by China's reckless investment, and consequently, there is not much room for newbuilds. Chinese government which supports domestic shipyards needs to explore a way out of this situation. Oil tanker may be the key to tackling the difficulties. The shipping industry may have to confront even more serious situation arising from a steep rise in demand if Chinese government leads the state-run shipping companies to place more orders for oil tankers, instead of bulk carriers that have low demand.

In that case, Chinese shipyards may secure the volumes in the short-term, but foreign shipping companies' share in China' crude oil cargo traffic volume will decrease, and resultantly, there will be a glut of ships on the marks around the globe.

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Duon System

Duon System (hereinafter referred to as "Duon"), a leading provider of measurement solutions for DCS (Distributed Control System) and successfully performed more than 70 projects since May 1989. With this experience, Duon started to develop Autrol smart transmitter after 1996 year, which is the core part of field instruments in the market.

'Autrol' with global reach

Duon has focused on developing pressure, temperature and Guided Wave Radar (GWR) transmitter with the high technology of Smart type differential and gauge pressure transmitter, the core part of field instrument technology that it named 'Autrol' series.

An official from Duon explained, "Brand name Autrol, which is manufactured by Duon, has been revolutionizing the global industries and harmonizing with all sorts of field instruments."

Specifically, Duon has performed more than 300 projects all over the world providing the reliable quality and improved technology of Autrol series and they have been certified by international organization certificates such as ISO 9001, CE, FM, ATEX and others.

Duon's Autrol Smart Transmitter series for differential, gauge, temperature, level products have been performed all kinds of plants such as thermal, paper, water treatment, food & beverage, energy, alternative fuel, gas, oil, nuclear and other industries that need to measure pressure with high accuracy and run sorts of Type Approval Tests.

The series of Autrol are classified by function of the transmitter as APT3100, APT3200, ATT2100, ATL-6100.

-APT3100 series for measuring differential, gauge, flow (DP type) and absolute

-APT3200 series for measuring gauge and absolute

-ATT2100 series for measuring temperature

Pressure transmitter APT3100 MP and LFC type

Pressure transmitter
APT3200 ordinary and
LFD type

GWR coaxial and rod type

The basic features of these products can be summarized as follows:

-Accuracy: +/-0.075%, +/-0.04% (Optional as special)
-Output signal: 4 to 20 mA (Two-wires) with HART
-Engineering units: Everything what user wants to indicate on LCD
-Damping time: 0.25 to 60 sec
-Automatic compensation of ambient temperature
-Setting various parameters: Zero/span, Fail-mode, Unit, Trim, etc
-Self diagnostic function: Sensor, A/D converter, memory, power, etc
-Button function: All parameter without HHT (Hand Held Terminal)
-Long term stability

Autrol Smart Pressure Transmitter, the flagship product of Duon, is a micro processor-based high performance transmitter, which has flexible pressure calibration and output, automatic compensation of ambient temperature and process variable, configuration of various parameters, communication with HART protocol.

All data of sensor (Tag No., type, range etc.) is to be input, modified and stored. HART communication can be Max 1.5km. In Multi-drop Mode, Max 15 transmitters can be connected and communicated with Host.

Duon's Autrol Smart Transmitters have performed all sorts of applications at more than 45 countries successfully with high class of international quality systems in field along with universal protocol, international certificates and regulations. In relation to that, an official from Duon explained, "The results have satisfied end-users and we are very proud of both Duon and Korea instrument market because no one had a result like Duon for Autrol Smart Transmitter in Korea."

Duon in marine, vessel, offshore industries

There are some important points where Smart transmitter is installed in vessel.

Ships are divided into commercial ships (tanker, cargo, LNG carrier, LPG carrier, etc.) and special service vessel (drillship, ice-breaking ship, etc). Generally, ship is equipped with various facilities such as engine, boiler, cooling system, ballast system, etc. The automation of power supply and measurement facilities are essential for the operation of ship, and Smart type measuring instruments which provide high accuracy and self-diagnosis capability ensure stability and efficiency in power supply, instrumentation, and control operations.

An official Duon emphasized, “Smart transmitter is interworking with the asset management system via HART Protocol, providing various advantages in maintenance, repair, and installation at the field.”

Regarding LNG carriers, LNG is transferred to the land-based location and stored in the storage tank after being collected at the gas field in deepwater and liquefied. At this time, special facilities are operated to prevent possible loss of LNG during the process of liquefaction, transport, and storage. It is absolutely advantageous to use high precision measuring instruments to ensure accuracy in the maintenance of factors that may affect the quality such as the temperature, pressure, and other conditions related to various facilities used for aforesaid storage and operation.

Having acquired the certifications related to the test and coating standards which aim to address the problem of the corrosion on the external surface of offshore facilities due to the salt, Duon can fulfill various requirements of customers and application.

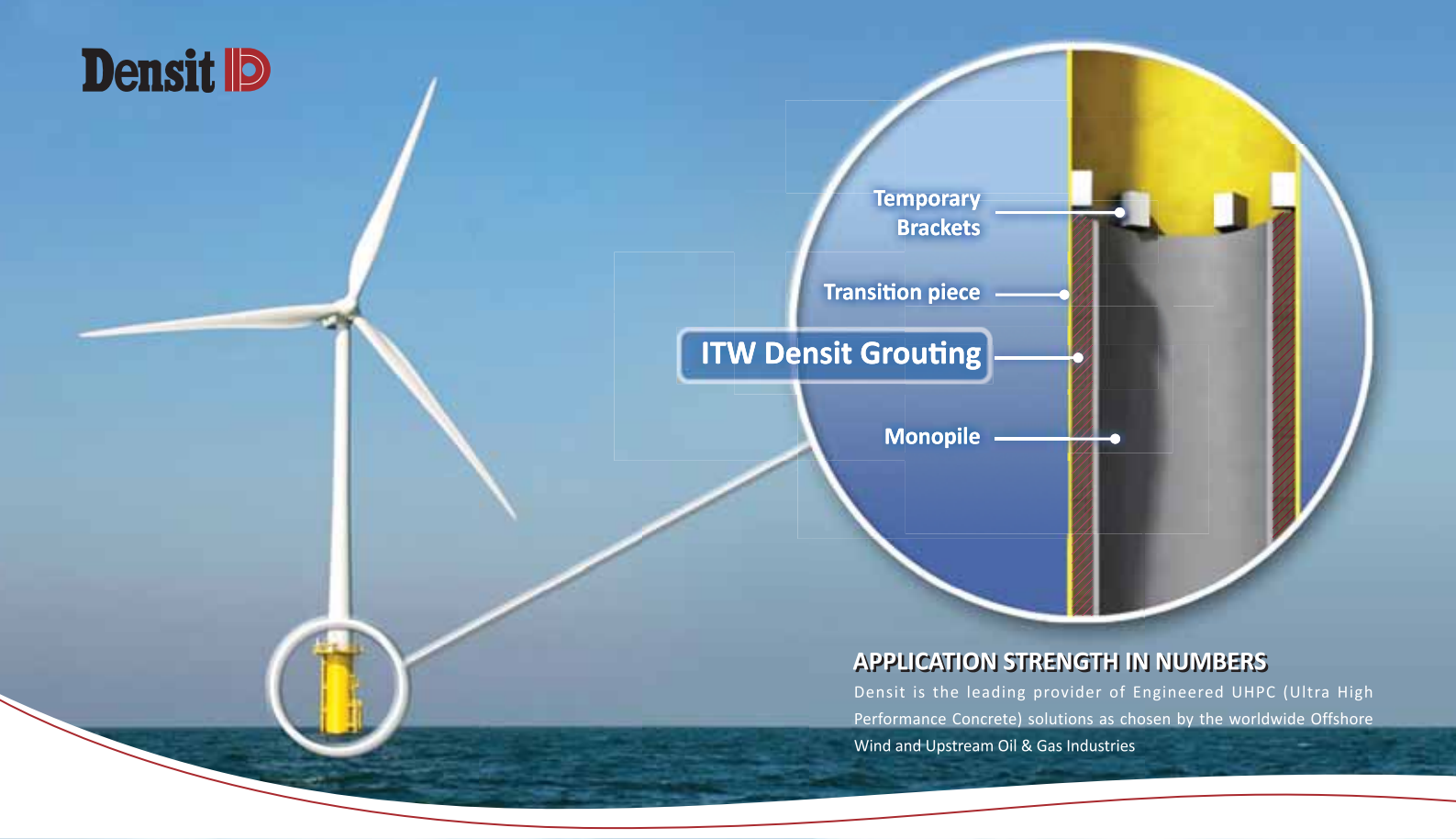
Recently, most of the transmitters, installing in vessel, are only possible to calibrate the unit with tangible pressure after installation at the field. However, Autrol doesn’t need to calibrate the unit at the field and it doesn’t need to calibrate with tangible pressure after installation. User just changes some parameters without tangible pressure if the user wants to change measuring range or other configurations. All these things are possible to be done because it is Smart transmitter and results come with efficient work at the field.

For those kinds of the purpose, most field instruments are required by high accuracy and long term stability. Autrol series are able to apply those requirements with better points of view such as fast response, fast shipments, reliable performing and competitive price.

Recently, Duon achieve LR, DNV, BV, ABS for marine, vessel, offshore plant. Duon sure that with certain certificate will improve the instrument as if Duon does inland projects.

An official statistics from Duon said, “We, as the finest transmitter manufacturer, can assure customers that Autrol Smart transmitters will definitely take their business to the next level.” And emphasized, “Harmonizing with Autrol Smart Transmitter will give customers trust partnership based on reliable technology.”

Densit



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KR's new and renewable energy business

Global warming and climate change are becoming increasingly more urgent to address. Green-house gasses caused by burning fossil fuels are thought to contribute towards global warming and KR is taking its environmental responsibilities extremely seriously.

Global warming and climate change are becoming increasingly more urgent to address. Green-house gasses caused by burning fossil fuels are thought to contribute towards global warming and KR is taking its environmental responsibilities extremely seriously. Part of its work involved searching for renewable energies of the future and to develop technologies that will enhance corporate social and economic responsibility. In March 2009, KR made and expanded its Energy & Industry Team to become an Energy and Environmental Business Center (EEBC) and in March 2011, changed its name to a Green & Industrial Technology Center (GITC) comprising three teams to drive this new sector forward. The three new teams are: New and Renewable Energy Team, Environment and Plant Team and New Growth Technical Support team.

New and Renewable Energy Team

The New and Renewable Energy (NRE) Team focuses on the process of evaluation and certification of the use of new and renewable energies such as those derived from wind, ocean and fuel-cells. The team has registered as a government recognized evaluation and certification organization. It is shortly expected to launch international certification services accredited by KAS (Korea Accreditation System) to operate as a product certification body for wind turbines. The increasing growth of the offshore wind energy sector has caused the NRE team to update and published KR's "Technical Guidelines for Offshore Wind Turbines" which was first published in 2008. The team will actively participate in projects that develop large offshore wind turbine sites within Korea and beyond.

Using its wide knowledge, experience and accumulated technical knowledge for offshore wind turbine systems, KR has now been designated as the main certification body for the Jeollanam-do 5GW wind farm project. The society is also in discussion about taking the certification lead for a 2.5GW wind farm which will be developed by the Ministry of Knowledge and Economy. Also last year, KR signed MOUs with a European wind turbine manufacturer and wind farm developer KORWIND, and also with a developer of wind

farms in Japan where no wind turbine certification body currently exists. In addition, KR signed a further MOU for certification and technological cooperation with NREL (National Renewable Energy Laboratory) which is a well known, leading renewable energy research institute operating under the US DOE (Department of Energy). KR has also received a Letter of Intent from DEWI - a top-class performance evaluation body.

Maintaining pace with developing technology, KR has launched SWB (Smart Wind Blade) - wind turbine blade design and evaluation software and SESWIND - wind turbine system structure analysis software. These programs are enjoying a wide use and good reputation from experts in the wind turbine industry. With continued effort and technological development, KR expects to become Korea's base for the development of the wind turbine industry and the strengthening of national competitiveness in this sector.

Throughout 2010, the NRE team has been developing a system certification process for ocean energy generation facilities. This has included the production of technical guidelines for tidal, wave and ocean thermal energy conversion. The team is actively participating in IEC TC 114 for international standards, and has proposed two NPs (New Work Item Proposals) to have a leading position in future IEC TC 114 discussions.

As one of the driving technologies of a future hydrogen society, fuel-cells are expected to be used in electricity generation, transportation, for household use and as a new energy source for ocean vessels.

KR published technical guidelines for the safe use of fuel cells in ships in 2010. The society is currently developing fuel-cell technologies for auxiliary power, emergency power, cogeneration and main propulsion for ships. This is being achieved through education programs and by conducting a national research project titled "Technology development of system design and performance evaluation of fuel-cells for ships." With this technical superiority of R&D and rule building, KR will soon become a world renowned certification body for fuel-cell use for land and marine activities.

Environment and Plant Team

KR's Environment and Plant Team (EPT) is working on a series of environmental issues aimed at assisting to reduce the impact of climate change and to contribute to sustainable development for future generations. In 2009, the team

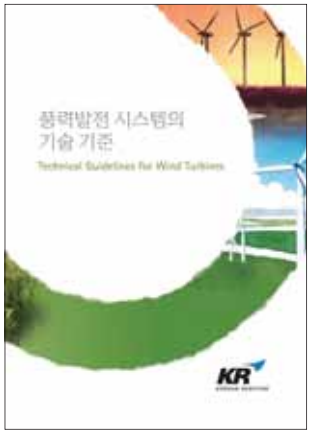
KR entered into an agreement on August 2010 with KORWIND, a German wind farm development company run by a Korean entrepreneur, on cooperation in the certification for wind turbine generators and technical collaboration.

became recognized as an appointed organization for "Emission Trading Trial Business" by the Korean Ministry of Environment. In this role, the team has verified the objectivity and accuracy of greenhouse gas emissions from the various participants active in the emission trading scheme. For the internationally approved verification skills, the EPT team is shortly expected to be accredited as CDM DOE (Designated Operational Entity) by UNFCCC (United Nations Framework Convention on Climate Change) to conduct validation and verification/certification of CDM projects.

This will allow the team to contribute to international issues such as the mitigation of climate change by UNFCCC as well as Korean greenhouse regulation in terms of the national vision, "Low Carbon Green Growth" and a 30% reduction of greenhouse gases by 2020.

Currently, there is no obligation for shipping to reduce greenhouse gasses but IMO's MEPC (Marine Environment Protection Committee) is currently debating this important issue which is high on the agenda of regional authorities, such as the EU as well as NGOs and all responsible ship operators.

To actively contribute to the sustainable development of the shipping industry, the EPT team is conducting research into various greenhouse gas reduction schemes such as the EEDI (Energy Efficiency Design Index), the EEOI (Energy Efficiency Operational Indicator) and the SEEMP (Ship Energy Efficiency Management Plan). In addition, the strategy and the effect analysis of MBI (Market Based Instruments) in the shipping industry are being scrutinized and developed



"Technical Guidelines for Offshore Wind Turbines" published by KR

with the industry through various seminars and consultations. Since 2009, the team has been working on the verification of greenhouse gas inventories of large corporate bodies.

The regulation of volatile organic compounds (VOCs) is based on the amendment to MARPOL Annex VI. From May 2009 it has become mandatory to install a VOC treatment system in cargo loading terminals that are likely to emit VOCs. KR has published technical guidelines to inspect and certify VOC treatment systems and, last year, conducted inspected systems in four major ports. KR is also developing related technology for the project titled "Development of Ship Vapor Recovery Unit and use of recovered product as fuel" for which KR is designated as main project facilitator by the Korean Ministry of Land, Transport, and Maritime Affairs. This is a significant government driven project which is funded at 10 billion Korean won over the next five year period.

The EPT team is also developing third-party inspection services for inland and offshore plants. For petro-chemical inspection in the Middle East region, KR has registered as a third-party inspector for Qatar Petroleum (Qatar National Petroleum Company) in cooperation with Moody International. The society is also recognized as the only third party inspection organization in Korea by KOGAS and is undertaking projects for Korean Public Procurement which has also designated KR as a specialized inspection organization.

New Growth Technical Support team

The New Growth Technical Support (NGTS) team is developing the support of new technologies in the energy and environmental sectors by growing base technologies for certification. The team has created exclusive tools for design evaluation and analysis for the certification of wind and ocean energy. It is currently engaged in a number of professional consulting projects such as "System design and evaluation of Multi-MW scale floating type wind turbines", "Design and evaluation of blades for 5 MW offshore wind turbines", and "Design and evaluation of tower structures for offshore wind turbines".

As environmental issues gain more prominence, the use of Carbon Capture and Storage (CCS) technology in ships to reduce greenhouse gas emissions is receiving more attention. The NGTS team is developing core technology and common codes in association with other classification bodies to make these technologies become more applicable to the marine environment and to support interested companies obtain certification. Examples of related projects include: "Design technologies of optimal arrangement of CCS system in ships", "CCS process system development", "Heat recovery technologies for CCS capture", "Integrated operation and management system for CCS ships", "Risk assessment and safety technologies" and "Monitoring and control system for pollution material emission".

KR's ocean energy experts are currently establishing international standards for ocean energy plants by participating in each working group of TC 114 as the official representatives of Korea. KR made a significant contribution by hosting the second TC 114 meeting in 2009 as the secretary organization of Korea, and has also proposed international standards for ocean thermal plants and mooring system of ocean energy platforms. In early 2010, KR announced its NOVA Green Ship initiative which focuses on new energy sources derived from technology integrations of renewable energies, environment and plant. These new and developing technologies are designed to maximize energy efficiencies and reduce pollution and will greatly assist Korea's shipbuilding industry.

Fossil fuel driven main engines will be replaced with fuel cell systems using hydrogen power and electric propulsion systems. A new ventilation concept discharges the air inside of the hull using natural wind created by the ship's propulsion will save energy and produce electricity using a wind power turbine. In addition, the NOVA Green Ship will improve energy efficiency from the recovery of waste energy and recycling using energy recovery ventilators in boiler rooms and ORC (Organic Rankine Cycle) in cooling systems. Additional energy will be created by small hydropower plants and photovoltaic power plants inside and outside of the hull.

KR's GITC is taking the lead to find the new energies of the future and will continue to broaden its business fields through developing renewable energy technology. This will assist in securing energy sources for the future and reducing greenhouse gas emissions.

