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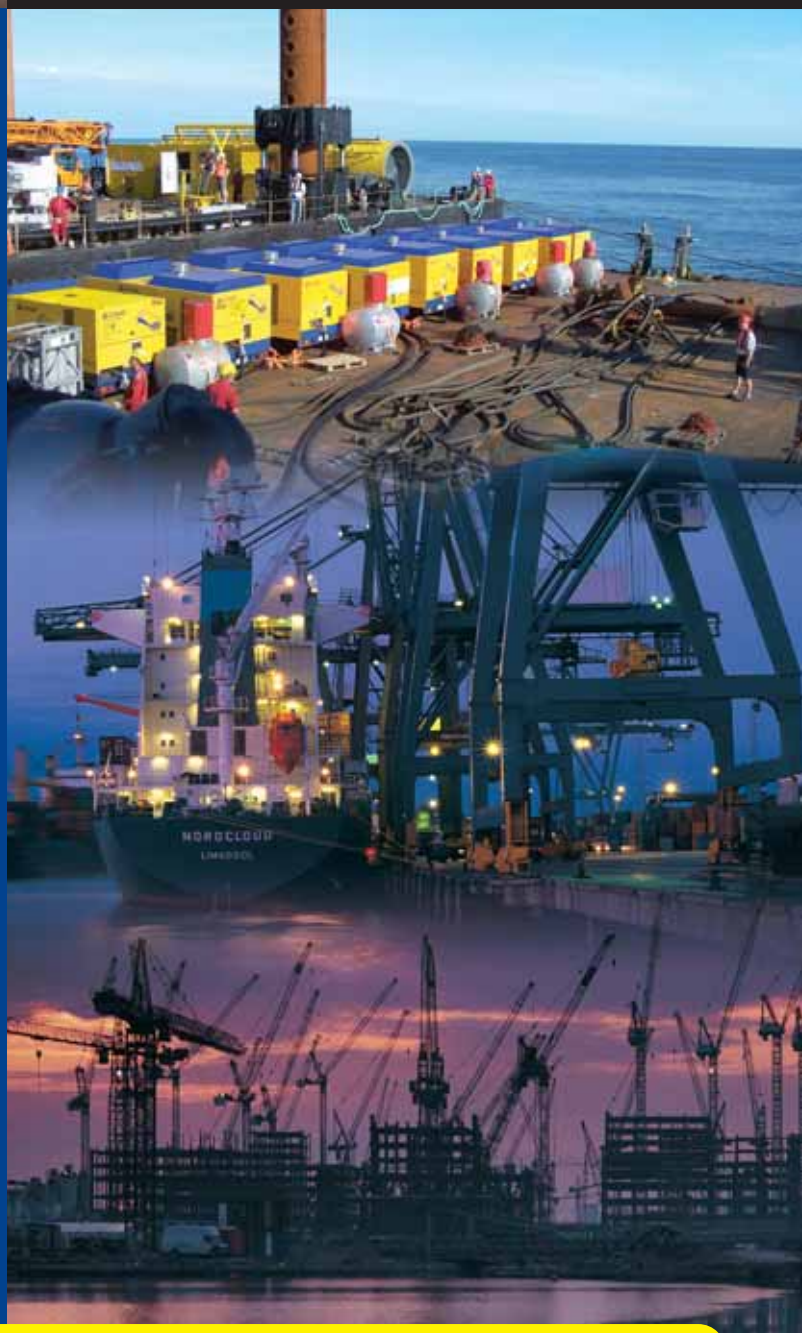

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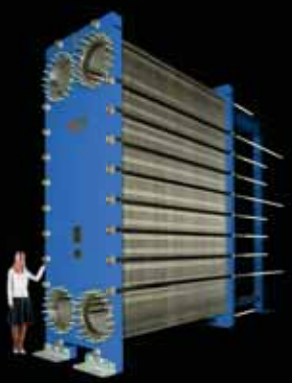

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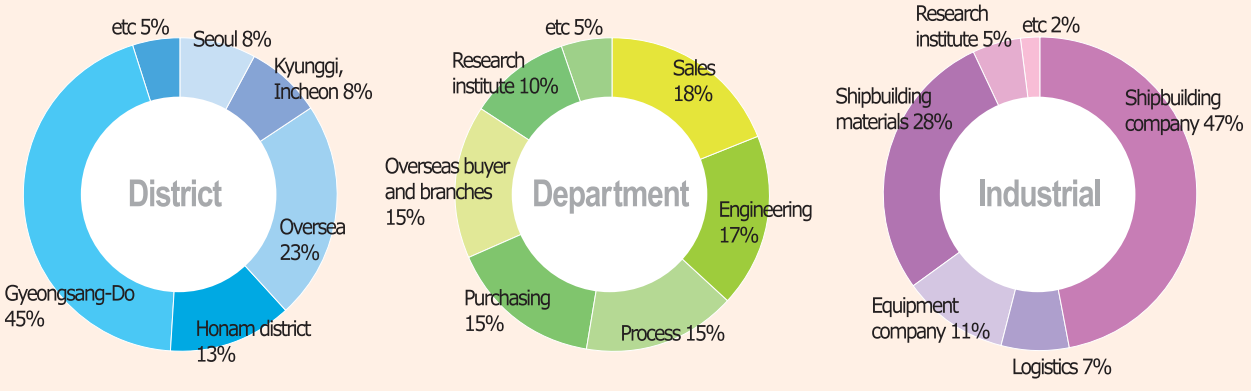

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Korean shipyards' patent applications soaring, backed by reward system

There was a stunning rise in patent applications filed by the 3 major domestic shipyards last year, brightening the future of shipbuilding industry, although the persistent slowdown in the world economy will take its toll on domestic shipyards.

Korean Intellectual Property Office (KIPO) recently published the results from its analysis of the trends in patent application in 2011. According to the results, the number of patent applications filings reached 183,762 nationwide in 2011, an increase of 4.3% compared with the previous year, Noticeably, the total of patent applications filed by the 3 major domestic shipyards in 2011 stood at 4,315, up 65% from the previous year, which signifies that these 3 major domestic shipyards have entered '1,000 patent applications' era.

In relation to that, officials in charge of patent applications at the 3 major domestic shipyards said, "This intensifying race to file patent applications has been fueled by domestic major shipyards' desperate attempts to place themselves in better position to win out in the fierce competition over technology and beat off competition from China."

Meanwhile, the number of patent applications filed by Hyundai Heavy Industries (HHI) last year soared by 242% from the previous year. An official from the Intellectual Property Office of HHI remarked, "The main drivers of the surge in HHI's patent application filings are the heightened interest of its executive officials in technology development and patent application, along with the clear compensation system that rewards inventors and the increase in compensation amount."

An official from KIPO commented, "Recently, there has been a relatively more significant growth in the number of patent applications filed by domestic shipbuilding and offshore industries, compared to Japanese and Chinese rivals. This reflects major domestic shipyards' intensified focus on technology development to overcome the sluggishness in the market and will have a positive effect in strengthening technological competitiveness of domestic shipbuilding and offshore industries."

SHI advances into the wind turbine markets of Scotland

Samsung Heavy Industries (SHI) is poised to aggressively target the European market for offshore wind turbines.

SHI entered into a memorandum of understanding (MOU) with the Fife Council of Scotland and Scottish Development International in Aberdeen, Scotland, on January 31 (local time) for the cooperation in the offshore wind turbine project in a ceremony attended by SHI President & CEO Roh In-sik and Scottish First Minister Alex Salmon. The coastal area of Scotland, characterized by strong and steady winds, is recognized as one of the most ideal places for building wind farms.

SHI will install and test 7MW offshore wind turbine prototype in the coastal area of Methil, Fife, Scotland, and build the transmission system connecting the turbines and the wind power grid in the region which will begin to supply the electricity from 2014. In addition, SHI will operate local manufacturing plants to mass produce offshore wind turbines in line with the demand in Europe.

Having signed this MOU, SHI will test its offshore wind turbine prototypes and acquire certification as part of efforts to make inroads into the U.K., the leader in offshore wind with 30% share of European market, and gain firm foothold in the European market which is expected to further expand.

SHI President & CEO Roh In-sik said, "SHI provides smart wind energy through wind turbine projects and contributes to the clean world. SHI will join the ranks of the world's top 10 companies in this sector by 2015."

SHI President & CEO Roh In-sik (4th from the left) and Scottish First Minister Alex Salmon (3rd from the left) are posing for a commemorative photo after signing the MOU.

Doosan Engine reached the production milestone of 80 million horse power in the low-speed large engine sector within the shortest period in industry

Doosan Engine announced on January 30 that it reached the production milestone of 80 million horse power in the low-speed large engine sector in the shortest period across the industry.

Doosan Engine accomplished this monumental cumulative production milestone of 80 million horse power when it successfully completed the test-run of the 98,000 horse power engine, which will be fitted to the 10,700TEU containership, at its manufacturing plant in Changwon on January 30. Thus, Doosan Engine exceeded the production milestone of 80 million horse power with the completion of 2,365th low speed engine. This new milestone in the low-speed engine sector has been set in 27 years and 3 months since Doosan Engine produced its first marine diesel engine in October 1984. Currently, Doosan Engine is the second largest marine engine producer.

Doosan Engine has been on steep growth path with an annual increase by over 10 million horse power in cumulative production each year since it reached the cumulative production milestone of 50 million horse power in 2008. It surpassed the cumulative production of 60 million horse power in 2009 and 70 million horse power in 2010. Furthermore, Doosan Engine has been producing high-end, highly durable, low-vibration and eco-friendly engines that reduced harmful emissions since 2010.

This engine, for which Doosan Engine successfully completed the test-run, measures 25.6m in length, 11.4m in width, 13.4m in height and weighs 1,975 tons.

Kim Dong-chul, CEO of Doosan Engine, said, "Not resting on the laurels of our success in reaching the production milestone in the shortest period, we will keep exerting efforts to cement our leading position in the production and supply of high quality engines, strengthen our competitiveness, and continue to invest in technology and increase our corporate value."

Doosan Engine completed the official test-run of its 98,000 horse power engine, which will be fitted to the 10,700TEU containership, at its manufacturing plant in Changwon on January 30, thus reaching the cumulative production milestone of 80 million horse power in the low-speed engine sector.

KSEG signed a USD 6 million supply contract with Vietnam's repair yard

Busan Metropolitan Government announced that Korea Shipbuilding Engineering Group (KSEG), Busan's joint brand of marine equipment, signed a USD 6 million contract with NOSCO, Vietnam's repair yard, to supply blasting and painting system package on February 6.

The products to be supplied under this contract will be used for removing foreign matter from vessel's external plate and painting the steel plates (re-painting) at the Vietnam's repair yard. To win this supply contract, KSEG and Busan Metropolitan Government steadily proceeded with marketing efforts to attract potential buyers, like providing free consulting to Vinashin Group and Vietnamese yards - which have faced crisis so far - through the Vietnamese trade office in Busan, holding the shipbuilding and offshore briefing sessions, and inviting the high-ranking officials of Vietnam's state-run shipyards and shipping companies.

KSEG and Busan Metropolitan government had engaged in extensive exchange of information with many contractors and pushed ahead with the marketing strategy for a long time, and as a result, won the bid against strong competition from international rivals such as Singapore and European companies backed by massive capital resources and specialist manpower. The Vietnamese trade office in Busan and KSEG will continue to work closely in launching various marketing campaigns which aim to increase the joint brand power and help expand the export and increase share in the global market.

8 members of KSEG participated in 'VIET-

SHIP 2012', the biggest specialized event dedicated to the shipbuilding, marine and transportation in Vietnam, which ran in Hanoi, Vietnam, from February 28 to March 1, showcasing their products and offered buyer consultation, etc. In addition, KSEG and Busan Metropolitan Government plan to host an offshore and shipbuilding seminar in Vietnam in the first half of this year in cooperation with the Vietnamese Chamber of Commerce and governmental organizations, etc, in order to reinforce strategic and collaborative relationship with Vietnam.

Moreover, KSEG and Busan Metropolitan Government will play a supporting role and map out various marketing strategies, like inviting the chairmen of Vietnam's state-run shipbuilding companies to Korea, offering free consulting to Vietnamese shipyards, inviting Vietnamese buyers, and holding international trade briefings in Busan. By doing so, KSEG and Busan Metropolitan Government will take the lead in efforts to attract excellent buyers, promote marine equipment industry of Busan, and add fresh momentum into the export.

DSME Heavy Industries Academy began offering courses

The trainees of DSME (Daewoo Shipbuilding & Marine Engineering) Heavy Industries Academy, who were selected through a fierce competition of 32 to 1, began their first training session with the special lecture by prominent figures in society.

For the trainees, DSME will provide intensive training programs that consist of 3 semesters of courses featuring introductory courses, many lectures by prominent figures, etc, until late January next year. DSME Heavy Industries Academy is an in-house training institute of DSME, which is dedicated to developing talented high school graduates into heavy industry experts.

Particularly, special lectures by renowned officials and celebrities were tailored to help build practical skills and capabilities, inspire the challenging spirit, nurture positive attitude along with good mentality required in DSME. The special lectures this time were offered by Co-Growth Committee Chairman Chung Woon-chan who emphasized the 'dream, vision, and plan of life', former baseball player Yang Joon-hyuk who encouraged the trainees to muster up courage to overcome crisis, and famous mountain climber Heo Yeong-ho who delivered the message about taking on the challenges and tidying over difficulties.

To help the trainees be equipped with the underpinning knowledge and skill, the most renowned professors in respective fields, including Lee Ho-wook, Professor of Business Administration at Yonsei University, Yoon Hyeon-sik, Professor of Shipbuilding Engineering at Chosun University, etc, were invited to give a series of lectures on business administration, economics, shipbuilding & marine engineering, history, practical on-the-job training, English, and so on.

Liberal arts education is also provided, as well as the courses designed to help build good personality. Professionals in movie, fine arts, music, etc, are invited to give special lectures, and the arts & physical education classes will help trainees develop their skills and abilities in sports and music.

These varied programs are differentiated from those offered in large companies and will provide the trainees with a greater depth of education compared to university education.

Nam Sang-tae, President & CEO of DSME, said, "DSME Heavy Industries Academy will offer the courses, including the arts and physical education programs designed to help build good personality, as well as foreign language courses, which are totally differentiated from the courses currently offered by universities or companies, and will provide the best support to help trainees become the best heavy industry experts."

STX OSV posted the highest profit in its history

STX OSV registered approximately KRW162.3 billion in operating profit, the largest in its history, in the fourth quarter last year.

STX OSV announced on February 14 (local time) in its reports on its fourth quarter performance of 2011 that it accomplished NOK 3.11 billion (approximately KRW 614.8 billion) in sales and NOK 821 million (approximately KRW 162.3 billion) in operating profit. Particularly, the operating profit ratio of 26%, which STX OSV accomplished in the fourth quarter, is unprecedentedly high. Along with that, STX OSV announced that it achieved NOK 12.401 billion (approximately KRW 2 trillion 451.7 billion) in annual sales, NOK 2.207 billion in annual operating profit (approximately KRW 436.3 billion), and annual operating profit ratio of 18% last year. Compared to the corresponding period of previous year, STX OSV's sales increased by 4%, while its operating profit jumped a whopping 83%.

STX OSV sailed smoothly, winning new

orders for a total of 28 vessels worth NOK 11.117 billion (approximately KRW2 trillion 135.9 billion) even in the midst of sluggish shipbuilding market hit hard by the financial crisis that began in Europe last year. STX OSV's order backlog stands at NOK 16.675 billion (approximately KRW3 trillion 203.8 billion) as of late last year.

An official from STX said, "The record-high profit of STX OSV is attributed to its strict compliance with the delivery based on its excellent technology and production capabilities, along with the expansion of its operation in the offshore plant sector amid the increasing subsea resource exploitation projects."

Meanwhile, Roy Reite, President of STX OSV, said, "STX OSV achieved splendid results in the platform supply vessel sector last year even in the face of global economic downturn. This year, we will also exert our best effort to solidify our leading position based on our unique ship design and construction capabilities."

Korea Eximbank takes flexible approach to the ship financing for domestic shipbuilding/shipping industries

Export-Import Bank of Korea (Korea Eximbank) announced on February 2 that it would take more flexible approach to providing ship financing support to shipbuilding and shipping companies this year.

Earlier, Korea Eximbank set a plan to provide ship financing support amounting to KRW 14.55 trillion for this year, including KRW 3.25 trillion in loan and KRW 11.3 trillion in guarantee. However, Korea Eximbank decided to immediately provide extra ship financing, in addition to the planned amount, to meet the unexpected increase in the demand of shipyards for funds.

This decision reflects the market opinion that Korea Eximbank needs to actively provide financial support to ease the difficulties of shipyards - which are experiencing slowdown due to the decline in order bookings amid a sluggish shipping markets - and shipping companies which face an unprecedented reduction in financial support from banks. Along with that, Korea Eximbank plans to consider cut to the guarantee rate in view of the market conditions or circumstances in shipbuilding industry.

Korea Eximbank's new support for ship financing, which was announced on the same day, will be channeled in the 3 areas. First, Korea Eximbank will expand the mid and long-term ship financing for domestic shipbuilding and shipping companies under significant financial strain due to the reduction in the ship financial support in the aftermath of Eurozone crisis. Second, Korea Eximbank's financial support will be expanded for high value-added vessels, such as drillship, super size containership, FPSO (Floating Production Storage and Offloading), etc. Third, Korea Eximbank will issue the Letter of Intent (LOI) to ship owners from the stage of order placement in a bid to help domestic shipyards win orders.

Since the outbreak of financial crisis in 2008, shipbuilding contracts have increasingly shifted to heavy-tail payments which cast burden on shipyards.

Korea Eximbank is helping cash-strapped domestic shipyards in the shipbuilding process. It already provided KRW 260 billion in ship financing in January, a 27% increase compared to the corresponding period of previous year.

Kim Yong-hwan, President of Korea Eximbank, said, "This supportive measure fully reflects the market opinion that a flexible approach to the ship financing support is necessary to assist domestic shipbuilding and shipping industries in maintaining the leading position. Korea Eximbank's support will help domestic companies focus on clinching new orders and stabilize the market."

Nexans acquired AmerCable Holdings for USD 275 million

Nexans recently agreed to acquire AmerCable Holdings (hereinafter referred to as "AmerCable"), the world's largest producer of industrial mining cables in the North America, for USD 275 million (approximately EUR 211 million). The amount to be payable in cash available at the conclusion of the acquisition agreement is 9.5 times greater than the adjusted EBITDA (Earnings Before Interest, Taxes, Depreciation and Amortization), apart from the remuneration to Quintana Energy Partner and copper cathode effect. AmerCable, located at El Dorado, Arkansas, has approximately 400 employees and manufactures special cables used in the very poor environment specifically for mining, oil & gas, renewable energy industries. AmerCable also offers unique engineering and support services for the aforesaid industries. Moreover, AmerCable has established a leading position in the North America (which represents 77% of the company's sales) and is expanding its business into China, Latin America and

Australia.
AmerCable's annual sales stand at USD 270 million as of December 31, 2011, a 30% increase compared to the previous year. This company has been ranked highest for revenue in this field, thanks to its excellent product line-up.
This acquisition of AmerCable will allow Nexans to secure a production base in the North America and complement its current product line-up through new strategies.
Frédéric Vincent, CEO of Nexans, said, "The acquisition of AmerCable dovetails nicely with our strategy to cement our leading position of Nexans in the industrial field that has bright prospects for high growth and profitability. Mining industry is witnessing a robust growth worldwide, and particularly, is expected to benefit from the strong coal markets in the United States and China. In addition, the oil and gas market is expected to benefit from the increased drilling projects (both onshore and offshore) and the growing number of oil well complexes. Furthermore, there has been a rising demand for AmerCable's products and services amid the increased exploitation of special oil and gas reservoirs in the North America. AmerCable's solid position in the mining and oil & gas sectors will result in twofold increase in the size of Nexan's sales in this sector and complement Nexans' current operations in the offshore and subsea sectors. Nexans' total sales from these sectors will increase to approximately EUR 350 million."

KATS expands R&D in standardization to help Korea become one of the world's top 7 countries in standardization

The Korean Agency for Technology and Standards (KATS) under the Ministry of Knowledge Economy (MKE) announced a plan to expand national standard technological capability for year 2012 on January 27. Along with that, KATS announced a set of relevant measures and basic direction of R&D related to technological standard, international cooperation, infrastructure expansion, etc., as well as the size of the planned capital injection.
To join the ranks of advanced countries in the field of standardization, the government plans to provide a total of KRW 22.5 billion that will be spread over 3 major sectors - R&D related to standards, international standard registration, and infrastructure expansion for standardization - this year based on the aforesaid plan. That represents a 22% increase compared from the previous year (KRW 18.5 billion), and there will be a sharp increase in investment fund to stimulate the R&D related to standardization and support international standard registration. The government support for the international standard registration will focus on ensuring domestic technologies are aligned to the international standards, setting up standards-setting body under the International Standard Organization, and facilitating the appointment of Korean officials to the International Standard Organization. The focus of support for R&D related to standardization will be on the futuristic transportation system that includes electric cars and smart vessels, device technology standards for products driving the nation;s export such as green semiconductor, next generation displays, etc, and technology standards for high value-added convergence such as printable electronic bio-medical/nano/IT applications, etc.
Noticeably, this plan aims to improve the operating mechanism of 5 projects, showing the government's zest to help Korea join the ranks of the world's top 7 countries in the field of standardization.
First, this plan reflects the shift towards setting the international standards and strengthening the leadership in international activities, going beyond the development of domestic standard. It has become increasingly necessary to focus on international standards, rather than domestic standards, considering that international standards have a direct impact on exports and regulatory effect on technology. The past 5 years have seen a twofold increase in standard setting and registration; about 50 domestic standards and 20 international standard registration. However, the vast majority were domestic standards. The new plan reflects recent trends in the international standard-setting process (joint proposal and task by technical committees/subcommittees/working groups (TC/SC/WG) to strengthen the acceptance of standards) and will lay the cornerstone for strategically expanding international leadership by setting up new organizations under the International Standard Organization and promoting the appointment of domestic officials to the International Standard Organization.
Second, private-sector companies will play

the leading role in driving forward the projects under this plan, instead of the research institutes. Private-sector companies will have more leeway in submitting project bids in order to gradually expand the project implementation by small and medium-sized companies, the major customers of standards, and ensure cooperation with large companies with respect to standardization. This new direction is based on the outcome of analysis showing that technologies developed by domestic companies are not fully reflected in international standards due to the lack of participation of companies in projects.

