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Shipbuilding



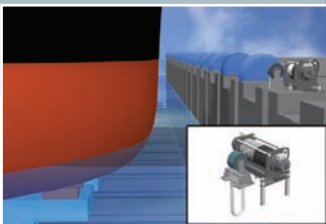
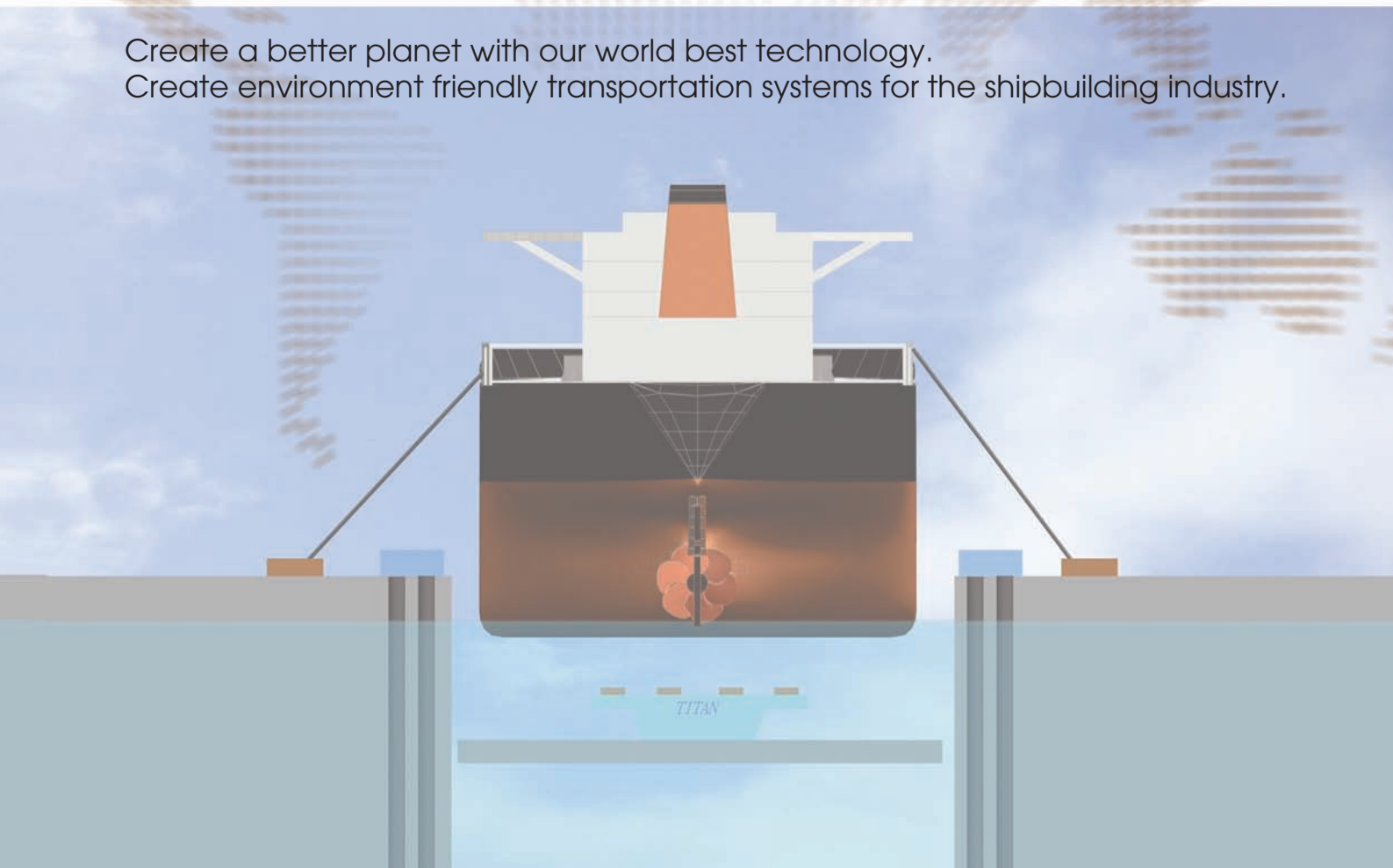
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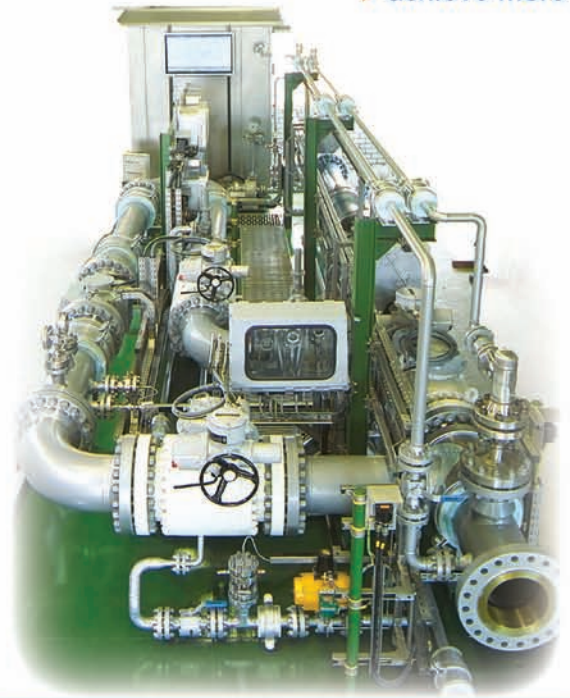
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KR held the opening ceremony for its Asia-Pacific head office

KR held the opening ceremony for its Asia-Pacific head office in Marina Mandarin Hotel in Singapore on July 26 (local time), attended by Oh Joon, the Republic of Korea's Ambassador to Singapore, Oh Gong-gyun, Chairman of KR, and around 250 officials from the organizations related to the maritime sector of the Asia-Pacific region.

KR has provided inspection services since it established local office in Singapore in 1981. However, KR elevated its Singapore office as Asia-Pacific head office status to expand the sales and marketing activities as part of efforts to strengthen its presence

in the Singapore market and increase the registrations in the Asia-Pacific. Song Hyun-chul was appointed as the President of the Asia-Pacific head office, who will be in overall charge of the KR's network comprised of 15 inspection organizations in the Asia-Pacific region.

The 4th KR Technical Seminar, which took place earlier on the same day, touched on the latest trends of international maritime organizations, current situations related to the port state control, provided introduction on the ship life cycle management system of KR, and involved active discussions between the attendees and officials of KR

on the energy efficient design index for ship, etc, in relation to the control of greenhouse gas emissions.

In addition, the topics covered in the seminar included an introduction to the validation of marine fuel, one of the new business of KR.

Oh Gong-gyun, Chairman of KR, said, "The establishment of KR's Asia-Pacific head office paves the way to provide customers in this region with even higher quality and quicker inspection services. We will carve out more market share in the Asia-Pacific region in the period ahead."

Students of Sandol School, an alternative school for the retarded children, took a field trip to SSME

Sungdong Shipbuilding & Marine Engineering (SSME) took part in the effort to help students of Sandol School, an alternative education institute for the retarded children and adolescents, make memories. Around 30 students, who joined the 2-day and 3-night experiential learning program for the summer vacation season, took a field trip to the shipyard of SSME in Tongyeong on the last day of the program. This program aimed at eliminating the bias against the disabled by promoting social exchanges and hands-on experience and provide an opportunity for having the first-hand experience of various occupations. The field trip covered the direct observation of ship construction process, photographing in front of ultra large crane, and special lunch in VIP restaurant inside the company building.

Lee Bo-mi, a student of Sandol School,

said, "Retarded children are just slow, not incompetent. I hope that many opportunities would be created for them to stand on their own feet in the society, like this opportunity offered by SSME in this field trip. Watching a ship is being built through the combination of many blocks, the students gained a greater sense of belonging to mainstream society and cherish hope and dream."

Sandol School, located in Gunsan, North Jeolla Province, is an education institute dedicated to helping retarded chil-

dren and adolescents lead independent lives and an alternative school mainly for the students with mental retardation, Down's syndrome, and autism.



Students of Sandol School took a field trip to SSME and watched the construction process of ship on July 22. The photo was taken at the shipyard of SSME.



KSA launched the 'Working-Level Council for Examining the International Trends'

Korea Shipowners' Association (KSA) launched the 'Working-Level Council for Examining the International Trends' on July 25 to keep abreast of international issues facing the shipping industry and explore effective countermeasures.

This Council consists of about 20 officials from KSA, ocean shipping industries, Korea Maritime Institute (KMI), Ministry of Land, Transport and Maritime Affairs, etc, and officially convenes bi-monthly to intensively examine international issues facing the shipping industry.

KSA launched this Council to ensure constant monitoring and effective response as international organizations and advanced countries are strengthening the regulations on the shipping industry recently.

Meanwhile, KSA hosted 'the 1st working-level council for examining the international trends' at its main conference room on July 25, in which issues, such as the U.S.-imposed sanctions against Iran and the stricter Competition Act of advanced countries such as EU, were examined and possible countermeasures were discussed.

On the same day, KSA gave explanation

with regard to the trends and outlook of the U.S.-led sanctions against Iran and the trend of Competition Act in countries such as EU, U.S.A, Hong Kong, Singapore, etc, during the working-level council, followed by additional explanation from Hanjin Shipping, Hyundai Merchant Marine, and others.

Particularly, the attendees raised concern about the lack of concreteness in the U.S.-led sanctions against Iran, which they said might cause some confusion, and requested the KSA to verify the facts through close cooperation with the government and KMI, etc, because, for example, ship owners were encountering difficulty in figuring out whether other companies were offering services to the Middle East countries and what the specific scope of sanctions should be.

In relation to that, KSA decided to continuously monitor the progress in the U.S.-led sanctions against Iran, and other matters, and provide related information to the member companies.

An official from KSA said, "The Council was launched to provide a platform for sharing information among the shipping industry, government, and KMI so as to ensure better respond to a series of international issues affecting the shipping industry, which have come to the fore one after another recently."

He added that he expected the regular meeting of this Council to play a key role in examining and resolving international issues.

GFEZA will undertake the project to attract R&D Centers in the offshore plant sector

Gwangyang Free Economic Zone Authority (GFEZA) participated in the bid for the 2nd municipality project that aims at commercialization of foreigners' projects for year 2011 (title of project: Offshore Plant Equipment Industry Foundation Project - Attraction of Offshore Plant R&D Centers), and successfully secured KRW 200 million (KRW 150 million from government coffers, 50 million committed by GFEZA) to defray the project cost.

The Ministry of Knowledge Economy (MKE) and KOTRA took a leading role in selecting the projects deemed to hold out excellent prospects for attracting foreign investments and having wide-ranging spillover impact on domestic industries. In the selection process, experts such as the principal researchers of Samsung Economic Research Institute (SERI) and POSCO Research Institute, university professors, etc, sat on the judging panel.

3 domestic organizations were selected out of the total of 6 candidate organizations. The project presented by GFEZA topped the list of the selected projects as it was found to have the brightest prospect for attracting investments in the period ahead.

Choi Jong-man, Commissioner of GFEZA, said, "GFEZA selected offshore plant sector, one of the 6 major key industries designated by the Ministry of Knowledge Economy, as the main magnet for foreign investment and has pushed ahead with the efforts to attract investments since last year. GFEZA's participation in this bid is a



Korea Shipowners' Association held the 1st working-level council for examining the international trends on July 25.



continuation of such efforts.”

He added, “Upon completion of the project, investment in offshore plant sector will gather momentum owing to the reduction in distribution costs, easier supply of raw and ancillary materials, which are the strength distinguishing GFEZA from the rest, installation of business-friendly industrial complex, and launch of R&D.

The outsourced projects selected this time will be carried out for the next 5 months, starting from September, and serve as the primary driver for attracting foreign investments from March next year.

HHIC issued an appeal to the public

“HHIC will never abandon Yeongdo shipyard nor leave Busan.”

Cho Nam-ho, Chairman of Hanjin Heavy Industries & Construction (HHIC) issued an appeal to the public at Busan City Hall on August 10, which included the measures for supporting the retirees and bringing the company back to normal conditions.