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SolidWorks Innovation Forum 2011, held for 2 days on October 6 and October 11, respectively

SolidWorks 2012, a design solution driving business success

Dassault Systèmes SolidWorks unveiled 'SolidWorks 2012', the 20th release of CAD software enhanced with new functions since the 1st release in 1995, in a press conference held on October 6. Dassault Systèmes SolidWorks stressed that the enhanced capabilities of SolidWorks 2012 would help create an environment to transform technological innovation into business growth.

Dassault Systèmes SolidWorks (hereinafter referred to as "SolidWorks"), a leading supplier of 3D CAD technology, held a press conference on October 6 to introduce 'SolidWorks 2012', the 20th release since the 1st release in 1995

In the press conference, SolidWorks unveiled the enhanced capabilities of SolidWorks 2012, a comprehensive design solution to drive business success and enable the integration of design and engineering.

Constant innovation for customers

SolidWorks, first released back in 1995 as 'SolidWorks 95' is rooted in relentless and user-friendly innovation, simplifying complex design processes, and thus has become an industry standard.

During the press conference launched to mark the release of the 20th SolidWorks, a discussion was held with regard to SolidWorks 2012, a new version, which delivers design solutions for business success, along with the review of CAD software products that SolidWorks introduced thus far.

Simon Booker, SolidWorks Marketing Manager for Europe and Asia, who attended the press conference, said, "SolidWorks puts the ideas of users above all else. We have pressed ahead with innovation for products by constantly embracing customers' input and simplifying complex processes. We have expanded investment in channels to cement our leading position in the market and is currently focusing on expanding 3D CAD market."

Lee Young-kwon, Country Manager of SolidWorks, said, "This 20th release reflects the commitment of SolidWorks, an unrivalled leader in the 3D CAD software market, to relentless innovation for customers." He stressed, "The Solid Works 2012 enables design processes that drive business success and is the best product that enables integration of design and engineering, helping domestic customers attain innovation and success."

Enhanced capabilities of SolidWorks 2012

The SolidWorks 2012 version, released this time, provides

A press conference held on October 6 to introduce new functions of SolidWorks 2012

Simon Booker, SolidWorks Marketing Manager for Europe and Asia, who attended the press conference

more 200 enhanced functions, including automated design functions for productivity, continuous workflow through improved performance and quality, significant improvements to overall product development processes, and extended support for collaboration and team connectivity. Through these functions, SolidWorks 2012 helps users to attain innovation designers to increase productivity, thus creating an environment wherein technological innovation is transformed into business growth.

SolidWorks 2012 provides the following capabilities:

•Automated design functions for productivity

SolidWorks software helps engineering and design teams streamline their design processes simply by removing one or two steps, profoundly impacting usability and productivity. SolidWorks 2012 offers improvements in the areas of:

-Drawings: New tools help create better-looking and more-accurate drawings in order to cut down on the revision process and help users detail designs faster.

-Sustainability: SolidWorks Sustainability's new, advanced user interface means users can more accurately model products with "what if" scenarios and better support unique and custom materials. Users can also closely model processes with parameters such as recycled content and duration of use.

•Continuous Workflow through improved performance and quality

SolidWorks 2012 makes the design experience flow more naturally, and without disruptions - meaning faster designs with fewer errors based on features such as:

-Large design review: Allows instant opening and review of massive assemblies or any individual component with walk-throughs, sectioning and measuring without the need for a high-powered computer or any special file preparation.

-Feature freeze: Eliminates unwanted feature rebuilds by locking all features above the "freeze" bar, speeding up the design of complex models where rebuilding of specific features isn't needed. Features can also be unfrozen at any point.

-Equation editor: New equation capabilities allow users to create equations faster and understand order more easily, providing new levels of flexibility and productivity.

•Significant improvements to overall product development processes

SolidWorks 2012 increases productivity and streamlines the overall customer product development processes with:

-Design costing: A flexible tool that automates manufacturing cost calculations for sheet metal and machined parts. Designers can make more informed decisions based on cost throughout the design process and continually model new scenarios for instant up-to-the-minute manufacturing estimates.

-Sheet metal: Design from scratch or convert customer 3D parts to sheet metal with new tools that provide control over the unique challenges of working with sheet metal - such as precise control of edge flanges, including up-to-vertex end conditions. Designs can be automatically flattened and documented for manufacturing, with export to CNC and manufacturing equipment.

-Simulation: SolidWorks Simulation includes enhanced motion

optimization that automatically uses motion study results to create sensors and refine complex and time-intensive machine aspects such as motor size, bearing loads and range of travel.

• Extends support for collaboration and team connectivity

As manufacturing becomes more global, design collaboration between disparate teams is now more important than ever. SolidWorks 2012 brings teams of all sizes together through:

-Integrated search, customization, and wider support with SolidWorks Enterprise PDM: Now integrated into the Windows Explorer, designers have easy access to favorite searches and a full search tool. Users can also customize the Windows Explorer UI to get faster access to the information they need. In addition, SolidWorks Enterprise PDM has new support for Office 2010 and an x64 web client.

-Lifelike experience with 3DVIA Composer: Designers can take more control over their renderings for a more realistic appearance. Enhancements include the easy addition of part-to-part shadows, ambient occlusion and shadows to 2D panels with precise control. A glow effect can also be added to highlight specific areas of interest.

SolidWorks 2012 released newly

Meanwhile, SolidWorks held 'SolidWorks Innovation Forum 2011', for 2 days on October 6 and October 11, respectively, at the Time Square in Youngdeungpo, Seoul, and the Pullman Hotel in Changwon under the theme 'Design Driving the Business' to introduce major enhanced functions of SolidWorks 2012 along with demonstration.

HHI played a key role in helping Korea win the 17th championship

Hyundai Heavy Industries (HHI) led Korea to victory in World Skills London 2011, the largest international vocational skills competition, thus further raising the status of the nation.

HHI announced that its 5 employees vied for medals in this competition held in Excel Center held at the ExCeL London exhibition and conference center in London from October 4 to 9 and won 3 gold medals and 1 prize of encouragement.

In World Skills London 2011, the medal contenders from HHI proved that they were the best of the best in their occupational skills. Oh Seon-jik (aged 20, the same hereinafter) won a gold medal in the category of CNC lathe, and Jeon Yong-jae was awarded a gold medal in the category of sheet metal. Yu Ye-chan took a gold medal in the category of polymechanics. Meanwhile, Kim Min-seok won a prize of encouragement in the category of plumbing.

Thus, HHI won 3 medals out of 13 awarded to Korea, the largest number among domestic companies.

So far, 87 persons representing HHI contended for medals in the World Skills competition and 97% of them won medals.

A total of 84 persons representing HHI have received medals, including 45 gold medals, 13 silver medals, since the 24th World Skills competition was held, thus playing a key role in helping Korea win 17 overall championship.

An official from HHI said, "We further raise the status of Korea by demonstrating our excellence in skills. Importantly, HHI led the nation to victory and proved its technological prowess throughout the world."

Moreover, 3 persons from HHI were appointed to the panel, who are Shin Chung-chan, General Manager (aged 54, Technical Training Institute), Jo Hye-hyeon, General Manager (aged 52, Cabin Production Division II), and Choi Woong (aged 50, Marine Planning Division), in addition to those vying for medals.

ABB Turbocharging. A100 – currently the last word in single stage turbocharging.

Taming the trade-off: the high pressure ratios and efficiencies of the A100 turbocharger generation are helping achieve IMO Tier II compliance at optimized fuel consumption. Stretching performance: the A100's wide compressor maps are enabling dual engine ratings with minimum system modifications for rapid, cost effective conversion from standard cruising speeds to economical slow steaming.
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Completion of a new R&D center

Hyundai Heavy Industries (HHI) launched a high-tech Integrated Research Center which will spearhead development of new technologies and products in heavy industrial sector in relation to high value-added ships, onshore/offshore facilities, energy and environment, etc, in an endeavor to spur R&D.

High ranking officers, including Min Gye-sik (8th from the left), Chairman of HHI, and Lee Jae-sung (7th from the left), CEO of HHI, are cutting tape for the opening ceremony of the Integrated R&D Center Building.

Hyundai Heavy Industries (HHI) established a state-of-art Integrated Research Center Building in a bid to spur R&D efforts.

HHI held a ceremony to mark the completion of the Integrated Research Center Building on September 21 at its Ulsan headquarters, attended by about 300 executives and employees including Min Gye-sik, Chairman of HHI, and Lee Jae-sung, CEO of HHI.

With the construction having commenced in July last year, this Integrated Research Center Building, a 6-story building with 1 basement, is built on land occupying 14,700m^2 with an injection of KRW 20 billion.

This cutting-edge Research Center is staffed with around 310 researchers including those with master's or doctorate degree, who will focus on securing state-of-art technologies including the newest technologies and products essential for the advancement of global heavy industries in relation to high value-added ships, onshore/offshore facilities, engines, energy and environment, etc.

Particularly, this Research Center will focus on expanding R&D capabilities and creating synergy through collaboration among HHI's several research institutes such as HHI's Maritime Research Institute, Industrial Research Institute, and Product Development Research Institute which were situated in separate locations of its Ulsan headquarters before.

In addition to this Integrated R&D Center, a new Welding Test facility dedicated to the research into welding, materials, automation, environment and energy, and a new Painting Test facility dedicated to developing technologies in the field of painting and corrosion-protection were established in parallel.

HHI expects that this new R&D Center will increase the R&D performance by over 5% yearly and further raise efficiency in operation of facilities, equipment, and manpower.

Min Gye-sik, Chairman of HHI, said, "Technology is the key to coping with uncertain future. The completion of this Integrated R&D Center Building will pave the way for HHI to proceed with and stimulate technological development in a more comprehensive, systematic, and efficient manner."

Meanwhile, HHI completed the Industrial Research Institute and Maritime Research Institute. the nation's first private-sector research institutes, in 1983 and 1984, respectively, and is currently operating a total of 5 domestic research institutes including Electro-Mechanical Research Institute, Techno Design Institute, Product Development Research Institute, and others.

Furthermore, HHI has overseas research institutes in Hungary and China, which forms a global technology network leveraged to raise R&D efficiency and attract excellent local manpower.

Stable power supply

Schneider Electric announced that it supplied UPS (Uninterruptible Power Supply) and space-saving circuit breaker for motor protection to Marine Radio Co (MRC), the world's leading company in the field of internal communication systems for marine application, to help ensure stable power supply.

Smart-UPS

Multi-9 C60

Schneider Electric, a global specialist in energy management, announced that it supplied 'Smart-UPS', an uninterruptible power supply that maintains power in the event of unexpected power outage, and the space-saving 'Multi-9 C60', a circuit breaker for motor protection, to Marine Radio Co (MRC).

MRC, a leader in the internal communication system with 90% share in the domestic market, manufactures and supplies internal communication and broadcasting equipments to large and small and medium-sized domestic and overseas shipyards and has representative offices in China and Singapore. MRC has made inroads into Japanese market, garnering 10% of share, and successfully secured firm foothold in global market.

Marine radio communication required UPS that can ensure stability and reliability of power supply on board vessels vulnerable to power losses under harsh marine conditions, and it was necessary to further enhance the space-saving efficiency of the circuit breaker that shuts off the power to protect the motor from damage caused by overload or short circuit. For these reasons, MRC introduced Smart-UPS and Multi-9 C60 of Schneider Electric.

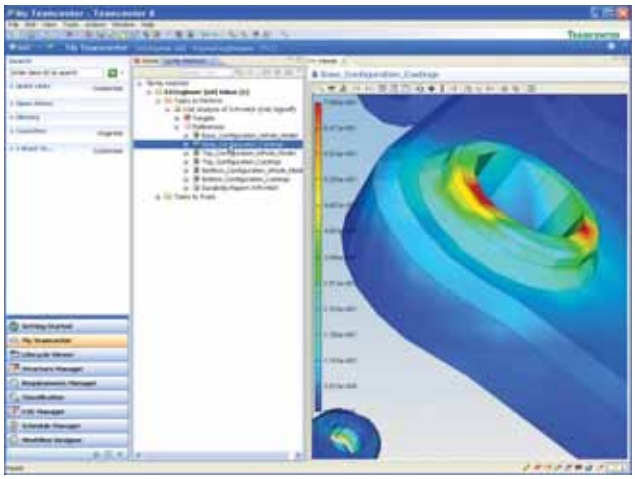
Schneider Electric's Smart-UPS, which attracted huge attention in the wake of recent nationwide blackout, provides excellent operability, ensuring stable power supply in any situation. Moreover, Multi-9 C60, a circuit breaker for motor protection, is small-sized and high performance device, allowing the users to set up the system optimized for ship's size.

Smart-UPS and Multi-9 C60 which MRC introduced have ensured stable power supply under any circumstances and dramatically reduced malfunctions, and importantly, after-sales-service cost which comprised a large proportion out of the entire project costs was reduced by over 5%.

An official from MRC said, "We have dramatically saved the costs since we established the optimized space-saving system with the introduction of Smart-UPS and Multi-9 C60, and are satisfied very much with the products and services of Schneider Electric. We plan to increase the introduction of Schneider Electric's products in the period ahead."

Siemense PLM Software to supply PLM platform to a submarine company

Siemense PLM Software recently decided to supply its PLM software Teamcenter to BAE Systems Submarine Division, the largest defense company in Europe. Thus, Siemense PLM Software cemented its leading position in the PLM software sector within the shipbuilding industry.



Teamcenter of Siemense PLM Software

Recently, Siemense PLM Software announced that BAE Systems Submarine Solutions (BAE Systems) signed a contract in March of this year to standardize on Teamcenter software for the development of its next generation submarine. This commitment will enable BAE Systems to drive productivity improvements, establish common processes and enhance global collaboration across the lifecycle of this important new programme.

Teamcenter, the world's most widely used PLM system, will serve as the information backbone of BAE Systems' product development process, managing all of the information generated and needed to design, build, commission and support a nuclear submarine. The Teamcenter deployment supports a business strategy vision which seeks to ensure that BAE Systems can reliably, predictably and affordably deliver submarines to the Royal Navy. The UK future nuclear deterrent programme recently passed its decision point allowing the work to proceed to full design.

"BAE Systems decided to deploy a PLM approach to the future nuclear deterrent submarine programme as part of developing an Integrated Product Delivery Environment (IPDE), which will enable the design process to be managed more effectively and predictably, in what is one of the most challenging new product programmes in UK industry today," said Tony Johns, BAE Systems' Future Submarines Director. "To support this approach, we conducted a thorough selection process which concluded in nominating Siemens PLM Software's Teamcenter as the strategic PLM tool. Siemens PLM Software proved to be the best vendor for BAE Systems to partner with, and we are very pleased to leverage their skill and experience in PLM toolsets and methodologies for the benefit of this programme."

"We are very pleased to become a strategic partner and to sign a major PLM agreement with BAE Systems Submarine Solutions," said Robin Hancock, vice president and managing director of Siemens PLM Software, UK. "Teamcenter will serve as BAE Systems' global collaboration platform to manage all engineering and product data within a single system, enabling the company to achieve its goal of increasing productivity, innovation and excellence as it develops the world's most advanced submarines."

Siemens PLM Software's shipbuilding leadership

Siemens PLM Software's industry-leading technology is used by shipbuilders and suppliers to collaborate, plan, design and validate the development, manufacturing through life support of ships and submarines. The solutions satisfy the critical needs of leading ship builders for managed collaboration across complex engineering functions and throughout the extended supply chain. By breaking down barriers between engineering functions and all other disciplines associated with the product lifecycle, and by providing real-time access to design, analysis and simulation, Siemens PLM Software will enable efficiencies and key innovations throughout the industry.

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ABB Turbocharging focuses on product and personnel development in 2011

ABB Turbocharging

The past year has seen some significant product and application engineering developments at ABB Turbocharging, based in Baden, Switzerland. But it has also seen a "changing of the guard" within senior management, in which Oliver Riemenschneider, previously senior vice president of sales, marketing and service has taken over as head of the ABB Turbocharging global business unit. This comprises a worldwide sales organization with over 100 sales offices and service stations in over 50 countries. Leadership of the Swiss national organization ABB Turbo Systems, including three producing works in Switzerland and the Technical Center in Baden, where turbocharger R&D and engineering takes place, is assumed by Urs Gribi, previously head of engineering and development.

In turn, Axel Kettmann, formerly head of the worldwide service network, becomes senior vice president of sales, marketing and service while Rolf Schweizer leaves his roles as senior general manager of new business to head the service business. Schweizer is replaced by Christoph Rofka, formerly general manager of new business in the medium speed engine segment. New head of engineering and technology, including research and development and turbocharger testing is Christian Roduner, while on the production side, Maurizio Boschetti takes over management of the Swiss producing works and the global production network.

ABB Turbocharging's A190-L turbocharger for 2-stroke low speed engines.

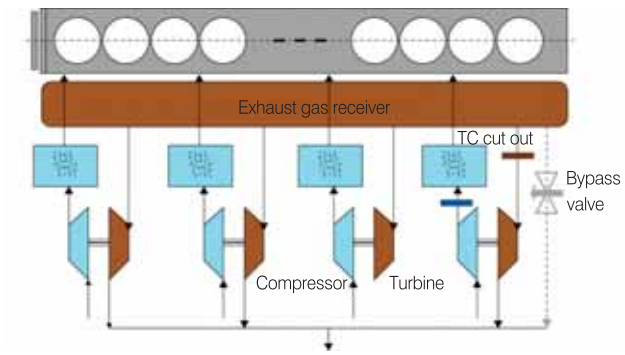


ABB Turbocharging's concept for dual engine ratings involves varying the numbers of turbochargers in the engine's exhaust gas stream and fine tuning using only a bypass valve.

A190-L turbocharger for 2-stroke low speed engines

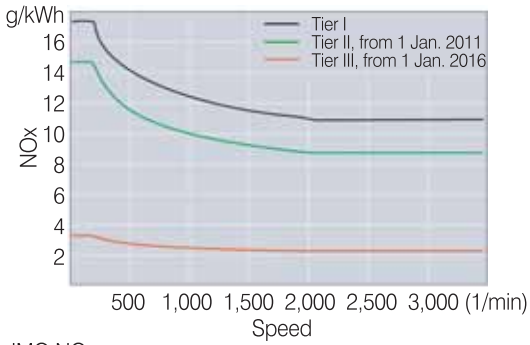
In the company's current range of single stage high pressure ratio machines, turbochargers from the A100-L generation for low speed 2-stroke engines, achieved both a new efficiency record and proved the benefit of its wide compressor maps in an innovative dual engine rating concept.