Third, this plan makes it mandatory for the officials in charge of standard and R&D (standard PDs, officials in charge of projects funded by national treasury and research projects) to cooperate, which aims to differentiate the support for respective projects funded by national treasury, prevent duplication among projects, support achievement of goals, and increase the efficiency of management.

Fourth, this plan adopts flexible evaluation system, shifting away from the rigid and one-size-fits-all evaluation. To increase the success chance of projects that include aggressive targets, the organizations which cannot meet project objective with a certain time frame will be given extensions to project period through prior inspection. In this case, the organization that undertakes the project will be evaluated after project objectives are fully achieved within the extended period without additional support.

Fifth, subsequent supportive programs will be implemented based on the results accomplished by the projects. This plan also makes it mandatory to seek international registration if the result of project is domestic standard-setting (draft), and consider providing the support in conjunction with the test equipment projects if the standard approved as international standard relates to international test standards.

DSME completed the world's first onshore installation of azimuth thruster

Daewoo Shipbuilding & Marine Engineering (DSME) announced that it successfully completed the onshore installation of an azimuth thruster, one of the ship propulsion system, on February 4 for the first time worldwide.Using the onshore installation method, the world's first, DSME connected the wire to the 98-ton azimuth thruster which was then lifted for installation. Thus, DSME shortened the thruster installation phase by about 6 months.

Azimuth thrusters were installed under water line after the launch of ship so far, involving ancillary works such as the deployment of divers, lifting/hoisting operation, hoisting operation, etc. However, this onshore installation method obviates unnecessary procedures and remarkably shortens the duration of task.

Azimuth thruster is a propulsion system that can rotate 360 degrees and used for the propulsion and position control of various vessels, offshore plants, etc. Usually, 3 to 7 azimuth thrusters are installed on board, depending on the type of vessel.

The vessel fitted with this azimuth thruster is a pipe-lay vessel ordered in August 2010 by Heerema Offshore Services B.V., a world-leading company that specializes in the transportation, installation, and dismantling of offshore structures, and scheduled for delivery by the end of this year.

The vessel, a pipe-lay vessel, measures 215m in length, 46m in width, and weighs 32,000 tons. Equipped with 4,000-ton capacity crane and large pipe reel, etc, this vessel can install pipes at a maximum water depth of 3,000m.

Bram Van Koert, the official in overall charge of construction at Heerema (Netherlands), who watched the installation of the azimuth thruster, said, "I am amazed at the excellent technology of DSME. I hope that the world's best ship will be built with the world's best technology."

An official from DSME said, "This world's first method for onshore installation of azimuth thruster is the result of the precise plans and active cooperation to develop a new installation method."

The azimuth thruster is being installed on land at the onshore dock of DSME's Okpo shipyard.

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Overview of LNG cargo tank

Despite the recent global economic downturn, approximately 300 LNG carrier orders are expected to be placed worldwide for the next 10 years. French GTT which has the core technology for the LNG carrier cargo tank, the essential facility of LNG carrier, has recently become available for acquisition, drawing huge attention from the industry.
This report provides a close-up view of the situation wherein domestic shipbuilders which swept nearly all LNG carrier orders placed worldwide had to pay tremendous amount of royalty fees, as well as the development of technology for LNG carrier cargo tank and industry's move to acquire GTT.

Liquefied Natural Gas (LNG) carrier refers to the vessel designed to transport LNG from the production base to LNG receiving terminal, and is also called 'LNGC (LNG Carrier)'. LNG, mainly composed of methane (CH_4), is the natural gas cooled down to minus 162 degrees centigrade, converted from a gas into a liquid and reduced to 1/600th of its original volume. Specific gravity of LNG ranges between 0.43 and 0.50.

According to the data of Clarkson published recently, the global placement of orders for LNG carriers - which stood at 25 vessels in 2007 - sharply declined to 5 vessels in 2008 and zero vessel in 2009 in the aftermath of the global financial crisis that began in the United States. The LNG carrier market, however, is recently showing strong performance as newbuilding orders for LNG carriers worldwide stood at 6 vessels in 2010 and 51 vessels in 2011, respectively.

The market for LNG carriers is expected to take a favorable turn amid the growing demand for LNG which is attributed to the increasingly rigorous regulations on the emissions of greenhouse gases such as NOx and SOx and the anxiety over Japan's nuclear crisis.

LNG cargo tank

LNG cargo tank refers to the tank for storing and carrying the LNG and is one of core facilities for LNG carrier. LNG cargo tanks are divided into two types; independent type separated from the hull and membrane type fully incorporated into the hull. The independent type tanks include the Moss type developed and patented by Norway-based Moss Losenberg, while the membrane type LNG cargo tanks are classified into Mark III and NO96-2 LNG cargo containment systems patented by France's GTT.

Moss type consists of the dual structure of an independent spherical aluminium tank and a supporting skirt structure. The design of moss type was used widely for LNG carriers in 1980s, but there has been a steady decrease in the adoption of the moss type recently. The advantage of moss type lies in the relative simplicity of spherical shape that is fit for withstanding high internal pressure and high reliability.

As various engineering methods and analytical techniques improve recently, the membrane type - which is a non-self supporting tank consisting of thin metal layer - was found not to have structural problem or high susceptibility to damage from impact pressure caused by LNG sloshing. As a result, there has been a surge in the demand for membrane type. The soaring demand for membrane type is attributed to the increased efficiency in the use of space, specifically the area on the upper side of deck, easier expansion and contraction in response to the changes in the weight of the stored LNG, higher visibility, etc, as well as relatively inexpensive price.

Meanwhile, the marine transportation of LNG cargo began to be considered from early 1950s. The transportation of the first LNG cargo by ship began in 1958 when Methane Pioneer, remodelled at Alabama shipyard in United States, was built.

Methane Princess, a conch type with a carrying capacity of 17,400m^3, became the first LNG carrier fitted with independent cargo tank brought into service in 1964. while Polar Alaska, built in 1969, was the first membrane type LNG carrier which has the capacity of 71,500m^3. The moss type LNG carriers began to be built in 1973, and since then, moss type and membrane types have dominated the global market for LNG carriers.

Table 1. LNG cargo tank Classification based on the type of LNG cargo tank

Type	Membrane type		Independent type	
	GTT Mark III	GTT 96-2	Moss	IHI-SPB
Tank shape				
Tank material thickness	SUS 304L 1.2mm	Invariable steel 0.7mm	Al alloy (5083) 50mm	Al alloy (5083) Max. 30mm
Heat protector thickness	R-PUF 250mm	Plywood+Perlite 530mm	PUF 250mm	PUF 200mm

Construction inside the LNG carrier cargo tank

Domestic development of LNG carrier cargo tanks

Although Korean shipbuilders take up more than 80% of share in the global market for LNG carriers, they have been paying a royalty rate equivalent to 4 to 5% of ship prices to foreign companies for the core technology of cargo tank (cargo containment). Particularly, Korean shipyards have a heavy reliance on France-based GTT's proprietary technologies for the cargo tanks of membrane type LNG carriers and have paid technical fees totalling approximately KRW 1.8 trillion for 197 cargo tanks of LNG carriers awarded to them since 2010.

Hyundai Heavy Industries (HHI) has introduced the cargo tank technology from the Norway-based Kvaerner Moss Technology and France-based GTT since 1980s. Meanwhile, Samsung Heavy Industries (SHI) and Daewoo Shipbuilding & Marine Engineering (DSME) have introduced the technology for the membrane type incorporated into the hull from France-based GTT since 1990s.

To reduce reliance on foreign technology, Korea Gas Corporation (KCG), HHI, SHI, and DSME participated in the Industrial Core Technology Development project driven forward by the Ministry of Knowledge Economy (MKE) in 2004 and embarked on the developing the next-generation cargo containment system technology for LNG carriers.

The effort over the 5-year period resulted in the development of indigenous cargo tank 'KC-1 (Korean Cargo Containment System-1)' for LNG carrier in early 2010, which was subsequently certified by major classification societies, and 52 patent applications related to the core technology were filed both at home and abroad.

KC-1 cargo tank which consists of double barrier wall structure incorporates the technology differentiated GTT's technology. The heat sink system of KC-1 has extremely simple structure compared to the existing system, thus reducing the costs of material and construction. In addition, the double barrier structure has the advantage that the leakage of LNG in the primary barrier does not have any thermal impact on the secondary barrier because both barriers operate within similar temperature range.

Moreover, KC-1 cargo tank can provide the liquid tightness and gas tighteners at the same time because the secondary barrier consists of metal membrane same as the one used in the primary barrier, thereby resolving the problem of leakage from the secondary barrier.

The KC-1 development project was participated by the Korea Gas Corporation, the supervising organization, and the 3 shipbuilders, along with companies, such as Kangrim Insulation, Finetech, Hankuk Fiber, Ilseok Precision, Powwell, and 6 universities, such as Kyonggi University, Pusan National University, Seoul National University, Inha University, Korea Advanced Institute of Science and Technology, and Korea Maritime University.

Major domestic shipyards are also striving to develop cargo tanks for LNG carriers. These shipyards, which have paid high royalty rates to overseas companies, are strongly motivated to secure core technologies in the shortest time possible to place themselves in a better position to win orders. Although domestic shipyards' technologies for cargo tanks of LNG carriers remain in their inchoate stage of development, shipyards, such as SHI, DSME, STXOS, etc, recently developed LNG carrier cargo tanks with indigenous technology, which brightens the outlook for the industry.

DSME: world's largest independent type LNG cargo containment system

DSME successfully developed the independent-type LNG cargo containment system essential for the construction of LNG carrier or LNG-FPSO, etc., on June 2010.

This new cargo containment system, known as 'ACT-IB (Aluminum Cargo Tank Independent type B)' is made of aluminium and has the world's largest storage capacity of any independent type containment systems which have been developed thus far.

An official from DSME said when this technology was developed, "DSME plans to apply this technology to the LNG-

Schematic diagram of 'ACT-IB (below)', the independent type LNG storage cargo containment system developed by DSME, and LNG-FPSO (above) fitted with it.

FPSO that will have an annual production capacity of 2 million tons of LNG. This new independent type cargo containment system developed with our own technology for extremely low temperature LNG containment system - a field which have been dominated by Japan or France - can be immediately incorporated into very large LNG carriers or LNG-FPSOs, which will help save a tremendous amount of royalty fees."

Particularly, this new cargo containment system with a capacity of 210,000m^3 of LNG is nearly 3 times larger than the conventional cargo containment system, the similar independent tank type with a capacity of approximately 80,000m^3 currently operational in Japan. Moreover, This new cargo containment system is about 50% larger than Korea's daily LNG consumption of 150,000m^3.

With this new technology, DSME has secured the designing technology for independent tank type LNG-FPSO, besides the existing membrane type LNG-FPSO.

DSME has completed international certification for the safety of cargo containment system through various analyses and tests required under IMO for the same type of cargo containment system (B type tank), such as thermal stress analysis, fatigue analysis, crack growth analysis, and others. Moreover, DSME developed an insulation system capable of withstanding extremely low temperature jointly with domestic companies and received Approval-In-Principle (AIP) in early 2010 from DNV (Det Norske Veritas), one of the world's leading classification societies.

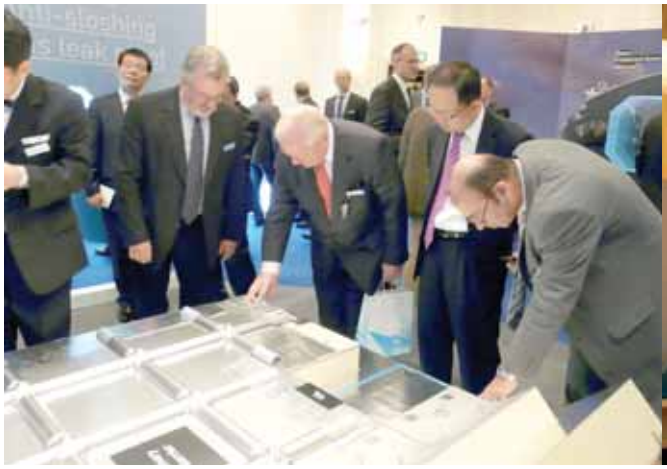
DSME plans to apply the ACT-IB system to the fuel tank of LNG fueled ship, which is DSME's next-generation green ship powered by LNG.

SHI: Cargo tank for membrane type LNG carriers

SHI has become the first shipbuilder to independently develop a model of cargo tank for membrane type LNG carriers in September 2011.

The development of this model based on indigenous cargo tank technology, the final hurdle to be overcome by the Korean shipbuilding industry, represents a major step forward in achieving technology independence in shipbuilding.

This new cargo tank developed independently by SHI was named 'Smart Containment-System Advanced (SCA)'.



A ceremony to mark the launching of SHI's LNG carrier cargo tank, held at Hilton London Paddington hotel in U.K. on September 6, 2011

SHI embarked on a research in collaboration with the Korea Advanced Institute of Science and Technology (KAIST) since 2007 with an objective of independently developing domestic technologies for cargo tank, and received certification of basic design and detailed design from major classification societies such as Lloyd's Register Shipping (LR), American Bureau of Shipping (ABS), etc. Additionally, SHI obtained the certification for the mock-up in April 2011 and held technical symposiums for the world-renowned oil companies such as BG, Chevron, ConocoPhillips (CoP), Exxon Mobil, etc, as part of the preparation to announce its independent model.

The LNG carrier cargo tank, developed by SHI, incorporates upgraded technology based on existing membrane type cargo tanks. Specifically, it enhanced the membrane shape, incorporates newly-developed secondary barrier materials and ultra insulation new materials, thereby increasing the stability, air-tightness, and efficiency in transportation.

In the first place, it improved the corrugated shape of membrane in the primary barrier which comes into direct contact with LNG to reduce the cargo sloshing, thus dramatically increasing the stability of the vessel during the navigation. The secondary barrier which encloses the primary barrier has enhanced sealing structure, i.e., the air-tightness, as it is made from the newly-developed double-reinforced metal composite materials, instead of triplex which is a glass fiber composite material. Moreover, it dramatically improved the LNG transport efficiency by applying ultra insulation new material to the insulation panel that prevents vaporization of LNG. Generally, some gases vaporized during the voyage of LNG carrier are used as fuel for propelling the vessel and the remaining gases are combusted or discharged. The aforesaid newly-developed materials are effective in reducing the vaporization of LNG.

Roh In-sik, President & CEO of SHI, stressed when this new model was developed, "This new cargo tank model for LNG carriers, developed by SHI for the first time worldwide, will relieve SHI of the burden of technical fees ranging somewhere between KRW 9 billion to 10 billion per unit of LNG carrier and further strengthen the position of SHI in the market for LNG carriers."

STXOS: Independent type LNG cargo tank

STX Offshore & Shipbuilding (STXOS) completed the development of independent type LNG cargo tank using its proprietary technology and received AIP from Norway-based classification society DNV in November 2011.

This independent type LNG cargo tank technology developed by STXOS can be applied to the fuel tanks of large LNG carriers, offshore plants such as LNG-FPSO, and LNG-powered vessels.

The independent tank is manufactured externally and fitted to the hull which results in time and cost-savings, unlike the dependent type cargo tank which is built separately after insulation materials are attached to the inside of the hull structure following the completion of ship. In addition, the independent type cargo tank has come into the limelight for its advantage that it can resolve the problem of internal damage arising from the sloshing of the gas liquefied at extremely low

temperatures and external impact during the navigation.
The independent cargo tank was mainly installed on 80,000CBM class LNG carriers due to the technological constraints thus far. However, this independent type cargo tank developed with the pure technology of STXOS can be installed on board 213,000CBM class LNG carrier, which is unprecedented worldwide.
STXOS named this large-capacity independent type cargo tank, developed by using its own technology, as 'ITS (Independent Tank of STX)' and plans to press ahead with R&D in the related fields with an objective of reducing royalty payments.
Heo Joo-ho, Director of STXOS' Technology Research Institute, said, "We developed the technology that can be incorporated into LNG-powered ships, as well the environment-friendly high value-added LNG carriers and LNG offshore plants for which the safety is the highest priority. This technology represents a major milestone in our advancement into the market for energy efficient and eco-friendly ships and vessels capable of navigating effectively in the polar regions. We anticipate that this new indigenous technology will lead to the reduction in shipbuilding costs and royalty payments and dramatically increase the efficiency in production process."
STXOS received AIP for its independent type LNG cargo tank from the world-leading classification societies and filed 6 patents for its cargo tank structure, assembly, supporting structure, etc, in Korea.

Meanwhile, HHI which built the nation's first LNG carrier in 1996 has focused on developing indigenous LNG cargo tank since 2007, and obtained the approval for its LNG cargo tank developed with its own technology from the classification societies in 2009. In addition, HHI embarked on the development of welding technology for the cargo tank of LNG carriers operating in the polar region in 2010, thus taking the lead in the development of related technology.

Acquisition of GTT, the most-talked-abut issue in industry

Domestic shipbuilders are eyeing to take over the slumping French GTT, which has the core technology for membrane type LNG carrier cargo tank, has recently become available for acquisition and the most-talked-about issue is who will take over the GTT.

GTT's 3 major shareholders, GDF Suez, Total, and Hellman & Friedman, are looking to sell their stakes in GTT. Currently, GDF Suez has a 40% stake in GTT, while Total and Hellman & Friedman hold 30%, respectively. If these 3 major shareholders unload all their stakes in GTT, the acquisition price is expected to reach EUR 1 billion (approximately KRW 1.48 billion). At present, domestic shipbuilding companies, China State Shipbuilding Corporation, France's Sovereign Wealth Fund, etc, are considering the bid for the French GTT.

It may come as a good news for domestic shipyards which have paid a tremendous amount of royalty fees to GTT which has the core technology for cargo tank although they swept nearly all LNG carrier orders placed worldwide. The prevailing opinion is that the price tag is simply too high for a shipyard,

POSCO was reportedly moving to acquire GTT on its own. However, domestic shipbuilding heavyweights have formed a consortium for a bid to take over GTT, according to the major daily newspaper and related reports. It is reported that M&A Department of Korea Development Bank and BNP Paribas were selected as the advisors to facilitate the acquisition of French GTT. Additionally, the contenders will step up the bid when they receive the Information Memorandum (IM) next month.

Domestic shipyards are joining hands to take over GTT in order to reduce the amount which they must pay in royalties and maintain competitive edge over Chinese rivals trailing closely behind Korea and successfully win the bid against China which is currently looking to acquire GTT. Domestic shipyards will have to pay tremendous amount of royalties to China if Chinese shipyard acquires GTT, and as a result, Chinese shipyards which lag behind their Korean counterparts 7 to 8 years in technology related to LNG carriers will overtake Korean shipyard without delay.

Meanwhile, some express apprehension about the attempt of domestic shipyards to acquire GTT. Above all, the price tag of GTT is skyrocketing. Although the sale price is currently EUR 1 billion, the investment bank Lazard which was appointed to handle the sale may push up the price even higher due to the heated bidding competition between Korean and Chinese shipyards. Furthermore, major domestic shipyards are facing a strain on working capital due to the increase in order intake from offshore fields last year, and consequently, experiencing cash flow constraints.

It should be noted that GTT's patent over the cargo tank will expire around in 2020. Although ship owners consider the LNG cargo tanks developed by domestic shipyards have more excellent performance compared to the LNG cargo tanks of GTT, they have a preference for cargo tanks designed with GTT containment systems for reason that domestic shipyards' LNG cargo tanks have no track record yet. However, time will come soon when the LNG cargo tanks developed independently by domestic shipbuilding heavyweights will be fitted to vessels. Some suggest that the 3 domestic shipbuilding heavyweights' acquisition of GTT will not result in losses, considering that newbuilding orders for about 300 LNG carriers will be placed worldwide in the next decade and domestic shipbuilding heavyweights are expected to sweep at least a half of them.

AVEVA opened new product training centre in Korea

Recently AVEVA has announced it will open a new office in Seoul, Korea, that will incorporate a dedicated product training centre, following an increased demand for AVEVA solutions. The office will also host sales, marketing, product support, and administration functions for AVEVA customers in Korea.

"This new office, in particular the product training centre, enables AVEVA to offer a better service to our customers", said Park Eun-joo, Senior Executive Vice President of Korea and Japan division, AVEVA. "We can vastly increase the number of participants at this new training centre, as well as host more meetings. AVEVA has had offices in Korea for over ten years. In this time we have seen an increased demand for trained users in AVEVA products and solutions across the Plant and Marine industries. We are proud to be able to continue to demonstrate and strengthen our support and commitment to the Korean market".