Chairman Cho said, “We can rehire the laid-off employees only when the company becomes more competitive and strong enough to be back on track. HHIC will give the best support that it can, such as the tuition support benefit for children of employees, to honor the voluntary retirees who leave the company unavoidably.”

He stressed, “We will keep the current level of employment until the agreement reached between management and labor union is fully implemented and all operations of the company are back to normal. By making the utmost efforts to bring the company back to normal conditions within

3 years, HHIC will rehire the laid-off employees who had to unavoidably leave the company.

He added, “Although some employees had to leave in the process of restructuring, I feel strongly responsible for not having communicated more and sought understanding. As chief officer, I could not help thinking deeply about the livelihoods of the families of about 1,400 employees and about 2,000 employees of vendors.”

Asked about the reason why he was on a business trip abroad, he explained, “Working out a solution to the labor dispute is the priority, but I believe that the only way for the survival of company is to bring a lot of business. So, I have focused on winning contracts while working closely with domestic executives.”

He appealed, saying, “Restructuring is the last opportunity for putting the company back on track and bringing new life to both officers and employees. Despite the agreement between the management and labor, the life-or-death situation of company has turned into a social issue due to the reckless intervention of those outside the company, and this has been a big stumbling block to the normalization of the company. Please help us, so that the dispute between the management and labor can be resolved by the management and labor and the efforts of the vendors can pay off.”

He went on saying, “As a responsible member taking part in the local economy, HHIC will set up new funds for local residents, as well as all our corporate officers and employees, and ensure that practical compensations are disbursed to the vendors every year based on the principle of co-growth, depending on the performances.”

An official from HHIC explained, “The tuition support benefit for children of employees who voluntarily leave the company includes the benefits for pre-schoolers and are worth a total of KRW 10 billion. Despite financial trouble, HHIC made this decision to grant maximum privilege to the retirees.”

Those who voluntarily retire will be offered the retirement bonus equal to 22-month salary, apart from the severance pay, as well the tuition benefits for 2 children per employee during the whole enrolled period until graduation.

The official from HHIC said, “All members, including both officers and employees, and vendors, are making desperate efforts to help the company, based in Yeongdo where HHIC laid its foundation of business, be back on track and regain its status as top shipyard nationwide.”

He added, “The local community desperately hopes that the dispute is settled and Yeongdo shipyards is revitalized. I hope that all people would support and encourage us, so that the company can be back to normal at the soonest.”

HHI’s naming ceremony was telecast via satellite, first-ever worldwide

Hyundai Heavy Industries (HHI) and Hyundai Samho Heavy Industries (HSHI) carried live satellite coverage of their naming ceremonies being held in the eastern and western parts of the country simultaneously for the first time worldwide on August 11.

These naming ceremonies, aired live at the same time via satellite, were held for 1 ship



Naming ceremony televised via satellite first-ever worldwide on August 11

built at the Ulsan shipyard of HHI and 1 ship constructed by HSHI which is HHI's affiliate based in Yeongam, South Jeolla Province.

Officials who attended the naming ceremony at HHI watched the live broadcast of the event taking place far away in the West Sea via a large LED screen, 5m long and 4m wide, installed at the ceremony site and enjoyed various activities like the unveiling of the ship name, setting off fireworks, and breaking out the champagnes. The live telecast of these simultaneous naming ceremonies was made via 'Olleh-1 satellite', the first communication satellite of KT which was put into orbit in December last year. HHI and HSHI mobilized SNG (Satellite News Gathering) vehicles for the transmission of live events via satellite.

This type of naming ceremonies was unprecedented worldwide and even for HHI which held over 1,700 naming ceremonies thus far. These naming ceremonies took place to commemorate the simultaneous construction of 2 identical type of ships in Ulsan and Yeongam, South Jeolla Province, for the same ship owner.

These 2 ships are the world's largest 13,100TEU containerships commissioned by the Canada-based Seaspan, which measure 366m in length, 48.2m in width, 48.2m in height, and will be chartered to

COSCO, a China-based shipping company. Meanwhile, the ship built by HHI was named 'COSCO Development', while the ship constructed by HSHI was named 'COSCO Harmony'.

Rockwell Automation adds tag write capability, enhanced security to web-enabled HMI software

Manufacturers have greater flexibility and mobility to make real-time changes to plantfloor operations using the latest version of FactoryTalk ViewPoint software from Rockwell Automation. In addition to tag write capabilities, the latest version of the company's Web-enabled human-machine interface (HMI) software also features enhanced security capabilities that allow administrators to manage and control who can access system and machine parameters from outside the plant.

FactoryTalk ViewPoint 2.0 software extends visualization and real-time decision-making capabilities to browser-based remote users, such as plant managers, supervisors and mobile workers. The software supports fully scalable and animated Web displays of existing FactoryTalk View HMI software and Allen-Bradley PanelView Plus applications. The latest release adds compatibility with Google Chrome 10 and Safari 5, in addition to the existing support for Microsoft Internet Explorer 6, 7 or 8, and Mozilla Firefox 3.

FactoryTalk ViewPoint soft-

ware is also ideal for system integrators and OEMs that want to monitor customer installations, perform diagnostics or provide support for visualization applications they have deployed. The software is also becoming vital for applications that require monitoring of remote, unattended sites, such as in the water/wastewater, oil and gas, and mining industries.

"Remote visualization and control marks a major advance in the manufacturing industry," said Tad Palus, FactoryTalk ViewPoint software product manager, Rockwell Automation. "With FactoryTalk ViewPoint 2.0 software, users can access critical plant information in the form of graphics displays, dashboards and diagnostic reports, and make decisions based on this information when and where it is most actionable and valuable to them. Delivering this information via a secure Web browser provides a cost-effective and easy-to-maintain way of reaching remote users."

FactoryTalk ViewPoint 2.0 software allows users to remotely access and write to FactoryTalk View Machine Edition and Site Edition (SE) applications using numeric and string (text) entry objects, and momentary, maintained, multi-state, ramp and interlocked pushbuttons. Companies with



FactoryTalk ViewPoint



FactoryTalk View SE applications also can remotely access and write to FactoryTalk View SE commands, including set, toggle, ramp and simple expressions (ex., Tag1 = Tag2 * .55 + 72).

The enhanced security system allows

administrators to define user groups and assign them access for view and/or write capabilities. Previous FactoryTalk ViewPoint versions only permitted administrators to allow or disallow users' access to the entire FactoryTalk ViewPoint application.

Intergraph released new version of Standard Database for SmartPlant Reference Data

Intergraph has released the newest version of Standard Database for SmartPlant Reference Data, a pre-configured, best-practice solution to enable rapid implementation of SmartPlant 3D and SmartMarine 3D (collectively known as Smart 3D), and materials management. The Standard Database reduces the effort required to define items, descriptions and dimensions that satisfy requirements throughout various phases of a project by delivering a comprehensive range of commodity codes used to uniquely describe materials through a project life cycle, while employing sophisticated and exhaustive rules to maintain material descriptions.

A major part of this new release includes providing all SmartPlant Reference Data users access to available Process Industry Practices (PIP) piping material specifications through Intergraph's partnership with PIP. PIP is a consortium of process industry owners and engineering construction contractors, which publishes and maintains recommended Practices for the process industry that are used by companies all over the world. The newest version of Standard Database will include 40 PIP specifications, with a further 25 to be available in the next release.

Standard Database is bundled with SmartPlant Reference Data, the Intergraph solution that provides materials libraries at the corporate and project levels, enabling better standardization and change management. SmartPlant Reference Data maintains catalog and pipe specifications

STX Windpower B.V developed 2MW-class wind power system

STX Windpower B.V. successfully developed new wind power system.

STX Windpower B.V. announced on August 8 that it completed the development of 2MW-class high efficiency wind power system (model name: STX93 2MW) and finalized the installation of the experimental prototype inside the test bed located in Lelystad, Netherlands.

This model has the blade measuring 45.3m in length and 93.3m in the rotation diameter, the largest among the wind power systems that have been developed by STX Windpower B.V so far. Using the single main bearing, it is the most lightweight among the wind power systems of the same class.

Particularly, STX93 2MW adopts the gearless type, an upgraded version of the existing model which uses the gear box. The gearless type has lower rate of breakdown and is relatively easy to maintain and repair because it has no gear device between the rotation axis and generator and therefore has smaller amounts of parts compared to the model

which uses the gear box.

STX93 2MW incorporates various technologies enhancing energy efficiency, such as the permanent magnet technology, ambient cooling system, etc, which can compensate for the shortcomings of consumable materials.

This model, developed by STX Windpower B.V. will obtain technical certification in December this year upon the qualification test by the certification organization.

An official from STX Windpower B.V. said, "We will speed up entry into the global wind power market by maximizing the synergic effect in collaboration with related affiliates while expanding the sales activities through the global network of STX."



2MW-class gearless type wind power system developed by STX Windpower B.V. (model name: STX93 2MW)



for Smart 3D, SmartPlant Materials and other SmartPlant Enterprise solutions. PIP specifications are ready for use in Smart 3D, reducing implementation time for faster project start-up. SmartPlant Reference Data users can quickly and easily transfer the PIP specifications as-is into the Smart 3D model, and use them immediately in the Smart 3D model.

“PIP is pleased to be working with Intergraph to make our piping material specifications available to the industry,” said Bernie Ebert, director of PIP. “Our partnership with Intergraph will enhance delivery, and provide additional outlets for our PIP Practices. In addition, access to SmartPlant Reference Data will enable us to better manage future revisions and updates to our piping material specifications.” “Our partnership with PIP will enhance Standard Database for SmartPlant Reference Data, delivering more value to our customers,” said Patrick Holcomb, Intergraph Process, Power & Marine executive vice president. “These PIP specifications are available for design and material management, and applicable in a variety of industries, making them relevant for any start-up project. As an active contributor to industry standardization initiatives, Intergraph is the first commercial software vendor to integrate the PIP specifications and distribute globally, enabling our customers to be more efficient and productive for increased global competitiveness.”

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The ARC Advisory Group, a leading industry analyst firm, ranked Intergraph the No. 1 overall engineering design 3D software and process engineering tools (PET) provider worldwide according to its PET Worldwide Outlook Market Analysis and Forecast through 2013.

Rolls-Royce opened Regional Training Centre at Singapore's Seletar Aerospace Park

Recently, Rolls-Royce announced the opening of a Regional Training Centre (RTC) in Singapore to provide world-class, accredited training for customers and employees across Asia. The RTC is the first section of the USD 700m Rolls-Royce Seletar Campus to be opened.

Through the RTC, Rolls-Royce will help to develop the talent pool the company and its customers require, while promoting a culture of engineering excellence in Asia. Specifically, the RTC is equipped to deliver a broad spectrum of learning, from IT to management and leadership, as well as technical skills across all Rolls-Royce business sectors of Civil, and Defence Aerospace, Marine and Energy. The first technicians will graduate from the RTC in September, taking up new roles in the new Seletar Assembly and Test Unit (SATU).

Jonathan Asherson, Rolls-Royce, Regional

Director, Southeast Asia, said, “This is an important milestone for Rolls-Royce as we increase our capacity and capability to meet the growing needs of our global customer base. We are investing significantly to develop our presence in Singapore and today marks the first stage of our new, state of the art, Seletar facility coming on stream. The Regional Training Centre combines the latest technology, equipment and facilities, and customers in the region will now, for the first time, be able to access our world class training right at their doorsteps.”

Bob Blenkinsop, Rolls-Royce, Director of Resourcing, Organisation and People Development said, “Rolls-Royce takes training and development very seriously and has an extensive global programme for customers and employees. It is exciting to be opening a training centre in Singapore, to complement the others we have in the USA and UK. This is a fast growing region and now customers and employees will no longer have to travel to Europe or the US to access the world-class training facilities which we now have here.” A benchmark in training standards, the RTC is a European Aviation Safety Agency (EASA) Part-147 approved training centre, as well as Singapore Workforce Development Agency (WDA) Approved Training Organisation, offering international and national accreditation to trainees.

Rolls-Royce has been working with Singapore's National Trade Union Congress' e2i (Employment and Employability Institute) and the Singapore Workforce Development Agency, to develop training and qualifications to support the aerospace industry as it continues to develop in the region.