In final testing of the A190-L turbocharger for low speed 2-strokes before its market release, ABB technicians measured peak efficiency at 75.8%. The figure is both impressive perse and because it was measured on a turbocharger featuring a higher pressure ratio than the model that achieved the previous record, ABB Turbocharging notes.

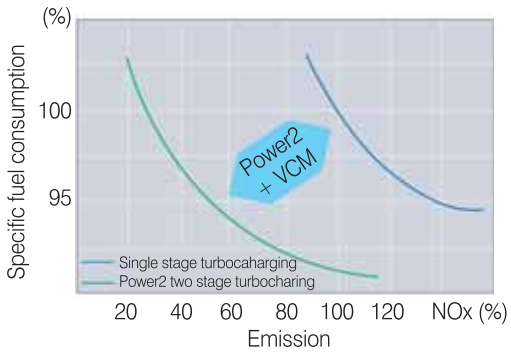
The turbocharger configuration for engines with dual ratings has been designed by ABB's application engineers to facilitate rapid, simplified changeover from a power output

A Wärtsilä 4-stroke diesel engine with two stage turbocharging technology.

Power2 two stage turbocharging on the test bed at the ABB Turbocharging technical centre.



IMO NOx curves.



Taming the trade-off: the fuel saving and NOx reduction potential of ABB's Power2 two stage turbocharging and VCM valve control management for diesel engines.

matched to normal vessel cruising speeds to an output matched to a fuel saving "slow steaming" mode. It responds to a specification on a series of 10 container ship newbuildings contracted by Singapore-based operator NOL.

Exploiting the very wide compressor maps of the A100-turbocharger allows the two required ratings to be achieved by varying the number of turbochargers in the engines' exhaust gas stream with adjustments using only very basic, traditional variable turbocharging technology (wastegate, bypass). This contrasts with the more complex and costly alternatives of fitting different turbochargers with different air delivery characteristics, buying new internal components and dismantling and reassembling the turbochargers to fit them - this can involve turbine and compressor wheels as well as the nozzle ring and diffusers - or using techniques like variable turbine geometry to vary turbocharger air delivery characteristics.

In detail, the ABB system adopted for the new container ships is designed to allow the ten, 12 cylinder, 98cm bore low speed two-stroke diesels powering the container ships to achieve ratings of just over 72MW at 104rpm for normal cruising and just over 54MW at 97rpm for slow steaming.

The solution comprises four A190-L turbochargers, one of which can be cut-off from the exhaust gas stream. This is achieved either via a motorized valve or a simple blanking plate. In spite of the reduced level of energy in the engine exhaust gases due to the lower engine power rating, the width of the A190-L's compressor maps allow the three turbochargers still in the exhaust gas flow to efficiently produce charge air at the pressures and volumes needed for the lower engine rating.

2-stage high pressure turbocharging

ABB Turbocharging also reports that its Power2 two stage high pressure turbocharging system passed a significant milestone with the conclusion of Type Testing in the presence of the classification societies. The testing took place on a rig at the ABB Turbocharging's technical centre in Baden, Switzerland and signifies approval by the classification societies for all the two stage turbocharging systems in the Power2 portfolio.

The test run and subsequent component inspection were witnessed by representatives from Lloyd's Register (LR),

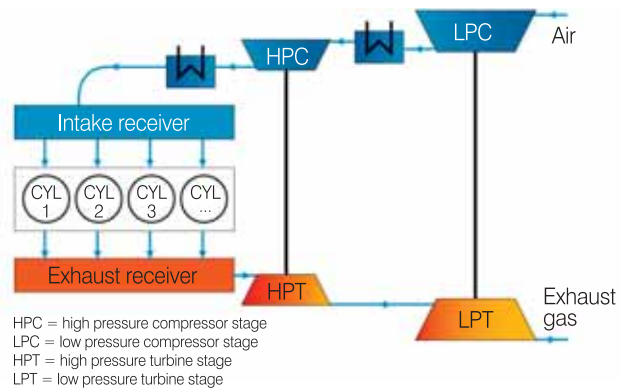
Germanischer Lloyd (GL), American Bureau of Shipping (ABS), Bureau Veritas (BV), Registro Italiano Navale (RINa), Russian Register (RS), Polish Register (PRS), Nippon Kaiji Kyokai (NK), Korean Register (KR), Det Norske Veritas (DNV) und China Classification Society (CCS), in addition to a representative of the Japanese Government Ministry for Land, Infrastructure and Transport. (JG/MLIT).

First commercial application

Significantly, given the interest in gas engines as a means of complying with IMO Tier III limits on NOx emissions in Emissions Control Areas (ECAs), or providing a low emissions means of covering a ship's "hotel load" when in port (cold ironing), ABB Turbocharging's Power2 two stage turbocharging technology has already entered commercial service on a spark-ignited, lean burn gas engine.

The engine involved is a stationary 24 cylinder GE Jenbacher type J624 producing 4.4MW compared to the 4MW of its predecessor with conventional turbocharging. It operates on a daily basis in a horticultural cogeneration plant in the Netherlands, which provides heat for market gardening under glass and electrical energy to both the market garden and the local grid.

In addition to its increased power density, the J624 gas engine with Power2 two stage turbocharging also offers an efficiency increase of about 2% while, typical of modern lean burn gas engines, undercutting the IMO Tier III limits on NOx by a wide margin. In a further benefit, ABB states, the higher level of charge air pressure from the ABB two stage turbocharging system helps the engine maintain rated outputs in climates with high ambient temperatures and humidity and



Schematic of ABB Turbocharging's Power2 two stage turbocharger system.

on gases of variable calorific value.

At the present stage of development, these enhancements are based on pressure ratios well over 6 bar, enabling the GE engine to run at mean effective pressures above 22 bar and giving the scope for the future application of advanced Miller Cycles on the GE gas engine. With higher charge air pressures, more fuel can be burnt in more air for more power and, as in diesel engine Power2 applications, the levels of charge air pressure also enable Miller Cycles to be applied.

On gas engines the cooling effect of the Miller Cycle on the cylinder charge, as it expands in the cylinder due to earlier inlet valve closure, can be used to keep the temperature of the air/gas mixture further from the "knock boundary" during its compression. The gas engine can hence be operated more flexibly in terms of its settings (e.g. mixture richness, ignition timing) while avoiding pre-ignition.

Basic technology

The Power2 two stage turbocharging system consists of two turbochargers of different, tuned frame sizes connected in tandem on the compressor side via an intermediate cooler - cooling the compressed air issuing from the first turbocharger means the second turbocharger needs to do less work and can be more compact. Development is already well underway, both on turbocharger test beds at the ABB Turbocharging technical centre in Baden and on two and four stroke engine from major engine builders.

Taming the trade-off on diesels

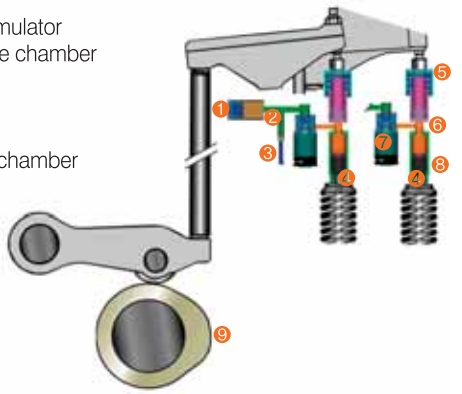
On 4-stroke diesel engines, Power2 two stage turbocharging technology is capable of producing pressure ratios as high as 8 and hence allows builders of four stroke diesels to exploit very strong Miller Cycles. Power2 two stage turbocharging is hence instrumental in alleviating one of the hitherto most intractable constraints in the search for lower NOx emissions from diesel engines i.e. the necessary compromise between NOx emissions and specific fuel consumption (SFC), or "NOx-SFC Trade-off". The trade-off reflects the fact that NOx formation reduces with lower combustion temperatures while engine fuel efficiency increases with higher combustion temperatures. Hence, in the early days of emissions reduction on diesel engines, a widespread measure was to reduce combustion temperatures by retarding fuel injection to reduce the rate of heat released from the fuel. Thus, a fuel consumption penalty was incurred in the inter-

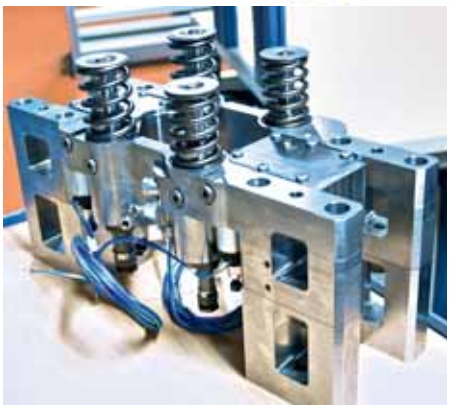
ests of lower NOx emissions.
However, while the trade-off will always be a fact of every engine developer's life, the findings of ABB and its development partners show that using a combination of much higher turbocharging pressures, variable valve timing, advanced fuel injection technology (e.g. common rail), and electronic control, the trade off can be shifted into a much lower range of NOx emissions and fuel consumption. In fact, ABB Turbocharging's increasing experience with Power2 on four stroke diesel engines has resulted in a growing expectation that two stage turbocharging will make a very significant contribution to achieving the 80% reduction in NOx emissions required in ECAs under IMO Tier III.

VCM

Finally, ABB Turbocharging reports very satisfactory results for its VCM Valve Control Management in tests on test engines as well as increasing interest from the market. VCM is a hydrostatics-based variable valve train system being jointly developed by ABB Turbocharging and engine component specialist Schaeffler Technologies. It is capable of varying both valve timing and lift and offers engine builders a vital technology for realizing Miller Cycles which can be varied from "strong" to "mild" to cover a wide range of engine operating conditions.
VCM is based on Schaeffler Technologies' INA UniAir system for automotive engines and targets 4-stroke diesel and gas engines in the power range above 400 kW. A prototype of the new VCM system is currently undergoing an extensive test program. Following successful test bed trials, results from on-engine trials have confirmed the system's functionality on a hot engine and its ability to enable highly flexible valve timing and lift on large 4-strokes engine.

1. Pressure accumulator
2. Middle pressure chamber
3. Oil supply
4. Engine valves
5. Pump unit
6. High pressure chamber
7. Solenoid valve
8. Actuator/brake
9. Camshaft





The VCM system for large engines uses a high pressure oil chamber between the inlet valve and its rocker to vary valve timing and lift. A solenoid valve controls the filling of the chamber with engine lube oil from a camshaft actuated pump. The pump also pressurizes a brake unit above the inlet valve to limit forces when the valve contacts its seat.

Miller enabler and Power2 complement

As such, VCM is an ideal complement to ABB Turbocharging's Power2 two stage turbocharging on 4-stroke diesel and gas engines strong Miller Cycles to achieve a combination of low NOx emissions, increased power density and improved specific fuel consumption.
While strong, Miller Cycles are needed at an engines rated output to enable these improvements, at lower loads the shorter inlet valve opening of strong Miller valve timing leads to increased emissions of smoke and particulates, higher thermal loading of the engine and a deterioration in response to load changes. Likewise idling and starting are adversely affected. To counter these, VCM allows inlet valve timings to be varied over a wide range, using hydraulic technology to achieve smooth adjustment. As such, the system is also a versatile and valuable tool for closely adapting engine performance to the operating profile of a given engine application, ABB states.

VCM operating principle

Variation in valve timing and lift is achieved by interposing a high pressure oil chamber into the engine valve train between the valve and its mechanical actuation system. A solenoid valve varies the filling of the chamber with engine lube oil pressurized by a camshaft actuated pump. This enables both the timing of the opening and closing of the valve to be varied as well as the distance the valve opens (valve lift). The pump also feeds a brake unit above the valve to limit forces when the valve contacts its seat.

Photo: Siemens

Enormous growth potential is projected for offshore wind energy in Europe. The Swedish offshore wind park in Öresund, between Malmö and Copenhagen, is pictured here.

Complete solutions for specialized offshore vessels

Requirements for specialized offshore ships are becoming more and more demanding, especially for vessels deployed to install offshore wind-power facilities. Since borders blur between the operational areas of shipbuilding, offshore and hoisting technologies, a holistic approach for these is vital.

Siemens

Installation vessels for offshore wind parks have to be able to travel at a reasonable speed, position themselves dynamically, and independently transform into a stable platform. In addition, their design has to take environmental issues and safety concerns into consideration - from the conception phase through to day-to-day operation. Innovations from Siemens Marine Solutions provide a comprehensive picture of what is possible in this exceedingly specialized field.

According to forecasts, wind energy in Europe holds enormous growth potential. A large number of offshore wind parks are currently in the planning phase, and once these parks go online, they will have the ability to deliver several hundred megawatts of energy. Developing wind parks carries a number of logistical challenges, and as a result demand is growing for specialized ships that can transport, install and maintain offshore wind turbines. Siemens offers a broad range of innovative solutions that span a wide spectrum of demands for equipping these vessels, from energy production and distribution to automation and complete jacking systems, including the necessary drives.

Positioning of drilling vessels and platforms

Ships and platforms used for offshore oil production have to be lifted above sea level and wave activity to create a solid environment for the operations on board. Gusto MSC, a subsidiary of Netherlands-based SBM Offshore, and Siemens Energy worked jointly to develop the VSD Rack & Pinion Jacking System, an electrical drive and control system for a hydraulic hoisting system also known as "Blue Jack." The Blue Jack is based on frequency-controlled electrical drives that position the legs on the seabed more quickly and precisely than conventional systems. In addition, lightweight construction and an improved distribution of weight mean less wear and tear on the mechanisms. These improved features have a positive impact on commissioning and actual vessel operation.

Siemens supplies the electrical systems for the hoisting setup, which includes drive systems based on Sinamics S120, the Simatic S7 Controller, the process control system Simatic PCS 7 and the individual drives. The Blue Jack system itself comprise converters and electrical motors that are arranged in a multi-layer safety and drive system. In addition to these benefits, environmentally harmful hydraulic oils are not necessary, in contrast to traditional solutions.

The converter-driven hoisting process is considerably easier to carry out than conventional hoisting systems, which means safer operation of the vessel. Two installations of the electrical hoisting devices on platforms in the North Sea have led to follow-up contracts from the oil and gas industry. Furthermore, Gusto MSC and Siemens see a bright future for equipping electrical hoisting systems in ships used for the installation of offshore wind turbines.

The need for special ships for the transport, installation and maintenance of offshore wind parks is growing.

Monitoring the entire operation

Efficient and environmentally friendly ship operations are depend on a comprehensive overview of all onboard processes, and it is imperative that all operational data is coordinated and optimized. The innovative Siship EcoMAIN IT platform gives operators the ability to monitor all onboard systems in an office environment via a standardized interface. If needed, operators can also make adjustments using the interface. In addition, suitable fleet-management systems can be set up. The basis for this ship-management solution is a platform on which all operational data is collected and saved in a uniform format.

Existing system modules, for example for energy management, as well as new and third-party systems can be installed and supplied with the collected data. Behind every module is an individual process simulation to visualize possible operational procedures and give the operator suggestions, such as how to optimize ship navigation or reduce fuel consumption. Until now, systems like these successfully managed individual processes but the data consolidation of all system modules was not optimally processed or used. With EcoMAIN, a data platform and module are available to help monitor ship operation and optimization holistically. In addition, standardized interfaces enable data exchange among each individual system. As a result, this innovative technology helps reduce costs, energy use and emissions.

Commanding all processes

Operating a ship is a complex undertaking that involves a number of procedures that can only be optimally coordinated when controlled completely and transparently. Likewise, economical ship operation can only be ensured when all processes occur in concert. Integrated automation

Borders blur between the technologies for shipbuilding, offshore and hoisting technology when it comes to installation vessels.

solutions can eliminate error sources in all onboard processes and take advantage of optimization potential. At the same time, these solutions decrease possible operational errors, and therefore protect both personnel and the machinery.

All technical processes on board are integrated in a standardized automation system - their interplay is driven according to strictly defined parameters. System overviews are simple to operate and the integration of subsystems via a standardized interface allows the operating team to make sound decisions. As a result, the personnel managing the ship have a comprehensive overview of all processes, enabling them to react quickly and precisely at all times.

Thanks to standardized industrial components for converters and automation, all onboard systems are strategically coordinated with one another. For example, the inverter for the ship's operation and the inverter for the jacking system can be fed from the same DC link. Because the required power changes over time, a better use of components is possible, which saves space, weight and costs. All systems - whether the modular ship automation system Siship Imac, the Blue Drive propulsion system, the power-management system Siship PMA or the Blue Jack hoisting system - are constructed with proven industrial standard components.

Homogenously linked, the automation system takes over all control and monitoring functions, thereby allowing for efficient and universal control of vital systems. Considerable savings potential is achieved using a uniform technological platform with automation and drive technology for nearly all of the onboard systems - and this applies not only to ship operation but also to spare-parts management and personnel training.

Increased performance, safety and profitability

Efficient and widely available drive technologies are the key to long-term competitiveness as well as investment security. Of all onboard systems, drive technology has the biggest impact on safety and profitability as well as on ship operation. Moreover, fuel consumption is an integral area in which savings can be achieved.

Utilizing a suitable drive also has impacts on other factors. For the setup process, the drive has to hold the ship in an exact position. It is crucial that drive performance be sufficiently dimensioned and all systems highly reliable. The highest precision and coordination between the systems is especially important when a vessel switches from floating to stationary service. The risks of wind gusts or rough seas can only be prevented in stationary-service mode - such events can jam or even break the legs. Once the ship is positioned on stilts, the steadfastness of the construction has to be monitored continually; changes in the pressure applied to the legs - for instance while a crane is in service - need to be detected early so that operators can make adjustments quickly and decisively. In a floating state, dynamic ballast compensation in the ship's automation is indispensible for safe operations. Further prerequisites for different areas of operation and procedure profiles include sufficient performance reserves and good maneuverability. The modular, space-saving drive design also reduces onboard space requirements.