In addition, AVEVA also operates the Marine Technology & Service Centre (MTSC) in Busan, Korea. The role of the MTSC is to provide engineering and research & development support.

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Professor Park Won-gyu, President of Research Institute for Future Wind Energy Technology, Pusan National University

Research Institute for Future Wind Energy Technology, Pusan National University, opened on February 15. This research institute plans to carry out various projects, including the project that aims to develop core technologies in offshore wind power, etc., to build the research infrastructure for wind power R&D and training with an objective of helping domestic wind power industry dominate the future wind power market.

Professor Park Won-gyu, President of Research Institute for Future Wind Energy Technology, Pusan National University, expressed his ambition, saying, “We will continue to develop core technologies to cope with the demand for new technologies and foster globally competent R&D workforce.”

Q : First, congratulations on the opening of the Research Institute for Future Wind Energy Technology (hereinafter referred to as "WETech-Future Center"). What is the background that led to the opening of WETech-Future Center? And give a brief account of what has happened so far.

A : Wind power has emerged as alternative energy source that can resolve the issue of high energy prices resulting from the stark realities of global warming, environmental pollution and near-depletion of fossil fuels. Particularly, the government will pave the way for Korea to join the ranks of the world's top 5 countries in the field of renewable energies with a capital injection of KRW 40 trillion by 2015. Furthermore, the government will help domestic wind power companies capture 15% share in the global market within the same time frame. For that, an offshore wind farm with an installed capacity of 2.5GW will be built in phase on the eastern coast of the nation with investment funds totalling KRW 9.2 trillion which will come from the government coffers and private-sectors.

Pusan National University (PNU) has carried out a number of wind power R&D projects and offered training over the last 5 years. In 2011, PNU successfully won the bidding for large-scale national projects, such as the GET-Future laboratory project, a project that aims to develop fundamental technology for deepwater floating wind power structure/platform, a project to develop advanced technology in wind power sector in tandem with a specialized manpower development program tailored to meet the demand of companies for professional workforce - who hold master's and doctoral degree - in wind power sector. In addition, PNU WETech-Future Center which opened recently will play a pivotal role in building global R&D network and infrastructure related to the wind power as an institute dedicated to the research and training in the southeastern part of the nation.

WETech-Future Center was granted license on December 21 last year - following the energy development technology project in May 2011, briefing sessions on the training program designed to develop professional manpower in the energy sector, project application submittal & selection process, etc, - and finally opened on February 15.

As the southeastern region of the nation is home to many domestic wind power companies, WETech-Future Center is expected to play a leading role in technological collaboration with industries and promoting the manpower development while proceeding with the wind test bed project.

Q : What will be the major projects and role of WETech-Future Center in the period ahead?

A : The government is currently pushing ahead with a variety of projects related to offshore wind power industry. It has set an ambitious goal to make Korea become one of the world's top 5 countries in the wind power sector and gain the undisputed No. 1 spot by 2030. As said before, WETech-Future Center, nestled in the southeastern region home to many domestic onshore/offshore wind power companies, is better positioned to undertake the projects for developing technologies in wind power along with manpower development programs.

WETech-Future Center will take on these roles:

-Developing core and fundamental technologies necessary to lead the wind power market

-Fostering specialized manpower in wind sector to better cope with the rapid expansion of offshore wind power market

-Developing the training programs tailored to develop core workforce related to the practical certification

-Building the global R&D network to promote the development of core technology for wind power

In other words, WETech-Future Center will focus on promoting the technology development and commercialization in the wind power and energy sectors that have been thrust into the limelight as the next-generation growth engine, helping build up technological competitiveness necessary to dominate the global market, and fostering professional manpower tailored to the requirement of companies. Particularly, WETech-Future Center is currently moving forward with the research that aims to develop core technology for futuristic floating wind power generation.

WETech-Future Center, fully dedicated to developing core technologies and cultivating specialized R&D manpower in the wind power sector, will play a pivotal role in the future wind power energy sector. In addition, WETech-Future Center will be also actively engaged in exchange and collaboration with overseas specialized organizations in the wind power sector, seeking to further expand its global research capabilities.

By doing so, WETech-Future Center will make great strides toward becoming the nation's best training and research institute and establish a leading position worldwide in the offshore wind power sector, and proceed with development of core technologies to cope with the demand for new technologies and foster the world's best R&D manpower.

Q : Core technology, holding the key to the success for domestic offshore wind power projects nationwide, has taken on added importance recently. What are the technologies that WETech-Future Center is focusing to develop?

A : Currently, the global onshore wind power market is saturated, and even the shallow sea wind power market has already entered the phase of commercialization. As the focus of wind power market is shifting away from the onshore to offshore wind power, core technology development is a prerequisite for turning the wind power industry into a major locomotive of the nation's economic growth.

Technological leadership is important in coping with the requirements of future offshore wind power market, and specifically, the floating structure technology is the core technology in the offshore wind power sector.

The deepwater wind power market will be at the heart of the wind power market. WETech-Future Center will focus its capability on the deepwater floating wind power sector to secure the leading position and global competitiveness in the market for large-scale offshore wind turbines, ultimately contributing to the advancement of offshore wind power industry. For that, we strive to develop technologies and professional manpower through collaboration with great scholars abroad, as well as our research workforce that forms the backbone of WETech-Future Center.

Moreover, WETech-Future Center will also make steady investment in the future wind power core technologies, like developing high-efficiency wind turbines and low noise and lightweight wind turbine technologies.

Q : I think that WETech-Future Center is on an important mission to help promote the advancement of domestic wind power market. What is the unique strength of Pusan National University (PNU) WETech-Future compared to other research institutes?

A : About 40% of domestic wind power companies and 80% of domestic offshore wind power companies are concentrated in the southeastern region of the nation. Particularly, this region is home to 7 shipbuilding/offshore plant companies which are ranked 10th in the world. Besides, Busan Metropolitan Government is poised to build a wind parts complex, the nation's first, in this region which has a preponderance of research centers compared to other regions across the country.

In addition to these regional advantages, WETech-Future Center is equipped with the infrastructures and facilities optimized for the R&D and experiments related to the offshore wind power, including large water tank, multi-directional wave maker, wind tunnel, high-speed circulating water channel, various wind power-related software, etc.

Furthermore, WETech-Future Center has built excellent convergence training environment, another advantage in addition to its infrastructure resources. WETech-Future Center is staffed by about 70 faculty members specializing in machinery and shipbuilding fields and serves approximately 420 students pursing master's and doctoral degrees. In addition, the Institute for Machinery Technology and the Global Core Research Center for Ships and Offshore Plants (GCRC-SOP) are situated in close proximity to each other within the university, thus allowing the researchers to engage in systematic cooperation. With this excellent convergence research team playing a key role, about 40 research papers related to the wind power have been published and 50 or so research projects have been carried out in related fields over the last 5 years.

The research team, comprised of the faculty members of Pusan National University and students pursuing master's and doctoral degrees, is well recognized for its excellence in the related field and has the competitiveness on a par with that of world-renowned research teams in offshore wind power sector.

Q : Some point out that Korea does not have suitable wind conditions, specifically, the direction of wind, for wind power generation. Considering that, what do you think about the wind energy's competitiveness?

A : Korea does not have good wind conditions for wind turbines from the standpoint of wind characteristics or water depth, unlike the North Sea of Europe and Baltic Sea. However, Korean government has made it mandatory that 10% of the total electricity should be produced using renewable energy sources by 2022 in accordance with the Act on the Promotion of the Development, Use, and Distribution of New and Renewable Energy. Thus, the RPS (Renewable Portfolio Standard) target is expected to be met mainly by offshore wind power and onshore wind power that will comprise 38.8% and 10.0%, respectively, based on 2022.

The government plans to develop the wind power industry as the main driver of export growth like the shipbuilding industry, which brightens the outlook for the wind power industry.

The opening ceremony of WETech-Future Center, held in Pusan National University (PNU) on February 15.

Meanwhile, large-scale offshore wind farm projects are announced constantly in many countries worldwide. The offshore wind power market is expected to expand at an annual growth rate of 31% and projected to be worth KRW 160 trillion on annual basis by 2050.

Korea, which has the world-leading technology and unrivalled competitiveness in the offshore plant sector, has unlimited development potential of technology in offshore wind power. If Korea maps out export strategies in conjunction with offshore plant industry, the wind power industry will become a primary driver of export growth.

Q : Then, what is your view on the outlook for wind power industry at home and abroad?

A : As mentioned before, the Act on the Promotion of the Development, Use, and Distribution of New and Renewable Energy contains a provision that requires 10% of total electricity to be produced by using renewable energy resources by 2022. Thus, the RPS target is expected to be met mainly by offshore wind power and onshore wind power that will comprise 38.8% and 10.0%, respectively, based on 2022.

The total domestic installed wind power capacity will stand at 2,250MW (680MW capacity is installed offshore) by the end of this year, which is expected to increase by 500MW each year in the period ahead. In addition, export in domestic wind power industry soared to USD 1.27 billion in 2010 from USD 58 million in 2004. By 2030, domestic production and export in wind power industry are projected to be worth KRW 12.5 trillion and KRW 66 trillion, respectively, and approximately 170,000 jobs are expected to be created.

The wind power market is worth USD 63.5 billion which accounts for 40% of the global renewable market worth USD 162 billion as of 2009. The global renewable energy market is projected to be worth approximately USD 1 trillion by 2020, which is equivalent to size of automotive market in 2009.

In particular, offshore wind power has come under the spotlight as the focus of the global wind power market is shifting towards large wind power facilities and offshore wind energy. The installed wind power capacity has increased over the last decade at an annual rate of 55.5% from 54MW in 2001 to 2,863MW in 2010. The offshore wind power market comprises only 1.6% of the total wind power market, but is experiencing a growth rate surpassing that of the total wind power market. The offshore wind power sector is expected to rise at an annual growth rate of 36.8% over the next decade, and the installed offshore wind power capacity is expected to reach 80GW by 2020.

Countries which dominate the global wind power market, such as U.K., Denmark, Germany, United States, China, etc., have announced offshore wind power projects at the national level and spearhead the construction of offshore wind farms and development of offshore wind facilities. The explosive growth in demand being witnessed in the offshore wind power sector brightens the prospects for offshore wind power industry. Korea also needs to establish a long-term plan for the next 10 years and steadily focus on R&D and manpower development.

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Infusing new vitality to offshore plant equipment industry

The government recently announced a measure to stimulate the growth of offshore plant equipment industry in an endeavor to increase local content in domestic offshore plants and further sharpen competitiveness. This measure aims to help domestic equipment manufacturers to expand their market reach and develop essential equipment.

Measures for stimulating the offshore plant equipment industry

The Ministry of Knowledge and Economy (MKE) recently announced the 'measure to invigorate offshore plant equipment industry' in a bid to promote co-growth in shipbuilding and offshore industries by increasing the local contents in offshore plant equipment and building up industrial competitiveness.

This measure aims to help domestic equipment manufacturers make inroads into markets, develop core and essential equipments, and expand the resource base in an attempt to raise local content up to 35% by 2020 and reach a domestic production volumes worth USD 14 billion by 2020.

•Support for equipment manufacturers' entry into markets

Domestic equipment manufactures, which achieved high localization rate by leveraging the contracts for the purchase and sale of natural gas, are seeking registration as approved suppliers of items not placed on the vendor lists of international oil giants. In fact, Royal Dutch Shell and Total expressed intent to positively consider adding Korean equipment manufacturers to their vendor lists.

MOU signing ceremony held at Paradise Hotel in Busan on February 13 for promoting the growth of offshore plant equipment industry

For the co-growth with equipment manufacturers, 3 major domestic shipyards are ready to assist equipment manufacturers by promoting the adoption of domestic equipments and helping these equipment gain ground in related markets.

In addition, the 3 domestic shipyards will provide mentoring support for the registration on the vendor lists through experienced experts and companies and offer the courses designed to develop necessary manpower in order to help complete the vendor registration process. In relation to that, Korea Plant Industries Association's courses dedicated towards fostering professional manpower will be offered from the September this year.

•Strengthening technological competitiveness

100 strategic items - which have low level of local content but have significant spillover effect - will be identified in tandem with the roadmap driven by a set of goals to develop technologies for offshore plant equipment. Specifically, the Technological Collaboration Committee, which consists of experts from universities, industries and research institutes,

will be charged with the planning of aforesaid roadmap for the development of technologies for offshore plant equipment and play supportive role by dispensing related advice.

In addition, active support will be provided to bolster technology development by means of various projects and programs, such as industrial convergence core technology development project, flagship programs for the southeastern metropolitan area of the nation, flagship programs for developing technologies vital for future industries. Each program and project will provide the following support:

-Industrial convergence core technology development project: support for core technology and equipment related to plant engineering

-Flagship programs for the southeastern metropolitan area of the nation: support for the offshore plant equipment sector from 2012 to 2014

-Flagship programs for developing technologies vital for future industries: support for technology development related to deepwater resource production from 2012 to 2017

To secure global competitiveness of essential equipment, strategic technology partnership will be formed with major foreign companies, along with M&A. For that, a capital injection of KRW 51.2 billion is planned for this year through the projects for international cooperation in industrial technology.

• Expansion of support base

Offshore Plant Equipment R&D center will be launched in Mieum district, Busan, in the second half of 2012, which is dedicated to the research in offshore plant equipment. Also, it will support R&D in equipment and help resolve technological bottlenecks.

In the first half of 2010, Equipment Test & Certification Center will open, providing the test and certification services. In 2013, the Center for Developing Professional Manpower in Advanced Technology will be established.

Moreover, Offshore Plant Industry Development Committee - comprised of the members from shipbuilding industry, equipment manufacturers, research and supportive organizations - will be launched in March to add new vitality to the offshore equipment industry. This committee will have tripartite subcommittees, ie., technical cooperation subcommittee, corporate subcommittee, and supportive organization subcommittee, and will be charged with identifying excellent equipment, planning R&D, providing link between shipyards and equipment manufacturers, and facilitating related organizations to make entry into markets.

Briefing session regarding the registration on the vendor lists of Shell and Total after the MOU ceremony

Meanwhile, an official from the MKE commented, "These measures to invigorate offshore plant equipment industry will be vital for offshore plant industry to make entry into offshore plant market and secure new growth engine, while shipyards will reinforce competitive edge and drive co-growth which is propelled by effective production cost and delivery management, and others. Recent growth in the global offshore plant market and swelling orderbook at domestic companies set the stage for greater business opportunities in the period ahead. Specifically, aforesaid measure was taken to increase the supportive role of both government and shipyards, which will help overcome the barrier of entry such as customers' conservative procurement practice for purchasing equipment which usually account for approximately 52% of costs, requirement for test & certification/track record, etc, in connection with equipment.

According to Douglas Westwood, the global offshore plant market which was

worth USD 140 billion in 2011 is projected to be worth USD 230 billion in 2015, USD 320 billion in 2020, and USD 500 billion in 2030. The proportion of offshore plant orders placed with domestic shipyards which stood at 44% in 2010 and 57% in 2011, respectively, is expected to jump to 71% by 2012.

MOU, a springboard for greater growth of equipment industry

The government, Korea Gas Corporation, and shipyards which construct offshore plants signed a memorandum of understanding (MOU) at Paradise Hotel in Busan on February 13 in a bid to promote cooperation and stimulate the growth of offshore plant equipment industry. The MOU ceremony was attended by the officials from Royal Dutch Shell and Total which expressed intent to put Korean manufacturers on their vendor lists.

This MOU specifies the roles for respective organizations and the provision of support necessary to develop the equipment industry. Specifically, this MOU contains the provisions for the support and cooperation on vendor registration, briefing sessions on vendor registration process, collaboration for technological development and exchange, adoption of Korean-made equipment, etc. The parties to this MOU agreed upon the establishment of private sector and government cooperation committee which plays a catalytic role in promoting industrial growth, as well as provide advice and support. The private sector and government cooperation committee, composed of 3 subcommittees - such as the technical cooperation subcommittee, corporate subcommittee, and supportive organization subcommittee - will provide technical advice on technology development and vendor registration, promote exchange among companies, explore joint marketing opportunities, etc.

As a first step forward, the committee will leverage the cooperative relationship with international oil giants and help put Korean equipment manufacturers on their vendor lists. Ahn Seung-beom, President of Shell Pacific Enterprise Ltd., said, “Shell maintains close cooperative relationship with Korean partners with respect to the gas supply, order placement and construction of offshore plants. We will fully cooperate to facilitate excellent Korean manufacturers to be placed on our vendor list for offshore plant equipment and parts.”

Shin Jeong-won, President of Total Gas & Power Kore, said, “Total has placed a number of orders for oil and gas offshore platforms with Korean shipyards and maintains strong collaborative relationship with them. We hope that our relationship with offshore plant industry is strengthened by expanding the adoption of excellent Korean-made equipments with proven performance.”

After the MOU ceremony, a briefing session was held for domestic equipment manufacturers in relation to the registration on the vendor lists of Shell and Total. The briefing session drew more than 200 officials from equipment manufacturing companies, which reflects the heightened interest in making inroads in the offshore plant market which has a bright outlook and looks poised to experience sustained growth.

Major details of MOU

-Korea Gas Corporation: It made request for cooperation in putting Korean equipment manufacturers on the vendor lists of international oil giants in conjunction with the contracts for the purchase and sale of natural gas.

-Hyundai Heavy Industries (HHI), Daewoo Shipbuilding & Marine Engineering (DSME), Samsung Heavy Industries (SHI): These shipyards will help put Korean equipment manufacturers on the vendor lists of international oil giants, facilitate domestic equipment manufacturers to develop technology and gain foothold in related markets, and promote the adoption of domestic equipment.

-Flagship Industry Support Group of Southeastern Metropolitan Area: It will identify and support technology development projects, provide marketing support necessary for domestic companies to make inroads into markets (briefing sessions, dispatch of trade mission, etc), and offer advise to companies.

-Ministry of Knowledge Economy: It will provide administrative support and lay the foundation for the development of technology for equipment, facilitate companies to make entry into markets by organizing trade fairs and briefing sessions on export, etc, and help develop professional manpower.

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Asia Pacific Maritime 2012

Asia Pacific Maritime (APM) is widely regarded as the region's premier maritime event, showcasing the latest in marine equipment, technology and services in the shipbuilding & marine, workboat and offshore sectors. This year's APM will be held at Sands Expo & Convention Centre in Singapore for 3 days from March 14 to 16, along with various auxiliary events.

Asia Pacific Maritime (APM) is widely regarded as the region's premier maritime event, showcasing the latest in marine equipment, technology and services in the shipbuilding & marine, workboat and offshore sectors.

APM - A one-stop knowledge hub

APM offers a holistic business experience by combining a comprehensive exhibition, high-powered conferences and seminars, and a host of networking sessions that connect more than 13,000 quality Asia Pacific buyers to international maritime suppliers.

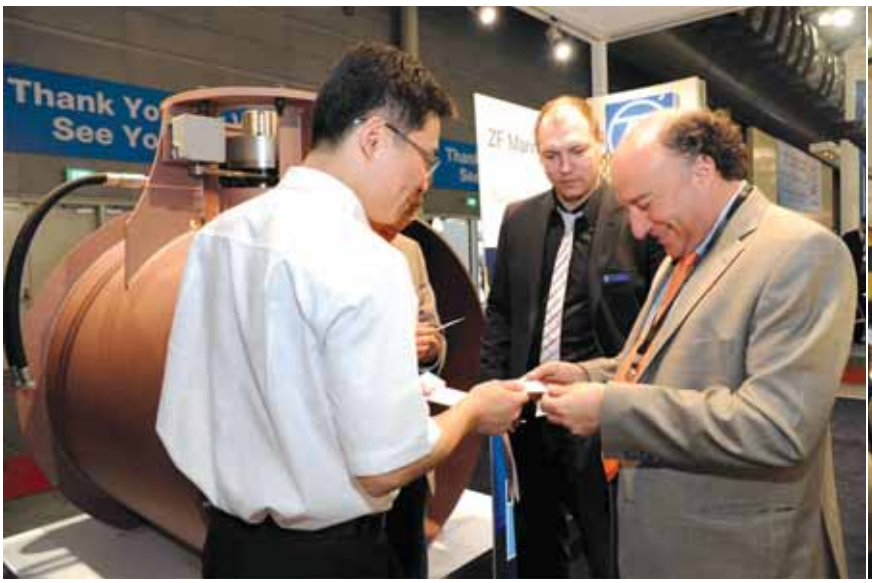
Conferences at APM 2012 will address latest trends and updates relevant to the marine industries, including Offshore & Support Vessels, Marine Propulsion and Auxiliary Machinery, Marine Electronics and Communications, Water Treatment, Financing and many more.

APM 2012 is on track to become bigger and better, with more than 900 leading international maritime exhibitors from over 50 countries and participation from over 12 national pavilions. This serves as a strong testament to APM's continued success in reaching out to key industry players in Asia.

APM 2012 will be taking place between 14 and 16 March 2012 at the Sands Expo and Convention Center, Marina Bay Sands, Singapore.

Global industry dialogue at the APM 2012

Several bright spots in the maritime industry are showing prospects and opportunities even as the global shipping industry faces a slow sail this year. Offshore, shipbuilding, green shipping and a growing Asia - these sectors will be the focus of the APM 2012.