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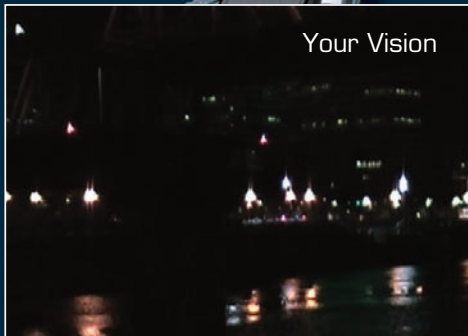
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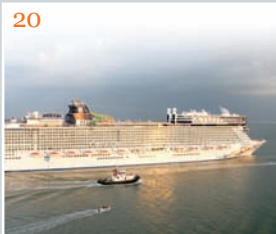
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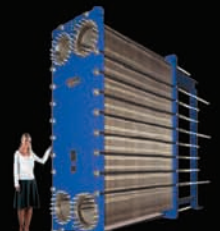
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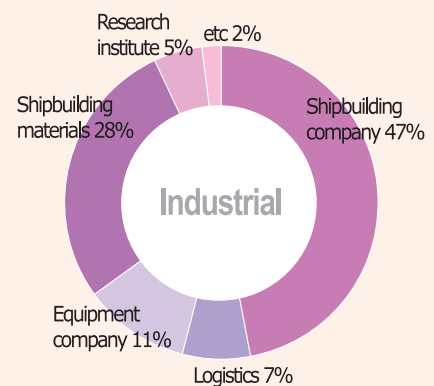
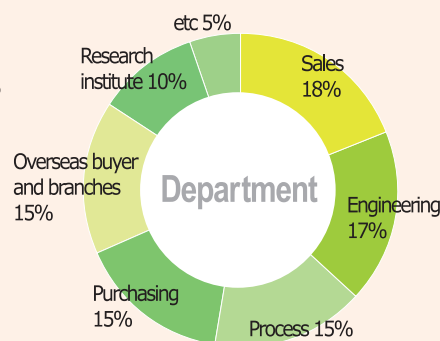
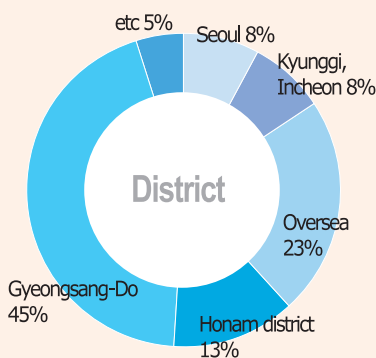
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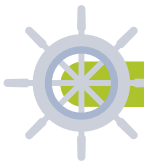
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Current technology for shipboard fuel cell

Pressure has been mounting to redesign ships amid increased interest in the use of eco-friendly energies and growing demand for high-efficiency onboard power generation systems that reduce energy consumption. Against this backdrop, shipboard fuel cell technology has sparked heightened interest recently.

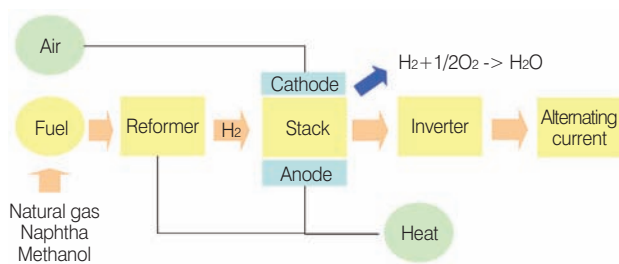
Shiboard fuel cells, which produce no pollutants such as NO_x and SO_x regulated internationally by International Maritime Organization (IMO), can help resolve environmental problems and save energy, and are expected to attract a growing attention as viable alternative for fossil fuels.

In Korea, R&D related to shipboard fuel cells has just begun, but is expected to gain momentum from the green energy strategic roadmap unveiled by the government and efforts of shipyards, related companies, and research institutes.



Fuel cell is an energy conversion device that converts the energy generated from the chemical reaction of hydrogen and oxygen into electricity, unlike the existing secondary cells that store energy. The supplied hydrogen is transformed into hydrogen ions and electrons at the anode, and hydrogen ions then travel to the cathode side where they react with air, etc, to form water, and the external flow of the separated electrons forms electric current.

The whole system consists of the reformer (which uses hydrocarbon fuel, such as methanol, gasoline, LPG, etc, at high temperature), stack (the main body made up of several hundreds of cells piled up together in series), inverter (which converts the direct current from fuel cell into alternating current), and auxiliary devices.



Source: Renewable energy R&D strategy

Fig. 1 Schematic diagram of fuel cell system

Fuel cell has the advantage of being non-polluting, no noise emission, high efficiency, etc, compared to the existing international combustion engines, and therefore can have multi-

ple applications including mobile/portable and transportation applications, etc.

In other words, fuel cell which generates electricity without combustion of fuel is an eco-friendly energy source that does not emit any air pollutants or greenhouse gases such as CO₂. Unlike international combustion engines, fuel cell converts the energy of fuel into electricity without the need for creating explosion known as combustion and therefore emits no noise during operation and achieves higher power density per km, compared to secondary batteries. Additionally, fuel cell can have efficiency rates between 70% and 85%, surpassing that of internal combustion engines, as the heat recovery efficiency of 40% is added to the power generation efficiency of both electricity and by-product water which ranges between 30% and 40%.

Fuel cell is divided into 9 types, depending on the type of electrolyte, and varies in operating temperature, power output and applications based on type.

Growing need for fuel cell

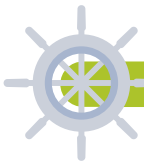
Pressure has been mounting to push through a change of current ships that emit various types of emission gases and pollutants amid growing demand for eco-friendly energies and high-efficiency onboard power generation systems that can save fuels.

According to the 'Second IMO GHG (Green house gas) Study 2009' published by International Maritime Organization (IMO), ships produces an estimated 3.3% of the world's CO₂ emissions, 10 to 15% of the world's NO_x emissions, and 4 to 6% of the world's SO_x emissions, which far exceeds the

Table 1. Type of fuel cell

Category/characteristics	High temperature type		Low temperature type			
	Molten Carbonate (MCFC)	Solid Oxide (SOFC)	Phosphoric Acid (PAFC)	Alkaline (AFC)	Proton-exchange membrane (PEMFC)	Direct Methanol (DMFC)
Type	Molten Carbonate (MCFC)	Solid Oxide (SOFC)	Phosphoric Acid (PAFC)	Alkaline (AFC)	Proton-exchange membrane (PEMFC)	Direct Methanol (DMFC)
Electrolyte	Carbonate	Ceramic	Phosphate	Alkaline	Ion-exchange membrane	Ion-exchange membrane
Operating temperature (°C)	550-700	600-1,000	150-250	50-120	50-100	50-100
Main catalyst	Perovskites	Nickel	Platinum	Nickel	Platinum	Platinum
Efficiency	80	85	70	85	75	40
Purpose	Power generation	Power generation	Small and medium-sized buildings	Special purpose (spaceship)	Transportation, home use	Portable applications

Source: Understanding of renewable energies



emissions from other modes of transport (based on 2007). In particular, all merchant ships are required to reduce NOx emissions 80% below the current level by 2016 in accordance with the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78 Annex VI). However, it is reported that this target cannot be reached with current engine technologies unless the facilities for the disposal of pollutants are installed additionally. Besides, there has been a soaring demand for high fuel efficient ship engines below rated load to save energy.

Fuel cell represents an energy technology that can most effectively control and address the imbalance between energy supply and demand, a weakness of wind power and solar power, and has wide-ranging applications, thus holding out bright prospects for leading the energy market in the period ahead. Furthermore, full cell produces no emissions of CO₂, NOx, SOx, dusts, etc, generates very low noise and vibrations, and has high power generation efficiency, which makes it very likely that fuel cells will be used as next-generation engine to power ships. Moreover, full cell can be modulated and therefore can reduce complexity in shipbuilding and combination process, which is a great advantage in reducing

the shipbuilding costs. Thus, fuel cell can substitute existing power source and is recognized as the sole energy source to power the vessels which are currently unable to use renewable energy sources such as solar power and wind power as main power source due to the constraint of space.

The applications of fuel cell on board ships may include the special operation mode power such as emergency backup power, auxiliary power generation, silent navigation function, etc, and power generation facilities adjacent to the coast. Among others, fuel cells can be used in ships like LNG carrier and LPC carriers, specialized vessels such as icebreaking vessels which can cause serious environmental pollution, cruise ships, yachts, coastal passenger ships, naval vessels, etc, which require silence navigation and cleanness.

Currently, IMO is developing a mandatory set of regulations on the greenhouse gas emissions from newbuilds and existing ships in line with the global endeavor to mitigate greenhouse gas emissions. The technical regulations are expected to go into full force in 2013 and the market-based regulations are said to be currently under discussion.

The global shipbuilding industry will inevitably make a transi-

Table 2. Long-term outlook on the demand for newbuilds worldwide (2005 to 2022)

Type	No. of ships	Unit: 1 million CGT	Unit: 1 million DWT	Unit: 1 million GT
Annual average (1790-2006)	1,110	15	37	25
Draft guide	1,524	31	70	52
High growth scenario	1,259	25	58	42
Low growth scenario	1,861	39	88	65

Source: Clarkson Shipbuilding Forecast Club, "The Newbuilding Market 2007-2013", March 20

Table 3. Size of marine engine market

Type	Current	2020
Annual quantity of ships built worldwide	1,000	1,500
Average power output of emergency generator	300kW	
Average power output of generator	1,000kW x 3 units = 3,000kW	
Average power output of main engine	10,000kW	
Total output	13,300kW	
Market size per unit of ship (\$800/kW)	KRW 12.768 billion	
Global market size (\$800/kW)	KRW 12 trillion 768 billion	KRW 19 trillion and 152 billion

Source: Korean Register of Shipping (KR)



tion to the low carbon and green shipbuilding, considering the sustained increase in the price of ship fuels and the rigorous regulations that will actually preclude low energy efficient ships from being built and departing the ports.

Fuel cell market conditions

Korean shipbuilding industry has held top spot since 2000 in terms of all industrial indexes such as new order intake, shipbuilding volume, order backlog, etc, on the back of the robust growth in the global shipbuilding market. According to the analysis of the global shipbuilding market, the demand for newbuilds is expected to jump 23% to an annual average of 31 million CGT by 2020 (based on draft guide). The global market for marine engines is projected to be worth KRW 13 trillion, considering that an annual average of 1,000 units of large ships were built between 2001 and 2008, and is expected to be worth KRW 20 trillion by 2020 (based on existing

engines).

In 2010, the German Classification Society (GL) estimated that the fuel cell systems could substitute 160GW of auxiliary diesel engines around the globe based on the feasibility study pertaining to the introduction of fuel cell system for onboard auxiliary power.

Technological advances in the related fields have led to a dramatic decrease in the price of fuel cell. Fuel cell - which is a high-efficiency source for power generation and reduces fuel costs in vessels sailing long-haul voyages - is considered more cost-effective in overall aspects compared to the rival technologies.

According to the research by manufacturers of marine engines in EU, the prices of existing fuel cell systems climb up as a result of degraded engine efficiency, additional use of energy, and lack of space for installation when facilities for removing SOx, NOx, and PM are additionally installed in

Table 4. Size of domestic market and spill-over effect

Power generation system	Import substitution effect	No. of supplied units	Remark
Fuel cell power generation system for ships (2020)	KRW 7 trillion 660.8 billion	600 vessels (7,800MW in all)	<ol style="list-style-type: none"> 1. Import substitution effect: if the emergency power generator, power generator, main engine of ships are replaced by fuel cell systems 2. If domestic shipyards win orders for 600 vessels, which are 40% of 1,500 vessels commissioned worldwide yearly, in 2020 3. Fuel cell system capable of providing an average of 13,300kW of power is required per unit of ship. 4. The cost of fuel cell system per unit of ship would be estimated at KRW 33.25 billion on the assumption that the average price of fuel cell system is \$2,500/kW (the price of fuel cell system per kW is subject to change, depending on the technological advancement). 5. KRW 33.25 billion x 600 vessels = KRW 19 trillion 950 billion

Source: Korean Register of Shipping (KR)

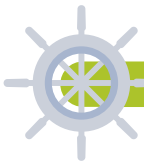


Table 5. Comparison of Korea, China, Japan in the marine equipment sector

Type	China	Korea	Japan
Rate of domestic equipment installation	About 45% (export ships)	About 85%	About 95%
Structure of manufacturers	Annexed to shipyards Production in independent companies	Emergence of independent companies	Production in independent companies
Major countries for import	Japan	Japan	Europe, Korea
Development of essential equipments	Good	Inferior	Superior

Source: Korea Marine Equipment Association (KOMEA)

compliance with the emission standards of pollutants from ships. Thus, market-entry pricing for fuel cell is estimated at \$2,500/kW, and the current manufacturing cost per unit of U.S.-based FCE is known to be approximately \$3,500/kW. Korean builds about 40% of all ships constructed worldwide.