Customised solution for each vessel

From electrical and diesel-electric drives, azimuth drives and boosters all the way to highly

efficient hybrid concepts, all systems developed and built by Siemens are tailored exactly to the individual requirements of the particular vessel.

The Skandi Aker, a service ship used for oil extraction, is equipped with modern diesel-electric drive technology from Siemens, which has a positive effect on sailing, positioning and speed. This vessel is currently the largest single-hull service ship used for underwater drilling. It can be used for deep-sea drilling with risers as well as for construction and installation works in water depths of up to 3,000m. To ensure readily available and efficient drives, Siemens delivered the complete diesel-electric drive system, including medium-voltage power production and distribution as well as drive controls.

The drive technology on the Skandi Aker includes a medium-voltage drive, two azimuth rudder propellers, two retractable rudder propellers and two lateral thrust units. In addition, transformers and electric motors with the accompanying Blue Drive frequency converters were installed. These converters were specifically constructed to withstand harsh onboard conditions in regard to temperature changes, vibration and humidity. The onboard network is supplied by six generators, including a power-management system for the distribution of medium-voltage current. The generator power-adaptation system ensures that the generators are not overloaded and that the electricity supply does not cease in the event that a generator breaks down. The power-plant protection system immediately recognizes critical operational conditions in the generators and ensures that the affected generator is taken offline before damage can occur.

Ships used in the installation of offshore wind power plants have requirements similar to those for oil-extraction vessels. The Sea Installer from Danish wind power specialist A2SEA is currently being equipped with a complete propulsion system including power generation and distribution as well as an automation system. COSCO Shipyard Group of Natong, China, is constructing the vessel, which has a self-elevating platform and can operate in waters with a depth of up to 45m. The ship will be used primarily for upcoming offshore projects in the UK as well as for the German offshore market. Siemens is also delivering the main generators and the distribution transformers for the ship's medium-voltage distribution in addition to the switchgear and the power-management system. Furthermore, the contract covers installation of medium-voltage transformers and the drives for the bow, plus the motors for the main-drive rudder propeller. The ship's automation system, Siship Imac, takes over monitoring, alarm and control functions of the electro-technical facilities onboard the ship.

Siemens is delivering the complete drive package for Sea Installer, which belongs to wind power specialist A2SEA

Additional contracts for special offshore ships are in the pipeline, including the equipment of a new farm installation vessel, which will be built by the J.J. Sietas KG Shipyard, Hamburg. Siemens will deliver the main generators and the distribution transformers for the ship's medium-voltage distribution as well as the switchgear and the power-management system. In addition, Siemens is providing the medium-voltage transformers and drives for the bow thruster as well as the soft starter and motors for the main drives. Siship Imac will control and coordinate onboard operations.

The author:
Christian Mueller, Sales Manager, Siemens Marine Solutions

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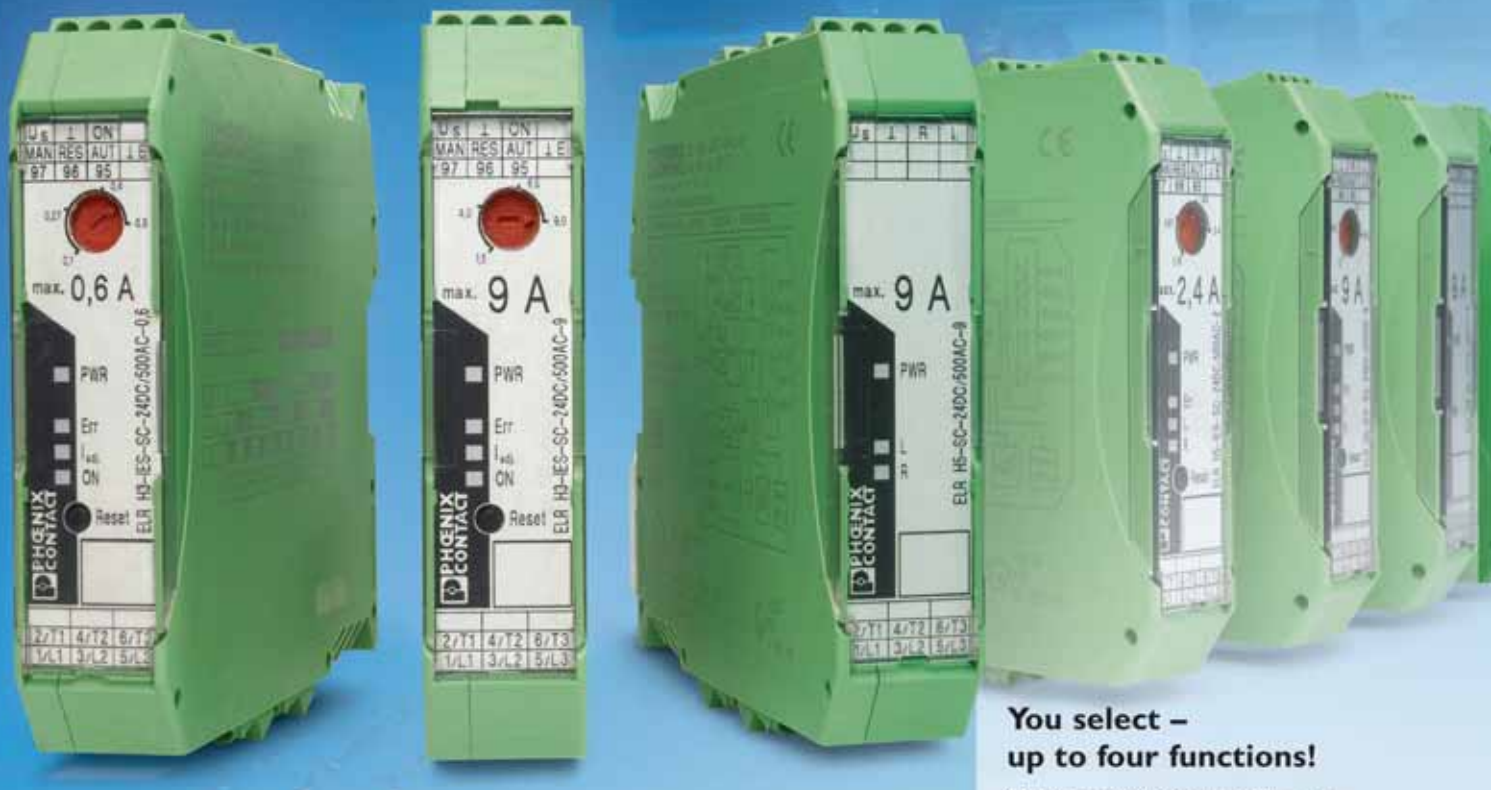

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Making process upgrades with minimal disruptions

Oil & gas producers and operators can upgrade their safety systems with minimal disruption to facility operations. For a successful process upgrade, it takes careful analysis of the system design and a detailed approach to the engineering and migration strategies.

Rockwell Automation Korea

Recent events in the oil & gas industry have substantially increased interest in maintaining the highest standards of safety at all times. These events have spotlighted the potential worker, environmental and business ramifications of a significant safety event. Oil & gas producers and the operators who manage their production facilities demand the highest level of safety in order to help protect personnel, the environment and production assets while maintaining maximum uptime and minimal operational disruption.

Contrary to popular belief, installing an upgraded safety system does not necessarily require a lengthy shutdown of the facility. With careful planning and detailed, thorough engineering, a safety system can be upgraded with minimal disruption to facility operations.

The role of a Safety System

Adam Howard, EPC operations manager, Rockwell Automation, explains that in oil & gas production operations, the distributed control system (DCS) manages the normal operation of the plant. The function of the safety instrumented systems (SIS) is to preserve life, the environment and the equipment being monitored.

The most common types of safety systems in oil & gas production are the fire and gas (F&G) and emergency shutdown (ESD) systems. The primary objective of the F&G system is to monitor for the presence of fire through smoke, heat and flame detection, as well as for potentially dangerous levels of hydrocarbons by “line of sight,” “point,” and acoustic gas detection methods. If any of these conditions are detected, the system implements appropriate alarming, firefighting and suppression measures.

The core objective of the ESD system is to help protect people, the environment and production assets against misuse, equipment failure and catastrophic failure in the plant. When the ESD system is activated, it may require an orderly shutdown of the production process to help protect personnel and the integrity of the plant.

Typically, the F&G and ESD systems are physically indepen-

dent of each other and separate from the DCS.

Operational considerations

Facility owners normally upgrade their safety systems for a variety of reasons. For example, one driver is to prolong field life. Another driver is to meet current codes and standards. Yet another driver is to improve functionality with regard to remote operations, diagnostics and interfaces between systems.

Every piece of equipment or system will eventually come to the end of its useful life cycle. According to Howard, safety systems need to be upgraded some 15 to 20 years after initial installation. The need to upgrade becomes apparent through equipment obsolescence, erroneous operations, or an inability to expand or enhance the system.

Safety upgrade strategies

Implementing a safety system upgrade requires an in-depth analysis and risk assessment of the existing technology. A safety system upgrade should follow a systematic and well-documented process.

The first step is to establish a clear understanding of the existing design, including the specific nature of the system's core architecture and the functional operation. During this phase of the project, the safety integrity level requirements may need to be established or re-affirmed.

Once this baseline is firmly defined, staff can determine which system upgrades, enhancements and improvements may be needed. This preparatory work is essential in helping ensure the functionality is correct and the design is traceable.

In order to execute a "live" migration from the legacy system to the new system, designers need to exploit the inherent redundancy built into the legacy safety system. Given that most legacy systems have an "A" and "B" side, each executing the same logic, one "side" can be switched off and removed without shutting down the system. While the system is in this degraded state, it is fully operational and, if designed that way, fail-resistant. However, by switching off one "side," the system redundancy and fault-tolerant capabilities will no longer be available.

This configuration will allow the new system to be installed and run in parallel to the legacy system, allowing a quick and effective migration between the systems during live plant operations.

Once the new system is built, it is essential that it is fully tested against the defined and agreed-upon baseline before it is

installed in the field. By testing the system before the live change-out in the field occurs, engineers can be confident that the functionality will meet the operational requirements.

In addition to the build and test records that the system manufacturer produces, the engineering team should produce comprehensive and detailed work packs that include method statements, implementation details, reversionary plans and check sheets to verify the installation, commissioning and handover of the system.

Installation and migration

Once the new system has been tested and shipped, it can be installed and commissioned. It is at this phase of the project that the detailed planning and preparation already undertaken will prove critical to the successful migration of the safety system. Steps to a successful installation follow.

-Fully verify the functionality of the existing legacy system, including any standing inhibits or overrides retained from that system.

-Install the new system in its final location and carry out basic functional tests - often called "travel-well" tests - to help ensure that the system is fully operational ahead of the system migration.

-Remove one "side" of the legacy system. The system is now in the degraded state.

-Hook up the field inputs, such as fire and gas detectors, to the new system, while retaining the inputs to the legacy system.

-Fully test that both systems see all inputs and that logic solver output actions implemented are identical to the legacy system.
-Fully verify the human machine interface (HMI) functionality for the new system.

The outputs of the safety system can now be migrated from the legacy to the new system. At this stage, the new system will assume control. This also is where the major difference between the migration of an F&G and ESD system occurs. F&G outputs tend to be normally de-energised, or "energise to action," whereas ESD outputs tend to be normally energised, and therefore "de-energise to action." Transferring the outputs from one system to another without inadvertently tripping the plant or falsely setting off your fire and gas protection system can be challenging for system migrations of this nature.

Migrating a normally de-energised output is relatively straightforward and is normally done in under a minute per output. During this time, there is no protection for that output.

Migration of normally energised outputs present a different challenge that can be addressed by either electrically "holding up" the output using a temporary supply or locking off the output device. This takes more planning and operational permits and is consequently more time-consuming, taking typically one to two hours per output.

Once all safety system outputs have been migrated, full control of the safety functions will have passed from the legacy system to the new system. The new system will now be subjected to full system tests. Any tests that cannot be carried out while the plant is live will need to be delayed until the next facility shutdown when full system tests can be carried out.

Finding the best approach

Live migration of safety systems during plant operations is possible with careful analysis of the system design and operational requirements and a thorough and detailed approach to the engineering and migration strategies. In addition, the need for detailed and comprehensive planning and preparation cannot be overemphasised.

According to Howard, "The preparatory work can pay off in the long run for the plant operator, and one of the best resources is your system's vendor. Many safety system providers can provide guidance, design recommendations and on-site assistance to help ease the migration, minimise downtime and optimise your system's performance."

Future technology (4): The digital ship

E-Navigation technologies are being adopted by the front runners in shipping, and by 2020 the majority of the fleet will have followed. They combine accurate position data, weather and surveillance data, onboard and remote sensor data, ship specific characteristics, and response models. E-Navigation technologies could prevent accidents and optimise secure, economic, and environmental performance.
Onboard electronic charts will become the unifying platform on the digital ship, integrating and visualising information from other applications related to areas such as security and navigation risks, port entry, and weather routing.

DNV

Electronic Chart

Electronic Chart will act as a platform for additional geographical information services

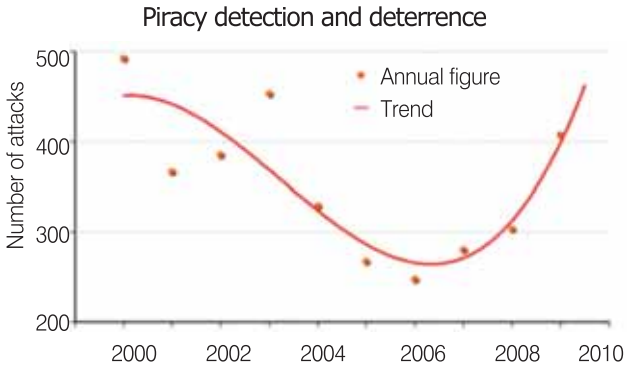
Navigational console

ECDIS integrated into the bridge navigation systems will become standard for all large ships

From a ship perspective, e-Navigation refers to the ability to access, integrate, process, and present locally and remotely acquired maritime information onboard, and to transmit key sensor information to shore or to other ships. Key technologies relate to navigation (e.g. electronic charts, radar, sonar), condition monitoring (e.g. hull stress sensors), vessel tracking (e.g. AIS, LRIT), satellite imagery and communications, and computer software. In sum, these elements provide decision support to, for example, the ship master.

While some e-Navigation technologies are presently in use by front runners in shipping, by 2020 the majority of the fleet will have followed. e-Navigation encompasses all aspects of ship operation; from safe navigation, including avoiding extreme weather events, to minimising fuel consumption and emissions and reducing maintenance costs, as well as effective ship-port communication for optimised port entry and cargo handling. Harmonised data are processed by computer models and presented in an integrated format useful for decision-making, onboard and onshore. Thus a wide range of stakeholders are able to benefit. Most e-Navigation development is focussed towards onboard applications. However, onshore facilities can provide more computing power and additional expertise, which can complement and augment onboard systems.

Such systems can also provide support to decision makers onshore, such as the ship owner or port authorities, who also require support tools, e.g. for effective monitoring of fleets. By 2020, systems based on AIS, LRIT, and other satellite services, will enable global monitoring and tracking capabilities. This could serve as a basis for a range of support applications. Full benefits may require high data transmission rates, possibly limiting use in remote areas.



Global number of attempted and committed piracy attacks
Source: IMO

ECDIS

Ship grounding accidents are recurring events that cause considerable material damages, and even fatalities and harmful oil spills.

The Electronic Chart Display and Information System (ECDIS), using Electronic Navigation Charts (ENC), reduces grounding probability by about 30%. New IMO regulations require that ECDIS is implemented throughout most of the fleet by 2020. ECDIS will function as a platform for other support systems, such as advanced weather routing, piracy detection, sea ice awareness, and floating objects alerts. Thus ECDIS is a key e-Navigation technology. However, by coupling to non-navigation systems, its potential benefits could extend well beyond safe navigation, to items such as port scheduling and customs clearance systems. Competence in mastering the new technology will be essential, and users must be conscious of the dangers of information overload and alarm blindness.

Advance weather routing

Traditionally, weather routing has mainly focussed on safe navigation, avoiding bad weather. However, weather routing could also optimise fuel consumption (about 10% savings), time of arrival, crew and passenger comfort, or hull fatigue. The preferred route will be provided by a risk-based approach and will depend on the selected optimisation objective, ship characteristics, and variations in wind, waves, and currents. Warning criteria for extreme weather events, including rogue waves, are needed, and also consideration of the effects of climate change.

Towards 2020, the accuracy and spatial-temporal resolution of metocean real-time and forecast data is expected to have improved, along with data collection from remote and onboard sensors. Response models for sea-keeping and resistance in waves will be customised to individual ships and routes. This will be achieved by utilizing real-time and historical data with self-learning algorithms.

Piracy detection and deterrence

High insurance premiums reflect the likelihood of armed robbery, piracy, and terrorism to seafarers and ships. These threats are not expected to subside over the next decade.

Successful threat mitigation requires early detection and effective, remotely-controlled deterrents (e.g. water, sound, electric shock).

Commercial, high performance radars already have 4 times the range of standard navigational radars. They can detect dingy-sized objects over a distance of up to 4nm (nautical miles), and this will have increased to 10nm by 2020. Realtime data from radars, sonars, and cameras, together with long-range satellite data, will be processed by an onboard warning system. During the next decade, it is expected that private service providers will offer piracy warnings via satellite, which are integrated with the onboard system.

In response, pirates will try to adapt their attack strategy.

Ship-port synchronisation technology

Shipping contracts typically require vessels to steam at "utmost despatch", i.e. at top speed, between ports, regardless of the availability of berths at the destination port. This leads to unnecessarily high fuel consumption and emissions, and contributes to port congestion, as vessels rush to their destination only to have to lie at anchor for days.

By 2020, berth planning algorithms, using satellite tracking and weather routing, will be integrated into ship-port communication systems. This will facilitate synchronisation and generate berthing schedules that maximise the terminals' throughput at minimal transhipment cost, while minimising vessels' dwelling and fuel consumption.

As ships tend to be more vulnerable in waiting situations close to shore, reduced time in port will also enhance ship safety and security.

Developing a Riser Management System for deepwater drillships and semisubmersibles

As the drilling riser operates in water depths approaching over 3,000m, it is very important to monitor its operation. In particular, LabVIEW MathScript and formula nodes enabled pre-existing IP developed in text-based languages to be included within the software, allowing for more effective code reuse.