Regarded as Asia's premier maritime event, APM is set to see dynamic discussions between world maritime leaders on the outlook of the shipping industry and the opportunities to help industry players cope with the slowing economy.

Industry heavyweights, Noboru Ueda, Chairman and President of ClassNK and Vice-Chairman of the International Association of Classification Societies (IACS) Council, and Mr Simon Bennett, External Relations Director of the International Chamber of Shipping (ICS) will co-host the keynote session at APM 2012, themed Asian Shipping: Coping with Turbulent Waters.

"The strength of the shipping industry is inexplicably tied to volatile economic trends and trade patterns. However, despite the uncertainty in the industry, the outlook for Asia remains bright," said Ueda. "Singapore, in particular, with its tripartite model of forging partnerships is a shining example of how to overcome the downsides of the sluggish global economy."

Bennett has a more cautious view. "It is currently necessary for any prudent ship operator to anticipate the unexpected. While we had assumed that the worst was over following the 2008 banking crisis, the health of the global economy is still very fragile, and most shipping markets expect a very rough ride in 2012. The only real bright light perhaps is Asia, which continues to sustain demand for many shipping trades, although with the current uncertainty in Europe, even this cannot be guaranteed."

Maritime associations in Asia are optimistic on the region's ability to ride out the storm and steer towards a positive forecast.

"The maritime industry in Indonesia is now more advanced and the focus has moved beyond domestic trade to international trade as well. Domestically, shipbuilding, offshore, tugs and barges, and vessels are performing well," said Carmelita Hartoto, Chairman of Indonesian National Shipowners' Association (INSA).

She added, "The commitment by Singapore, Malaysia, Indonesia and Vietnam to implement the ASEAN Economic Community (AEC) by 2015 will grow ASEAN into a highly competitive and connected economic region. Production and distribution networks will be widened and deepened, in turn supporting the maritime industries among ASEAN member countries. ASEAN has also determined priorities that cover opportunities in cooperation in maritime connectivity and the development of port facilities among ASEAN member states."

"Malaysia has a thriving offshore oil and gas sector and we will continue to consolidate our position as the deep-water hub in the South East Asia region and commanding lead in handling halal cargo. Intra-ASEAN and intra-Asian trade volumes are also expected to grow, and so will transhipment. These will provide some glimmer of hope to what will otherwise be a tough year ahead for ports," said En. Nazery Khalid, Senior Fellow of Maritime Institute of Malaysia (MIMA).

On the launch of the Malaysian Shipbuilding/Ship Repair Industry Strategic Plan 2020 in December 2011, he added that it will give a much needed boost to the local shipbuilding and ship repairing industry. "The plan charts a

clear course to develop and promote Malaysia into a major player in the small- to medium-sized shipbuilding market, attracting investment, nurture expertise and create employment opportunities."

Marjan Lacet, General Manager of Holland Marine Equipment (Singapore Branch), is also confident that the maritime industry in Asia is going strong. "Geographically, Asia plays an important role in the future for many Dutch maritime companies. In February 2012, Holland Marine Equipment will open its Singapore branch office. This branch will actively help to build and establish a network between Dutch maritime companies with local companies in the Asia Pacific market."

APM 2012 brings world maritime industry to Asia

Michelle Lim, Managing Director of Reed Exhibitions, which organises APM, said, "To date, 90% of the exhibition space has been taken up and we are expecting over 13,000 visitors. Such a positive response echoes the experts' view on the prospects in Asia and the growing interest from international players in the region."

"With the growing influence of Asia in the shipping industry and the strategic location of the event in Singapore, we are seeing more exhibitors from the West looking to leverage on APM to seek opportunities and use it as a springboard to establish connections with Asian players," Lim added.

The budding outlook is further illustrated with the event welcoming two new official pavilions from Taiwan and Australia, making a total of 14 official pavilions. Norway, United Kingdom, Germany, Japan and China will also be expanding their pavilions in terms of size and participation numbers, signalling more robust market activity at this year's event.

APM will be held at a brand new location at the Marina Bay Sands. Spanning two levels, the event will occupy a total area of 18,000 square metres. The 12th edition this year will be bigger and highly relevant to international industry players to help them cope with the current economic downturn.

The high-powered event comprises a comprehensive exhibition, a host of international networking sessions and a series of conferences and seminars led by world maritime leaders. This year's conference will zoom in on the key growing sectors - namely offshore, bunkering, green shipping and technologies - as well as pertinent issues such as work safety.

The 4th Offshore Support Vessels Summit, organised in partnership with ACI, will analyse new markets, the challenges and the latest cutting-edge technologies in the offshore shipping industry. The International Bunker Industry Association will host the keynote session entitled Environmental issues affecting bunker supply and quality: the Asian Perspective to discuss the latest regulatory update and issues surrounding fuel supply and fuel quality.

The Singapore Institution of Safety Officers, with the support of the Ministry of Manpower and Workplace Safety and Health Council, will organise a session to discuss workplace safety and health, one of the most concerned topics of the maritime industry. "Environmental awareness and social responsibility have been the buzzwords in the maritime industry for half a decade now. These broader perspectives are necessary in today's business, to keep up the awareness at political and international levels," said Mark Lerche, Export Consultant, Danish Marine Group.

For more information, please visit the official website at www.apmaritime.com.

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Commercialization of wing-in-ground craft

Daewoo Shipbuilding & Marine Engineering (DSME) signed a co-growth agreement with Wing Ship Technology on February 1 to develop wing-in-ground craft mooring facilities, as well as launch joint marketing campaign, in a bid to successfully commercialize the wing-in-ground craft. Specifically, both companies are poised to be on co-growth path paved through the cooperation in the development and production of wing-in-ground craft which provides convenient access to offshore plants, instead of helicopters.

Daewoo Shipbuilding & Marine Engineering (DSME) recently signed a co-growth agreement with Wing Ship Technology, a venture company that specializes in the world's best wing-in-ground craft, thus setting the stage for successful commercialization of wing-in-ground craft through mutual cooperation.

DSME and Wing Ship Technology entered into the agreement in a signing ceremony held at the DSME' headquarters in Junggu, Seoul on February 1. Under the agreement, both companies will jointly develop the wing-in-ground craft mooring facilities for offshore plants, cooperate in the development and joint production of 200-seat wing-in-ground crafts and develop military wing-in-ground crafts, as well as launch joint marketing of wing-in-ground crafts.

DSME has made constant efforts to expand the cooperation since 2007 when Wing Ship Technology was established, and has invested a total of KRW 7 billion spread out over the last 4 years, thus playing a pivotal role in helping Wing Ship Technology successfully develop 50-seat wing-in-ground craft. In addition, DSME plans to leverage its sales capabilities to help Wing Ship Technology successfully enter the market with the new wing-in-ground craft.

Wing Ship Technology, a venture company, became the world's first company that succeeded in launching the commercial 50-seat wing-in-ground in December last year. The company was established in 2007 mainly by a team of researchers of Korea Ocean Research & Development Institute (KORDI) who were exclusively dedicated to the commercialization of the wing-in-ground craft.

The test-run of 'WSH-500', the world's first 50-seat commercial wing-in-ground craft, in December last year

New co-growth model

The cooperation agreement entered into by both companies presents specific model for the co-growth of large companies and small-to-medium venture company, and come into limelight. Particularly, the agreement provides a robust basis for both companies to tread an exceptional co-growth path by bringing their complementary strengths and expertise to jointly develop the wing-in-ground craft mooring facilities for offshore plants and military wing-in-ground crafts.

For example, wing-in-ground craft can become safer and more cost-effective means of transportation, compared to helicopters, which provides easy access to offshore plants. This safer and more cost-effective offshore access provided by wing-in-ground craft will further increase the merchantability of offshore plants, and both companies will benefit from the cooperation.

Goh Yeong-reul, Vice-President, super-

vising the planning and coordination at DSME, commented, "Wing-in-ground craft is the next-generation means of transportation which combines the advantages of operationally efficient ship and fastest and most time-efficient aircraft. I think that wing-in-ground craft has huge market potential as it can provide convenient access to islands not easily accessible by ship or airplane."

Wing-in-ground craft

Wing-in-ground craft (WIG) combines the advantages of ship and aircraft and is a high speed transport that operates above the surface of the water. It achieves the flight by making use of the principle (wing-in-ground effect) that flying in close proximity to the water surface increases aerodynamic lift force on the wing surface while the air flow resistance on the wings does not increase very much.

Although wing-in-ground craft has the wings like airplanes, its operation is not affected by warm current because it travels close to the water surface. The International Maritime Organization (IMO) classifies the wing-in-ground craft as ship that is required to comply with the ship operation regulations.

Wing-in-ground craft which operates 1 to 5m above the water surface is not in contact with the surface and therefore is subject to smaller force of resistance compared to ordinary ship. Thus, wing -in-ground craft can achieve flight as fast as 200-300km/h and has no risk of plunging into the ocean from high altitudes.

Wing-in-ground craft uses marine and automative engines and runs on diesel fuel. Its mileage rate is 68% of aircraft and 21% of ship of same kind. In addition to this outstanding cost-effectiveness, wing-in-ground craft has the advantage of far less production cost compared to aircraft.

Wing-in-ground craft that achieves the flight through wing-in-ground effect is more efficient means of transportation, compared to high speed cruise ship, aircraft, and helicopter, from the standpoint of speed, operational efficiency, fuel consumption and others. Thus, wing-in-ground craft is expected to bring about a change in the marine freight and passenger transportation system and contribute to the technological advancement in related industries, such as shipbuilding, aviation industry, etc, if commercialized successfully.

Technology development

Wing-in-ground craft program was launched in Russia (former Soviet Union) for military applications in 1960s. However, its development and operations have been led by Germany, United States, Japan, China, etc. Wing-in-ground craft began to be converted from miliary to civilian applications such as passenger and freight transportation after the collapse of Soviet Union. Currently, wing-in-ground crafts are being actively developed for civilian applications.

In Korea, a consortium of private-sector companies, led by the Korea Ocean Research & Development Institute (KORDI), was formed in 1995 to develop the technology for wing-in-ground craft. As a result, 4-seat wing-in-ground craft completed the test-run in 2001, and 20-seat wing-in-ground craft completed the test-run in August 2007.

In september 2007, the plan for large-scale wing-in-ground craft commercialization project' was announced at the 27th Ministers' Conference on Scientific Knowledge. In November of the same year, Wing Ship Technology was established with the mission of commercializing the wing-in-ground craft and is currently building the system to design and produce medium and large-sized wing-in-ground crafts.

Table 1. Outlook of the demand for wing-in-ground craft

Type	Domestic market (no. of vessel)	Overseas market (no. of vessel)	Total (no. of vessel)
2010	10	168	178
2015	18	316	334
2020	34	523	557
2025	42	814	856

Source: Report on the development/commercialization of wing-in-ground craft with a seating capacity for 350 passengers (Jan. 2009)

GL Exchange Forum: Environmental Updates for the Maritime Industry

GL (Germanischer Lloyd) held the GL Exchange Forum on 'Environmental Updates for the Maritime Industry' in Greece on January 23. This forum, attended by more than 150 representatives from related industries, journalists, etc, provided a unique platform for in-depth discussion and presentations with respect to the mitigation of environmental impacts in the maritime industry.

GL's Exchange Forum on "Environmental Updates for the Maritime Industry" looked at the vital task of reducing the maritime industry's environmental impact. With concern over the international economic situation dominating the headlines, the tendency is for environmental issues to take a back seat. The Forum, however, demonstrated that this goal was not only important in of itself but showed how going green could help the industry to boost its bottom line.

More than 150 representatives from the maritime industry, shipping companies, ship management agencies, maritime journalists and stakeholders met to hear presentations from GL experts and discuss the drivers, implementation and commercial implications of the operational and design challenges facing the maritime industry as it seeks to reduce its environmental footprint, while maintaining a solid commercial footing.

Athanasios Reisopoulos, Area Manager Southern Europe, welcomed the guests and introduced the speakers. Dimitrios Korkodilos, Managing Director of Andriaki Shipping Co. Ltd and Chairman of the GL Hellenic Technical Committee, continued as moderator of the Forum.

Korkodilos in his opening speech noted that: "The introduction of new environmental regulations that affect ship design and operational aspects has been the main incentive for GL to organize this Forum, together with keeping the Greek shipping community updated on significant developments as well as available tools."

LNG, an attractive alternative energy source

The more widespread use of LNG as an alternative to conventional shipping fuel has the potential to make an immediate positive impact on the maritime industry's environmental impact. The elimination of sulphur and nitrous oxide emissions, particulates and a considerable cut in carbon dioxide are factors which make LNG an attractive option. As ever, however, the question must be asked as to how this stacks up economically. In his presentation Dr Pierre C. Sames, GL Senior Vice President Strategic and head of Research &

Development, laid out some of the results which have emerged from a GL joint study looking at the costs and benefits of LNG fuelled vessels.

Examining a range of containerships from 2,500 to 18,000 TEU, the study, conducted in cooperation with leading engine manufacturer MAN Diesel & Turbo, models the cost and payback times of LNG and scrubber systems - calculating a variety of scenarios based on fuel price, investment costs, use of waste heat recovery systems, and route exposure to emission control areas (ECAs). For vessels operating predominately in ECAs (65%) Dr Sames noted that the study suggests that the payback on an LNG system was only two to three years, while for smaller vessels (2,500TEU) the study demonstrates that at a price of 1$/mm BTU less than HFO, LNG becomes the preferred option.

Technology innovation to reduce environmental pollution

Innovation to reduce the environmental impact of shipping has been spurred by a series of new regulations, both in force and up coming, introduced by both local and international maritime agencies. The 62nd session of the Marine Environment Protection Committee (MEPC) of International Maritime Organization (IMO), in particular brought significant changes to the regulatory landscape in shipping with the Energy Efficiency Design Index (EEDI) and the Shipboard Energy Efficiency Management Plan (SEEMP).

In his presentation, Athanasios Reisopoulos, GL's Area Manager Southern Europe, examined how recent emission rule changes would challenge the shipping industry. Focusing on the main air pollutants in the exhaust gases of engines, he explained the measures and technologies used in order to reduce emissions from shipping. Having analyzed the effect of the main parameters in the EEDI formula he outlined a number of examples of technical measures aiming at increasing the energy efficiency of ships and reducing CO_2 emissions. Last but not least Reisopoulos presented GL's zero emission container feeder vessel design concept, powered by liquid hydrogen created by using surplus offshore wind generation capacity.

Irrespective of which fuel a vessel may be using, in both new designs and ships in operation, significant gains in the environmental impact of shipping can be made by maximising efficiencies. Prof. Dr. Ing. Volker Bertram, from GL's Maritime Solutions unit FutureShip, presented a number of options whereby owners, operators and designers can make use of the advances in integrating computer aided design and computational fluid dynamics to improve vessel efficiency, reduce fuel use, thereby limiting not only emissions but costs.

Aristidis Efstathiou, Business Development Manager Area Southern Europe, concluded the Forum with his presentations on "Guidelines for compiling a Shipboard Energy Efficiency Management Plan". Efstathiou highlighted the fact that the SEEMP will soon become mandatory for all vessels (larger than 400 GT) at their first IAPP renewal or intermediate survey after 01 January 2013. In order to support its clients, he continued, GL has developed a clear guidance on the form and implementation of the SEEMP. He showed how GL's user friendly standardized templates and energy management expertise could make it easier for a vessel's operators to create a SEEMP, either as a stand alone document or as an integral part of a broader management system.

First energy management certification in shipbuilding industry

Samsung Heavy Industries' Geoje shipyard won the international standard for energy management for the first time in shipbuilding industry. This certification attests to SHI's leading position in standardization of shipbuilding industry, ranging from the quality, through environment and health/safety, to energy management.

Samsung Heavy Industries' Geoje shipyard acquired the international certification for energy management for the first time in shipbuilding industry.

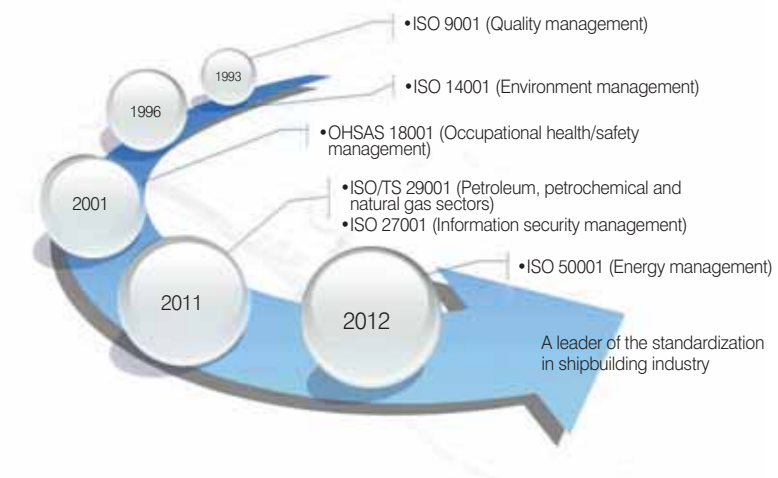
Samsung Heavy Industries (SHI) announced that it won 'ISO 50001' certification from Lloyd's Register Quality Assurance (LRQA) on February 2. ISO 50001 is an international standard for energy management with respect to companies' planning, practice, operation, etc, for energy-saving, and came into force in June, 2011.

SHI, which announced green management in January 2010 for the first time in shipbuilding industry, set up 'Energy Management Task Force' and has proceeded with researches in its drive towards energy-saving measures. As a result, SHI has completed energy management roadmap that aims to reduce greenhouse gas emissions by 20% by 2020, and recently set up energy management system, including integrated IT system for energy management and the gauging system designed for measuring the consumption of energy such as electricity, gas and fuel at shipyards.

SHI's acquisition of ISO 50001 attests to the global recognition of its dedication toward energy efficiency improvements.

Energy management taking on added importance

International certifications obtained by SHI



Energy management system is a standardized approach to the energy management, wherein the whole members of company, including the chief executive officer, establish the objectives of energy management and constantly push ahead with appropriate improvement activities to accomplish energy and cost-savings.

ISO 50001 certification has emerged as essential certification along with ISO 9001 (quality) and ISO 14001 (environment), and is gaining considerable attention from companies as the energy management has taken on added importance in reducing greenhouse gas emissions.

SHI will constantly develop its energy management system to ensure energy-savings in the whole shipbuilding processes, and furthermore, dramatically reduce greenhouse gas emissions. By doing so, SHI anticipates its energy management system will deliver energy savings worth in excess of KRW 15 billion yearly.

Roh In-sik, President & CEO of SHI, said, "The acquisition of ISO 50001 certification will place SHI in a better position to achieve more efficient use of energy in its drive for green growth powered by environment-friendly product development and strengthen our competitive-

ISO 50001 certification award ceremony was held at SHI's Geoje shipyard. Employees of SHI and officials of Lloyd's Register Quality Assurance are taking commemorative photos.

Park Dae-yeong, SHI's shipyard Director (Vice-President), and Luis Benito, Country & Marine Manager, Korea, for Lloyd's Register Asia, are showing the ISO 50001 certificate.

ness in winning new orders."

SHI is the nation's first company that won ISO 9001 acknowledging the compliance to international standards in 1993. Moreover, SHI obtained ISO 14001, the standard for environmental management, in 1996, and OHSAS 18001, the standard for occupational health/safety management system, in 2001, thus becoming the first shipyard to obtain these 3 major international certifications.

In addition, SHI has been at the forefront of standardization efforts in the shipbuilding industry. Specifically, SHI became the first shipyard to acquire ISO/TS 29001, an international standard for the petroleum, petrochemical and natural gas industries, in 2011, and win ISO 27001 certification, an international standard for information security management.

Student Competition

Honeywell launched 'Student Competition' in 2008 to foster talents and uncover the next generation of process manufacturing and technology leaders from academic institutions worldwide. Honeywell has expanded its annual Student Competition in 2012 which includes Korea, India, Japan, China, South East Asia, Australia, New Zealand, etc, this year.

Honeywell has expanded its annual Asia Pacific Honeywell Users' Group (HUG) Student Competition. The student competition, which was launched in 2008 in Europe, the Middle East and Africa (EMEA) and in 2010 in the Americas, is designed to foster talent and uncover the next generation of process manufacturing and technology leaders from academic institutions around the world.

Students in Asia Pacific are challenged to use the Honeywell UniSim Design Suite, an intuitive and interactive process modeling solution, to create a process design that could solve a critical plant business issue. Efficiency, productivity, reliability, safety and the environment are just some of the issues students need to consider when developing their solutions.

Selection of the winner in August, 2012

A committee made up of experts in the field will select the winning team, who, together with the sponsoring tutor, will attend the HUG conference being held at Surfers Paradise, Gold Coast, Australia in August 2012, where they will present their project. The Asia Pacific HUG 2012 Student Competition is open to any student currently enrolled in the engineering department of an accredited college or university in Australia, New Zealand, Korea, India, Japan, South East Asia and China.

This year, five consolation prizes will also be awarded. The winning students and their sponsoring tutors will be able to attend their choice of one of two advanced UniSim Design training courses.

Submissions should be made online using a 300-word abstract and PowerPoint presentation, and must include details of the experiment, describe why the approach is innovative and the main benefits of the project. The deadline for receipt of the submission is 30 April 2012.

Review of 2011

Rajab Khalilpour, a student at the University of Sydney's school of Chemical and Biomolecular Engineering was the Pacific HUG 2011 winner, impressing the judges with his simulation and optimisation project to capture carbon from a coal-fired power plant. The opportunity gave Rajab exposure to a real-life challenge, as well as recognition amongst the industry for his winning submission.