The fuel cell market would be worth about KRW 20 trillion on the assumption that fuel cell power generation system is used in these ships built nationwide. Particularly, domestic shipyard is expected to gain even larger share in the global market for large ships if ships fitted with fuel cells are successfully commercialized earlier in the large ship sector, which will further cement the nation's status as the world's largest shipbuilder.

Meanwhile, annual value of domestic market for fuel cell and parts/equipments is projected to be worth KRW 3 trillion to 6 trillion, and the annual import of shipbuilding equipments is estimated at USD 1.823 billion based on 2006. In addition, the aforesaid market and the import of marine equipments are growing 13.2% yearly. With a large portion of these equipments being imported from Europe and Japan, Korea is paying a considerable amount of royalties to these countries, and as a result, royalties comprise a significant proportion of shipbuilding costs.

Marine fuel cell development projects abroad

Europe is leading the world's ship industry, and the researches related to the ships fitted with fuel cells can be divided into 2 categories. One is the feasibility study which examines the possibility and course of developing fuel cell equipped ships, and the other is the empirical study that validates the operation of ships fitted with fuel cells.

FCShip (Fuel Cell Technology in Ship) project, the most typical research to validate technical feasibility, was launched in July 2002 and completed in June 2004. 21 organizations from 6 European countries, including Norway, participated in this project which reviewed the feasibility of using the cell fuels for power generation and propulsion of ships. Meanwhile, ZEMship (Zero Emission Ship, from November





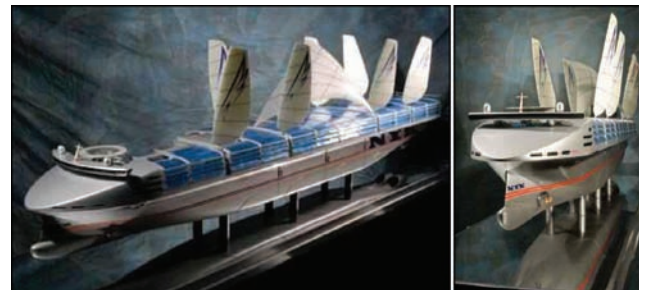
FellowShip project



Ship with a carrying capacity of 100 passengers, fitted with fuel cell, and hydrogen charging station



Overview of METHAPU project



Japan's NYK super eco ship concept design

2006 to April 2010) is the most typical empirical study, in which a ship with 2 fuel cells of 50kW PEM Fuel Cell and a carrying capacity of 100 passengers was developed. The ship has been test-run since early 2008.

Another prominent research is FellowShip (2003 to 2010) which was participated by Norway, Germany, Sweden, Finland, and Spain. This research focused on demonstrating the Molten Carbonate Fuel Cell (MCFC) and Solid Oxide Fuel Cell (SOFC) technology applied onboard vessels, and was carried out in 3 phases, examining the concept design, production, test-run and suitability, etc.

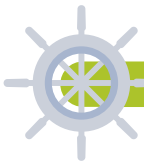
Besides, METHAPU project (using the methanol fuel, conducted from November 2006 to April 2009) was carried out to develop auxiliary power systems for ships based on the Fellowship project and install the fuel cell room and methanol tank container onboard coastal passenger ships, car carriers, cruise ships, etc. In addition, HDW (Germany), launched in 2002, was the first project to install the fuel cell, of which development dates back to early 1980s, onboard submarine. U214, the upgraded version of the first model U212, applied

120kW PEM fuel cell module with 2 of these modules forming a 240kW and was exported to Korea, Greece, etc.

U.S. Navy's SSFC (Ship Service Fuel Cell) was the most prominent research in the United States, which was carried out under the supervision of ONR (Office of Naval Research) with an objective of developing eco-friendly power generation system for use in the naval shipboard environment, which can reduce fuel consumption of U.S. Navy ships and help build up war capabilities at the same time. 2.5MW MCFC was installed onboard the vessel as the main source of energy for the propulsion.

Moreover, MARAD (US Maritime Administration) looked into the possibility of installing the fuel cell onboard 434TEU feather vessel powered by diesel and electricity, and WTA (Water Transit Authority) examined the possibility of applying PEMFC onboard high speed ferry boats.

In Switzerland, fuel cells were developed which can be installed onboard small passenger ships and leisure boats. In Iceland, fishing boats equipped with fuel cell are operating. In Italy, researches have been carried out for onboard integra-



tion of fuel cell system into small passenger boats. In Japan, the Shipbuilding Association of Japan completed a feasibility study and IHI examined the possibility of using the fuel cell onboard LNG carriers, ferry boats, including the applications for shipyard.

Domestic development of fuel cells

The R&D related to fuel cells in Korea remains at the inchoate state. Land-based fuel cells began to be installed in 2007, and currently, the installed capacity of land-based fuel cells in large cities, such as Seoul, Busan, Daegu, etc, already exceeds 400MW, which proves the stability of land-based fuel cell system. However, shipboard fuel cell technology need to overcome many challenges in order to ensure stable power supply even in places exposed to salt, vibration, etc. Thus, R&D which aims to develop fuel cell equipped ships needs to be proceeded systematically in collaboration with shipbuilders, shipping companies, classification societies, etc, as well as fuel cell manufacturers. As the government

has laid out 'green energy strategy roadmap' recently, shipboard fuel cell projects will be undertaken by domestic shipbuilders, Korean Register of Shipping (KR), PostPower, etc. Under the projects to develop MCFC system for auxiliary marine power, shipboard fuel cell stack, stack package, shipboard application technologies will be developed along with experimental demonstration at sea. The supervision organization plans to develop fuel cell stack package which integrates some auxiliary devices such as 200kW MCFC stack, pre-reformer, humidifier, etc, and some shipbuilders plans to develop a series of technologies such as air supply system, fuel vaporization system, water treatment system, power system, etc, for the installation onboard vessels and interconnected operations. Ship parts and MCFC stack package, etc, fully designed and manufactured, will be installed and interconnected onboard the vessels, which will be followed by the experimental demonstrations at sea and the process to obtain certification of shipboard fuel cell systems which will be essential in play-

ing a leading role in the international standardization.

Meanwhile, related industries nationwide are actively involved in adapting fuel cell technologies for ships amid growing interest in fuel cell equipped ships.

On May 15, 2009, the 'Research Group for Eco-friendly Fuel Cell Equipped Ships' was launched under the supervision of the KR, which consist of around 70 officials, including the fuel cell experts, from shipping companies, shipyards, Korea Shipbuilders' Association (KOSHIPA), fuel cell manufacturers, equipment manufacturers, research institutes, academic societies.

An official from KR explained the purpose of 'Research Group for Eco-friendly Fuel Cell Equipped Ships', saying "We will promote multifaceted cooperation for the coordination of interpersonal network of related experts, R&D, and commercialization in developing shipboard fuel cell and related systems."

Meanwhile, South Gyeongsang Provincial Government has pressed ahead with these efforts since it expressed the intention in December 2009 to develop shipboard fuel cells in an endeavor to stimulate the development of green energy industry.

On December 21, 2010, South Gyeongsang Provincial Government held a reporting session on the feasibility of shipboard fuel cells, in which it decided to move ahead with the development of technologies in 3 phases over the period between 2011 and 2020. For that, South Gyeongsang Provincial Government will build a network of university-industry-research institute and establish a 'shipboard fuel cell center' in a bid to secure the fundamental technologies such as the electrode and electrolyte, hydrogen storage and supply technologies, etc, for the next 3 years from 2011.

Additionally, South Gyeongsang Provincial Government will proceed with the projects that aim to commercialize small and medium-sized fuel cell systems suited for the marine environment of South Gyeongsang Province from 2014 to 2016 by combining the shipbuilding/maritime technologies and fuel cell technologies. Also, South Gyeongsang Provincial Government plans to develop core technologies of fuel cell systems over the next period between 2017 and 2020 and build up domestic and international competitiveness through mass production and localization of parts.

South Gyeongsang Provincial Government won the bid in May last year for the government's renewable energy test-bed project in the field of fuel cells.

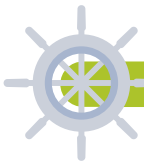


On March 27, 2009, STX Heavy Industries entered into a partnership with Daegu City to develop the green energy industry and decided to infuse KRW 100 billion into the aforesaid project by 2014 with the funding from both private and public sectors. This partnership aims to facilitate implementation of strategic roadmap that the government laid out to develop green energy industry, and is part of the strategy for developing the green energy industry in Daegu and South Gyeongsang Province, the mecca of green energy nationwide.

An official from STX Heavy Industries remarked, "Developing the hydrogen fuel cells which can replace the existing shipboard diesel power generators is very crucial for the shipbuilding industry from the perspective of energy efficiency or environmental impact."

Daewoo Shipbuilding & Marine Engineering (DSME) and POSCO Power entered into MOU (Memorandum of Understanding) on December 28, 2009, to jointly develop and install shipboard fuel cell system, an eco-friendly power source, which provides power for the propulsion of large ships. The shipboard fuel cell, which both companies agreed to jointly develop, will provide power below 3MW and be installed in LNG carriers as auxiliary power source. It will be used to generate electricity during departures and arrivals at the ports and provide electrical power for onboard systems.

An official from POSCO said, "Although we embarked on the full-fledged development of technology in this field 3 to 4 years behind developed countries, we can surpass them



Officials from STX Heavy Industries and Daegu Metropolitan Government are taking commemorative photographs after the cooperation agreement was signed on March 27, 2009, to develop green energy industry.



On June 8, DSME and Korea Institute of Science and Technology entered into cooperation agreement on the joint research in the field of offshore/onshore energy environment plants.

within the next 5 years if we combine the world's best ship-building technology and POSCO's expertise in fuel cells. Over the mid and long-term, we will develop fuel cell systems with the power output of over 10MW, which can be installed on board all types of vessels including diesel-powered ships."


Furthermore, DSME entered into cooperation agreement with Korea Institute of Science and Technology in June this year to jointly develop technologies in the field of offshore/onshore energy environment plants and robots. This agreement aims to jointly research into the foundation technologies for the manufacturing and commercialization of offshore/onshore clean energies, shipboard fuel cells, reformer system technologies, etc.

Outlook

Fuel cells that can be used on board ships include Polymer Electrolyte Membrane Fuel Cell (PEMFC), Molten Carbonate Fuel Cell (MCFC), Solid Oxide Fuel Cell (SOFC), etc. Among them, PEMFC is a fuel cell that uses a polymeric membrane as an electrolyte and works at low temperature. Thus, it has excellent load following properties and short start-up times, and therefore is being developed for homes and automotive applications. However, PEMFC is suited for ships with rela-

tively low capacity due to lower efficiency compared to MCFC and SOFC which operate at high temperature.

By contrast, MCFC and SOFC have the advantage of operating at high temperature, have high efficiency and allow the use of various fuels. However, they have long start-up times and therefore are mostly used for high-capacity power generation. Thus, MCFC and SOFC are suited for high-capacity ocean vessels. Thus, it is expected that PEMFC will be installed in small ships while MCFC and SOFC will be installed in large ships. They are expected to carve out significant share of the market segments for shipboard fuel cells.

As SOFC for applications in large ships still remains at the inchoate stage of development, considering current pace of technological advancement, it seems that it will take long time before SOFC becomes usable for power generation on board ships. Hence, MCFC will be installed on board large ships such as ocean vessels for the time being, and MCFC and SOFC are expected to garner significant share of market when SOFC technology can be applied. 