National Instruments Korea

•The Challenge:

Designing a system to analyse the stresses on a subsea drilling riser in various operational modes to recommend optimum vessel positions and operational envelopes to enhance the safety of riser operations.

•The Solution:

Using NI CompactRIO to create a stand-alone unit to acquire, host, and transmit data from the subsea drilling riser and other vessel systems and NI LabVIEW software to analyse the data to estimate stresses and recommend position and setup modifications to vessel and drilling operators.

BPP-TECH provides specialist engineering, research and development, and project management services to offshore and renewable energy markets throughout the world. We have more than 20 years of experience in the offshore energy sector.

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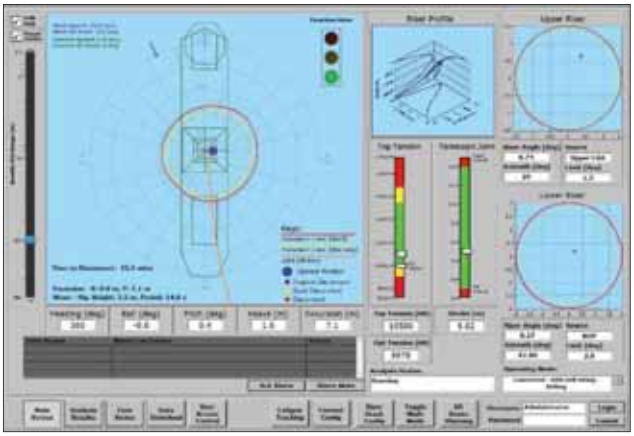
Semi sub

Offshore drilling and Riser Management Systems

With today's deep water wells approaching 3,000m deep and the significant focus on them as a consequence of the oil release from the Deepwater Horizon disaster in the Gulf of Mexico, the need for a reliable management system to monitor riser performance is critical. A drilling riser is a long, slender structure composed of sections of connected steel tubes that link the subsea infrastructure to the drilling vessel. Risers are essential to drilling operations because the drill string and other tools are passed through them to the well.

The riser is subject to immense force from currents, vessel motion, waves, tension, its own weight, and hydrostatic pressure over its entire length. Its slender structure makes it prone

Main console



Main software screen

to high-frequency vibrations, known as vortex-induced vibrations (VIV), due to current flow, resulting in a reduction of fatigue life. With riser lengths reaching 3,000m or more, the requirement for monitoring is even more critical.

The BPP Riser Management System

The BPP-TECH RMS is an onboard RMS that provides real-time guidance for carrying out normal-tensioned drilling or completion and work-over riser operations onboard a vessel. The RMS can operate with the riser in several variations of connected and disconnected modes. Connected modes include operations such as an actively drilling vessel connected to the blowout preventer (BOP) stack, or when it is running tools into the well. Disconnected modes include operations when the riser is disconnected from the BOP stack, such as during an emergency disconnection or right before the riser lands on the BOP.

In addition to monitoring, the BPP-TECH system combines a clear, intuitive user interface with appropriate instrumentation. A state-of-the-art 3D dynamic numerical model of the riser system predicts the behaviour of the riser in the prevailing conditions to optimise operations. BPP-TECH's RMS provides a full range of sensors and formal reporting for an extensive picture of lifetime performance.

We developed a system with two main components: the data acquisition system and the main console display. The data acquisition system consists of an NI cRIO-9012 real-time controller with three NI 9871 C Series modules. The main console is a Windows-based PC running software developed in-house with LabVIEW. The PC and CompactRIO communicate via Ethernet.

RMS software

We wrote the software using LabVIEW with the LabVIEW MathScript RT Module and it runs on a dedicated console positioned on the bridge of the vessel. The data acquisition hardware acquires data streams through various sources and consolidates them into a single data stream received via Ethernet, minimising the need for specific interfacing hardware.

We can directly measure the stresses on the riser using discrete sensors placed along its length, but this presents operational issues. By including 3D finite element models of the riser within the software, we can acquire external environmental conditions through the NI data acquisition system to estimate the shape and subsequently derive the stresses.

We use LabVIEW to model the riser and apply environmental conditions such as 3D current velocities and wave period and height.

We also include top and bottom riser angles to indicate the riser departure angle from the BOP stack at the wellhead and the approach angle into the flexjoint on the drill vessel. Then we analyze the data and use it to calculate stresses in the riser. This, along with other acquired and derived data, forms the basis of the RMS.

Based on this analysis, we can calculate several other factors

such as optimised vessel position, recommended vessel position, drift-off paths (approximate path vessel will drift along due to environmental conditions in the event of a dynamic positioning system failure), and permissible operating watch circles. These are ergonomically displayed using built-in LabVIEW indicators customised according to client specifications.

LabVIEW MathScript and formula nodes enabled pre-existing IP developed in text-based languages to be included within the software, allowing more effective code reuse. We used the built-in LabVIEW mathematics and linear algebra VIs for the matrix manipulations and calculations required to perform finite element modelling. We used the inherent parallelism of LabVIEW to take advantage of the multicore capabilities on the host computer.

Riser Management System hardware

Data acquisition system selection was critical in the RMS design. We needed configurable hardware to accommodate a wide range of I/O as we received signal streams from various hardware and instrumentation sources. The data acquisition unit also typically needed to be located some distance away from the host console, positioned on the bridge of the vessel. Because of its wide range of modules and Ethernet capability, CompactRIO satisfies all of these requirements.

During development, the input specifications to the RMS data acquisition system went through several iterations. For example, the system used a mixture of analogue and digital measurements before a complete RS485 serial solution was implemented. Using CompactRIO, we interchanged and experimented with a variety of modules to accommodate almost any type of signal interface until we came up with a final optimum solution. The onboard real-time controller and field-programmable gate array (FPGA) preprocess the signals before they are communicated in a standardised format to the main console via Ethernet. This greatly simplified system development because there are no architectural or major software changes required if we alter modules or measurements.

We used the USB port on the controller to update firmware in the field and its FTP functionality for easy configuration and data file transfers, meaning that we can install software updates on the data acquisition hardware without removing it them from the vessels.

The rugged and reliable nature of the CompactRIO real-time OS and hardware made it an ideal choice for the offshore environment. We used LabVIEW to develop a full-featured, multicore-capable application with a rich graphical interface. With the NI suite of hardware and software, integration and communication between all modules was easier, thus reducing development time without sacrificing functionality and performance.

*Author:
Rodrigue Akkari, BPP-TECH

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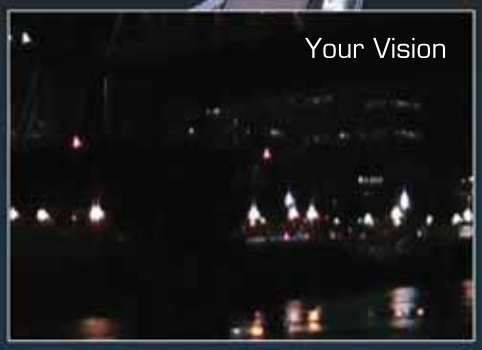

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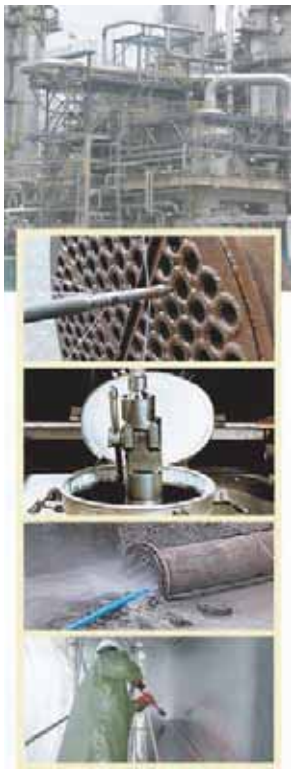

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HHI secured an order for its 10th drillship this year

Hyundai Heavy Industries (HHI) added 1 drillship to its orderbook, which brings the total number of drillships ordered to HHI so far this year to 10 units worth USD 5.5 billion.

HHI announced on September 22 that it won an order worth approximately KRW 600 billion from Noble Drilling, a world's leading offshore drilling contractor for the oil and gas industry, for the construction of 1 drillship.

This drillship is 1 unit out of the 2 optional vessels included in the contract which HHI signed with Noble Drilling early this year and scheduled for delivery by the second half of 2014. The order for another 1 optional vessel was already firmed up in March.

This drillship to be built by HHI measures 229m in length and 36m in width and has a maximum drilling depth of 12km under water.

HHI's drillship features optimized design in terms of size with world's most advanced drilling capacity, reduces maintenance cost and increases fuel efficiency, thus attracting favorable reaction from ship owners.

David Williams, Chairman of Noble Drilling, lauded the superiority of HHI's drill in the signing ceremony, saying "HHI's drillship has many advanced technological features such as efficiency design and world's most advanced drilling capacity."

This year, HHI has won orders in a row for a total of 10 drillships worth USD 5.5 billion from world's leading drilling companies of North Europe, including 4 units from Switzerland-based Noble Drilling, 3 units from U.S.-based Diamond Offshore Drilling, 2 units from U.S.-based Rowan, and 1 unit from Norway-based Olsen.

Kim Oe-hyeon (right), President of HHI, and David Williams, Chairman of Noble Drilling, are shaking hands after signing a contract to build a drillship.

STX Europe clinched an order for a large cruise ship

STX Europe announced that it signed a contract with the German-based TUI Cruises on September 27 (local time) to build a 97,000-ton large cruise ship.

STX Finland anticipates that TUI Cruises has an option to place an order for additional ship upon the decision by TUI's Board of Directors.

This cruise ship ordered to STX Finland will measure 295m in length and 36m in width with 1,250 staterooms. It can accommodate up to 3,500 persons including passengers and crews.

This ship will be built at the Turku shipyard in Finland and is scheduled for delivery by early 2014. The Turku shipyard expects that this shipbuilding project will create around 5,500 jobs.

STX Finland plans to incorporate various eco-friendly features into this ship and dramatically increase fuel efficiency to satisfy the requirements of ship owner.

This ship will have a variety of entertainment facilities, such as various restaurants, spa, theaters, etc. Particularly, it will have higher balcony ratio compared to ordinary cruise ships to provide passengers with the most comfortable sailing experience on board this cruise ship.

Image of the cruise ship ordered to STX Europe from the German-based TUI Cruises

TUI Cruises, which placed an order with STX Finland for this cruise ship, is a Germany-based shipping company founded in 2008 as a joint venture between TUI AG, the Europe's biggest travel company, and Royal Caribbean, the world's largest cruise operator. TUI Cruises advanced into the cruise ship market with the successful delivery of 'Mein Schiff', a cruise ship, in 2009.

Kim Seo-joo, President of STX Europe, said, "This newbuilding contract which we signed with TUI Cruises this time is important not only to STX Finland but also to the entire shipbuilding industry of Finland. By leveraging the world's best cruise ship building technology of STX Europe, we will build the next-generation cruise ships that have a wide range of environment friendly features."

Richard J. Vogel, President of TUI Cruise, expressed his trust in STX Europe, saying "The extensive cruise ship building experience of STX Europe and the long-term partnership with Royal Caribbean have been the key factor in awarding this project to STX Europe."

Nexans signed a turnkey supply contract with PGS, which includes lead-in cables

Nexans announced that it entered into a turnkey contract worth EUR 3 million with Petroleum Geo-Services (PGS) on September 22 to supply lead-in cable systems. This lead-in cable systems will be used for the cutting-edge GeoStreamer seismic array technology currently being deployed on board marine survey vessels of PGS.

This contract is expected to mark a key turning point for Nexans which has gained a far-reaching reputation as the leading supplier of seismic and oceanographic cables and is currently making a strategic move to offer complete services for lead-in cable systems, including fairings (wireless) and terminations.

Nexans' specialized seismic cable manufacturing plant in Rognan, Norway, is working closely with MøreNot AS for the installation of fairing (streamlined shape) and Siemens Subsea Products (formerly Bennex AS) for terminations in order to deliver 35 systems used for the GeoStreamer seismic survey.

PGS acquires, analyzes, markets, and sells accurate marine seismic data around the globe. This data allows oil and gas companies to effectively explore for hydrocarbon accumulations, develop and manage new oil and gas fields.

The vessels are towed during this exploration process by 8 to 18 cables usually spaced 1km apart. Each lead-in cables include electronic listening and recording apparatus fitted with sensitive sensors.

Usually, the lead-in cables measure 1.1km in length with a variety of internal electrical and fiber optic cores being protected by steel wire armoring in 3 layers, and are important for the on-board analysis and processing of seismic signals transferred from the arranged recording apparatus.

As lead-in cables reduce unwanted noise and prevent potential data corruption, their reliability is very important. Inaccurate data unavoidably leads to repetition of exploration and may delay the survey and cause operational loss.

In addition, the ribbon fairings fitted to the outer armoring, which are in the form of short polymer strips, play a crucial part in decreasing the vibration of cable while it is being towed through the water. This helps enhance the quality of signal transmitted to the sensitive analytical device on board the survey vessel.

Ragnar Vogt, Marketing and Sales Director, Nexans Telecom Division, said "Nexans is already well positioned as a world's leading supplier of marine seismic cables. However, customers demand integrated turnkey solutions which include cables. That is why we are operating the effective one-stop-shop by developing the lead-in cables and proceeding with new strategies to carve out more market share."

He added, "This contract which we signed with from PGS is a major breakthrough that will cement Nexan's leading position. We are poised to leverage the combination of both internal experts and reliable external partners, so that we can further develop the integrated serviced philosophy of Nexans for marine seismic operators."

The lead-in cables for the PGS vessels are due for delivery by February 2012.

STX OSV secured an order for 1 PSV

STX OSV, the specialized vessels division of STX Europe, clinched an order for Platform Supply Vessel (PSV).

STX OSV announced on October 6 (local time) that it received an order for 1 unit of PSV from Troms Offshore Supply AS, a Norway-based shipping company.

This vessel will measure 81m in length with a deadweight of 3,800 tons and feature 'PSV 08' design developed independently by STX OSV.

The hull of this vessel will be built at the STX OSV's Braila shipyard in Romania, while the remaining outfitting works will be completed at its Brevik shipyard in Norway. This vessel is scheduled for delivery by the first quarter of 2013.

Troms Offshore Supply AS, headquartered in Norway, is a shipping company that specializes in PSVs. STX OSV is currently building 1 unit of PSV at Søviknes shipyard, which was previously ordered from Troms Offshore Supply AS.

An official from STX OSV said, "Ship owners have a growing interest in the PSVs amid heightened interest in marine resources. STX OSV, which has the world's best PSV construction technology, will spur efforts to win additional orders in the period ahead."

Image of PSV to be built by STX OSV

DSME clinched orders worth KRW 2 trillion 250 billion for offshore plant and drillship

Daewoo Shipbuilding & Marine Engineering (DSME) won orders for fixed offshore platforms and drillships all at once, exceeded its annual order target off USD 11 billion.

DSME announced on October 14 that it received an order worth USD 1.4 billion (approximately KRW 1 trillion 610 billion) from Chevron, the global oil giant, for the construction of a fixed offshore natural gas refinery platform. Additionally, DSME announced on October 15 that it received an additional order worth USD 550 million (approximately KRW 640 billion) from an offshore drilling company in the Americas for a drillship.

This offshore platform consists of a 37,000-ton topside and a 27,000-ton steel gravity base substructure supporting the topside. It will be fitted with gas-liquid separation and dehydration & compression facilities, etc, and can refine approximately 55 million m^3 of natural gas per day.

This platform will be built at the Okpo shipyard of DSME and delivered to the ship owner by the second half of 2014. After delivery, this platform will be operating in Wheatstone field, 200km north of Onslow in North Western Australia.

Meanwhile, DSME will undertake the entire processes on a turnkey basis that encompasses the design, purchase, construction, and installation of the platform, including the topside and substructure.

The key factor in the award of this contract was the long-term and solid cooperative relationship between DSME and chevron, and both companies agreed upon the terms and conditions of the contract without major difference.

Including this contract, DSME has been awarded orders for 11 offshore projects, including 10 offshore platforms and 1 FPSO (Floating, Production, Storage, and Offloading) unit, from Chevron, and has successfully completed and delivered 8 offshore platforms and 1 FPSO unit, thus solidifying the cooperative relationship.

Nam Sang-tae, CEO & President of DSME, said, "DSME and Chevron have maintained strong cooperative relationship in the offshore

Nam Sang-tae (second from right), CEO & President of DSME, and officials from the ship owner are raising a toast after signing a drillship contract on October 15 in the United States.

plant field over the last 3 decades. This contract attests to the unrivalled expertise of DSME to carry out turnkey projects."
The drillship ordered this time will adopt the DSME-12000 design developed independently by DSME and will have a capacity to bore into the seafloor to a depth of up to 12,000 feet (about 3,600m) in ultra deep water.
For that, this drillship can load the drilling pipes and casing weighing up to 3,200 tons, about 1,000 tons more compared to existing drillships, and will be a dual derrick type that enables the drilling and pipe assembly to be performed at the same time for each tower when drilling a well. Thus, the work can be completed over 25% faster than when there is only 1 drilling tower.
This order brings the total orders to DSME to 44 units, including ships and offshore facilities, worth about USD 12 billion.