Students from all over the world have produced outstanding results, including 2011 Americas HUG student competition winners Miroslav Pajic and Harsh Jain, from the University of Pennsylvania. Their design won in the wireless category with a project that focused on distributed controller grids and the next generation of robust wireless control and actuation. The Americas winners of the UniSim category were Pedro Amer and Nahir Torres from the Universidad de Oriente in Venezuela, who together created a process simulation model of a high-pressure steam generation boiler. At the EMEA users conference, Igor Krylov, from the Moscow Institute of Physics, was the winner and his project determined effective and safe ammonia process modes, the results of which can be incorporated into new alarm technology for real ammonia production facilities.

UniSim Design Student Competition 2011 Winner were Rajab Khalilpour at the School of Chemical & Biomolecular Engineering, University of Sydney, and Garry Mahoney, Sales Director at Pacific Honeywell Process Solutions.

"The HUG student competition presents a valuable opportunity to help promote the manufacturing industry's up and coming talent," said Tony Cosgrove, vice president, Asia Pacific, Honeywell Process Solutions. "The importance of exposing students to new and exciting ways of critical thinking to meet real-world problems ensures the newest and freshest ideas and innovations are captured to help grow and transform the industry."

Shipbuilding & Offshore Painting and Surface Treatment Center was formed

The Shipbuilding & Offshore Painting and Surface Treatment Center will be established in Ulsan for the first time nationwide to build up global competitiveness in the painting and surface treatment sector. This Center slated for completion in 2014 will enable companies to handle related works at home without the hassle of international travel, thus bringing time-and cost-savings.

Ulsan Metropolitan Government recently announced that it would launch 'Shipbuilding & Offshore Painting and Surface Treatment Center' for the first time nationwide as part of effort to secure global competitiveness in the field of painting and surface treatment, one of the three major elements in shipbuilding industry.

This Shipbuilding & Offshore Painting and Surface Treatment Center - which is to be established under the supervision of the Korea Testing & Research Institute (KTR) - will be built within Techno Industrial Complex in Duwang-dong, Nam-gu, Ulsan with a funding of KRW 22.2 billion (KRW 11.7 billion from national coffers, KRW 5 billion from local government's coffers, and KRW 5.5 billion from private-sector), occupying 16,500m^2 of land and 6,600m^2 of floor space.

The basic and detailed designs will be finalized by October, and the construction will start in 2013 and be completed by 2014.

Stronger competitiveness of shipbuilding industry

The panting and surface treatment is one of the three major elements for value-added creation in shipbuilding industry, along with steel plate and welding. However, the painting/surface treatment industry in Korea has been struggling considerably for many years. Specifically, inadequate R&D infrastructure was a major constraint, making it unavoidable for the Korean painting/surface treatment companies to turn to foreign marine certification bodies whenever the ship construction was underway.

Even China, which is engaged in fierce competition with Korea, is giving unsparing support to painting/surface treatment industry and recently established an institute dedicated to the research in the ship corrosion protection painting in collaboration with DNV (Det Norske Veritas) in a bid to dominate the market and narrow the gap in technology.

Currently, Yeongnam head office of KTR - designated by world-renowned classification societies (in Norway, United States, France, Korea, etc) as the specialized institute for technology in the ship corrosion protection painting - is performing related duties as assigned.

Choi Won-tae, President of KTR which supervises the establishment of Shipbuilding & Offshore Painting and Surface Treatment Center, commented, "The establishment of the Center will allow companies to handle related works at a time without the hassle of international travel, which will not only bring time-and cost-savings but also help increase competitiveness of domestic shipbuilding industry."

Yeongnam head office of KTR, which opened in Daun-dong, Junggu district, in March 2007, is the largest internationally accredited test & analysis organization staffed with 50 specialists and equipped with about 400 precision analytical instruments and is an international provider of testing and certification services covering the whole range of industries, including nuclear power, wind power, steel, electricity, electronics, etc, as well as the flagship industries of Ulsan such as shipbuilding, automotive, petrochemical and fine chemical industries.

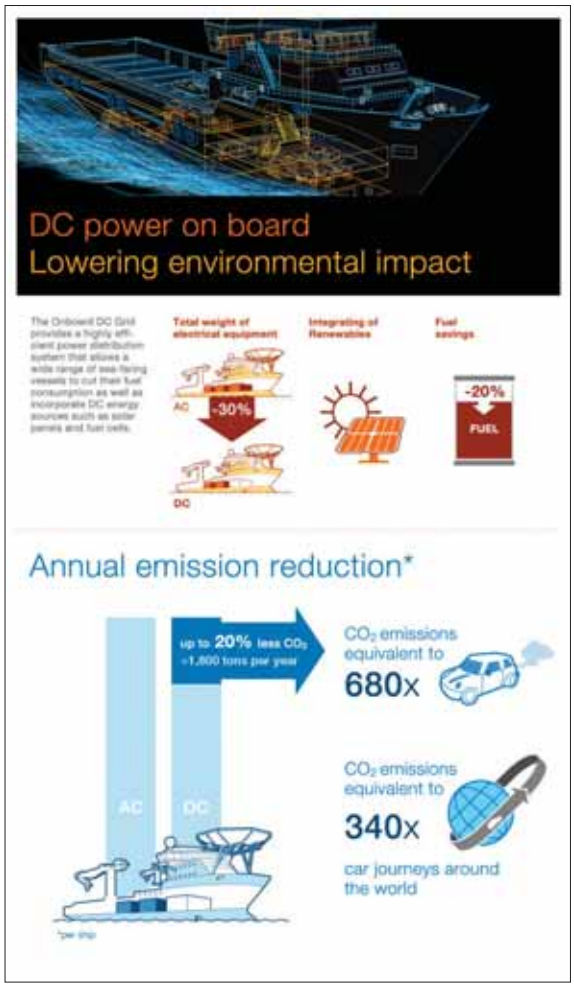
Breakthrough order for DC technology

ABB wins order to install the first ever DC-based electric solution for a vessel. The Onboard DC Grid will allow vessels to cut fuel consumption and emissions by up to 20 percent.

ABB, the leading power and automation technology group, has won an order from ship owner Myklebusthaug Management to supply the first ever direct current (DC) power grid on board a ship recently. The equipment will allow a new offshore platform support vessel, under construction in Norway, to operate at the highest energy efficiency level to minimize emissions.

In traditional electrical propulsion vessels, multiple DC connections are made to thrusters and propulsion drives from an alternating current (AC) circuit, accounting for more than 80 percent of electrical power consumption. ABB's Onboard DC Grid represents a step forward in optimized propulsion by distributing power through a single DC circuit providing significant power savings.

Launched in May 2011, ABB's Onboard DC Grid is part of a revival of power solutions using DC, and will provide highly efficient power distribution and electric propulsion for a wide range of vessels. It is designed for ships with low-voltage onboard circuits, such as offshore support vessels, tug boats, ferries and yachts, and can reduce fuel consumption and emissions by up to 20 percent.



"With this solution, the vessel will be ready to maximize opportunities in energy savings with supplementary DC energy sources, such as solar panels, fuel cells, or batteries connected directly to the ship's Onboard DC Grid," said Veli-Matti Reinikkala, head of ABB's Process Automation division.

"The Onboard DC Grid will help the vessel operate from the very first day at the highest levels of fuel efficiency with low emissions."

ABB will provide its full onboard DC system, including all power, propulsion and automation systems for the 93 meter long, 5,000 ton multi-purpose oil field supply and construction vessel, which is scheduled for delivery in the first quarter of 2013.

A key advantage of ABB's Onboard DC Grid is that the ship's engines no longer have to run at a fixed speed, so the engine's speed can be adjusted to optimize fuel consumption. By eliminating the need for bulky transformers and switchboards, the footprint and weight of the electrical system can be reduced by up to 30 percent, leaving more space on the vessels for passengers or cargo while also providing greater flexibility in the positioning of system components in the vessel.

ABB is a leader in power and automation technologies that enable utility and industry customers to improve performance while lowering environmental impact. The ABB Group of companies operates in around 100 countries and employs about 135,000 people.

*Related details will be presented in next month's issue.

Rosy future of deepwater drilling market

Global Information, a magazine specializing in providing knowledge and information, indicated that the capital expenditure in deepwater market would reach USD 232 billion over the next 5 years from 2012 to 2016, an increase of 90% compared to the previous 5-year period, and the Latin America's capital expenditure in deepwater oil and gas field drilling markets would surpass that of Africa, based on the recent report of Douglas-Westwood forecast.

Global Information announced that Douglas-Westwood recently published 'The World Deepwater Market Forecast 2012-2016'.

Steven Kopits, Director of Douglas-Westwood, said, "Oil companies have a bright outlook in 2012 in overall sense, the subsea, particularly, the deepwater exploitation will continue to make up a significant part in the portfolios of major IOCs (international oil companies such as Total, Shell, BP, Exxon, etc) and some NOCs (state-run oil companies such as Petrobras, Statoil, etc) over the long-term."

According to this report, the total capital expenditure in deepwater drilling market is expected to reach USD 232 billion over the next 5 years from 2012 to 2016, an increase of 90% compared to the previous 5-year period.

The rosy future for deepwater business clearly presents long-term opportunities. The deepwater projects, which have become capital-intensive, have put E&P (Exploration & Production) companies under greater financial strain on one hand, but create huge opportunities for global oil-field service and equipment companies to cave out large share of the market on the other hand.

Douglas-Westwood has tracked and analyzed the deepwater market since it published its first report on deepwater exploitation in 1998, developing unmatched knowledge and experience in this field. This report provides the market analysis, market forecast, and insight into how the changes in the industry over the long-term and medium-term will affect the businesses.

Lucy Miller, the author of the report, mentioned, "The regional focus of the resource exploitation is the so-called 'golden triangle' between the African continent and American continent. Based on the forecast of Douglas-Westwood, Africa and the Americas are expected to represent 72% of the deepwater capital expenditure. Particularly, Latin America is expected to experience remarkable growth and surpass Africa's deepwater capital expenditure by the middle of the period which was forecast. The oil field exploitation by Brazil's state-owned oil company, Petrobras, in Campos and Santos offshore basins on the coast of Brazil is expected to drive the growth."

An alliance for efficient FPSO solutions

The market for floating production, storage and offloading (FPSO) vessels is linked to the global demand for oil. As the market recovers, the Wärtsilä-Emerson alliance is becoming increasingly important.

Emerson Process Management Korea

The long-term fundamentals with respect to energy use have not changed. Energy demand is expected to continue to grow, while oil and gas are expected to remain the primary energy sources in the near future. Exploration and production costs will continue to increase as more remote oil sources, such as deep-water off shore wells, have to be tapped.

From a low of USD 35 per barrel in December 2008, oil prices were back in the USD 70-80 range by the end of 2009. Future market indicators suggest prices of USD 100+ in the not-so-distant future. It is this future price prediction that lies behind the viability of the more difficult projects.

Deep-water oil exploration has been constrained thus far by restricted rig availability. However, by 2012 the number of deep water drilling rigs in operation is expected to double, and therefore the number of deep water finds will undoubtedly increase. This will produce a growing requirement for FPSO systems.

More than 150 projects involving the potential use of FPSO systems are currently at various stages of planning. About one-third of these are already at an advanced stage of bidding or final design, and most of these projects will move forward.

An FPSO unit is usually the best, and often the only, way to extract hydrocarbons from deep-water wells. FPSOs are able to withstand sea motion, have large oil storage capacity, large deck space and load capability, can operate in shallow or deep water, are re-deployable, and are inherently safe. Though they need a turret in some areas, and sometimes require subsea installations and flexible risers, FPSOs can be relied on to provide stability, volume and inherent safety.

Sharing technologies

In 2008, Wärtsilä entered into an alliance with US-based Emerson Process Management to jointly develop safe, efficient and enhanced solutions for FPSO owners and operators worldwide. The Wärtsilä-Emerson alliance manages a large scope of complex equipment interfaces under single responsibility, thereby mitigating project completion risks.

The outcome of this alliance has been that the two companies have successfully combined their strengths to give customers:

-Reduced project risk
-Faster project execution
-A full range of power, propulsion and automation systems
-Best in class products integrated into overall solutions
-An optimal CAPEX/OPEX solution.

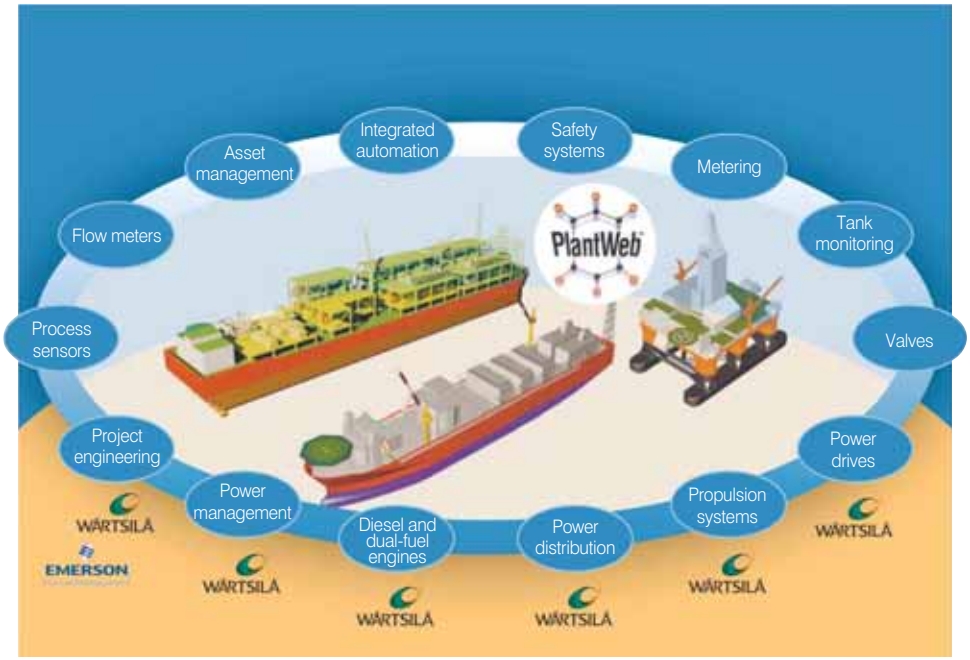


Fig. 1 Developing technologies and capabilities into solutions

Wärtsilä and Emerson are major suppliers to the offshore industry. Together, they are able to deliver completely integrated energy and automation systems for FPSO vessels, as well as for semi submersible oil and gas drilling rigs.

The range of products and systems delivered by the alliance, includes those for power generation, power distribution, power drives and propulsion, and a completely integrated FPSO topside control and safety system, i.e. the process equipment. Projects are taken from the feasibility study phase, to front-end engineering and design (FEED), to system deliveries and installation, and all the way through to operational and lifecycle support.

The FPSO projects are designed and co-ordinated by the Wärtsilä and Emerson teams in Norway. The two companies have worked together to develop standards and procedures using their experiences from previous offshore and marine projects. The concepts and design work will incorporate innovative solutions, such as integrated operations, embedded asset management, and the use of smart wireless technology. Both Wärtsilä and Emerson have a significant presence in all the main offshore market areas. In addition to the existing alliance teams located in Norway and Singapore, further teams are planned for Houston and Rio de Janerio. These local execution and support centres will act as hubs, co-ordinating services around the globe.

The goal is not only to provide engineering services on an individual project basis, but also to better manage the challenges of complex global project execution. This is achieved by gaining better control of standardization in the design and implementation of work performed in different locations for the same project. These marine and off shore centres will, therefore, act as centralized bases for each design package. Consequently, the handover to other world areas and other teams, during and after the project, can be efficiently managed.

Project handling

Solutions related to automation and control, and power and propulsion, comprise a relative small percent of project cost, but they have a large impact on:

-Plant design efficiency
-Technical risk and complexity
-Engineering schedule
-Design cost.
-Construction performance
-Risk and complexity
-Installation schedule
-Installation cost.
-Start-up execution
-Plant commissioning and start-up
-Schedule
-Cost.

Scope, time, quality, and resource and procurement management are all crucial elements in the fast-track nature, and highly competitive market demands, of these FPSO projects.

By taking responsibility for electrical, instrumentation, automation, and telecom solutions (EICT), Wärtsilä and Emerson together become a vital partner in the engineering and management of the project. The exchange of information

between stakeholders and topside EPC (engineering, procurement and construction) contractors, package unit suppliers, the conversion yard, and others is better managed, and any gaps between engineering and execution can be bridged.

Project execution

During project execution, the alliance acts as the integrator and interface manager, performing the engineering for the complete EICT scope. This is done in structured processes, is ISO 9001 quality assured, and makes use of an advanced object oriented engineering tool COMOS, as well as project management tools. These tools provide access to global resources, all of which follow the same procedures, have uniform marine and offshore standards, and talk the same engineering language.

For all alliance projects, Wärtsilä and Emerson use a PMI

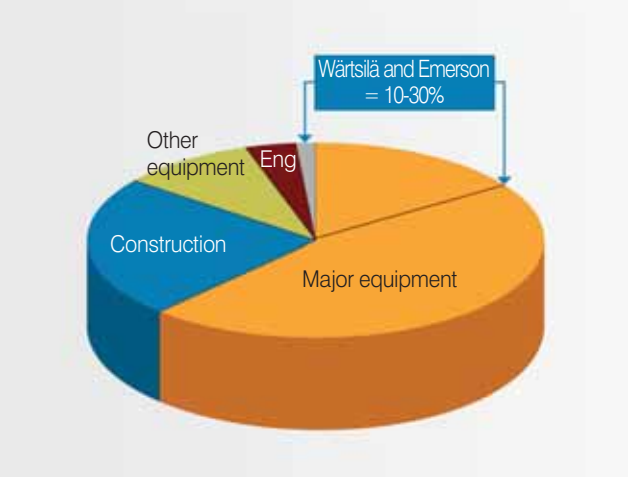


Fig. 2 By combining Wärtsilä and Emerson offerings, the alliance becomes an important partner in fast track conversion projects

PlantWeb is a digital vessel architecture that delivers proven results, and the DeltaV system makes it easy. Designed with this digital architecture in mind, the DeltaV system fully integrates "Smart Plant" capabilities including HART, FOUNDATION field bus, high speed discreet busses, embedded advanced control, and advance unit and batch management. The seamless, intelligent field integration provides an infrastructure for advanced applications, such as AMS Suite - an intelligent device manager for quick, easy device re-ranging, configuration and diagnostics. The results are better process efficiency and reduced process variability.

Operational performance

In today's offshore production facilities, experienced and certified personnel are essential for effective and safe operation. But since finding the personnel with the right skill levels is increasingly difficult, it is essential to utilize the existing resources in the most cost effective way.

With PlantWeb technology and the Asset Management Portal, the Wärtsilä-Emerson integrated Remote Asset Management Centre can provide a safe and cost effective solution for managing, maintaining, and monitoring a customer's critical assets. By integrating this service within the customer's organization, the alliance is able to simplify the daily management of assets. This benefits the customer in the following ways:

-Process availability.
Predictive intelligence helps detect and avoid causes of equipment failure that could lead to unplanned downtime. Product specialists are available 24/7.

-Maintenance efficiency and effectiveness.
Potential equipment issues are detected and diagnosed before they affect process performance.

-Optimizing of offshore and onshore maintenance activities.
This ensures efficient use of resources by using land based asset management, condition monitoring and performance analysis.

-Regulatory compliance.
Companies can provide alert tracking, calibration records, and detailed audit trails of operations.

-Throughput and yield improvement.
Early warning of potentially reduced operating conditions will minimize downtime.

-Increased quality.
Instruments and equipment are easily maintained to perform at their optimal level.

(Project Management Institute) gate model for sales and project execution. The model has different stages, namely initiation, planning, execution and control, and closing. The project management teams become involved during the early stages of the sales process to ensure that customers are offered the best solution.

This means that the customer needs a purchase agreement with just one supplier for engineering, electrical systems, the safety & automation system, and telecoms, covering:

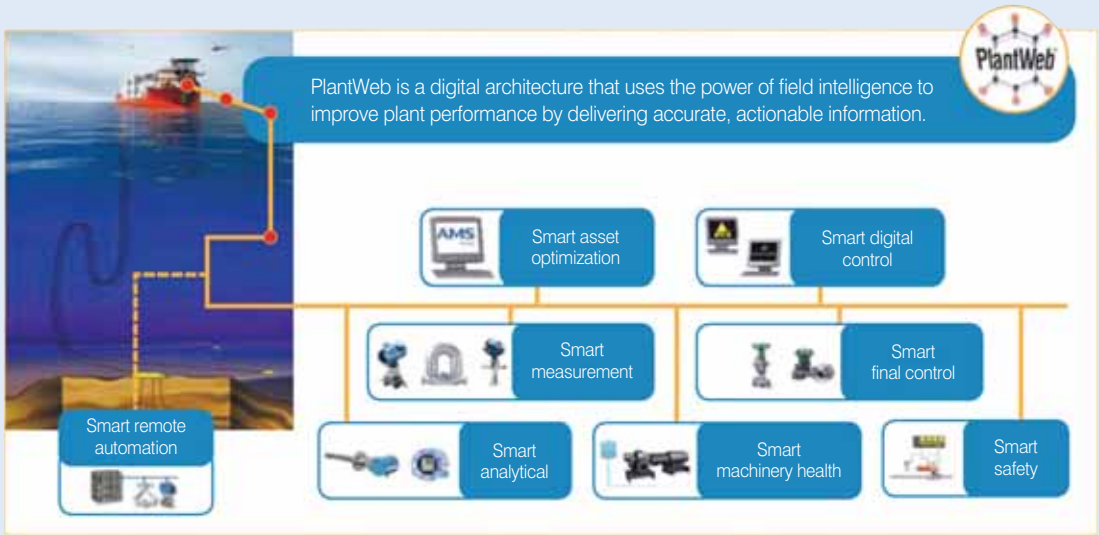
-System and detailed engineering (hull)
-Interface management
-Delivery of systems and products
-Relevant 3rd party suppliers
-Commissioning and start-up
-Operational support.