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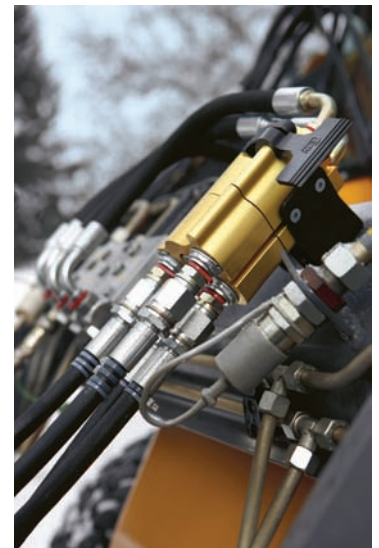
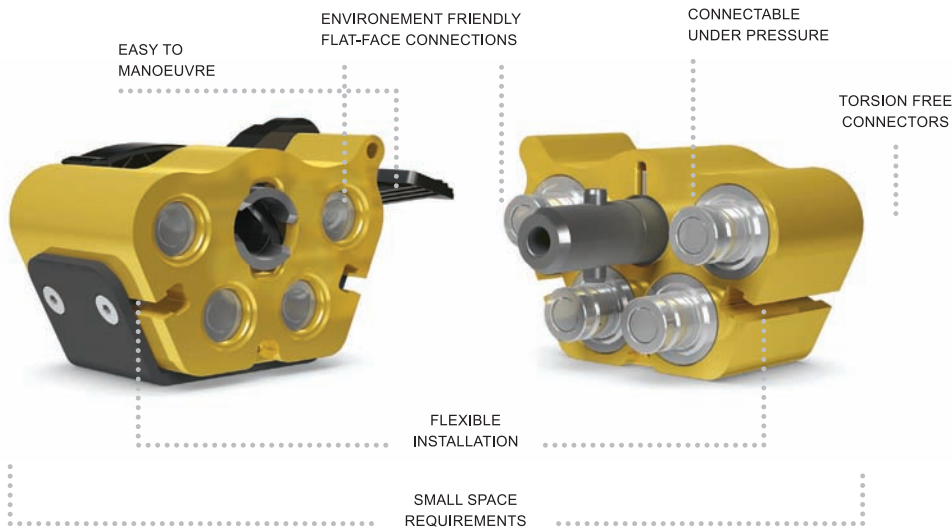
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Nexans operates 3 legal entities in Korea, i.e., Kukdong Electric Wire, Nexans Korea, and Nexans Daeyoung all which have different areas of business. Kukdong Electricwire supplies the cables for the shipbuilding & offshore facilities and local area network, and Nexans Korea specializes in the cables used in automobiles, communication and power network and utilities. Nexans Daeyoung provides cables and cabling solutions for the buildings.

Daesung Cable, whose foundation dates back to 1960, was renamed to Nexans Korea in 2001. Kukdong Electric Wire, founded in 1969, became a member of Nexans Group in 2003 and has



Kang In-koo, CEO of Kukdong Electric Wire

focused on marine cables for ships.

Kukdong Electric Wire has developed and manufactured the cables used in ships and offshore facilities since its establishment, and has gained reputation as the world's leading manufacturer and supplier of the onboard marine cables manufactured by incorporating the world's best technology. Specifically, Kukdong Electric Wire has climbed to the high growth path in tandem with the domestic shipbuilding industry, thus playing a key role in the nation's economic growth.



Factory of Kukdong, Jincheon

The turning point for Kukdong Electric Wire came in 2003 when it became a member of Nexans Group, the world's leader in the cable industry, thus paving the way for another great leap forward. Kang In-koo, CEO, stressed, "Kukdong Electric Wire currently specializes in the marine cables for ships and offshore facilities and has proceeded with the marketing efforts to move beyond the Korean market and serve the markets around the globe."

In particular, the merger between Nexans and Kukdong Electric Wire has created synergic effect for both companies. Nexans has become the undisputed No. 1 company in the field of marine cables used in ships and offshore facilities and expanded its production base in Asia, the world's fastest growing region. That is consistent with the Nexans Group's policy for scaling up investment in the developing regions and growing markets.

Meanwhile, Kukdong Electric Wire has been allowed to have access to the latest technology, global sales network, advanced business management techniques of Nexans, which are essential for the company's transformation into a global company. As a majority of ship owners are concentrated in Europe, Nexans which is already registered as a vendor is better-positioned to enter European markets than unregistered domestic companies. In addition, Nexans can deliver whole products in full package much faster through its plants worldwide.

Kang In-koo, CEO, said, "Jin Cheon Research Center of Kukdong Electric Wire was promoted as the 4th Nexans Research Center of Nexans Group last year, and has focused on the material field (rubber compound, rubber extrusion) in collaboration with other research centers. I am proud that Jin Cheon Research Center became a new addition to the 3 Nexans Research Centers located in Lyon, Lens, and Nuremberg in Europe, respectively."

Nexan's marine cables for ships

Currently, Kukdong Electric Wire manufactures a broad range of cable solutions and services for ships, offshore facilities, ports and harbors, LAN, nuclear power plants, etc, among which marine cables for ships comprise as high as 75%. Kukdong Electric Wire has carved out 17% share in the global market for shipboard cables.

Specifically, Kukdong Electric Wire, Nexans Group's cabling solutions business unit in the shipbuilding and offshore sectors, undertakes the whole processes ranging from the product planning/production through the service to the marketing for customers worldwide.

The marine cables used in the shipbuilding and maritime sectors have to meet more rigorous standards compared to other types of cables. These marine cables for shipbuilding and maritime applications must be composed of fire-resistant and nontoxic materials and furthermore, deep-water subma-



Inside view of factory manufacturing various industrial cables of Nexans



rine cables must be prevented from being chewed by animals such as rodents.

Kang In-ko explained, "Customers' requirements have become more diverse and difficult to meet. For instance, BP requires that the cables should withstand even the water spray in case of fire, as well as flame retardancy."

Putting customers above all else, Nexans is making utmost effort to develop and supply the products that meet the requirements of customers and putting an added emphasis on the communication with them. For that, Nexans is making considerable investment in R&D.

Among the most noticeable products of Nexans for the shipbuilding and maritime applications are included ICE Flex, Shipboard F.O. Cable, and LSHF Cable NEK TS 606.

Nexans launched the cable for application in polar regions amid growing interest in opening up the sailing routes in the Arctic oceans. This cable is called 'ICE Flex'. Cables for polar regions must stand up to the extreme cold in the polar regions, and this product can be cold bended up to -50°C . Previously, the cables had the cold bending at -40°C and

cold impact at -35°C .

Nexans expects ICE Flex to be widely used in Russia and extreme-cold regions, and is considering vigorous marketing campaign targeting these regions.

Moreover, Nexans has begun to develop and supply shipboard F.O. cable as fiber optical communication cables are replacing the existing copper communication cables at a faster pace amid increasing trend for large ships. Specifically, Nexans has played a leading role in the replacement of existing copper communication cables with fiber optical communication cables in the shipbuilding and maritime markets. LSHF Cable NEK TS 606 has enhanced flame retardant and fire resistant properties.

Besides, Nexans is selling HIS cable which was developed jointly with Hyundai Heavy Industries (HHI). HIS Cable was developed based on the Korean standards, instead of foreign standards such as JIS. Specifically, HIS Cable is an upgraded product which can be applied in various ways based on the requirements of customers or regions and are lightweight/low volume product. Besides, this product has



HIS cable

greater flame retardant, cold bending & cold impact, and oil resistant properties.

HIS Cable has drawn favorable reaction from customers since its launch last year, and Nexans expects that this product will be a key contributor to the sales growth.

All products of Nexans are recognized as the world's best. Nexans' manufacturing plants throughout the world strictly control the quality of products, and Nexans is ensuring rigorous quality control to meet the requirements of customers who put more emphasis on

quality. In Korea, Nexans was awarded the silver prize in the National Quality Control Competition in 2008 and acquired the certificate of qualification for nuclear power quality assurance in 2009.

Customer is our top priority value

Kang In-koo, CEO of Kukdong Electric Wire, stressed, "All these products that have been mentioned fully reflected the recent requirements of customers and ship owners. I am convinced that the efforts to understand and satisfy customers' requirements have been vital for Nexans to become the leader in the global cable market and the key factor behind the growth of Nexans."

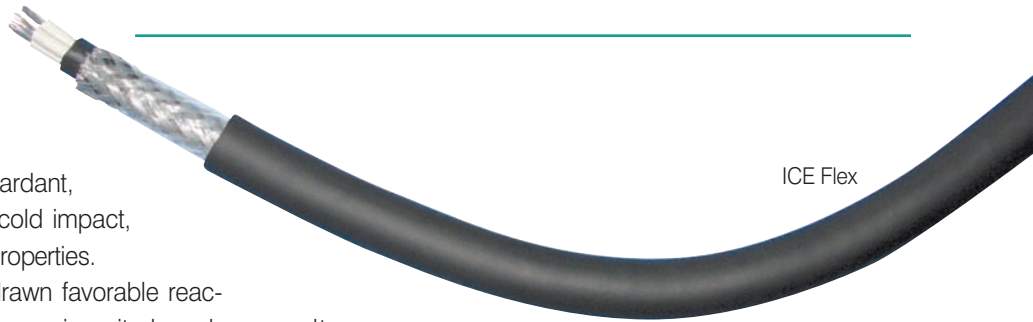
Nexans takes 'Customer Orientation' as top value. Nexans annual meeting in late March this year, which brought together top executives, was a good illustration of Nexans' customer-oriented approach.

The first value important to Nexans is 'Think customer'. Nexans listens carefully to customers, understands them fully, anticipates their changing needs, and creates excellent products, services and value.

The second value is 'Value people'. Nexans recognize people as the source of success. Nexans creates a trustworthy, respectful, and open-minded environment to maximize growth of individuals and expand their capabilities.

The third value is 'Commit to excellence'. Nexans accomplishes excellence in products, production process, and service through shared knowledge, self-development, continuous improvement, safety and best practices.

The fourth value is 'Take action'. Nexans creates a dynamic



ICE Flex

culture

which promotes

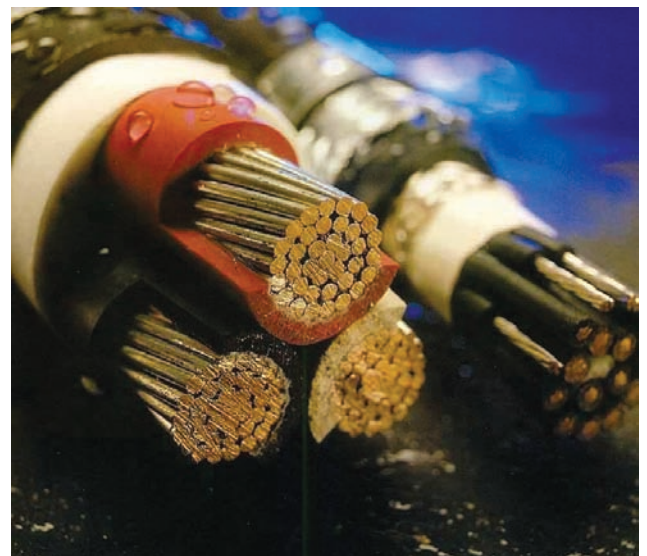
proactivity and innovation in quest for the achievement of its strategic objectives, and predicts and drives the change.

The fifth value is 'Be responsible'. Nexans makes its own decision and takes responsibility for its actions. In addition, Nexans conducts business in a safe and ethical manner and protects the environment.

The six value is 'Work globally in the broad world'. Nexans shares and works together within the Group and collaborates beyond the organizational boundary and promotes the sharing of information and knowledge.

Kang In-koo, CEO of Kukdong Electric Wire, stressed, "Customers, people, excellence, action, global collaboration are all important values. However, customers and people are listed before other values because they are more important. We take customers as top priority because customer satisfaction is key to our growth, advancement, and success in the challenging and changing market environment. Therefore, our most important mission will be how we will satisfy customers."