STX Europe won orders for 2 offshore plant modules

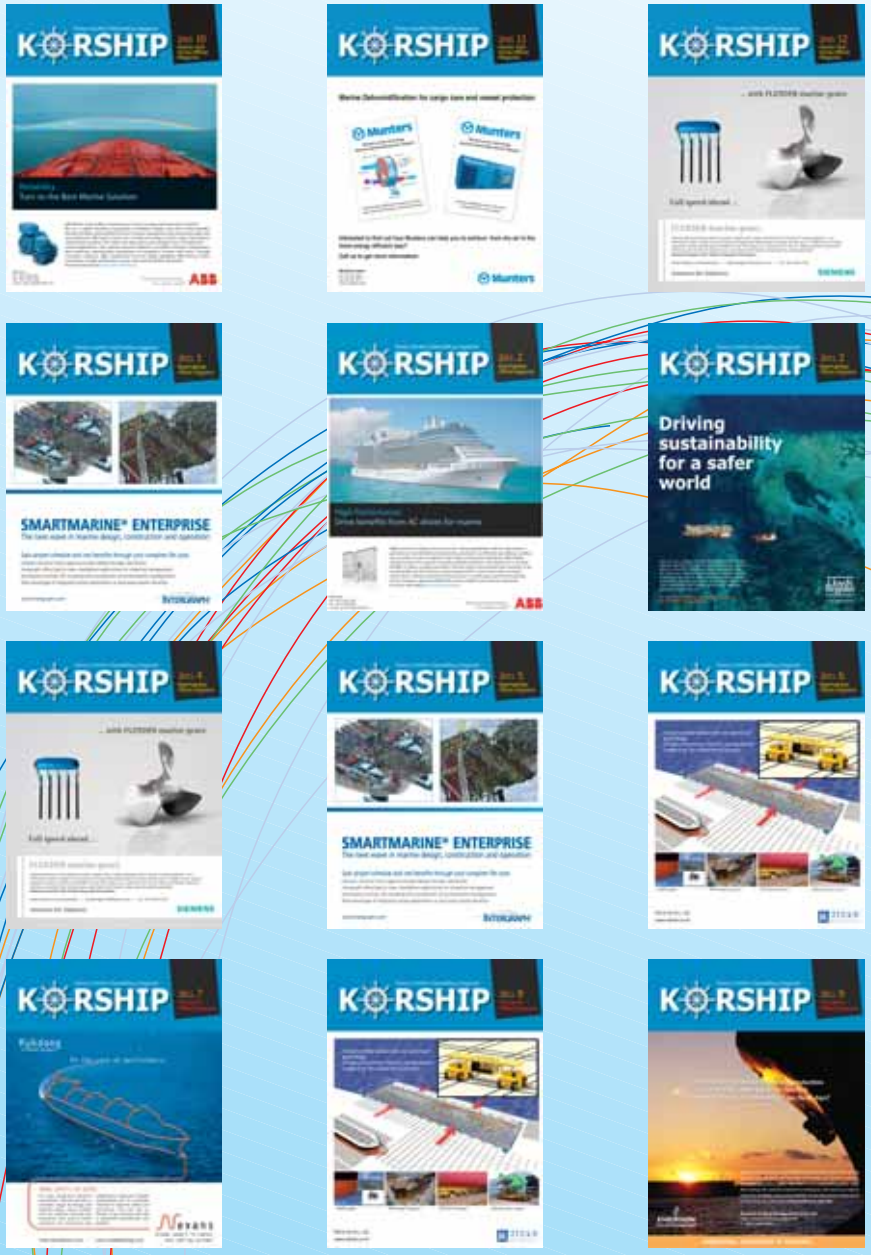
STX Finland, a subsidiary of STX Europe, announced on October 12 (local time) that it secured an order for 2 offshore plant modules.
Of the 2 offshore plant modules to be built by STX Finland, the first one will measure 63m in length, 52m in width, and 47m in height and while the second will measure 40m in length, 45m in width, and 13m in height. The 2 modules will have a combined weight of approximately 5,000 tons.
STX Finland will build these offshore plant modules at its Turku shipyard by the first half of 2012, and thereafter they will be sent to Norway for the remaining works.
Offshore plant modules are the blocks for facilitating the on-site assembly process under unfavorable conditions at sea or in extremely cold area, etc, and includes the topside and living quarters for crews, but does not include the hull.
STX Finland plans to use this contract as springboard to spur the growth of its offshore plant business and diversify its business portfolio that has been concentrated in the cruise ship and ferry boat sectors. Last month, STX Finland received an order for 2 Well Intervention Vessels from a Norway-based ship owner.
An official from STX said, "STX Finland is accelerating its drive to expand its business, like setting up Arctech Helsinki Shipyard Oy, a joint venture with Russia's state-run shipyard, at the end of last year. Having secured this contract, STX Finland will diversify its business portfolio which has been concentrated in cruise ship and ferry boat sectors."

DSME received orders for 2 LNG carriers

Daewoo Shipbuilding & Marine Engineering (DSME) announced on October 18 (local time) that it received an order worth over approximately USD 400 million for 2 units of 170,000 m^3 LNG carriers from the Sweden-based Stena Bulk. These vessels will be built at Okpo shipyard in Geoje island and delivered to the ship owner by 2014.
Stena Bulk, the ship owner, is the subsidiary of Stena Group, the largest industrial group in Sweden, and is a large shipping company operating over 90 crude carriers of various sizes. Specifically, Stena Bulk acquired 3 new LNG carriers from DSME early this year, thus advancing into the LNG transport market. Stena Bulk awarded this contract as part of effort to expand its LNG carrier fleets and make full-scale inroads into the LNG transport market.
Nam Sang-tae, CEO & President of DSME, said, "Stena Group has portfolio of different business units that cover the financing, real estate, renewable energy, etc, in addition to offshore business such as crude carriers, ferry boats and drillship. Based on this contract, we will proceed with business diversification strategy to better serve the ship owner that has various business portfolio."

Nam Sang-tae (second from left), CEO & President of DSME, and Dan Sten Olsson, Chairman of Stena Group, are raising a toast after signing the contract on October 18 (local time).

Including this contract, DSME has won orders for 46 units of ships and offshore facilities worth approximately USD 12.5 billion so far this year.



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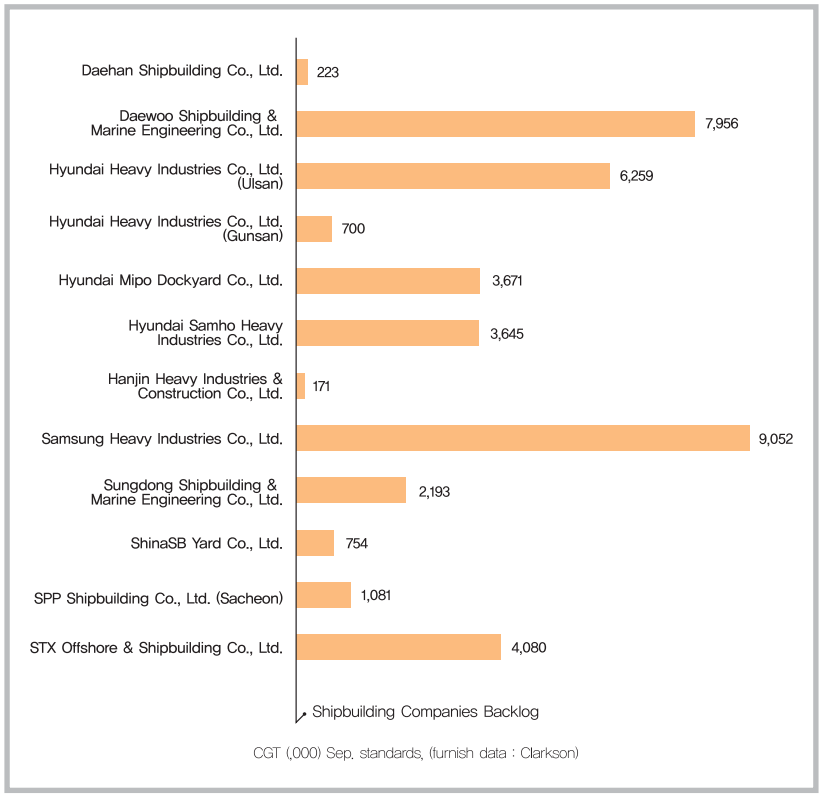
Korean shipyards reclaimed the top spot in the global shipbuilding orders/order amount in 2011 after being overtaken by China in 2010 by a slight margin in terms of new orders, shipbuilding volumes and order backlog, thus cementing the status of the country as the world's largest shipbuilder.

The prediction at the beginning of the year was right on target. The orderbook for high value-added ships, such as containership and LNG carriers, has grown and the newbuilding orders for offshore facilities have increased amid resumption of delayed projects in tandem with rising oil prices. Particularly, domestic shipyards which have high competitive edge in those 2 sectors have continued to win a wave of new orders since the beginning of the year.



According to UK-based shipping researcher Clarkson, domestic shipyards have maintained strong orderbook and been placed in the top cluster of world's leading shipyards.

Here, we take a close look at the performance of South Korean major shipyards, the world's leading players with strong growth in new orders as shown currently in the Clarkson data, such as Hyundai Heavy Industries (HHI), Daewoo Shipbuilding & Marine Engineering (DSME), Samsung Heavy Industries (SHI), STX Offshore & Shipbuilding (STXOS), and others based on the order backlog data.

Photo: Daewoo Shipbuilding & Marine Engineering Co., Ltd.

Offshore plant orders awarded to domestic shipyards in 2011

Date	Type	Number of vessel	Amount	Ship owner
January	Drillship	1 vessel (including 1 optional vessel)	KRW 590 billion	Diamond Offshore Drilling Limited, U.S.A
	Offshore Plant	-	USD 900 million	RasGas, Qatar
	Drillship	2 vessels (including 2 optional vessels)	KRW 1 trillion 140 billion	Noble Drilling, U.S.A
	Deepwater drillship	1 vessel	-	Atwood Oceanics, U.S.A
February	Offshore facility carrier	1 vessel	KRW 265 billion	Dockwise, Netherlands
	FPSO for the North Sea	-	USD 1.2 billion	BP (British Petroleum), U.K
	Platform Supply Vessel	1 vessel	-	-
	Fisheries Research Vessel	1 vessel	EUR 35 million	Ministry of Fisheries and Marine Resources, Republic of Namibia
March	Offshore Platform (North Sea Drilling & Production platform, Quarters & Utilities platform)	1 unit each	USD 600 million	BP (British Petroleum), U.K
	Deepwater drillship	2 vessel (including 2 optional vessels)	KRW 1 trillion 200 billion	Aker Drilling, Norway
	Drillship	2 vessels	USD 1.1 billion	Ship owner, U.S.A
	Platform Supply Vessel	1 vessel	-	Norsea Group AS, Norway
	Platform Supply Vessel	1 vessel	-	-
April	Drillship	1 (including 1 optional vessel)	-	Fred Olsen Energy, Norway
	Drillship	2 vessels	USD 1.12 billion	Maersk, Denmark
	Drillship	1 vessel	USD 680 million	Ocean Rig, Greece
	Shuttle Tanker	2 (including 2 optional vessels)	USD 200 million	European Navigation, Greece
May	Drillship	2 (including 1 optional vessel)	USD 1.12 billion	Rowan, U.S.A
	Deepwater drillship	1 (including 1 optional vessel)	-	Vantage Drilling, U.S.A
	Offshore Platform (Top side of offshore platform)	-	USD 414 million	Statoil, Norway
	FPSO	1 vessel	USD 636 million	Teekay Petrojarl, Norway
	Platform Supply Vessel	2 vessels	Around KRW 120 billion	Farstad Shipping, Norway
	FSO	1 unit	-	PTSC, Vietnam
	LNG-FPSO	1 unit	USD 3.026 billion	Royal Dutch Shell, U.S.A
June	Platform Supply Vessel	2 vessels	Around KRW 150 billion	Island Offshore, Norway
	LNG-FSRU	2 units (including 2 optional vessels)	USD 500 million	Höegh LNG, Norway
	Multifunctional Deep Water Anchor Handling, Offshore Service Vessels	2 vessels	KRW 240 billion	Farstad Shipping, Norway
	Drillship	1 vessel	USD 680 million	Ocean Rig, Greece
July	Drillship	2 vessels	USD 1.1225 billion	Maersk, Denmark
August	LNG-FSRU (Floating Storage and Regasification Unit)	1 vessel	USD 280 million	Excelerate Energy, U.S.A
September	Semi-submersible Rig	2 units	USD 1.1 billion	Songa Offshore, Norway
	Well Intervention Vessel	2 vessels	USD 420 million	Eide Marine Services AS, Norway
	Drillship	1 unit (optional vessel awarded on January 19)	Approximately KRW 600 billion	Noble Drilling, U.S.A
October	Fixed Offshore Platform		USD 1.4 billion	Chevron, U.S.A
	Drillship	1 unit	Approximately USD 550 million	Offshore drilling company, Americas
	Platform Supply Vessel	1 unit		Troms Offshore Supply AS, Norway
	Offshore Plant Module	2 units		

**Note : Based on the press release and public announcements of each shipyards, internal estimation of Monthly KORSHIP (estimation until October 15, 2011)*

Delivery	Shipyard
Mid 2013	Hyundai Heavy Industries
Late 2013	Hyundai Heavy Industries
On a staggered basis until late September 2013	Hyundai Heavy Industries
Second half of 2013	Daewoo Shipbuilding & Marine Engineering
October, 2012	Hyundai Heavy Industries
Early 2015	Hyundai Heavy Industries
2012	STX OSV
Early 2012	STX Finland
Late 2014	Hyundai Heavy Industries
Second half of 2013	Daewoo Shipbuilding & Marine Engineering
-	Samsung Heavy Industries
Jun-12	STX OSV
2012	STX OSV
Aug-13	Hyundai Heavy Industries
-	Samsung Heavy Industries
Oct-13	Samsung Heavy Industries
2013	STX Offshore & Shipbuilding
Second half of 2013	Hyundai Heavy Industries
Late May, 2013	Daewoo Shipbuilding & Marine Engineering
-	Samsung Heavy Industries
Mid 2013	Samsung Heavy Industries
First half of 2013	STX OSV
Early 2013	Sungdong Shipbuilding & Marine Engineering
2016	Samsung Heavy Industries
First quarter, third quarter of 2013	STX OSV
Second half of 2013, first half of 2014	Hyundai Heavy Industries
From the second quarter of 2013	STX OSV
Nov-13	Samsung Heavy Industries
Jul-14	Samsung Heavy Industries
First quarter of 2014	Daewoo Shipbuilding & Marine Engineering
Second hallf of 2014	Daewoo Shipbuilding & Marine Engineering
2013	STX Finland
Second half of 2014	Hyundai Heavy Industries
Second half of 2014	Daewoo Shipbuilding & Marine Engineering
	Daewoo Shipbuilding & Marine Engineering
First half of 2013	STX OSV
First half of 2012	STX Finland

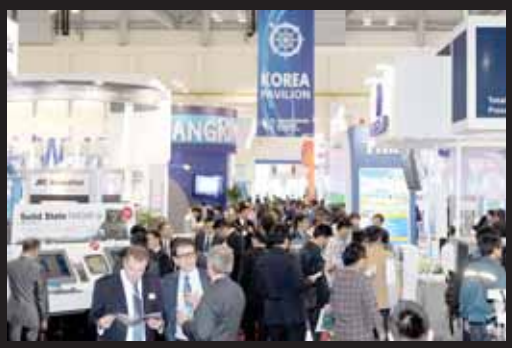
KORMARINE 2011

KORMARINE 2011 (International Shipbuilding & Marine Machinery and Material Exhibition), the 17th event since its launch, ended in great success on October 29. Particularly, this year's event, the biggest since its 1st event, attracted about 1,000 exhibitors from 40 countries with 1,266 booths, which specialize in shipbuilding, marine equipment manufacturing, offshore exploration, offshore plant sectors, etc, and drew over 40,000 visitors.

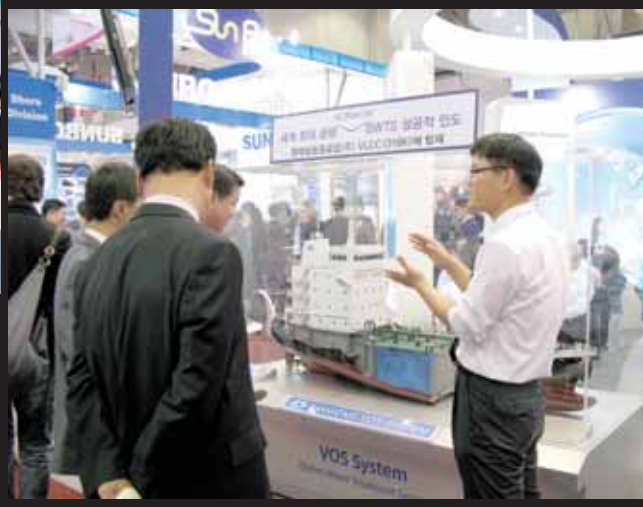
KORMARINE 2011 attracted many renowned domestic shipbuilders and marine manufacturers showcasing the latest products and technologies, such as Hyundai Heavy Industries (HHI) and STX, both of which participated with their shipbuilding subsidiaries and marine equipment manufacturing affiliates, including Kangrim, NK, etc, and overseas leading shipbuilders and marine manufacturers such as ABB, MAN Diesel, Alfa Laval , etc.

KORMARINE 2011 provided an excellent platform to view the latest technologies presented by many exhibitors from countries worldwide, including the exhibitors from Germany that featured as many as around 120 booths, and particularly, hosted a total of 12 national pavilions, including those from U.K., Norway, Finland, China, and Sweden which set up its first national pavilion in KORMARINE.

During the show, about 80 seminars, which provide an insight into the latest technology of the shipbuilding and offshore industries, were held all at the same time, including World Ocean Forum organized by Korea Association of Marine Industry, SEOUL DIGITIAL SHIP Forum (U.K., DIGITAL SHIP), Green Shipbuilding Conference (Denmark, Danish Marine Group), ISMT (Korea, Korean Society of Marine Engineering), Technology Seminar of HHI, and others.