A common database

Communication and interfaces are vital but challenging. The answer has been to convert the FPSO into a "digital plant", whereby the owner and all the major vendors and suppliers work using a common tool. A single database is used for instruments, electrical consumers, control system components, and the process equipment.

This saves time, produces correct information, and since the system is always being updated, it is easy to search and navigate. This in turn leads to a reduction in engineering man hours, reduced commissioning time and cost, faster and safer changes, fewer engineering errors, a reduction in handover cost, more readymade interfaces, and safe and effective modifications.

*Author: Sanjay Verma, Director,
Alliance Management, Wärtsilä Ship Power



Upgrades and modifications

Wärtsilä and Emerson are able to access the plant at any location or offshore site. The remote diagnostic centre's Integrated Automation System/Integrated Control and Safety System infrastructure allows small modifications and upgrades to be made anytime. The customer benefits through the remote implementation of changes and improvements to the process onboard, thus reducing costly trips, improving response time and leading to higher availability of the installation. Other benefits include the remote tuning of control loops, the implementation of advanced control/regulating strategies, operational online support to remove process bottlenecks, and online upgrades without production shutdown.

For decades, both Wärtsilä and Emerson have been major suppliers of products and technologies within the marine and offshore industries, and have a long history of supplying products and services to both FPSO new buildings and conversions globally. Their focus today encompasses all offshore production units, including oil and gas as well as floating LNG units, and is aimed at meeting fully the demands of their customers.

Reference: The Wärtsilä-Emerson alliance FPSO projects

FPSO Conversion "PETROJARL CIDADE DE RIOS DAS OSTRAS"

Scope of supply:

-Power station
-Power distribution
-Safety and automation system
-Telecommunication incl. navigation
-Total responsible for EI&T
-Commissioning/start-up

Shipowner: Teekay PetroJarl
Shipyard: Remotova Gdansk Shiprepair Yard
Delivery: October 2007
The first Wärtsilä-Emerson FPSO in Brazil.

FPSO Conversion "PIPA 2"

Scope of supply:

-Integrated engineering
-Diesel engines and generators
-Thruster systems
-Power distribution
-Safety and automation system
-Commissioning/start-up

Shipowner: Dynamic Producer Inc.
Shipyard: Sembawang Shipyard
Delivery: 2009
The world's largest drill ship and multipurpose FPSDO.

FPSDO vessel "MPF-01"

Scope of supply:

-Power station
-Power distribution
-Integrated control system, incl. PMS and safety systems
-Electrical propulsion system
-AC Drives for drilling applications

Shipowner: MPF Corp.
Shipyard: To be decided
Delivery: 2008
The world's first purpose built DP FPSO.

FPSO conversion "YUUM K'AK'NAAB"

Scope of supply:

-Power distribution and control
-Power management
-Low Voltage switchboards and UPS

Shipowner: Bergesen Worldwide Off shore
Shipyard: Sembawang Shipyard
Delivery: 2006
The world's largest FPSO conversion. The first FPSO to be deployed in the Gulf of Mexico, serving as a hub in the area and acting as an export terminal.

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Summary

Advanced marine modeling and design systems and tools can provide significant returns on investment in the form of more standardized deliverables, more rules-based design automation, and more customization to enable process innovation. These benefits can be achieved through the adoption of a technology, such as SmartMarine 3D, which offers a rule-driven solution for streamlining the design process. Working with an organization's in-house experts, familiar with the design and production practices, an implementation plan can be created to automate the most common modeling practices. Depending on the background of the in-house domain experts and/or the technology, design experts may require some amount of time and training using the new technology before sufficient knowledge and skills can be achieved - ultimately slipping the start of the customization efforts, prolonging the implementation timeframe, and delaying the point where the return on investment begins to generate savings. Since the creation of a rule driven solution involves some sort of "programming", it is logical to look to the software development community for techniques and methods to do this work in an effective and efficient manner.

Utilizing standard Agile programming methodologies, teams are created with individuals that fulfill roles such as subject matter expert, developer, product owner, documentation specialist, and tester. These knowledge resources are collocated and work on prioritized backlog items with known business values for fixed length cycles with identified Conditions of Satisfaction.

In this paper, we will discuss the pros and cons of this approach and summarize the experience of "lessons learned" through an actual implementation project, which includes development of customized rules and catalog content for the modeling, detailing, and production of marine vessels.

1. Introduction

As the global shipbuilding market becomes more competitive and changing demographics result in fewer young workers entering into the workforce to replace the existing design experts it is necessary for shipyards to automate design processes to achieve a higher quality product with a reduced set of design experts. This level of automation often involves some sort of "programming" to drive rule based solution technologies, such as SmartMarine3D, which allows customers the flexibility to automate the most common modeling practices.

This paper will describe how Agile Software Development methodologies were used in the development of automated rules for a SmartMarine3D implementation project. In this project, Intergraph worked in partnership with a shipbuilder to review and capture its design and construction standards and incorporate those standards into SmartMarine design rules. This partnership resulted in a level of automation that expedited the ship design and manufacturing process, allow production time to be reduced, which in turn generated immediate business value.

SmartMarine3D is delivered with an "out-of-the-box" (OOTB) set of rules and reference data that allow customers to use the application without the need to spend time and effort customizing the product. In many cases, however, customers determine that there are longer term benefits to be gained by expanding upon the delivered rules and reference data to suit their own unique business practices and processes. The extent to which they want to customize the OOTB content determines the time and effort needed. This paper focuses on how Intergraph and the customer worked together to apply Agile Development methodologies to the customization opportunity, in order to streamline and expedite the development of the reference data into an optimized implementation timeframe.

1.1 About agile software development methodologies

The principles of Agile programming were best described, in February 2001, when several of the leading experts in software development came together and developed what became the Agile Manifesto[1]:

We are uncovering better ways of developing software by doing it and helping others do it. Through this work we have come to value:

Individuals and interactions over processes and tools
Working software over comprehensive documentation
Customer collaboration over contract negotiation
Responding to change over following a plan

That is, while there is value in the items on the right, we value the items on the left more.

To adhere to this manifesto, several styles of Agile programming methodologies were created. Although there are slight differences in implementation, the overall goal and structure remains constant. The Agile approach described in this paper will follow the principles of the "Scrum" process. The Scrum process (as illustrated in figure 1) is an incremental design approach, where a cross-functional team consisting of a product owner, a Scrum master, a subject matter expert and developers are collocated and work from a prioritized list of tasks called the 'Product Backlog'.

The product backlog represents customization work that is intended to improve production and quality for automation efforts. This backlog is maintained in a priority order based on business value, which is set by the product owner. The product owner is solely responsible for all items in the product backlog.[2]:

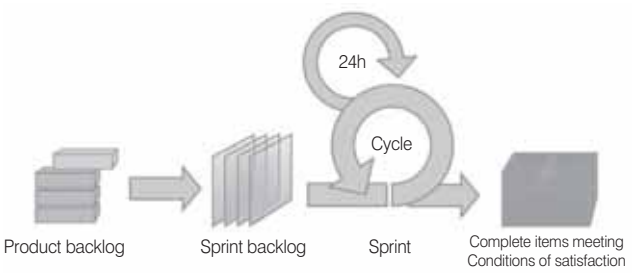


Figure 1: The Scrum process

The Scrum team then reviews the product backlog with the product owner at the beginning of each work cycle. These work cycles are called 'Sprints' and can last anywhere from 2 to 4 weeks.

During this review, the team will work with the product owner to define the level of effort needed to accomplish the Conditions of Satisfaction for each item in the sprint. At the end of the review, a 'Sprint Backlog' is created with a committed set of items from the product backlog and a known date for completion.

The sprint review will repeat at the beginning of every cycle, allowing the product owner the flexibility to change the order of his backlog or the conditions of satisfaction as needed, as the priorities of the project change.

2. Implementation project

2.1 Design and production practices

Intergraph entered into a partnership with a shipbuilder whose goal was to maximize the rule-based design within SmartMarine3D. The rule based design approach within SmartMarine3D allows the customers to customize each stage of model development, across all disciplines, from early design to manufacturing output[3].

For this implementation project, the shipyard provided an in-house expert (known as a "subject matter expert" in Agile terminology) familiar with the design and production practices currently being used at this shipyard, and who also acted as the product owner in our Scrum process. The team consisted of three developers specialized in content development, another subject matter expert familiar with the SM3D technol-

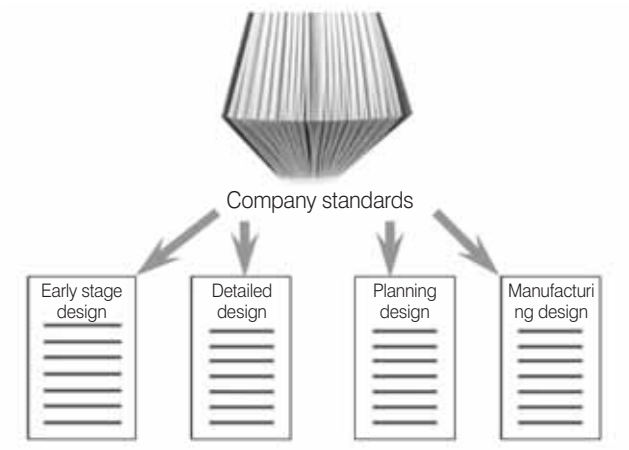


Figure 2: 1st level epics

ogy, and a local support person, who acted as the Scurm master for the team.

This shipyard already had experience developing and using an in-house, partially-automated 2D solution for design and as a result, had created a substantial set of well defined standards for design and production practices.

The first step of the process was to review the complete standards for the shipyard and break them down into subsets of data that would then become epics. Epics are high level collections of related tasks within the Product Backlog. The 1st level epics (shown in Figure 2) share commonality such as early stage, detailed, planning or manufacturing design.

From this first level epic, an additional review is done and a set of 2nd level epics are created directly proportional to a specific set of requirements that have been grouped by object types.

Some examples of early stage design requirements include (but are not limited to) epics for catalog content, bending algorithms and bracket automation. Detailing design requirements include (but are not limited to) epics for automated feature creation (e.g. slots, collars, clips, etc.), and automated welding data for two bounding parts.

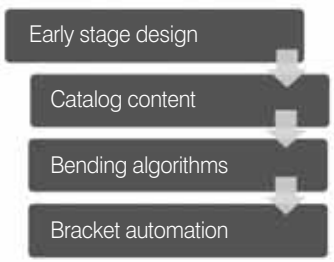


Figure 3: 2nd level epics

At this point, the breakdown of requirements is done at a very high level and the epics are too vague to be added directly to the product backlog. Epics are typically broken down into smaller scopes of work until they represent something that can be done in a single sprint. Typically, this level of detail is referred to as a user story called a "backlog item". There may be one or more backlog items grouped under an epic.

For illustration purposes, we will take one example of a company standard that has been identified as an early stage design backlog item, and demonstrate how it can be broken down into 2nd level epics, then 3rd level epics, and eventually into items to be added to the product backlog.

2.2 Creating a product backlog

The creation of a product backlog will be illustrated using the definition of bracket design rules as an example. After the customer design standards are broken into high level epics related to the production phase, as defined by the current shipbuilding practices, a more detailed review of the 2nd level epics can be done to determine how to divide the epics into items or tasks that can be completed within one Sprint of effort by the development team.

Some of the 2nd level epics can be broken down quickly, based on very common building practices. For example bending algorithms can be reduced to specify algorithms for plate and profiles. After a quick review, it was found that the current shipyards practices for bending were identical to the standards delivered practices, provided in the default content for SmartMarine3D. Therefore, no product backlog items needed to be created for these standards. However, the rules for when to apply bending by default were slightly different than those delivered by SmartMarine3D. As a result, the product owner created a item in the product backlog to automate the default selection for bending. This item is now available to be worked in a short amount of time.

Other 2nd level epics will still need to be reduced to a 3rd level of epics. As shown in figure 4, breacket automation can have many types of geometrical shapes, parameters, and designs, based on the number of structures being supported. Therefore, an additional level of epics can be created to further reduce the 2nd level epic, based on the number of structures a bracket is intended to support, as shown in figure 5.

At this point, detailed requirements can be created as shown in figures 6, 7 and 8 for the different type of shapes and geometric parameters that will control the final shape of the bracket created, as determined by a specific set of selected structure supports.

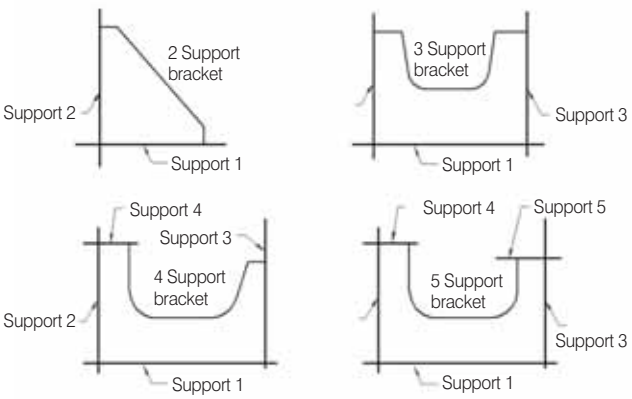


Figure 4: Bracket shapes

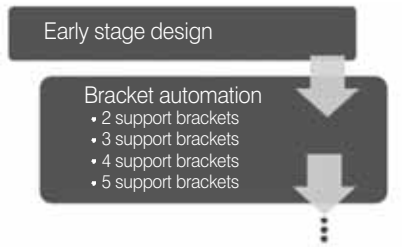


Figure 5: Bracket Automation breakdown

The product owner can now add additional information to maximize the rule based solution provided by SmartMarine3D, by defining information such as preferred selection logic and default parameter values.

An example of default selection logic can be decided based on the direction and type of supports selected as inputs to the bracket rules. In the cases similar to Figure 7, the rules

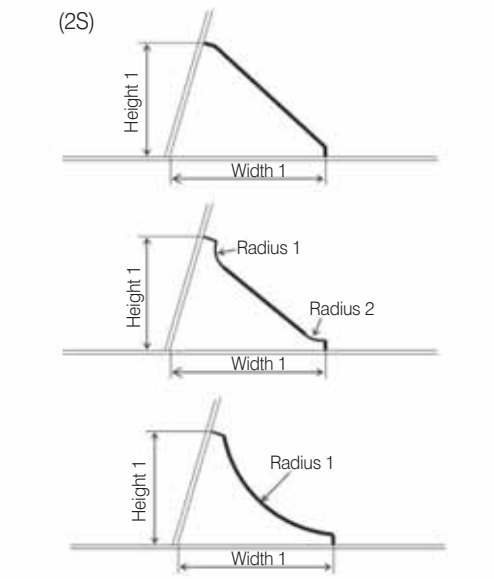


Figure 6: Example of 2 support brackets

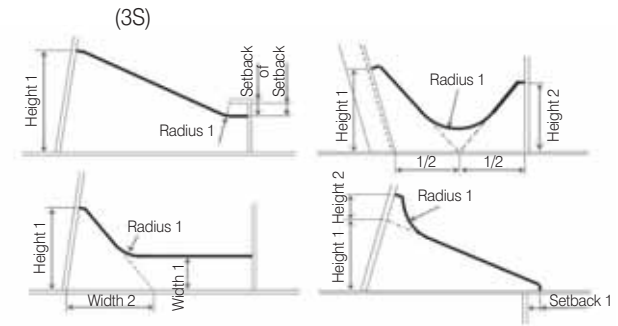


Figure 7: Example of 3 support brackets

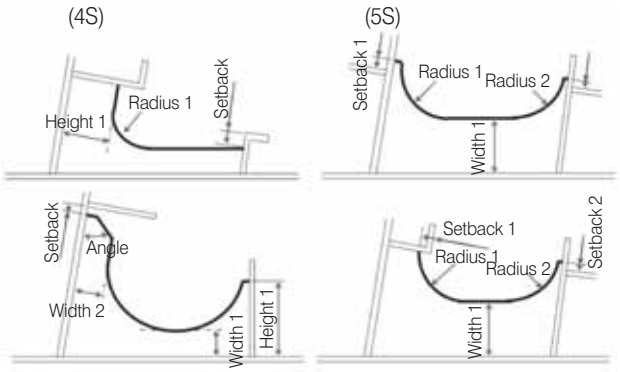


Figure 8: Example 4 and 5 support brackets

can be enhanced to evaluate the supports selected and differentiate whether or not the third support is a profile with its flange direction toward the bracket, if the third support is above support 1, or if the third support is below support 1.

An example of a parameter logic backlog item is the determination of the default values of a 2S bracket based on the angle between the two structures being supported, as shown in Figure 9.

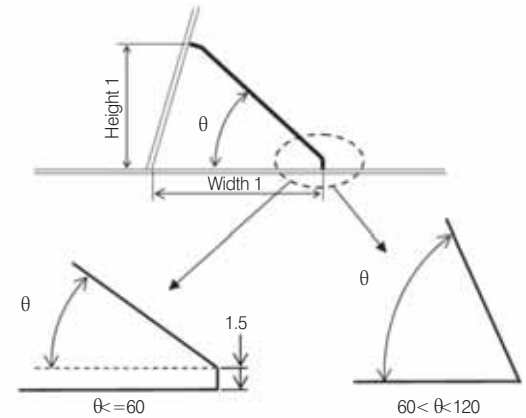


Figure 9: Two Support Bracket with automated parameter adjustment

After creating a backlog to track the full range of potential development tasks, the product owner is now ready to review the backlog items with the team to determine the level of effort required to complete each item. The backlog can be continuously adapted and re-prioritized as the customer's need change.

In the next section, we will continue with the example of bracket automation and review the interaction between the product owner and the team in determining the level of difficulty and assigning items to upcoming sprints.

< to be continued >

Future technology (8): Subsea production

Business forecasts indicate that more subsea wellheads than ever will be installed in the years ahead. A step change will occur with respect to subsea processing and subsea electric power supply. Standardised, building block-based field development will become the backbone of small, fast-track developments. In addition, passive data gathering is expected to move to automated decision-making, and it is expected that industry leaders will take full advantage of automated decision tools by 2020.

DNV

Introduction

There are three routes into the subsea future. The first is the development of novel technologies to cope with future demand for difficult reservoirs. The second is standardised, building blockbased field development. The third important route is extending the production life of existing fields.

The drivers for the first route include difficult oils and long-distance transport, and here the requirement for subsea processing will be clearly recognised.

The drivers for the second route are small, new developments and tail-end production for which time to first oil is critical, together with low investment costs in order to reach requirements to net present value, NPV.

Thirdly, towards 2020 many existing subsea fields will reach the end of their design life and face declining reservoir pressure. In order for production to continue from these fields, significant efforts will be required in assessing the integrity of the system, as well as introducing subsea processing.

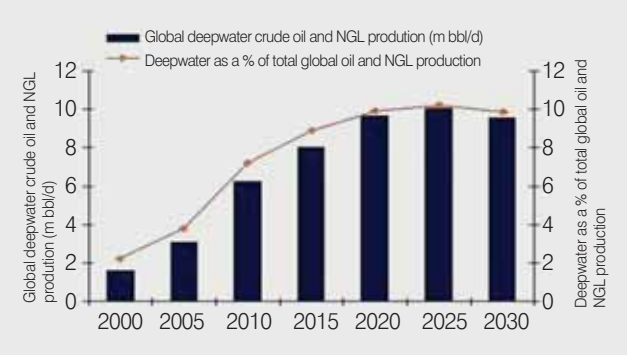
Subsea processing

New subsea developments, located at a distance from existing infrastructure or shore and requiring long tiebacks, along with fields with more complex reservoirs with heavy oil or high water cut, will require processing of the hydrocarbons subsea.

Subsea processing (separation and boosting) will require a step change in both technology and power consumption. Large subsea gas compression stations do not exist in 2010, but will have been developed by 2020.

From the power perspective, moving from kW to MW will require a new generation of subsea power systems. In addition to needing a new class of cables, penetrators, and power connectors, it will also be necessary to develop transformers, motors, and variable speed drives that are suitable for subsea use. Providing large watertight and pressure-proof housing, and dispose of the megawatts of generated heat adds to the complexity.

Global deepwater production



Deepwater oil and gas production is expected to peak at 2025 reaching 10 million barrels per day (Source: Wood MacKenzie and Business Insights)

Subsea separation module

Tordis subseas separation module - the first commercial subsea gas seperation module for the Norwegian Conttinental Shelf. (Source: FMC/Statoil)

Subsea developments are relatively young in comparison with conventional platforms. Several systems will reach the end of their design life by 2020. In order for this to be extended, operators will need to demonstrate the integrity of the production system, and also address issues such as obsolescence of the control system and declining reservoir pressure. Subsea separation and boosting will be necessary in order to handle drops in reservoir pressure, and new methods will be essential for extending the life of subsea installations.