He went on saying, "I think that there is strong correlation between happy employees and satisfied customers. As Nexans takes customers as No. 1 priority, I will keep cus-





tomers happy by ensuring excellent quality and strict adherence to delivery schedule and keep employees happy by enhancing safety and welfare. I stand firm in my belief that these things are essential for the revenue growth and advancement of company."

Tapping into new markets

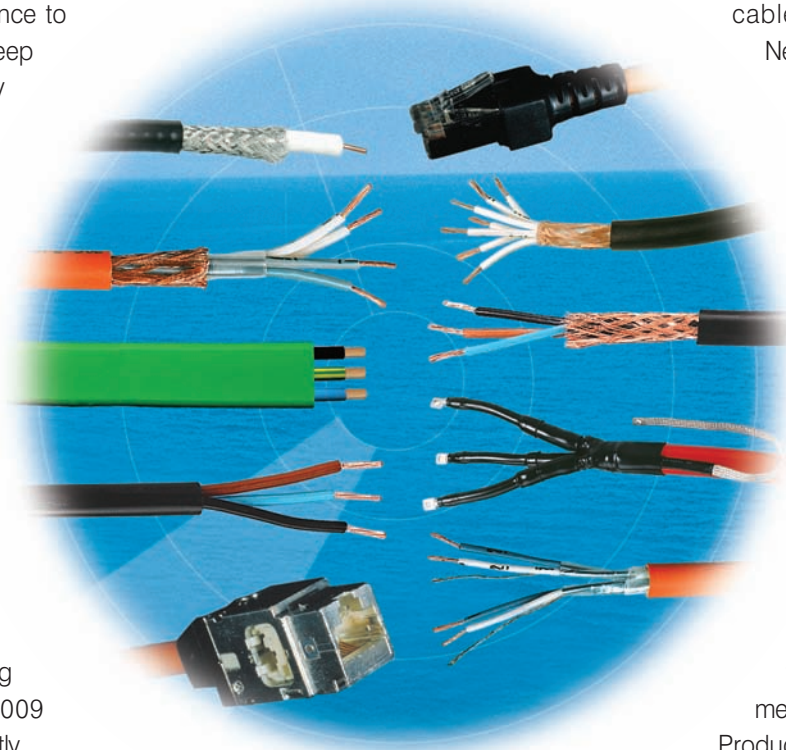
Nexans registered steady growth in the shipbuilding/maritime sectors which peaked in the period spanning between 2008 and 2009 before slowing down slightly. That slowdown came when the new vessel orders sharply fell amid global depression. However, Nexans has begun to rebound since the second half of this year along with the slow recovery of shipbuilding/ maritime industries from last year, and is expected to show growth from 2012.

In particular, Nexans plans to focus on the cables for offshore facilities requiring complex technologies, rather than merchant vessels which are under pressure of fierce price competition.

Kang In-koo said, "There has been a soaring demand for deepwater offshore facilities recently. We have already developed the deepwater submarine cables and built a global network encompassing Europe, United States, and Asia to immediately respond to the requests of customers anywhere. So, Nexans will be in the front lines of the offshore market in the years ahead."

Along with that, Nexans will further sharpen its competitiveness through the cost-saving and development of compound in order to effectively target the markets for LNG carriers which are dominating the global orderbook recently.

Meanwhile, Kang In-koo, CEO of Kukdong Electric Wire, said,



Nexans' marine cables for shipbuilding and maritime applications

"Currently, it can be said that the cable market is saturated.

Nexans will pursue gradual growth while maintaining its current market share."

He added, "Nexans' growth strategy is to supply new products and tap into new markets while retaining the leading position in Korea and Japan. For example, Nexans has

recently expanded its list of items that meet the qualification requirements of U.S. QPL (Qualified Product List) and German VG certifications amid growing demand in the defense industry. Nexans' interest in foreign markets is consistent with such

growth strategy."

Nexans was granted approval from U.S Navy QPL to supply cables in 2006, and is actively seeking to enter the North America market.

To achieve the growth target, Nexans will vigorously support customers by constantly participating in related trade fairs at the Group level and offering various programs such as technical seminar, field trip to factory, etc.

Additionally, Nexans will spur R&D to increase customer satisfaction. In line with the current trend of R&D toward the conductors away from the sheath (strength, elasticity, etc), Nexans is currently researching on the alloys that are cheaper but retain the electrical conductivity of copper while pouring more energy into the research on conductors.

Nexans plans to leverage the results of such research to cope with challenging operating environment and meet requirements of customers which become increasingly difficult to fulfill. ⚓

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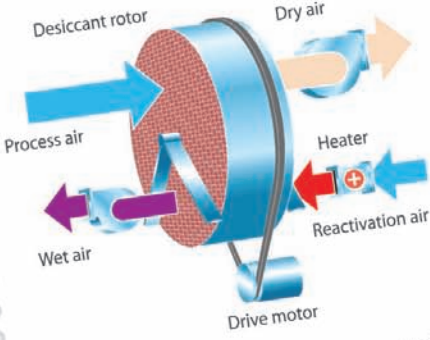
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MAN L27/38 Package specified for new advanced Cattleya-trawler at Karstensens Shipyard

Esbjerg-based Danish owner Flemming Pedersen has ordered a replacement for his 2006-trawler - scheduled for 2012 delivery, but now larger, more advanced and again powered by MAN Diesel & Turbo's L27/38 propulsion package.

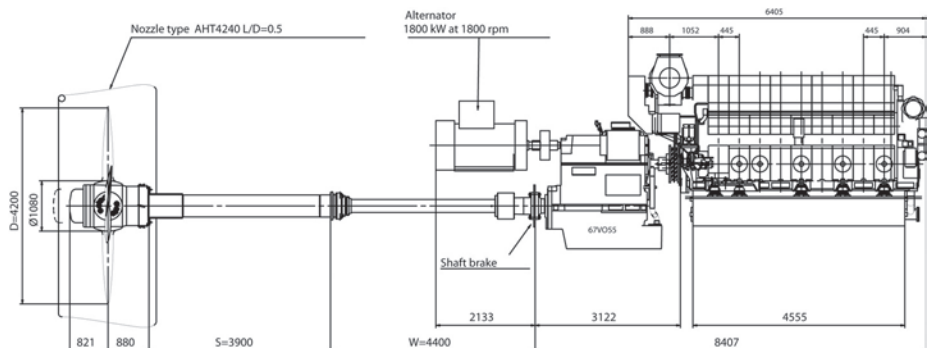
Esbjerg-based Danish owner Flemming Pedersen has ordered a replacement for his 2006-trawler - scheduled for 2012 delivery, but now larger, more advanced and again powered by MAN Diesel & Turbo's L27/38 propulsion package.

The complete main propulsion package concept has earned over several decades its favourable position in a number of ship segments - amongst others for medium to large-size fishing vessels. As a matter of fact the original 4 hp Alpha CP Propeller based propulsion package concept materialised for a fishing vessel as early as in 1903.

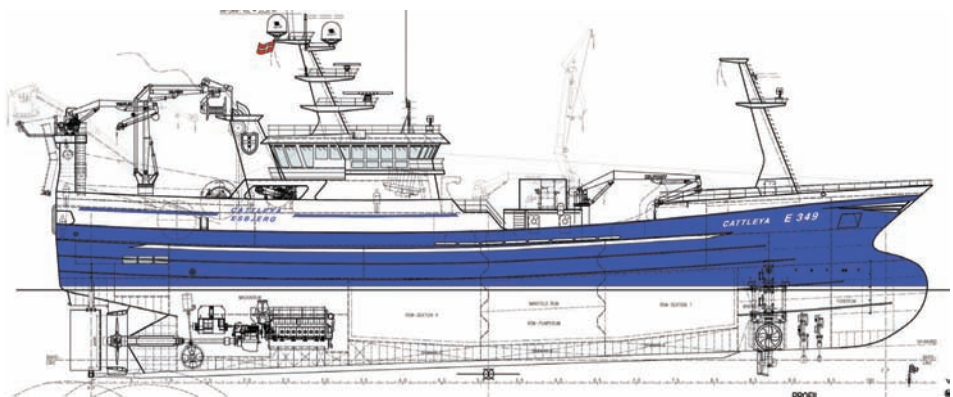
Today's about 4,000 hp propulsion package for the new 'Cattleya' will include main engine and box coolers, reduction gear with hydraulic shaft brake and a 1,800kW PTO and shaft alternator, propeller shaft line, stern tube, propeller and propeller nozzle - together with a complete propulsion control and safety system with manoeuvre stations for

four bridge positions. The newbuilding number from Karstensens Shipyard is 420 and the number for the current Cattleya was 399.

The name Cattleya will be continued from Flemming Pedersen's current vessel and a quick comparison of the ves-



'Cattleya's' 9L27/38 propulsion package outline



Shipyard's GA drawing for 'Cattleya'

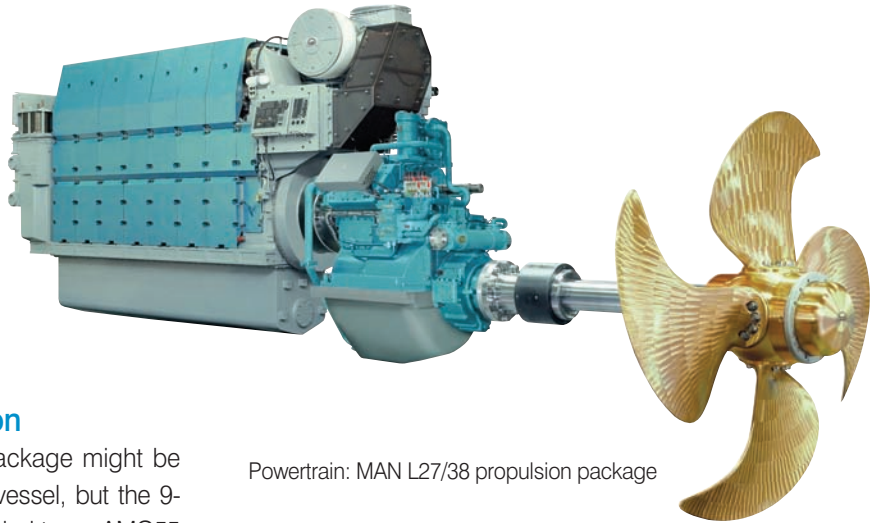
sel specifications show a radical capacity step-up. The length oa grows from 62.6 to 69.9 metre, and with 1.4 metre additional width the tonnage increases from 1,337 to 1,750. Furthermore the new vessel is based on state-of-the-art shipboard equipment and new design solutions together with the fine craftsmanship from Karstensens Shipyard.

Beneficial propulsion optimisation

The MAN L27/38 powered propulsion package might be seen as a direct repeat from the current vessel, but the 9-cylinder 2,999kW Tier-II engine will be coupled to an AMG55 (Alpha Module Gear) gearbox with a large speed reduction ratio of 800:119 r/min for an even larger and more efficient 4.2 metre ducted CP Propeller.

The new high-efficient AHT (Alpha High Thrust) propeller nozzle has been specified in this case for 'headbox' mounting. The optimisation and adaptation of the large propeller and nozzle into the vessel's aft ship design has been carried out in close cooperation with Karstensens' naval architects and engineers.

A propeller and propulsion-optimised aft ship solution equals energy optimisation, resulting in fuel consumption savings and less exhaust gas emission. The fine tuning of the final propeller blade design has been based on a careful assess-



Powertrain: MAN L27/38 propulsion package

ment of the vessel's predicted operational power/speed/duration profiles - considering the compromises in finding the perfect design solution for e.g. high-speed steaming and maximum pulling power efficiency at trawling speed with suppression of cavitation and noise.

Floating frequency

As a result of the vessel's floating frequency system (from 60 to 50 Hz), the propulsion system is also able to operate in 'shaft alternator mode' with reduced engine and propeller speed. With this part-load optimisation feature, offering up to 16.7% lower engine/propeller speed, the fuel consumption is further reduced.

Additionally, the vessel's electrically-driven retractable 800kW azimuth thruster propeller can be deployed for low power propulsion, standby, take-home and manoeuvring modes.