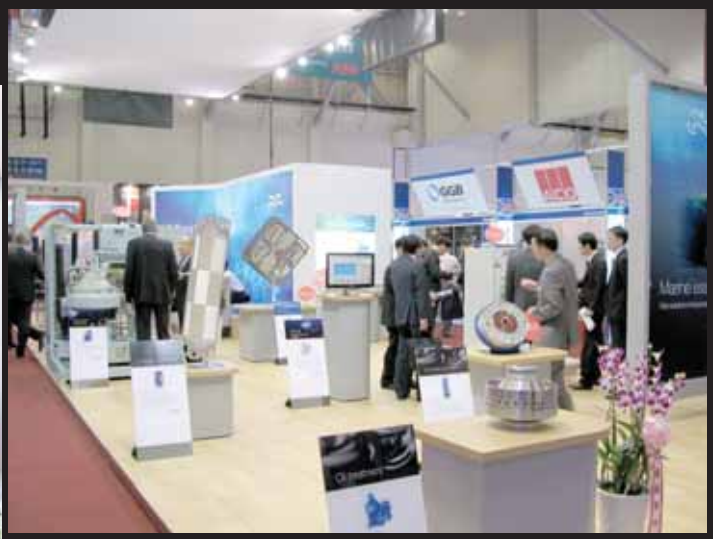



BEXCO
MARINE WEEK 2011 부산국제조선해양대제전


VOS System


ABB


CARGOTEC
KIBB · KALMAR · MACGREGOR




MAN


SPX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ing safety on board
Reliable cable solutions


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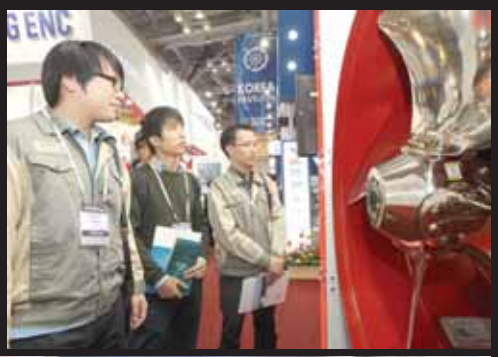
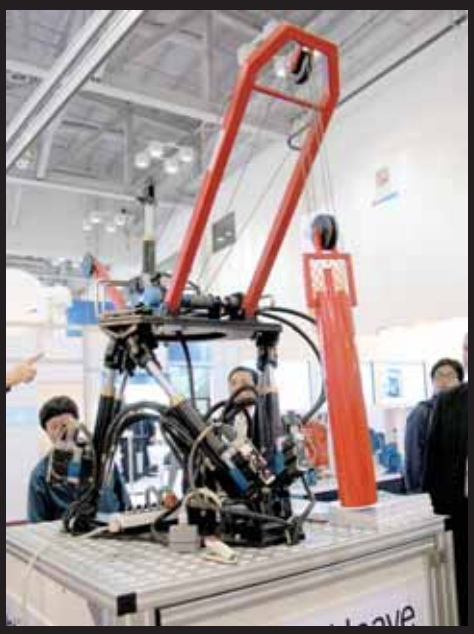
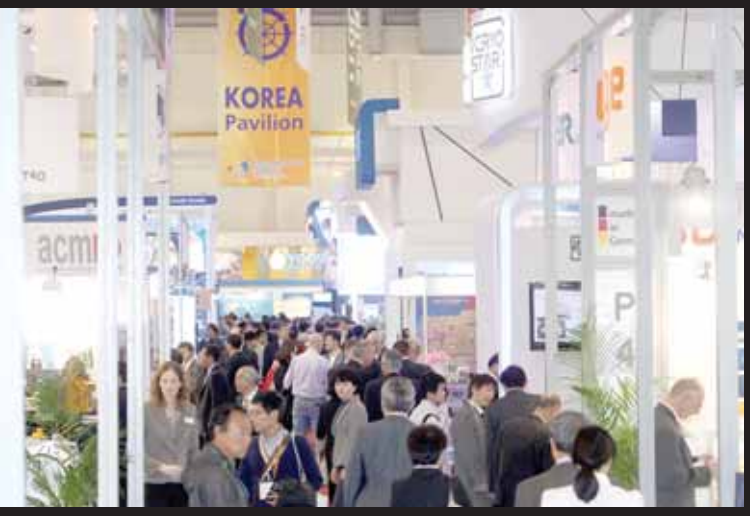
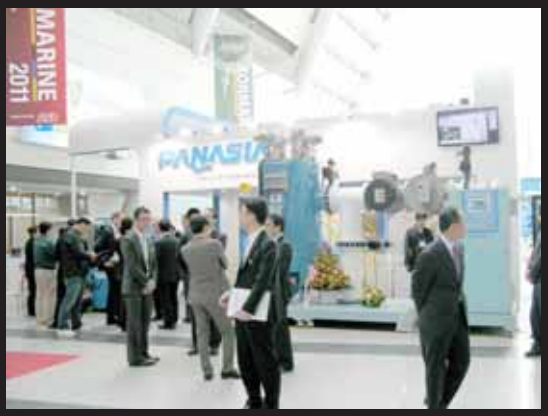
2011






KOREA
Pavilion


MARINE
2011


Surface Grinding Machine
Crankshaft Grinding Machine


HYUNDAI
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The Precision of Ultrasonics

The SDT Sherlog Line:

Accuracy, reliability for ultrasonic tightness testing

국제선급 인증(Type Approved) – ABS, DNV, LRS, HRS

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- 압축공기, Gas, 스팀, 진공누설탐지시, 각종 Tank·용기의 기밀검사시, 전력설비진단시

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Lloyd's Register

LIFE MATTERS

New Product

Profibus extender and I/O communication terminal

Phoenix Contact Korea

The new Profibus extender from Phoenix Contact enables straight forward integration of remote Profibus devices at data rates of up to 1.5 Mbps. The extender has two DSL connections per device. This means that in addition to point-to-point connections the extender can also be used to easily establish line structures with up to 30 devices.

To protect the communications modules, surge protection is required for both DSL connections. The DIN rail-mountable DSL surge protector from Phoenix Contact offers two a/b connections per screw terminal. When designing a line structure, users therefore need only one surge protector per intermediate station, thus saving space in the control cabinet and lowering costs.

Meanwhile, the IB IL PB-MA-PAC inline I/O communication terminal now enables the integration of Profibus devices into the Phoenix Contact automation solution.

The Profibus terminal can be integrated into the I/O system either as a Profibus DPV0 master or slave. With a maximum data width of 64 bytes IN/OUT, its primary use is to connect existing Profibus devices into an automation solution from Phoenix Contact. This is especially true for medium-sized applications built using the Easy Automation system based on compact controllers.

I/O communication terminal

Users can connect up to 16 DP slaves at a maximum baud rate of 12 Mbps. A memory stick is integrated into the front side of the terminal for storing the DP master configuration data. If service is required, the terminal can be directly replaced without having to reconfigure it. Profibus parameters such as the transmission speed can be set directly in the PC Worx automation software using a configuration tool.

The Profibus terminal expands the Easy Automation system for class 100 compact controllers to provide an additional option for communicating with external fieldbus devices.

Profibus extender

-TEL: +82-31-740-9900
-http://www.phoenixcontact.co.kr

Lithium ion cordless inspection camera

Tools Division of Robert Bosch Korea

'GOS 10.8V-LI'

The Power Tools Division of Robert Bosch Korea introduced 'GOS 10.8V-LI', a lithium ion cordless inspection camera recently.

GOS 10.8V-LI allows the user to identify the problem in narrow and dark space such as the brass pipe and drain pipes, enabling quick repair. Realistic image rendering on 320 (L) x 240 (W) 2.7" LCD display with high resolution allows for easy and accurate visual inspections. The smooth surface of the inspection lens ensures high quality image even in dirty environment. Depth of field ranges from 3.8cm to infinity, enabling the user to obtain clear and precise image.

The high performance LED light mounted on the frontal lens has 9 brightness levels to adjust the light intensity under various work conditions. Particularly, GOS 10.8V-LI is a very versatile product useful for various works such as plumbing works, installation of boiler, air-conditioner, etc.

The 122cm inspection lens cable that comes along with GOS 10.8V-LI and the very small lens measuring 17mm in diameter are very convenient for locating the problems in the ventilation window or tight space between the inner and outer walls. Both inspection lens and cable are waterproof, and therefore can be used in dirty and damp place.

Powered by a lithium ion battery, GOS 10.8V-LI is lightweight. The charging time is short and battery lasts long, thus maximizing the efficiency of work.

GOS 10.8V-LI has the following specification:

-Battery voltage: 10.8V
-LCD display: 2.7 inch
-Display resolution: 320X240 pixel
-Diameter of lens: 17mm
-Length of lens cable: 122cm
-Depth of field: 3.8cm - ∞

-TEL: +82-80-955-0909
-http://www.bosch-pt.co.k

New Product

Anti-piracy jet nozzles and others

Tanktech

Many shipboard equipment suppliers are focusing on the price-wise concerns when developing a new product. Particularly, Tanktech has put every effort into fostering new trends in the market based on customers' demands since its foundation.
As a result, Tanktech has constantly introduced various products reflecting the recent trends in the market.

Anti-piracy solution jet nozzles

Recently, there has been a tremendous surge in maritime piracy as pirates try to fill their coffers with monsoon season round the corner when pirates will be out of business due to high seas. Now, ship owners are looking for solutions to protect their assets. Tanktech has come up with an ingenious solution to prevent pirates from boarding the ship.
An anti-piracy system called PSJ-1004 that can be installed on the ship to prevent hijacking. This system consists of a number of high pressure water Jet machines installed on the ship side. These water Jet machines continuously rotate using the flow of water and provide a high pressure water curtain all around the periphery of the ship. This high pressure water curtain will prevent any pirates from boarding the ship using grappling hooks with rope or portable ladders. It is high time that ship owners take affirmative action to protect their vessel and lives of crew on board by investing in new technology.

VOC Reduction System

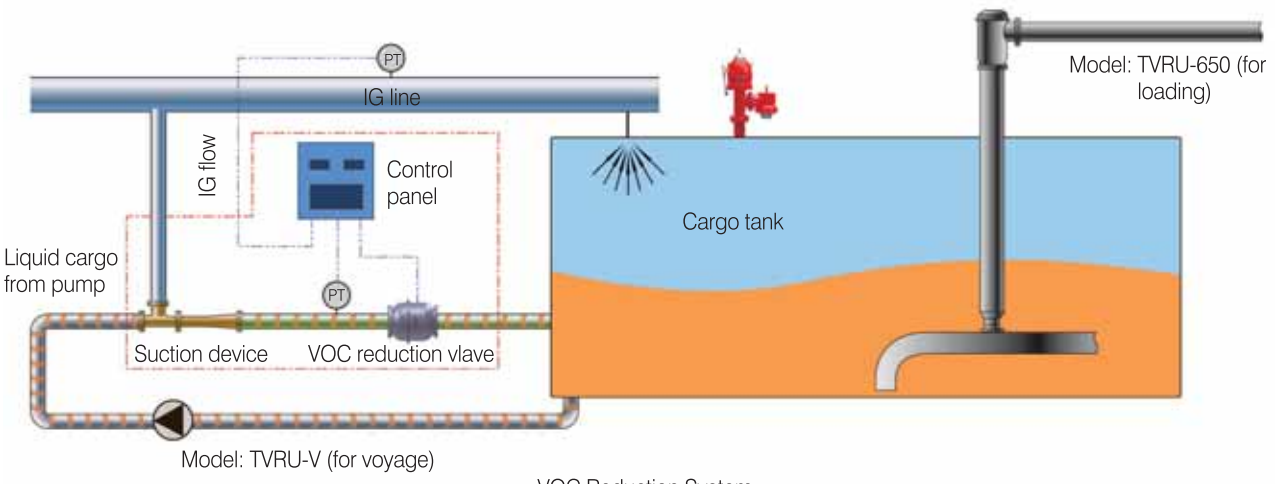
Volatile Organic Compound (VOC) is generated during voyage by thermal vibration and during loading by preventing. And, shipowers are questioning how to reduce its level. Here are two methods of Tanktech VOC Reduction Systems as follows.
First, Tanktech TVRU-650 (VOC Reduction Unit for Loading Line) can remarkably reduce VOC generation during loading by preventing the pressure of loading pipe line from dropping down under the vapor pressure of cargo. Because TVRU-650 just uses a fluid dynamic theory and has very simple inside structure without electric or mechanical moving part, no maintenance work is required.

Anti-piracy nozzle 'PSJ-1004'

And, second, Tanktech TVRU-V (VOC Recovery System) absorbs VOC from IG line or cargo tank using the ejector and dissolve back into cargo oil by VOC Reduction Valve and water head of cargo tank. Tanktech VOC Reduction Valve is operated when the water head inside cargo tank is too low to dissolve VOC into cargo oil. It has also Anti-cavitation function to prevent bubble generation due to the pressure drop in the downstream of valve.

The first developer of low pressure driven water-mist fire fighting system for cruise liner

Only when European makers are supplying water-mist fire fighting system for cruise ships where also built in EU countries only, who is the



VOC Reduction System

alternatives?

Tanktech, located in Gupyeong - Busan city, has developed and got EU MED type approval certificate with their new concept of water-mist fire fighting system for accommodation like cruise liner passenger area. The new concept of the system is based on low pressure activation which is the first ever developed technology in the market. And, it is the first Korean maker who commercialized the accommodation water-mist fire fighting system.

However, all those things are not exactly earth shattering if you know Tanktech awarded the Korean World-class Product Awards 2009 for water-mist fire fighting systems equipped in the machinery space.

-TEL: +82-51-979-1600
-http://www.tanktech.co.kr

NI Korea will hold NIDays 2011, a graphical system design conference

National Instruments Korea (NI Korea) will host the NIDays 2011 graphical system design conference at Renaissance Hotel in Seoul on November 15. This event is a Korea semi-equivalent of NI Week, a large-scale annual graphical system design technology conference held at the head office of National Instruments (NI) in Texas, United States, and consist of 6 tracks and over 30 technical sessions by application.

Particularly, Dr. James Truchar, a co-founder and current President & CEO of National Instruments, will provide an insight into the future of control and instrumentation solutions for domestic engineers and scientists.

NIDays 2011 will feature practical examples of advanced applications, as well as innovations and state-of-art technologies in the field of automation, control, and instrumentation. Furthermore, prominent domestic customers such as Samsung Medicine, KEPCO (Korea Electric Power Corporation) Research institute, Hyundai AutoEver, Innowireless, etc, will be invited to showcase the latest solutions of NI that cover a wide range of industries, including medicine, electronics, automotive, semi-conductor, LTE, shipbuilding, and other industries.

Noticeably, the session will include a series of presentations, such as the presentation by Dr. Park Sang-gyun of Korean Register of Shipping (KR) on HILs system for the evaluation of SOFC (Solid Oxide Fuel Cell) performance on board ships, the presentation by Dr. Shin Dong-ho of National Cancer Center (NCC) on the proton therapy equipment system, the presentation by Kim Ki-yeul of ToKNC on the trend and equipment design of latest semi-conductor automation test, and the presentation by Lee Jin-jong, the principal researcher of Hyundai AutoEver on the fault diagnosis test system for automotive safety system.

BMEA (Busan Marine Equipment Association)
Member List

ANSWER CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.answerclear.com
Main Products : CO2 Extinguishing Sys. External Fire Fighting Sys.
TEL : +82-51-831-3691

BANDO MARINE.
Head Office : Gangseo-gu Busan
Homepage Add. : www.bando.info
Main Products : Life Boat
TEL : +82-51-831-1950

BERM YOUNG VALVE.
Head Office : Gangseo-gu Busan
Homepage Add. : www.byvalve.com
Main Products : Quick Closing Valve, Ball Valve, Bellows, Beal Valve
TEL : +82-51-311-2511

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Head Office : Yangsan Gyeongsangnam-do
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Main Products : Fitting & Valve, Vacuum Clamp
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Main Products : O-ring, Sealing, Gasket
TEL : +82-51-831-4615

BOKYUNGTL CO., LTD.
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TEL : +82-51-832-0801

BO MYUNG METAL CO., LTD.
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Main Products : Stairway Body, Ladder, Hardware
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BUSAN INDUSTRY CO.
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Main Products : Powder Coating
TEL : +82-51-831-4810

BUSUNG PLANT CO., LTD.
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Homepage Add. :
Main Products : Cargo Reducer Piece
TEL : +82-51-831-1784

CEPHAS PIPELINES CO., LTD.
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Homepage Add. :
Main Products : Butterfly Valve
TEL : +82-51-263-3661

CHK CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.chkj.co.kr
Main Products : Telephone Booth, Work Shop, Cable Box, Spare Box
TEL : +82-51-831-9500

CHWANG HYEOP INSTRUMENTS.
Head Office : Gangseo-gu Busan
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Main Products : Telephone Booth, Work Shop, Cable Box, Spare Box
TEL : +82-51-831-3607

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Main Products : Sewage Tredtment Plant
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Main Products : Temperature & Press Sensor, Alarm Monitoring Sys.
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DAECHANG METAL CO., LTD.
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Main Products : Air Cooler, Oil Cooler, Oil Tank, Air Tank, Oil Heater
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Main Products : Flower Meter, Viscometer, Control Valve
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Main Products : Chain Block, Lever Block Trelley
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Main Products : Head, Air Receiver Tank, Pressure Vessel, Reactor
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Head Office : Gangseo-gu Busan
Homepage Add. : www.daesan-eng.com
Main Products : E/R Package unit, Pipe Group Unit
TEL : +82-51-831-0090

DAE SEONG MARINE TEC CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.ds-frp.com/
Main Products : Pipe Insulation System, FRP Weather Door
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DAESUNG IND CO.
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Main Products : Precision Instrument
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Main Products : Precision Instrument
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Homepage Add. : www.dhm.co.kr
Main Products : High Pressure Blower, High Pressure Washer
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Main Products : E/R Heater & Cooler, Copt, Condenser, Plate Heat Exchanger
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Main Products : Piston Crown
TEL : +82-51-417-7800

DUYOUNG INDUSTRIAL MACHINES CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Plate-Baffle
TEL : +82-51-831-2477

EM SYSTEC CO., LTD.
Head Office : Sasang-gu Busan
Homepage Add. : www.emsystec.com
Main Products : Marine Switch Board, Control Console
TEL : +82-51-302-8761

FRIEND CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.thefriend.co.kr
Main Products : Marine Cable Tray, Mud Box, Strainer
TEL : +82-51-831-9456

GEO MAEK SHOT&PAINT CO.,LTD.
Head Office : Saha-gu Busan
Homepage Add. :
Main Products : Deck Machinery Part, Hose Handling Crane
TEL : +82-51-264-3315

GEORIM ENGINEERING CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.kangrim.com
Main Products : Marine Indutrial Boiler, Exhaust Gas Boiler
TEL : +82-51-831-2929

GISUNG ENGINEERING CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Air Reserovir, Heat Exchanger
TEL : +82-51-831-4475

G. M. TEC CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.igmtec.com
Main Products : Duct Equip`t Seat Support
TEL : +82-51-831-5851

G.S HIGH-TECHER CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.gshightecher.koreasme.com
Main Products : Air Vent Head, Pipe Coupling
TEL : +82-51-832-0456

G&S PRECISION IND CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Cable Tray, Vent, Hull Outffittings
TEL : +82-51-831-0849