The all electric subsea station

With the introduction of the large electric power consumers required by subsea processes, it will ultimately be possible for the Christmas tree itself to be electrified. This will replace the hydraulic actuators currently used for most functions on the trees. An all electric subsea station will result in simpler umbilicals, as all the hydraulic lines will no longer be necessary.

One challenge is the length of power cables required. AC cables can transmit power for distances up to 100km, depending on cable type and voltage level. For distances over 100km, High Voltage Direct Current (HVDC) systems and cables are needed. The HVDC systems available in 2010 are suitable for subsea use.

A handful of highly advanced all electrical subsea systems are anticipated to be online towards 2020, with Åsgard and Ormen Lange leading the way, but extensive uptake will be further into the future.

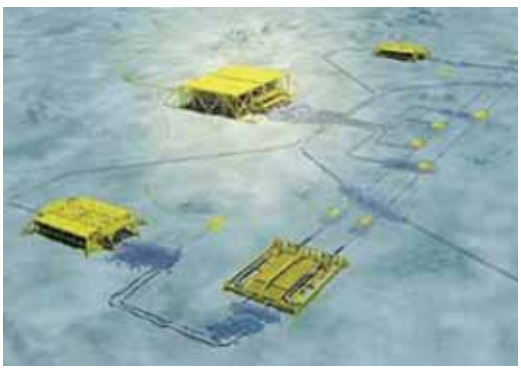
From passive data to automated decisions

Today's subsea systems contain instrumentation whose primary purpose is reporting on the status of critical components, and for controlling production. These data are today not used for investigating trends or for predicting future conditions. The amount of data available is increasing exponentially, and already there is so much data that a human operator is overwhelmed.

The industry needs higher availability and reductions in the time and costs needed for maintenance and intervention. For this to be possible, improved knowledge on the state of corrosion, erosion, and other degradation mechanisms is essential. Additionally, information on the condition of valves, actuators, and other key components is necessary. Finally, a key issue is smart use of all the collated data and information.

These developments will be enabled by greater capacity in communication lines, more sophisticated, cheaper sensors, and more intelligent software systems that can recognize trends and patterns, and that can predict future states through realtime simulation. In other words, a sort of artificial intelligence is necessary to assume the data-handling role currently filled by human operators. Industry leaders will take full advantage of automated decision tools in 2020.

Future subsea compression station



Ormen Lange provides about 15% of the gas consumed in the UK. In order to maintain production, a new gas compression system must be installed by 2020. (Source: Statoil)

Standardised subsea equipment

Many new fields will be smaller and marginal, thus demanding cheaper equipment with shorter delivery times. One solution is standardisation. Pre-designed, standard, approved subsea components will replace the tailor-made solutions of today. In order to decrease delivery times, less reliance must be placed on an extensive design process. Subsea equipment providers will be expected to keep the main building blocks of subsea systems in stock, enabling delivery of a complete system within less than one year, rather than after several years. Delivery of a complete subsea tree would be expected within a few months from ordering.

One challenge is to find the optimum balance between using standard products and meeting field-specific requirements. Another risk lies in the change in business processes, as equipment suppliers would need to produce equipment on speculation, rather than based on a firm contract. This business model will shift some of the financial risk from operators to the suppliers. We expect that by 2020 the majority of the components for marginal fasttrack developments will be based on standardised modules.

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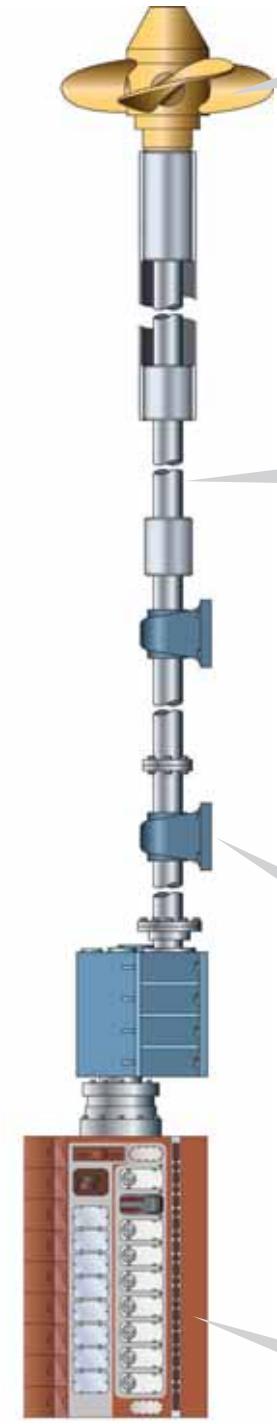

PROPELLER

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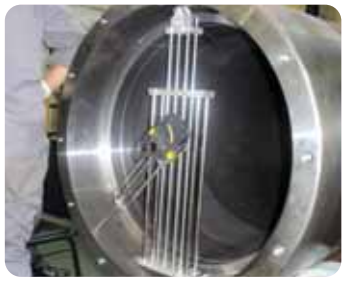
STERN TUBE

CENTALIGN Ultra
(unmounted shaft)



LONG SHAFT

ROTALIGN Ultra
(mounted shaft)

CENTRALIGN Ultra
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DSME signed its first contract of this year to build 5 vessels, including VLCCs

Daewoo Shipbuilding & Marine Engineering (DSME) made a good start by winning its first order of this year.

DSME announced that it signed a contract on January 30 with the state-run KOTC (Kuwait Oil Tanker Company S.A.K) to build 5 vessels, including 4 units of very large crude carriers (VLCCs) and 1 unit of Aframax product carrier (PC).

The contract is valued at approximately USD 560 million. These vessels will be built at DSME's Okpo shipyard and delivered to the ship owner by 2014. The VLCCs to be built under this contract will measure 333m in length and 60m in width, and each will have a carrying capacity of 317,300 tons of crude oil. Meanwhile, the Aframax product carrier will measure 250m in length and 42m in width and can carry 110,000 tons of refined petroleum products.

Particularly, these vessels, developed by DSME's state-of-art green ship technology, incorporate a variety of eco-friendly features such as de-VOC (Volatile Organic Compounds) system, etc., including the Pre-Swirl Stator (PSS), a fuel-saving device. Thus, these vessels are recognized as futuristic, environment-friendly, fuel-efficient and high-efficiency vessels conformant to the increasingly rigorous environmental regulations.

KOTC, the ship owner, has awarded orders for a total of 16 vessels to DSME thus far - including 4 VLCCs in 2008, 2 Aframax product carriers in 2010, and 5 vessels this time - since it placed an order for VLCC with DSME in 1992.

Nam Sang-tae, President & CEO of DSME, said, "KOTC, the ship owner, has constantly placed shipbuilding orders with DSME, and both companies have built long-term collaborative relationship. This contract is seen as a starting point of this year to push ahead with aggressive marketing strategy for garnering greater share in foreign markets and stimulating growth in our order intake."

Significantly, DSME secured this year's first order for VLCC around the globe even amid the recession in the newbuild product carrier market, considering that no order for VLCC with a deadweight of over 300,000 tons had been placed worldwide since April last year and the market for newbuild product carriers remains mired in deep slump according to Clarkson data.

Nam Sang-tae (right), President & CEO of DSME, and Nabil Bourisli (left), Chairman of KOTC, are posing for a commemorative photograph after signing a shipbuilding contract at the ship owner's office in Kuwait on January 30 (local time).

HHI won a USD 1.1 billion order for 4 LNG carriers and 1 LNG-FSRU

Hyundai Heavy Industries (HHI) was awarded a USD 1.1 billion contract to build 5 LNG carriers.

HHI announced that it signed a contract on January 13 with the Norway-based Hoegh LNG to build 1 LNG-FSRU (Floating, Storage, and Regasification Unit).

HHI secured an order for 2 units of 162,000m^3 LNG carriers from an European ship owner on January 8, and Hyundai Samho Heavy Industries (HSHI) won an order for 2 units of 162,000m^3 LNG carriers on January 10 from the Norway-based Golar LNG. Additional orders are expected to follow because the contract entered into with Golar LNG includes 2 optional vessels.

HHI has secured new orders successively, including the LNG carrier order placed for the first time this year worldwide, cementing its leading position in the LNG carrier market.

HHI also won a series of drillship orders consecutively in the early part of 2011, and clinched a record 11 drillship orders last year.

These LNG carriers to be built by HHI are membrane types that have the cargo tank onboard and adopt the dual fuel diesel electric (DFDE) system that uses both fuel oil and gas. These vessels are scheduled for delivery to the ship owner on a staggered basis from the second quarter of 2014 to the first half of 2015.

Although the prevailing opinion is that the demand for ordinary merchant ships will be declining amid economic recession, the industry anticipates that this large-scale newbuilding LNG carrier contract will mark a new breakthrough for domestic shipbuilders.

Natural gas emits far less greenhouse gases, such as NOx and SOx, etc., compared to oil or coal, and has emerged as alternative energy source. There has been a soaring demand for natural gas amid the ever-more-rigorous clampdown on CO_2 emissions and the anxiety over Japan's nuclear crisis.

The International Energy Agency (IEA) forecast that the world consumption of natural gas would soar to 153 trillion m^3 by 2030, up approximately 40% from 110 trillion m^3 in 2010.

Resultantly, there will be a surging demand for LNG carriers. According to Pareto Securities, the Norway-based investment bank, the number of LNG carriers needed to transport extra LNG cargo will jump approximately two-fold from 430 units in 2012 to 782 units by 2020.

LNG carrier tops the list of high value-added vessels and requires highly advanced technology for construction. HHI has built and delivered a total of 40 LNG carriers since it won an order for LNG carrier, the first nationwide, in 1991.

An official from HHI said, "The ship owner was enthralled by HHI's extensive shipbuilding experience and excellent design capability in LNG carrier construction. These LNG and LNG-FSRU carrier contracts would be a good starting point to achieve strong growth in new order bookings related to the natural gas exploitation and production in 2012."

The test-run of HHI's 'Abdelkader', a 177,000m^3 LNG carrier delivered in 2010. In the same year, Abdelkader was selected as the Ship of the Year by the world's 3 major magazines dedicated to the shipbuilding and shipping industries.

HHI set a new order target of USD 24 billion, up 19% from USD 20.1 billion last year, in the shipbuilding and offshore plant sectors (including the order intake of Hyundai Samho Heavy Industries in the same sectors) and is vigorously pushing ahead with strategies to win new orders.

STXOS secured orders for 2 LNG carriers, 6 tankers, etc., successively

STX Offshore & Shipbuilding (STXOS) won orders in a row, adding fresh momentum into its efforts to increase its order intake for 2012.

STXOS announced that it entered into contracts on February 10 (local time) with Sovcomflot and John Fredriksen Group to build 2 units of 170,200m^3 LNG carriers and 6 units of 50,000DWT tankers, respectively. The newbuilding price per unit of vessel is USD 200 million and USD 35 million each, and the contracts sealed on February 10 are valued in excess of USD 600 million.

The order for these LNG carriers was awarded as Sovcomflot exercised its first optional vessels, besides the 2 units covered in the main contract,

173,600m^3 LNG carrier built by STXOS

among the 6 vessels contracted with Sovcomflot last year. In addition, there are second batch of 2 optional vessels that will be delivered in the upcoming period. Moreover, the contract for tankers with a capacity of 50,000DWT includes 4 optional vessels of the same kind, which will lead to additional orders.

STXOS signed a Letter of Intent (LOI) worth USD 6.5 billion and contracts that include the provisions for additional vessels last year, which have been catalytic in raising its order intake recently, and is expected to win a successive wave of newbuilding orders even amid sluggish market conditions.

Particularly, STXOS is expected to incorporate eco-friendly design such as the high efficiency propulsion system into the 170,200m^3 LNG carriers, along with the heat preserving system of cargo tank that can minimize the loss of vaporized gas during transportation.

The high efficiency propulsion system uses high-temperature waste heat, generated from the engine, to create vapors which are then used to run the turbine engine, thus reducing fuel consumption by over 5% compared to existing electricity-powered LNG carriers.

An official from STX said in relation to this LNG carrier contract, "Winning LNG carrier orders in Russia - a country that has the world's largest proven natural gas reserves and is the world's largest producer of natural gas - is very important in carving out a large share of the huge potential market for LNG carriers. In addition, the tanker contract is an important step forward in building a relationship of trust with the world's largest tanker fleet operator."

Pareto Securities, the Norway-based investment bank, recently forecast in its report on LNG carrier market that global demand for the capacity of LNG carriers would rise two-fold from current level by 2020 and annual newbuilding orders for LNG carriers would be projected to be 40 units. Sovcomflot, which ordered LNG carriers, is Russia's most prominent state-run shipping company and headquartered in Saint Petersburg, and owns the fleet of 156 vessels.

Meanwhile, John Fredriksen Group, which placed the order for tankers, is based in Cyprus situated in the Eastern Mediterranean Sea and owns shipping companies such as Frontline Ltd, Golden Ocean, etc., and is the world's largest tanker operator.

The 2 LNG carriers will be delivered in the fourth quarter of 2014 and the first quarter of 2015, respectively, and the 6 tankers are scheduled for delivery on a staggered basis by late 2013. All these LNG carriers and tankers will be built at Jinhae shipyard of STXOS.

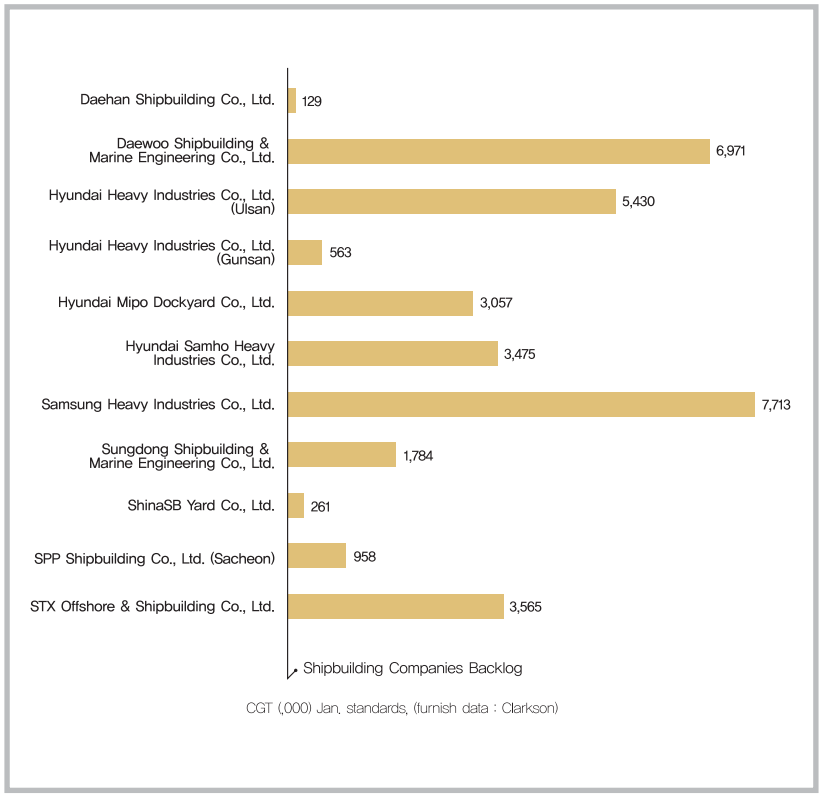
Besides, STXOS penned a contract with a Greece-based ship owner on January 31 to build 1 unit of 155,000DWT class DP2 shuttle tanker (Dynamic Positioning System 2 Shuttle Tanker) and has inked contracts for 6 medium-sized bulkers as of early this month. Thus, STXOS has won orders for a total of 15 vessels worth USD 900 million so far this year.

Shin Sang-ho, President and CEO of STXOS, said with confidence, "Building upon the momentum of our growth in new orders that we have seen since the beginning of this year, we will focus on expanding our sales activities to strengthen competitiveness in the whole types of vessels, specifically, high value-added vessels."

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 as the world's largest shipbuilder.

Domestic shipyards are expected to show strong performance, dominating the market for high value-added vessels, such as containership and LNG carrier, or offshore plants, although the growth may slow down amid sluggish global economy.

According to the Clarkson data published recently, many domestic shipyards still register high order inflow and maintain leading position in the global shipbuilding market.



Here, we take a close look at the performance of Korea's 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: ShinaSB Yard Co., Ltd.

Offshore plant orders awarded to domestic shipyards in 2011-2012

Date		Type	Number of vessel	Amount	Ship owner	Delivery	Shipyard
2011	January	Drillship	1 vessel (including 1 optional vessel)	KRW 590 billion	Diamond Offshore Drilling Limited, U.S.A	Mid 2013	Hyundai Heavy Industries
		Offshore Plant	-	USD 900 million	RasGas, Qatar	Late 2013	Hyundai Heavy Industries
		Drillship	2 vessels (including 2 optional vessels)	KRW 1 trillion 140 billion	Noble Drilling, U.S.A	On a staggered basis until late September 2013	Hyundai Heavy Industries
		Deepwater drillship	1 vessel	-	Atwood Oceanics, U.S.A	Second half of 2013 Marine Engineering	Daewoo Shipbuilding &
	February	Offshore facility carrier FPSO for the North Sea	1 vessel -	KRW 265 billion USD 1.2 billion	Dockwise, Netherlands BP (British Petroleum), U.K	October, 2012 Early 2015	Hyundai Heavy Industries Hyundai Heavy Industries
		Platform Supply Vessel	1 vessel	-	-	2012	STX OSV
		Fisheries Research Vessel	1 vessel	EUR 35 million	Ministry of Fisheries and Marine Resources, Republic of Namibia	Early 2012	STX Finland
	March	Offshore Platform (North Sea Drilling & Production platform, Quarters & Utilities platform)	1 unit each	USD 600 million	BP (British Petroleum), U.K	Late 2014	Hyundai Heavy Industries
		Deepwater drillship	2 vessel (including 2 optional vessels)	KRW 1 trillion 200 billion	Aker Drilling, Norway	Second half of 2013	Daewoo Shipbuilding & Marine Engineering
		Drillship	2 vessels	USD 1.1 billion	Ship owner, U.S.A	-	Samsung Heavy Industries
		Platform Supply Vessel	1 vessel	-	Norsea Group AS, Norway	Jun-12	STX OSV
		Platform Supply Vessel	1 vessel	-	-	2012	STX OSV
	April	Drillship	1 (including 1 optional vessel)	-	Fred Olsen Energy, Norway	Aug-13	Hyundai Heavy Industries
		Drillship	2 vessels	USD 1.12 billion	Maersk, Denmark	-	Samsung Heavy Industries
		Drillship	1 vessel	USD 680 million	Ocean Rig, Greece	Oct-13	Samsung Heavy Industries
		Shuttle Tanker	2 (including 2 optional vessels)	USD 200 million	European Navigation, Greece	2013	STX Offshore & Shipbuilding
	May	Drillship	2 (including 1 optional vessel)	USD 1.12 billion	Rowan, U.S.A	Second half of 2013	Hyundai Heavy Industries
		Deepwater drillship	1 (including 1 optional vessel)	-	Vantage Drilling, U.S.A	Late May, 2013	Daewoo Shipbuilding & Marine Engineering
		Offshore Platform (Top side of offshore platform)	-	USD 414 million	Statoil, Norway	-	Samsung Heavy Industries
		FPSO	1 vessel	USD 636 million	Teekay Petrojarl, Norway	Mid 2013	Samsung Heavy Industries
		Platform Supply Vessel	2 vessels	Around KRW 120 billion	Farstad Shipping, Norway	First half of 2013	STX OSV
		FSO	1 unit	-	PTSC, Vietnam	Early 2013	Sungdong Shipbuilding & Marine Engineering
		LNG-FPSO	1 unit	USD 3.026 billion	Royal Dutch Shell, U.S.A	2016	Samsung Heavy Industries
	June	Platform Supply Vessel	2 vessels	Around KRW 150 billion	Island Offshore, Norway	First quarter, third quarter of 2013	STX OSV
		LNG-FSRU	2 units (including 2 optional vessels)	USD 500 million	Höegh LNG, Norway	Second half of 2013, first half of 2014	Hyundai Heavy Industries
		Multifunctional Deep Water Anchor Handling, Offshore Service Vessels	2 vessels	KRW 240 billion	Farstad Shipping, Norway	From the second quarter of 2013	STX OSV
		Drillship	1 vessel	USD 680 million	Ocean Rig, Greece	Nov-13	Samsung Heavy Industries

2011	July	Drillship	2 vessels	USD 1.1225 billion	Maersk, Denmark	Jul-14	Samsung Heavy Industries
	August	LNG-FSRU (Floating Storage and Regasification Unit)	1 vessel	USD 280 million	Excelerate Energy, U.S.A	First quarter of 2014	Daewoo Shipbuilding & Marine Engineering
	September	Semi-submersible Rig	2 units	USD 1.1 billion	Songa Offshore, Norway	Second hallf of 2014	Daewoo Shipbuilding & Marine Engineering
		Well Intervention Vessel	2 vessels	USD 420 million	Eide Marine Services AS, Norway	2013	STX Finland
		Drillship	1 unit (optional vessel awarded on January 19)	Approximately KRW 600 billion	Noble Drilling, U.S.A	Second half of 2014	Hyundai Heavy Industries
	October	Fixed Offshore Platform	–	USD 1.4 billion	Chevron, U.S.A	Second half of 2014	Daewoo Shipbuilding & Marine Engineering
		Drillship	1 unit	Approximately USD 550 million	Offshore drilling company, Americas	–	Daewoo Shipbuilding & Marine Engineering
		Platform Supply Vessel	1 unit	–	Troms Offshore Supply AS, Norway	First half of 2013	STX OSV
		Offshore Plant Module	2 units	–		First half of 2012	STX Finland
		Platform Supply Vessel	4 units	KRW 2 trillion	Island Offshore, Norway	Consecutively from the 3rd quarter of 2013 to the 1st quarter of 2014	STX OSV
	November	Pipe Laying Support Vessel	2 units	USD 500 million	Odebrecht, Brazil	August of 2014	Daewoo Shipbuilding & Marine Engineering
	December	Offshore facilities (Gas platform and various facilities)	–	USD 900 million	Major multinational oil companies	2nd half of 2014	Hyundai Heavy Industries
2012	January	CPF (Central Processing Facility)	–	KRW 2.6 trillion	INPEX, Australia	4th quarter of 2015	Samsung Heavy Industries
		Semi-submersible rig	1 unit	USD 620 million	Odfjell, Norway	By mid 2014	Daewoo Shipbuilding & Marine Engineering
	February	LNG-FSRU		–	Hoegh, Norway	–	Hyundai Heavy Industries

**Note : Based on the press release and public announcements of each shipyards, internal estimation of Monthly KORSHIP (estimation until February 15, 2012)*

Wing-in-ground craft, KTX of Sea

Wing-in-ground craft achieves the flight through the wing-in-ground effect that enables the vessel to operate above the water surface on a dynamic air cushion created between the wing and the water surface. It can operate 1 to 5m above the water surface at a speed ranging from 150 to 300km and is called 'KTX (Korea Train eXpress) of Sea'. Particularly, wing-in-ground craft is the next-generation ship combining the aviation technology and high speed ship technology.