Cattleya - main data

Yard: Karstensens Shipyard, Skagen, Denmark

Yard number: 420

Delivery: October 2012

Owner: Cattleya A/S, Flemming Pedersen, Esbjerg, Denmark

Length oa: 69.6m

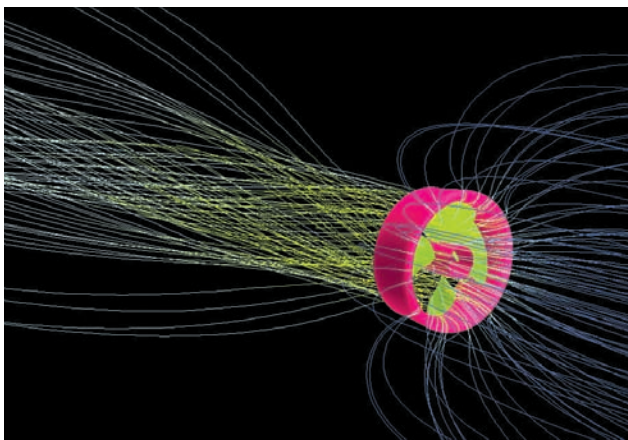
Width: 14.2m

Dept: 8.70m

Gross tonnage: 1,750

Speed: 16kn (estimated)

Bollard pull: 68 tons (estimated)



CFD graphics of AHT propeller nozzle: Compared to ordinary 19A nozzles, the new Alpha High Thrust design is normally characterised by a 6-8% bollard pull improvement and a lower drag at free sailing speed



Today's E349 'Cattleya' - delivered in 2006

Propulsion packagea

Engine: MAN 9L27/38

Power: 2,999kW at 800r/min

Reduction gear: MAN Alpha AMG55

Type: 67VO55

Reduction ratio: 800:119r/min

Propeller: MAN Alpha CPP

Type: VBS1080-ODG

Diameter: 4,200mm

Propeller nozzle: MAN Alpha AHT

Type: FD4240

Controls: Alphatronic 2000

Type: PCS & LMCS (Propulsion Control System & Local Monitoring Control and Safety System)

More fishing vessel propulsion in the pipeline

The MAN L27/38-based propulsion package is popular for high-end Scandinavian and North Atlantic fishing vessels, and Karstensens Shipyard is well positioned in this market. Other recent fishing vessel orders from the yard to be powered by the 2,999kW L27/38 propulsion packages from MAN Diesel & Turbo, Frederikshavn are:

- 'Havsnurp' (newb 419) - for Havsnurp AS (Kjell Inge Hole and Karstein Stølen, Norway)

- 'Gollenes' (newb 415) - for Gollenes AS, (Frode Kvalsvik & Asbjørn Ose, Norway)

- both vessels are 62.6m 1,375GT combined purse seiner trawlers - and continues the earlier L27/38-powered 'Strømegg', 'Western Viking' and 'Girl Stephanie' deliveries.

Assembled and tested in Denmark

Even though the Frederikshavn foundry, engine machining and engine production facilities of MAN Diesel & Turbo closed down last year - delivery of Danish assembled and tested L27/38 propulsion engines (a limited number per year) is still possible together with the MAN Alpha propeller and aft ship equipment.

Today, MAN Diesel & Turbo in Frederikshavn employs about 470 people with primary focus on R&D and sales of propeller and aft ship equipment, sales of medium-speed engines and propulsion packages for offshore vessels, work boats, tugs and fishing vessels - and the associated PrimeServ after sales, spare parts, upgrade and retrofit services. 



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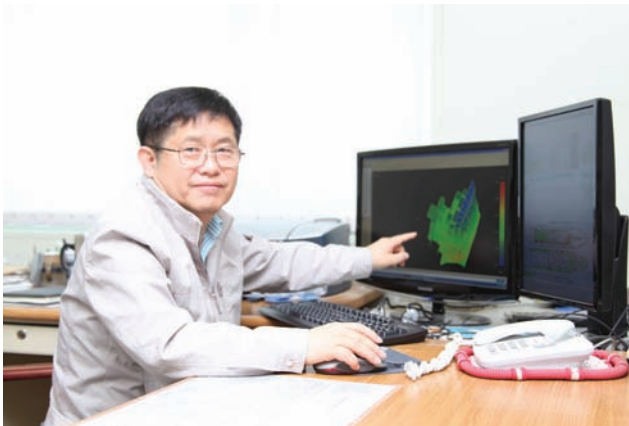
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Quick analysis of ship noise

Korea Institute of Machine & Materials (KIMM) recently developed TONAS, a new program for integrated analysis of ship noise, which enables quick verification of underwater radiated noise and cabin noise generated by various factors such as engine or power generator.



Dr. Kim Jae-seung at KIMM explains 'TONAS', a new program for integrated analysis of ship noise.

Total Noise Analysis of Ship (TONAS) was developed for the first time nationwide, which allows quick examination and verification of both underwater radiated noise and cabin noise generated by various factors such as ship engine or power generator, etc.

The research team led by Dr. Kim Jae-seung in the System Dynamics Lab at Korea Institute of Machine & Materials (KIMM) successfully developed TONAS which enables analysis of noise throughout ship and graphic representation of quantitative data related to the effects of soundproofing measures.

This new program enables examination of underwater radiated noise, as well as the noise measured in cabin, and therefore allows operators to comprehensively identify the source of noise generated both inside and outside ship and the effects of soundproofing measures. The intensity of underwa-

ter radiated noise has been regulated because it can affect military operations and has huge impact on marine biology.


As TONAS enables comprehensive evaluation of noise generated by ship, it can shorten the time needed to analyze noises when designing high value-added ships such as passenger ships that require low noise propulsion.

Furthermore, TONAS enables convenient visual monitoring of soundproofing measures to proactively determine whether the soundproofing measures are appropriate. Previously, effect of soundproofing measures had to be manually checked one by one, which added difficulty in evaluating the impact of soundproofing measures for ship.

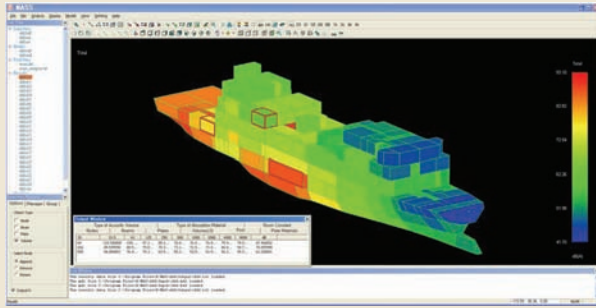
Ship noise analysis techniques developed thus far involved time-consuming process of separately analyzing the cabin noise and the underwater radiated noise for full ship modelling, etc.

By contrast, this new program called 'TONAS' enables sharing of the results of analytical modelling that segments the hull into several specific systems, thereby reducing the time needed for analysis and allowing simultaneous ascertainment of the results.

Dr. Kim Jae-seung, the principal researcher, remarked, "TONAS, a new program for integrated analysis of ship noise, is expected to make significant contribution to the advancement of nation's ship design and evaluation technology because it enables comprehensive verification of effects resulting from the use of new soundproofing materials, as well as the low noise design of existing ships."

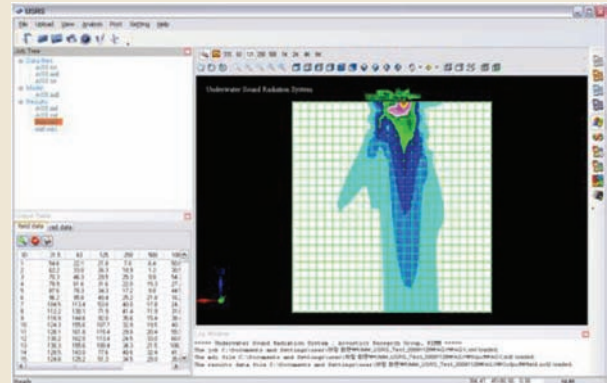
Meanwhile, the core programs (NASS, GLNASS*, etc) of this new integrated program completed registration in Korea, and the integrated program will be registered and commercialized soon. 

*NASS (Noise Analysis of Ship Structures), GLNASS (Graphic Library of Noise Analysis of Ship Structures): the programs, on which basis TONAS was developed



(1) Cabin noise analysis mode on the screen

On the screen, it can be seen at a glance how the ship cabin is affected by the noise propagated throughout the ship through diesel engine, etc, at the engine room near the bottom of ship. Cabins closer to the engine room near the bottom of ship show high noise level (red area, max. 93dB (A)), while those located on the upper area show low noise level (blue area, min. 42dB (A)). The noise level in the important cabins (residential area for crew) located in the mid area of ship ranges between 60 and 70dB (A), which suggests that appropriate soundproofing is required. This program can add various soundproofing measures such as sound absorption, noise barrier, floating floor, etc, and enables verification of appropriateness of soundproofing measures by comparing the noise level after soundproofing measures are put into place.



(2) Underwater radiated noise analysis mode on the screen

The screen shows the results of the analysis on the noise radiated into the water outside the ship. The results of analysis shows the pattern of noise radiation, as well as the intensity of noise radiated from the ship into the water. Particularly, the screen shows the distribution of intensity of underwater radiated noise throughout the full ship, thereby enabling the verification of major source of underwater radiated noise. In the Fig., the noise level is highest (red area) at the place close to the propeller and engine room, while the intensity of noise decreases gradually in proportion to the distance from the ship. Besides, it can be seen that the radiation pattern of underwater radiated noise is not circular but downward in terms of orientation.

Fig. 1 TONAS, a program for integrated analysis of ship noise, on the screen

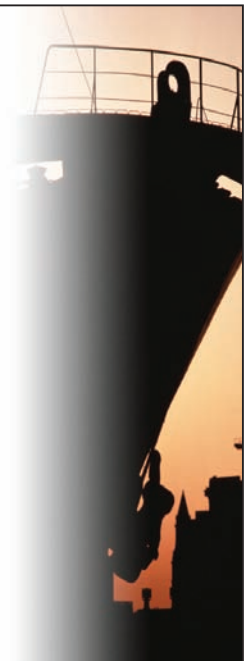
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World's first mobile after-sales service for ships

Hyundai Heavy Industries (HHI) recently developed 'm-PASS', the world's first mobile after-sales service, and began to provide the service from August.



Employees of Noble Drilling Holdings, a U.S.-based drilling company, are checking the information related to the after-sales service for ships using the smartphone.

Hyundai Heavy Industries (HHI) launched the mobile after-sales services for ships using the smartphone for the first time worldwide.

HHI developed 'm-PASS (<http://mpass.HHIshipAS.com>)', a mobile after-sales service system which enables quick response to the requirements of customers, and began to offer the service from August.

This system, developed independently by HHI, enables the ship owners to log onto the website with smartphone and register/search the problems of various equipments installed in ships and immediately check the information related to ships, maintenance personnel in charge of after-sales service, equipment manufacturers and others.

This system allows the problems to be resolved immediately without any constraint of time and space, thereby preventing the problems from escalating and saving the costs incurred

in providing after-sales services. With this mobile system, after-sale service staffs of HHI can check the information related to ship owners and equipment manufacturers, sailing schedules, technical information, etc, and exchange ideas.


This system enables HHI to conveniently accept and resolve problems using smartphone anywhere and anytime and thus is expected to further increase customers' satisfaction with HHI's after-ship service for ships.

Darrell Janssen, a supervisor at the U.S.-based Noble Drilling, said, "Now, we can instantly take and transfer the photos of problematic equipment of ship with smartphone and discuss with related maintenance personnel of HHI. It increases our trust towards the ships built by HHI."

HHI has already operated 'e-PASS', an website dedicated to the after-sales service, since August 2001, which enables the customers to resolve various

problems of ships conveniently in the cyber space, ranging from the delivery to the dismantling, and have access to a variety of information.

HHI developed m-PASS system from March, which allows customers to search necessary information easily and conveniently based on e-Pass and plans to provide after-sales services using smartphone even for marine engines in the period ahead.

Meanwhile, HHI has increased its core competitiveness by converging the information technology (IT) and shipbuilding technology recently. Specifically, HHI built the WiBro communication network, a high speed wireless data communication network, throughout its shipyards for the first time worldwide in May last year and became the world's first builder of Smart Ship in March this year which enables remote control and management of ships from onshore location. 