HAE DONG METAL CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.hdanode.com
Main Products : Zinc Anode, Al Anode
TEL : +82-51-831-3751

HAE DUK RUDDER & R.STOCK CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.rudders.co.kr
Main Products : Rudder & R.Stock, Rudder Horn, Rudder Carrier
TEL : +82-51-831-0101

HAE SUNG INDUSTRIAL.
Head Office : Saha-gu Busan
Homepage Add. : www.hsjs.co.kr/
Main Products : Cable Tray, Cable Way Fitting, Cable Coaming
TEL : +82-51-264-8103

HAEWON INDUSTRIES CO.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : P/Crown, P/Skirt
TEL : +82-51-831-4600

HAEWON IND. CO., LTD.
Head Office : Sasang-gu Busan
Homepage Add. : www.heawon.net
Main Products : Copper, Copper-Nickel, Monel Fitting & Flanges
TEL : +82-51-312-2161

HAEYANG FAMILY CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : F.P Propeller, C.P Propeller, Propeller Shaft
TEL : +82-51-831-3550

HAEYANG METAL CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : F.P Propeller, C.P Propeller, Propeller Shaft
TEL : +82-51-831-4591

HAEYANG PROPELLER CO., LTD.
Head Office : Gangseo-gu Busan

Homepage Add. :
Main Products : Marine Propeller
TEL : +82-51-831-4599

HANCHANG TRANS CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.hctr.co.kr
Main Products : Pole Mounted Transformer, Pad Mounted Transformer
TEL : +82-51-831-3470

HANJULEVEL.
Head Office : Sasang-gu Busan
Homepage Add. : www.hanjulevel.co.kr
Main Products : Level instrument Etc, Vapour Emision Control Sys.
TEL : +82-51-303-0537

HANLA IMS CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.hanlalevel.co.kr
Main Products : Cargo Tank Monitoring Sys. Tank Remote Sounding Sys.
TEL : +82-51-601-3019

HANLA IND CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. :
Main Products : Oil Filter unit, Gas Blower
TEL : +82-51-264-2201

HANMAUM KI-GONG CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.hankg.co.kr
Main Products : Air Cooler Housing, Oil Cooler Housing
TEL : +82-51-831-5211

HEARTMAN CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. : www.heartman.co.kr
Main Products : Nozzle Tip, Plunger Ass`y, Fuel Injection V/V
TEL : +82-51-262-8869

H.M.E.
Head Office : Kijang-kun Busan
Homepage Add. : www.hyomyungeng.com
Main Products : Battery Charger, Light Signal Column
TEL : +82-51-709-9000

HOSEUNG ENTERPRISE CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.hoseung.koreasme.com
Main Products : Tand Package Unit, Pump Package Unit, Cooler Package Unit
TEL : +82-51-831-2233

HWAJIN ENTERPRISE CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.hwa-jin.com
Main Products : Control Box, Gauge Board System
TEL : +82-512-831-9447

HWAJIN PF CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. : www.hwajinpf.com
Main Products : Butt-Welding Pipe, Fittings Carbon Steel
TEL : +82-51-204-3001

HWA SHIN PRECISION CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Life Boat Winch
TEL : +82-51-831-9839

HYOSUNG STEEL TECHNOLOGIES CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Steel plute cutting, Hy Auto or Manual
TEL : +82-51-831-5093

HYUNDAI HYCRAULIC CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.hhmc.co.kr
Main Products : TURNING ROLLER, BLOCK LIFT
TEL : +82-51-831-8611

HYUNDAI ZINC METAL CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. : www.hdz.co.kr
Main Products : Sacrificial Anode, Hot Dip Galvanizing, Ship Manufacture
TEL : +82-51-266-4788

HYUNJIN MATERIALS CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.hjmco.co.kr
Main Products : Cross Head, Connecting Rod, Piston Rod
TEL : +82-51-602-7700

ILDO MACHINE ELECT CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. :
Main Products : Heavy Electric Parts
TEL : +82-51-266-6066

IL - SUNG INDUSTRY CO.
Head Office : Sasang-gu Busan
Homepage Add. :
Main Products : Silencer, Water Air Filter, Air Intet Trunk
TEL : +82-51-312-4056

IN SUNG INDUSTRY CO.
Head Office : Saha-gu Busan
Homepage Add. :
Main Products : Profile, Steel Coalming Insulation
TEL : +82-51-293-7550

JAESEUNG ENGINEERING CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Steel Pipe Spool, Sus Pipe Spool, CuNi Pipe Spool
TEL : +82-51-831-8838

JEILSANKI CO.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products :
TEL : +82-51-831-5398

JEONG-AM SAFETY GLASS CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.jeong-am.co.kr
Main Products : Tempered Glass, Laminated Glass
TEL : +82-51-831-6161

JEONG HWA ACCOMMODATION SYSTEM CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.jeonghwa21.com
Main Products : Wooden Furniture
TEL : +82-51-974-8000

JEONG WOO COUPLING CO., LTD.
Head Office : Kimhae Gyeongsangnam-do
Homepage Add. : www.jwcjoint.co.kr
Main Products : Pipe Coupling, Pipe Repair Clamp
TEL : +82-55-339-7666

JIN GU ENGINEERING.
Head Office : Kimhae Gyeongsangnam-do
Homepage Add. :
Main Products : Rudder Stock, Stern Tube, Stern Roller, Winch
TEL : +82-55-343-3414

JIN IL BEND CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products :
TEL : +82-51-832-1919

JINKWANG ELECTRIC CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Pull Card Switch, Belt Sway Switch, Belt Speed Switch
TEL : +82-51-831-2571

JINYOUNG METAL CO., LTD.
Head Office : Sasang-gu Busan
Homepage Add. : www.jymct.co.kr
Main Products : Multi Core Tube, Welded Stainless, Steel Tube
TEL : +82-51-313-4001

JMC HYDRAULICS.
Head Office : Saha-gu Busan
Homepage Add. :
Main Products : Hydraulic Motor For Marine, Hydraulic Control Valve
TEL : +82-51-204-4046

JNC HI-TECHNOLOGIES.
Head Office : Gangseo-gu Busan
Homepage Add. : www.jnchitec.com
Main Products : Junction Box, Elect panel bard, Tel Booth
TEL : +82-51-974-9500

JOKWANG I.L.I CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products :
TEL : +82-51-602-0200

JONGHAP POLESTAR ENGINEERING CO., LTD.
Head Office : Youngdo-gu Busan
Homepage Add. :
Main Products : Diesel Engine Piston, Cylinder, Valve
TEL : +82-51-403-5514

JUNG GONG IND. CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. : www.jung-gong.com
Main Products : Ordinary Window Side, Scuttle, Heated Window
TEL : +82-51-261-2911

JUNG - WOO MACHINERY CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Carrier Housing, Split Bearing,Stock, Up.Lower Sleeve
TEL : +82-51-831-5394

KANG BACK INDUSTRY CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Electric Control Box, Valve & Similar , Equipment
TEL : +82-51-831-9025

KANGIL CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Pressure Vessel, Deaerator, Heat Exchanger
TEL : +82-51-972-5672

KANGRIM HEAVY INDUSTRIES CO., LTD.
Head Office : Changwon Gyeongsangnam-do
Homepage Add. : www.kangrim.com/
Main Products : Marine Indutrial Boiler, Exhaust Gas Boiler
TEL : +82-55-269-7701

K.C. LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.iccp-mgps.com
Main Products : M.G.P.S, I,C,C,P, System Fe Ion, Generator
TEL : +82-51-831-7720

KEO HUNG MACHINERY.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Deck Crane, Provision Crane, Hose Handling Crane
TEL : +82-51-831-6296

KEYSUNG METAL CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.keysungmetal.com
Main Products : Valve(Cryogenic, Ball), Strainer
TEL : +82-51-831-3391

KOC ELECTRIC CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Cast Resin Transformer, Dry Resin Transformer
TEL : +82-51-832-0550

KOREA HYDRAULIC CO.
Head Office : Gangseo-gu Busan
Homepage Add. : www.enpos21.com
Main Products : Electtric Motor Pump, Hand Pump, Single/Double Acting Ram
TEL : +82-51-832-1100

KOREA PHE CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.kphe.co.kr
Main Products : Plate Heat Exchanger, Tank Cleaning Heater
TEL : +82-51-261-2664

KOREA STEEL SHAPES CO., LTD.
Head Office : Sasang-gu Busan
Homepage Add. : www.ekosco.com
Main Products : Flat Bars, Equal Angles, Unequal Angles
TEL : +82-51-323-2611

KOREA TRADING & INDUSTRIES CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. : www.kticopper.co.kr
Main Products : Copper alloy coil, Plate
TEL : +82-51-293-4423

KORINOX CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.korinox21.com
Main Products : Cold Mill Stainless, Steel Coil
TEL : +82-51-832-0031

KORVAL CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. : www.korval.co.kr
Main Products : Crank Case Relief Valve, Main Starting Valve, Rotary Valve
TEL : +82-51-790-9700

KSP CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Ship Engine Valve Spindle, Flange, Ring Gear
TEL : +82-51-831-6274

KSV
Head Office : Youngdo-gu Busan
Homepage Add. : www.ksv-valve.co.kr
Main Products : Valve Spindle, Seat-Ring for marine Engine
TEL : +82-51-415-4466

KTE CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.kte.co.kr
Main Products : Electrical Equipment (Switchboard & Console)
TEL : +82-51-265-0255

KUKDONG ELECOM CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. : www.kukdongelecom.com
Main Products : Naviagtion/Signal LT, EX-Plosion Proof LT, Fluorescent LT
TEL : +82-51-266-0050

KUKDONG INDUSTRIAL ENGINEERING.
Head Office : Sasang-gu Busan
Homepage Add. : www.kdie.co.kr
Main Products : Exhaust Gas Pipe With Insulation, Fuel Injection Pipe and Bloc
TEL : +82-51-303-6900

KUKJE METAL CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.kjmetal.co.kr
Main Products : Manhole Cover, Portable Tank, EXH. Gas Pipe
TEL : +82-51-831-1541

KUM HAW PRECISION CO.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Coupling Flange, Bellows Flange
TEL : +82-51-831-5685

KUMKANG ENGINEERING.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Hand Rail, Storm Rail, Platform, Inc. Ladder
TEL : +82-51-831-0091

KUMKANG PRECISION.
Head Office : Saha-gu Busan
Homepage Add. : www.kkmarine.co.kr
Main Products : Engine Parts, (Air Reservoir) & Valve
TEL : +82-51-262-4893

KWANGIL CORP.,
Head Office : Sasang-gu Busan
Homepage Add. : www.k-i.co.kr
Main Products : Stainless Steel, HR Coil
TEL : +82-51-324-0006

KWANG JIN E.N.G CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Pipe Piece, Pipe Spool
TEL : +82-51-831-1435

KWANG JIN IND. CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Part of Heat Exchanger
TEL : +82-51-831-4131

KWANG JIN TECH.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Non Asbestos, Teflon, Rubber
TEL : +82-51-973-5566

KWANG LIM MARINE TECH. CO.,LTD.
Head Office : Sasang-gu Busan
Homepage Add. :
Main Products : Window Box, (STEEL, AL, SUS) Vent Hole
TEL : +82-51-313-0055

KWANG SAN CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.kwangsan.com
Main Products : Heating Coil unit, Expansion joint
TEL : +82-51-974-6301

KWANGWOON CO.,LTD.
Head Office : Youngdo-gu Busan
Homepage Add. : www.kwang-woon.com
Main Products : Square Window, Side Scuttle, Door, Hatch, Window Wiper
TEL : +82-51-414-9494

KYEONG SIN FIBER CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.ksfiber.co.kr
Main Products : Rudder Bearing Bush, Insulation
TEL : +82-51-831-0268

KYOUNGWON BENDING CO.
Head Office : Kimhae Gyeongsangnam-do
Homepage Add. : www.bending4u.com
Main Products : Hwase Pipe, Chain, Locker
TEL : +82-55-313-1277

KYUNGIL METAL CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Marine Equipment Plating, Head Rest Pipe Plating
TEL : +82-51-831-1677

KYUNGSUNG INDUSTRY CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.e-clamp.com
Main Products : Svs Corner & Anchor, Strip, Clamp
TEL : +82-51-831-4960

LHE CO., LTD.
Head Office : Kimhae Gyeongsangnam-do
Homepage Add. : www.lhe.co.kr
Main Products : Heat Exchanger
TEL : +82-55-340-0624

MANZU INDUSTRY. CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Phosphate Coat, Pipe & Structure Painting, Special Painting
TEL : +82-51-832-0944

MARINE RADIO CO., LTD.
Head Office : Youngdo-gu Busan
Homepage Add. : www.mrckorea.co.kr
Main Products : Public Addressor Sys, Common Aerial Sys.
TEL : +82-51-414-7891

MARINE TECHNICAL ENGINEERING CO., LTD.
Head Office : Sasang-gu Busan
Homepage Add. :
Main Products : Oily Water Seperator, Bilge Alarm, Air Dryer
TEL : +82-51-831-1118

MARSEN CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.marsen.com/
Main Products : Cargo Tank Monitoring System, Tank High/Overfill Alarm System
TEL : +82-51-831-2108

MAX TECH.
Head Office : Kimhae Gyeongsangnam-do
Homepage Add. : www.maxtech21c.com
Main Products : Engine, Shock Absorper, Gasket
TEL : +82-55-327-9652

MCM CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.mcm21.co.kr
Main Products : Valve, Junction Box, Switch Cover
TEL : +82-51-832-0505

MI JIN PRECISION.
Head Office : Sasang-gu Busan
Homepage Add. :
Main Products : Valve, Tube, Vend, Pipe for ship
TEL : +82-51-315-3143

MIJOO INDUSTRY CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products :
TEL : +82-51-831-1588

MIRAE ENGINEERING CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.miraeship.co.kr
Main Products : Hull Block, Steel Outfitting, Pipe Spool/Unit
TEL : +82-51-790-5800

MJ TSR CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.mjtsr.com
Main Products : Rubber Sheets & Hats, All Types of Parts for Shipbuilding & Industries
TEL : +82-51-832-0002

MODERN INTECH CO., LTD.
Head Office : Sasang-gu Busan
Homepage Add. :
Main Products : Curtain, Carpet, Upholstery, Mattress for Marine
TEL : +82-51-325-0260

MT.H CONTROL VALVES CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products :
TEL : 82-51-974-8831

MYTEC CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.imytec.com
Main Products : Heat Exchanger, Pressure Vassel
TEL : +82-51-831-7474

NAMSUNG SHIPBUILDING CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. :
Main Products : Rescue Boat Davit & Winch, Assembly, Line Hauler
TEL : +82-51-200-1277

NAMYANG METAL.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Stair Way Body, Bulk Head Hnlon, Galley Hood
TEL : +82-51-832-1721

NARA CORPORATION CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. :
Main Products :
TEL : +82-51-790-7505

NAVUTEC.
Head Office : Kijang-kun Busan
Homepage Add. : www.navutec.com
Main Products : Fire fighting & Safety, equipment for marine & Offshore
TEL : +82-51-728-5055

NEW-OHSEUNG CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. :
Main Products : Manifold, Spool piece, Chain compressor
TEL : +82-51-266-5724

NK CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. :
Main Products : Ballast Water Treatment System, Co2 System
TEL : +82-51-204-2211

NOKSAN FLANGE CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Flange for ship
TEL : +82-51-831-7956

OBOK ELECTRIC CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Transformer
TEL : +82-51-832-1751

OK KWANG ENG CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.okv.co.kr
Main Products : Marine valves, Strainers
TEL : +82-51-326-7741

OK KWANG METAL CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.okkwang.com
Main Products : Std Flange, Tube Sheet, Forging Material
TEL : +82-51-831-9885

ORIENTAL PRECISION & ENGINEERING CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.opco.co.kr
Main Products : Deck house, Engine room Casing, Life Boat
TEL : +82-51-202-0101

ORIENTAL PRECISION MACHINERY CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.opco.co.kr
Main Products : Crane Component
TEL : +82-51-831-0202

O.S.C.G CO., LTD.
Head Office : Sasang-gu Busan
Homepage Add. : www.oscg.net
Main Products : Cable grand, Junction box
TEL : +82-51-305-3910

PACO HITEC CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. : www.pacohitec.com
Main Products : Hydraulic hose, Fitting
TEL : +82-51-266-6994

PAL MI METAL IND CO., LTD.
Head Office : Jinhae Gyeongsangnam-do
Homepage Add. :
Main Products : Valve, Yoke, Fork, Knuckle, Carrier
TEL : +82-55-552-3840

PANASIA CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.worldpanasia.com
Main Products : Hi-level Alarm Sys. Tank level Gauge
TEL : +82-51-831-1010

PI PLUS CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.pharmaidsolutions.com
Main Products : Rudder stock, Pintle, Intermediate Shaft
TEL : +82-51-831-9338

POONG JIN METAL CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Emergency Shut-Off Valve, Veneral Bronze Casting Valve
TEL : +82-51-831-8510

PSM CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.psminc.co.kr
Main Products : Ring Flange, Shaft, Nozzle
TEL : +82-51-970-3000

SAEJIN INTECH CO., LTD.
Head Office : Kimhae Gyeongsangnam-do
Homepage Add. : www.saejinintech.com
Main Products : Emergency Towing, Arrangement, Universal Swivel Fairlead
TEL : +82-55-328-1458

SAMBOO METAL CO,, LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.samboometal.com
Main Products : Wheel, Shaft, Hyd-Net, Hyd Coupling Bolt, Flange
TEL : +82-51-831-1478

SAMGONG CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.sam-gong.co.kr
Main Products : Oil Purifiers, Ship' Accommodation, Ladders
TEL : +82-51-200-3040

SAMJOO ENG. CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. : www.sam-joo.co.kr
Main Products : Catering Furniture, Galley Hood, Laundry Equipment
TEL : +82-51-264-6677

SAMJUNG MACHINERY.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Piston Rod, Cross Head, Inter Shaft
TEL : +82-51-832-0190

SAM KWANG HI-TEC CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Rectangle Windows
TEL : +82-51-832-0177

SAMSUNG NONFERROUS METAL CO., LTD.
Head Office : Kimhae Gyeongsangnam-do
Homepage Add. : www.metalsamsung.co.kr
Main Products : Bushing, Liner, Sleeve, Pintle Bush
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