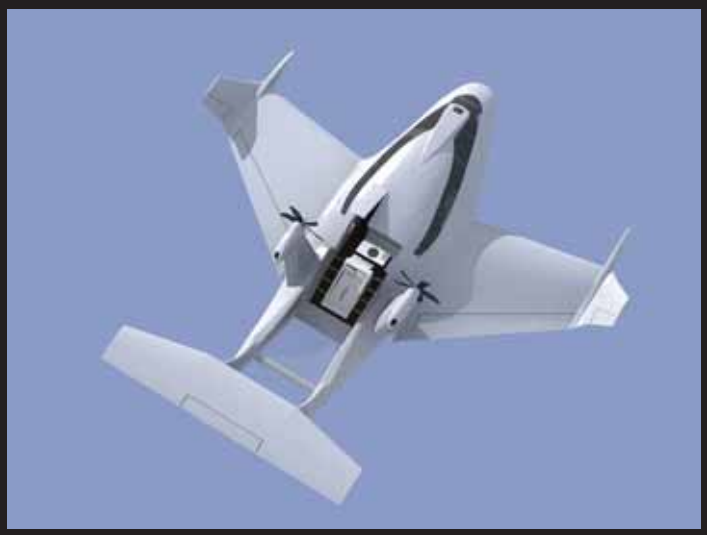
Wing-in-ground craft is 3 times faster than high speed ship and reduces the operation costs by more than a half compared to aircraft. Operating 1 to 5m above the water surface, wing-in-ground craft has no risk of plunging into the ocean and provides excellent reliability. Particularly, wing-in-ground craft has high energy efficiency with the advantage that CO_2 emissions are absorbed quickly by the sea water.

Wing-in-ground craft program was launched in Russia (former Soviet Union) for military applications in 1960s. However, its development and operations have been led by Germany, United States, Japan, China, etc. Wing-in-ground craft began to be converted from miliary to civilian applications such as passenger and freight transportation after the collapse of Soviet Union. Currently, wing-in-ground crafts are being actively developed for civilian applications.

In Korea, a consortium of private-sector companies, led by the Korea Ocean Research & Development Institute (KORDI), was formed in 1995 to develop the technology for wing-in-ground craft. In November, 2011, the nation's first 50-seat wing-in-ground craft prototype was built and currently is preparing for full-fledged operations after successfully completing the test-run.

■ Medium-sized wing-in-ground crafts


MIND SHIP
TECHNOLOGY



Schematic diagram of wing-in-ground craft

Bird's eye view of large wing-in-ground craft with a carrying capacity of 350 passengers

New Product

Explosion-proof motors (Flameproof d type) certified by ATEX

HIGEN MOTORS

71M-205M

208-315M

355L

The legacy of HIGEN dates back to 1963, 49 years ago, when Gold Star, now renamed LG Electronics, started motor manufacturing business for import substitution and later in 1999, LG Electronics went joint venture with OTIS Elevator, a U.S. based elevator company.

In 2008, HIGEN MOTORS was spun off as an independent corporation specializing in motors and energy transfer solutions.

HIGEN MOTORS specializes in motors and energy transfer solutions such as low voltage motors, high voltage motors, electric vehicle motors, servo drives and servo motors, inverter motors, permanent magnet motors, inverter built-in motors, spindle motors, and related products of industrial grade with power rating of 0.4kW to 1,500kW.

HIGEN MOTORS started marketing Explosion-proof motors (Flameproof d Type) of ATEX certification in the power range of 200W up to 260kW for marine and other industrial applications. These motors cover IIB Group and IIC Group which is the most stringent rating.

The explosion-proof must withstand the pressure from the internal explosion and prevent the flame to spread out to flammable gas outside the frame. And the surface temperature of motor must be low to prevent any ignition of the ambient flammable gas. The Explosion-Proof Motors of HIGEN MOTORS fully meet those requirements. In other words, the motors withstand the explosion pressure when any abnormal internal explosion is incurred by any explosive gas permeated inside the frame. In addition, it is built in an explosion-proof structure to prevent the flame to spread out to flammable gas outside the frame.

Major specification is as follows:

-Group symbol: Ex d
-Explosion-proof symbol: IIB, IIC
-Max.surface temp.: T4, T5, T6
-Housing structure: Fully-closed type (TEFC, TEAO, TENV), horizontal (B3), vertical (B5, V1), B3B5, etc
-Surrounding condition
**Ambient temp.: -20-50°C,*
**Humidity: below 80%*
-Application danger place: Zone 1, Zone 2
-Protection degree: IP55, 56, 65 & 66

-TEL: +82-2-369-8216
-http://www.higenmotor.com

Valcom atmospheric oil mist detector

KORTECH INSTRUMENT

The new version of the OMD designed and manufactured by Valcom is an atmospheric oil mist detector especially developed for the Marine and Offshore Industry, suitable for installation in machinery room and pump room in commercial, naval, Ro-Ro ships as requested by the international IMO Marine Regulations (Circ 1086).

Why oil mist can be a serious cause of fires?

When oil mist are formed with a particle size of between 3 and 10 microns that brings to a hazardous concentration of mist in the atmosphere.

At levels of saturation conditions are truly hazardous, and if no action is taken a fire can start.

The ignition temperature for this type of oil mist can be extremely low, much lower than the ignition temperature of the oil itself.

VALCOM OMD oil mist measuring is based on the most suitable physical principle of optical scattering for the application.

Infrared light emitted from a LED is received from two photodiodes for measure and reference purpose; by the comparison between the photodiodes output, the presence of oil mist can be detected.

The detectors are 100% calibrated in house with real oil mist, and the guaranteed flow rate of the sampled air is considerably high (about 20m^3/h).

The maintenance of the detector is friendly and the mechanical robustness excellent.

Also, the detector can be provided with an integrated digital acquisition system, that enables several OMD to be connected on the same pair of wires in a multidrop network configuration.

Standard HART commands are used to communicate with field instruments to determine process variables or device parameter and diagnostic information.

It is also possible to make instruments setup and calibration remotely.

The built-in Ethernet network card allows the join of an existent network or the creation of a new point to point network to send data or working from a remote position.

Atmospheric oil mist detector

The main HMI interface allows to monitor up to 16 OMD sensors per page altogether, showing the measure, the percentage of measure (in number along with coloured bar), a user defined tag to identify the sensor location and textual indication of the diagnostic and status of each sensor (fault, pre-alarm and alarm).

It is possible to browse the existing pages using the arrows on the upper right of the screen. The last not acknowledged event is displayed in the status window.

Buttons DATA LOG and ALARM LOG allow for configuration and visualization of registered data and alarm status during the time.

The SETUP button brings to the software configuration interface. The TEST, RESET and ACKNOWLEDGE buttons complete the certified ISA sequence.

-Tel: +82-31-444-2045
-http://www.valcom.it.

New Product

AVEVA Surface Manager

AVEVA Korea

AVEVA, a leader in engineering design and information management solutions for the plant, power and marine industries, has announced the release of AVEVA Surface Manager 12.1, another new product in its AVEVA Marine portfolio. AVEVA Surface Manager allows the transfer of surfaces to and from external systems, by the use of neutral standards offering greater flexibility and increased design quality.

Features of AVEVA Surface Manager include the import of surfaces from various formats for use in AVEVA Marine and graphically displaying the - shape of the geometry. It supports the most commonly used formats: IGES, SAT, DML and STEP AP 203 for the import and export of surfaces. In addition, AVEVA Surface Manager also enables the extraction of surfaces from existing AVEVA Marine projects for conversion into external formats for use in third-party software.

The new productalso offers tools for quality assessment of the managed surface and, if needed, can repair defects detected in surfaces transferred from third-party applications in order to be successfully used in the AVEVA Marine applications.

For the sub-division of work packages, AVEVA Surface Manager can also easily split surfaces so shipyards can protect the investment and confidentially of their hullforms by only distributing to sub-contractors the part of the hullform they need to do their work.

"AVEVA Surface Manager gives AVEVA Marine users the freedom to use the surface system of their choice and efficiently transfers the surfaces into AVEVA Marine", said Stéphane Neuvéglise, Head of Business Management - Marine Systems, AVEVA. "It alsoincreases design quality as Surface Manager allows users to check the imported surface quality and to repair surface defects before they are allowed to propagate in the design. Perhaps most importantly, it also helps shipyards to protect their Intellectual Property, by distributing only necessary components of the hull form to subcontractors."

All AVEVA Marine products are part of AVEVA's Integrated Engineering & Design approach which improves project efficiency and reduces engineering and design costs by offering complementary products that draw on common processes, disciplines and deliverables, through a single managed information model. There are three categories of product within the IE&D approach; AVEVA Engineer products create hullform, compartmentation, schematics, diagrams, datasheets, engineering lists and indexes. The AVEVA Design products create 3D models for detailed design and produce all associated production information. AVEVA's Manage products enable global work share, clash management and design review.

-TEL: +82-2-3284-5310
-http://www.aveva.com/marine

Combined with motor

igus Korea

From its beginnings with lubricant and maintenance-free basic linear bearings 17 years ago, the linear technology department at igus has progressed to linear guides, leadscrews and fully assembled units. Up to now, the main focus has been on manual operation in format adjustments. Now, the company is expanding its 'low-price, quick-delivery complete solutions' by adding a motor to their ready-to-fit linear units.

DryLin E SAW-0630

First own motor range

At the moment, the small focussed motor range covers stepper motors of the sizes NEMA17 and NEMA23. The motors are optionally available with encoder and/or brake. Stepper motors are a good accessory to the 'DryLin' linear drives due to their outstanding cost effectiveness, precision and simple operation. The units work reliably in a wide range of different environmental conditions (depending on the IP protection class chosen). The NEMA standard also guarantees good global availability. The company sets great store by the fact that the drive units for lubricant-free linear movements have been designed in such a way that they can also be driven by stepper motors made by other manufacturers (Festo, Oriental, Sanyo Denki, Berger Lahr, Gunda etc.). To achieve this, igus offers customers who already have a motor available a quick-fit connection by means of an aluminium spacer and motor flange to fit the NEMA motor.

Extremely light axis with NEMA17 motor

The new linear axis DryLin E SAW-0630 with NEMA17 motor presented at the Hanover Trade Show is driven via a trapezoidal or high-helix thread leadscrew. Numerous pitches from 1.5mm to 15mm are available (design size 1040, also new: up to 50mm). The drive leadscrews are supported by ball bearings. The leadscrew nuts are made of tribologically optimised 'iglidur' high-performance polymers and guarantee lubricant freedom over the entire stroke length. Almost all the components used for the ready-to-fit linear unit are made of plastic and aluminium, which means the system has an extremely low mass. The 'SAW-0630' is ideal for simple lubricant-free format adjustments, feed movements and the handling of lightweight components. The new driven axis is available ex stock within three to four days, in the required length and including the motor.

Tribologically optimised polymer gliding film

The actual linear guide is based on the maintenance-free 'DryLin W' system that has been in use sucessfully for many years and comprises a bearing housing and tribologically optimised polymer gliding film for excellent friction and wear values. The design makes a flexible and modular structure possible, making assembly easy. There are numerous design possibilities to choose from, with a total of twelve rail profiles available, from single or double rails made of hard-anodised aluminium, to individual bearings or complete slides through to guides with adjustable bearing clearance for customised clearance-free settings. The guides are also available as linear axes with a toothed belt drive.

-TEL: +82-32-821-2911
-http://www.igus.kr

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

BMT CO., LTD.
Head Office : Yangsan Gyeongsangnam-do
Homepage Add. : www.superlok.com/
Main Products : Fitting & Valve, Vacuum Clamp
TEL : +82-55-783-1000

BO KYOUNG IND., CO.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : O-ring, Sealing, Gasket
TEL : +82-51-831-4615

BOKYUNGTL CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Rudder Body, Winch, Crane
TEL : +82-51-832-0801

BO MYUNG METAL CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. :
Main Products : Copper Tube & Pipe, Cupro-Nikel Pipe, Copper Fitting
TEL : +82-51-266-4101

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Homepage Add. : www.byhd.co.kr
Main Products : Stairway Body, Ladder, Hardware
TEL : +82-55-345-1951

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Homepage Add. :
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
Homepage Add. : www.chkj.co.kr
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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Head Office : Kumjung-gu Busan
Homepage Add. : www.cmkkorea.com
Main Products : Temperature & Press Sensor, Alarm Monitoring Sys.
TEL : +82-51-521-2883

DAECHANG METAL CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. :
Main Products : Main Bearing support, Chain Wheel, Gear Wheel
TEL : +82-51-264-0831

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Head Office : Gangseo-gu Busan
Homepage Add. : www.ddentec.com/
Main Products : Air Cooler, Oil Cooler, Oil Tank, Air Tank, Oil Heater
TEL : +82-51-832-1123

DAE HAN HEAT ELECTRIC MACHINERY IND.,CO.
Head Office : Kijang-kun Busan
Homepage Add. :
Main Products : CO_2 Welder, DC Tig, Welder, AC ARC Welder
TEL : +82-51-724-6777

DAEHEUNG IND. CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.daeheungind.kr/kr/
Main Products : Forged Flanges, Nozzel & Forged Neck, Forged Items for ship
TEL : +82-51-831-6635

AQ TECK CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Flower Meter, Viscometer, Control Valve
TEL : +82-51-831-3720

DAEHWA TECHNICAL CO., LTD.
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Main Products : Shot & Blast, Painting, Painting's Manufacture
TEL : +82-55-329-5705

DAEJUNG SPECIAL STEEL CO., LTD.
Head Office : Gangseo-gu Busan
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Main Products : Winch, Shaft, Gear Cluch
TEL : +82-51-831-1133

DAEKYUNG CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. : www.dkhoist.com
Main Products : Chain Block, Lever Block Trelley
TEL : +82-51-264-6611

DAERIM MACHINERY CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.dae-rim.kr
Main Products : Head, Air Receiver Tank, Pressure Vessel, Reactor
TEL : +82-51-831-1456

DAESAN ENGINEERING CO., LTD.
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
TEL : +82-51-832-2071

DAESUNG IND CO.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : VENT SYS, OIL TANK, Out Fitting
TEL : +82-51-831-7427

DAE WON HEAVY INDUSTRIES CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.daewonindustry.co.kr/
Main Products : Deck Machinery, Deck Equipments, OffShore
TEL : +82-51-831-5215

DAEWON METAL IND. CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.galvanizing.co.kr/
Main Products : Hot Dip Galvanizing, Pipe for Shipbuilding
TEL : +82-51-831-2541

DAEYANG ELECTRIC CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. : www.daeyang.co.kr
Main Products : Precision Instrument
TEL : +82-51-200-5331

DAEYANG INSTRUMENT CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. : www.daeyang.co.kr
Main Products : Precision Instrument
TEL : +82-51-200-5331

DAEYANG SP CO., LTD.
Head Office : Yangsan Gyeongsangnam-do
Homepage Add. :
Main Products : Welding machine
TEL : +82-55-388-3800

DA HEUNG ENG. CO., LTD.
Head Office : Sasang-gu Busan
Homepage Add. :
Main Products : Marine valves
TEL : +82-51-311-1882

DAOM METAL.
Head Office : Sasang-gu Busan
Homepage Add. :
Main Products : Sus plate, Flange, Pipe sleeve
TEL : +82-51-315-1347

DEAIL MACHINERY.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Piston Rod, Cross headpin, Propeller Shaft
TEL : +82-51-832-1119

DECKWIN CO., LTD.
Head Office : Youngdo-gu Busan
Homepage Add. : www.deckwin.com
Main Products : Winch
TEL : +82-51-413-1193

DH-M CO., LTD.
Head Office : Seo-gu Incheon
Homepage Add. : www.dhm.co.kr
Main Products : High Pressure Blower, High Pressure Washer
TEL : +82-32-527-5782

DHP ENGINEERING CO., LTD.
Head Office : Dongnae-gu Busan

Homepage Add. : www.dhpeng.com
Main Products : Plate Type heat Exchanger, Disk & Shell type heat Exchanger
TEL : +82-51-556-4200

DINES CO., LTD.
Head Office : Gangseo-gu Busan
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Main Products : Silencer, Fire Damper, Lashing Bridge, Rudder
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Homepage Add. : www.dklok.com
Main Products : Instrument TuBe Fitting, Instrument Valve
TEL : +82-55-338-0114

DNP CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.dnpco.kr
Main Products : Fire & Gas Damper, Galley Equipment, AL, Steel Furniture
TEL : +82-51-831-4551

DOLIM PRECISION.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Cross Head Pin, Main Journal, Crank Shaft
TEL : +82-51-831-8861

DONG-A VALVE IND.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Marine Offshore valve, Strainer
TEL : _+82-51-831-1500

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Head Office : Jinhae Gyeongsangnam-do
Homepage Add. : www.dongbangsm.co.kr
Main Products : General Steel Poping, Framo & Hydro Piping, Module Unit
TEL : +82-55-545-0882

DONGHAE INTEC CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.dhintec.co.kr
Main Products : Sleeve, Scupper, Suction Bell Mouth
TEL : +82-51-831-2565

DONG HUN ENTERPRISE CO.
Head Office : Sasang-gu Busan
Homepage Add. :
Main Products : Ball Valve
TEL : +82-51-314-2610

DONGHWA ENTEC CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.dh.co.kr
Main Products : E/R Heater & Cooler, Copt, Condenser, Plate Heat Exchanger
TEL : +82-51-970-1000

DONGHWA M&E CO., LTD.
Head Office : Kimhae Gyeongsangnam-do
Homepage Add. : www.donghwame.com
Main Products : Heat Exchanger
TEL : +82-55-340-6700

DONGHWA PNEUTEC CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Air Comfressor, Cylinder, Cylinder, Head, Piston
TEL : +82-51-974-4800

DONGIL SHIPYARD CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. :www.dongilshipyard.co.kr
Main Products : Rescue Boat Davit & Winch, Assembly, Line Hauler
TEL : +82-51-200-1211

DONGKYUNG INDUSTRY CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.dki21.co.kr
Main Products : Reducer, Gear
TEL : +82-51-832-1602

DONG NAM ENGINEERING CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. : www.dongnam-eng.com
Main Products : Electric Control Panel
TEL : +82-51-204-3984

DONGNAM PRECISION IND. CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Multi Core Tube, Sus Cable Tray & Cover, LNG Line Out Fitting
TEL : +82-51-831-3500

DONG SUNG HIGHTECH.
Head Office : Gangseo-gu Busan
Homepage Add. : www.dshitech.com
Main Products : Shutter Grill, P-Chamber, Diffuser, Frie Damper, Volume Damper
TEL : +82-51-831-9561

DONGYANG G.T.S.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Compresed Centellen Board, Metal Inserting Gasket
TEL : +82-51-831-6505

DONGYANG HYDTEC CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.dongyang-hyd.com
Main Products : Rudder & propeller Truck, Block lifter, Gripper Jack System
TEL : +82-51-831-6185

DONGYANG METAL CO., LTD.
Head Office : Sasang-gu Busan
Homepage Add. : www.dy-metal.co.kr
Main Products : Swing bolt a' ssy, Fittings
TEL : +82-51-814-5157

DONGYOUNG ELECTRIC CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.dyelectric.com
Main Products : Main Switchboard, Emergency Switchboard
TEL : +82-51-261-9800

DSB ENGINEERING CO., LTD.
Head Office : Youngdo-gu Busan
Homepage Add. : www.dseng.com
Main Products : Totally Enclosed, Lifeboat, Herged Qrarity Davit
TEL : +82-51-412-5937

DSE BEARING CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.dsebearing.com
Main Products : Metal Bearing
TEL : +82-51-831-2046

DSK CO., LTD.
Head Office : Youngdo-gu Busan
Homepage Add. : www.dskworld.com
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 Outfittings
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
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Homepage Add. :
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