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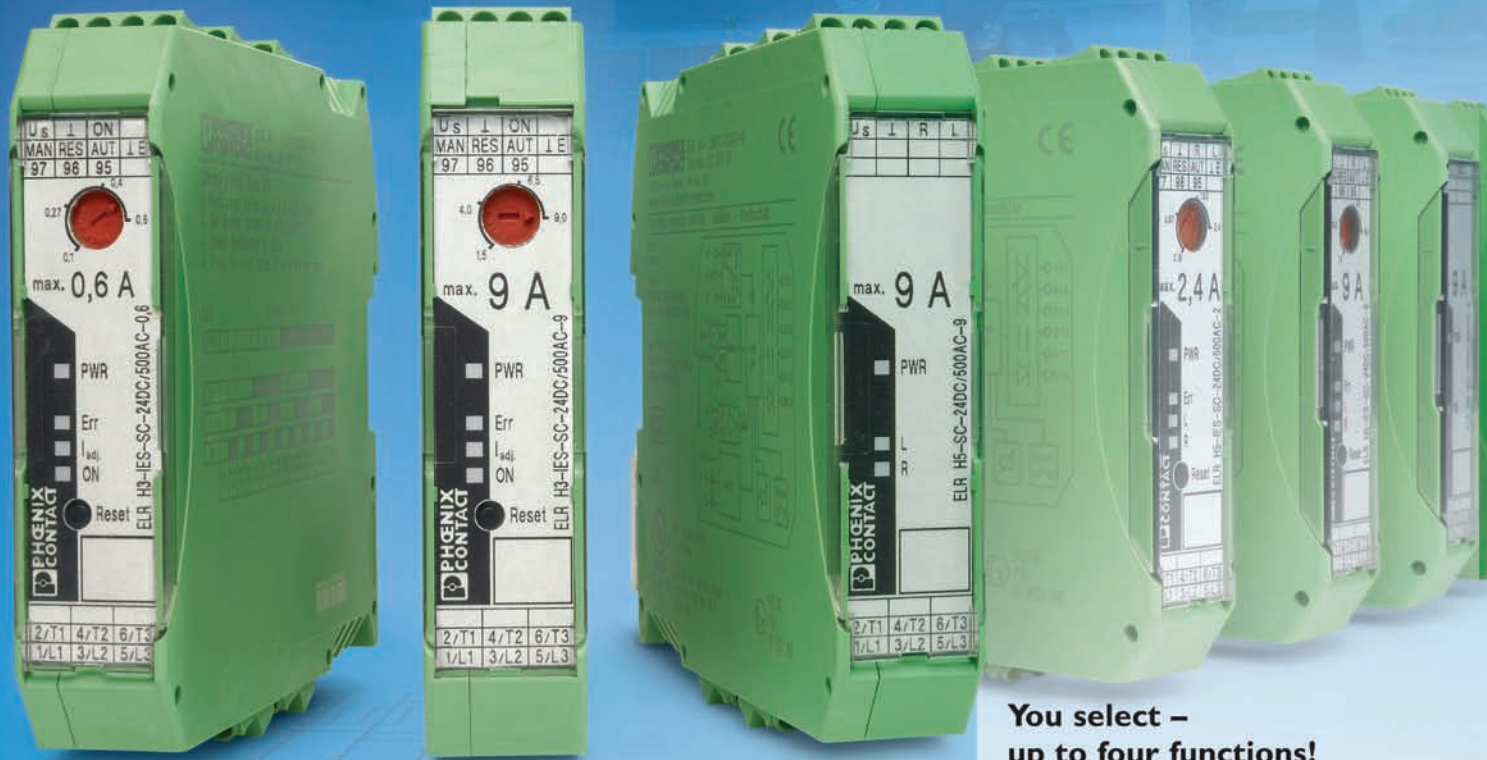
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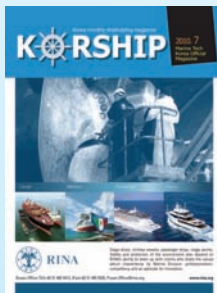
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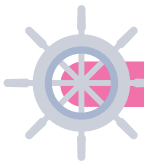
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Rapid rise of Indian ship repair industry

Indian ship repair industry is found to hold great potential for further growth according to the data released by KOTRA recently. That is because the Indian ship repair industry has secured competitive advantage attributable to India's geographic conditions and relatively low labor costs.

The ship repair industry has come into limelight as one of the industries holding out great potential for growth in India according to the data published by KOTRA recently.

The history of modern ship repair industry in India began in Bombay (currently Mumbai) in 1750, and India's ship repair industry has continuously shown strong performance since 1947 when the country gained its independence from British colonial rule.

The potential size of Indian market for ship repair is projected at approximately 44 billion rupees (USD 990 million) yearly, considering the Indian ships and foreign ships that call at Indian ports. However, the Indian ship repair industry has seen the customers attracted to its major competing countries, e.g., Singapore, United Arab Emirates (UAE), Bahrain, etc, for reasons such as poor infrastructure, including the underdevelopment of industries related to the ship repair industry. Consequently, Indian companies in the Indian ship repair sector have a combined annual sales of no more than approximately 11 billion rupees (USD 250 million) which is only a quarter of the potential market value.

Currently, there are about 10 large repair shipyards and 40 to 50 small and medium-sized repair shipyards in India. 35 repair shipyards have been officially registered with the Directorate General of Shipping of India.

Repair shipyards can obtain certificate for business registration. They can be eligible for various tax exemptions only after being registered with the Directorate General of Shipping of

India. Only a total of 7 repair shipyards have obtained permanent certificates for business registration among those registered, such as Alcock Ashdown & Co, Chennai Port Trust, Cochin Shipyard (CSL), Garden Reach Shipbuilders & Engineers (GRSE), Hidustan Shipyard (HSL), Mumbai Port Trust (MbPT) and Mazagaon Dock (MDL).

Among the most prominent repair shipyards in India are included CSL, HSL, Western India Shipyard, MDL, ABG Shipyard, etc.

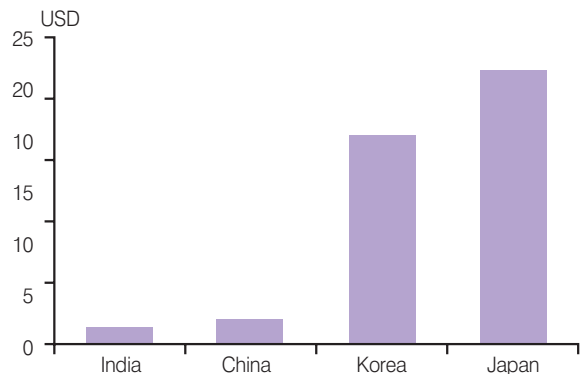
Why India?: Factors of competitive advantage

First, the key factor behind the competitive advantage of Indian ship repair industry are India's the strategic location and low labor cost.

India is surrounded by sea on 3 sides, and forward-looking and savvy Indian merchants have played a pivotal role in the intermediate trade flow mainly from the regions such as Gujarat, Tamil Nadu, Kerala to the area connected to the North-South and East-West corridors, serving the markets in the Middle East, Africa and South East Asia since long before. In addition, India has become one of key hubs along the international trade routes of the Indian Ocean and is expected to see the trade volume increase further. Thus, the



The most prominent repair shipyards of India



Source: EIU, KPMG Analysis

Fig. 1 Cost of labor a day (2008)



interrelated shipbuilding and ship repair industry are very likely to accomplish strong growth.

Second, the labor cost in India is relatively low compared developed countries and other emerging economies. The annual sliding cost per person is USD 1,200, which is USD 21,000 lower compared to Korea or Japan, the world's leading shipbuilding countries.

Factors hindering the growth of ship repair industry

Indian companies have been unable to meet the demand despite their differentiated competitive advantage. In overall sense, 9 types of problems have been stumbling blocks for the private-sector investments in the ship repair sector and weakened the growth potential.

- High cost of investment, high tax rates, outdated and rigid labor law
- Old equipment and machinery
- Outdated repair process and techniques
- Insufficient skill update and lack of job skill training system
- Lack of ability for professional operations
- Problems in the supply due to poor domestic infrastructures for the production of raw materials and spare parts
- Excessively high reliance on the public sector for winning the orders
- Complex and inconvenient government regulations

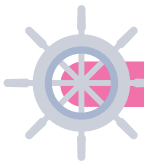
- Excessively low labor productivity

The Indian government is making efforts to ease regulations and attract direct foreign investment despite weak foundation of related industries.

The global ship repair market is projected to be worth USD 10 billion to 12 billion. However, the current size of Indian ship repair market is estimated to be worth no more than USD 100 million, which leaves much room for the future growth of Indian market for ship repair. In India, there is only one repair shipyard which is the Western India Shipyard, and most shipyards in India carry out both newbuilding and repair works in contrast to China that has as many as 176 shipyards specializing in repair of vessels. India recently completed construction of several repair shipyards and plans to build more in the region along the east coast of India adjoining the Bay of Bengal, as well as the west coast of India adjoining the Arabian sea.

Suggestions

Indian ship repair market is growing fast. Although the weak foundation of related industries hinders the growth in revenue, sales have steadily increased. India has seen the demand for ship repair increase every year, and the revenue growth is expected gather momentum if the foundation of related industries becomes solid. With the india's domestic



trade volume expected to growth by 14% yearly over the next 5 years, the Indian government is moving to make significant investment in the ship repair/shipbuilding industry.

Noticeably, the Indian government has eased regulations that limit the percentage of equity for foreign direct investment in the private-sector shipbuilding industry including the repair shipyards, thus allowing the ratio of foreigners' investment up to 100% which means complete liberalization.

Foreign investors are also showing interest in making investment in the sectors related to the shipbuilding industry of India. Particularly, Japan is expected to make an increased investment in India. Japan has directed an increasing percentage of foreign aid to India every year and offered 1.179 billion yen (approximately KRW 13,884,600,000) in grants for

supporting technical collaboration recently.

The Indian state of Gujarat, situated on the west coast of India, has emerged as the hub of the nation's ship repair industry. The state of Gujarat, which has come to the spotlight as a global manufacturing hub, is the most industrialized region in India and has been considered as the top-rated region suited for investment in socioeconomic infrastructures according to the survey of Deutsch Bank. The state of Gujarat, which encompasses 1,600-km long coastline, has modernized port facilities and plans the construction of global standard shipyards. In particular, the state of Gujarat, which generates 25% of container traffic, has been one of the major magnets for foreign investment in shipbuilding and ports and therefore Korean companies interested in launching ship repair business in India needs to pay attention to this region.

Rosy prospects for indian shipbuilding industry

In relation to Indian shipbuilding industry, the demand for bulk carriers and containerships in the Indian maritime industry increased as the country has maintained double-digit growth in international trade volume since 2000 in the wake of the policies that promoted liberalization.

In addition, the soaring demand for energy has led to an increase in the construction of offshore oil/gas drilling facilities. Furthermore, Indian government's plan for naval modernization and capability build-up has prompted a sharp

Table 1. Trends of new orders received by Indian repair shipyards over the last 5 years

(Unit: USD 1 million)

Shipyards	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	Total
CSL	42.7	47.2	49.4	50.6	52.8	242.7
HSL	44.9	47.2	49.4	49.4	51.7	242.6
MDL	0.7	0.7	0.7	0.7	0.7	3.5
Western India	12.4	14.6	16.9	19.1	21.3	84.3
ABG	3.4	4.4	5.9	8.3	11.9	33.9
Vipul Shipyards	0.5	0.6	0.7	0.8	0.9	3.5
NN Shipbuilders	0.02	0.02	0.05	0.05	0.05	0.19
Two International Standard Shipyards		44.9	134.7	179.6	179.6	538.8
Other shipyards	80.8	107.7	134.7	134.7	134.7	592.6
Private-sector shipyards	22.4	22.4	22.4	22.4	22.4	112
Total	207.82	289.72	414.85	465.65	476.05	1,854.09

Source: Federation of Indian Chambers of Commerce and Industry, Ship Repairing Report



increase in the construction of military vessels, as warships and submarines.

The Indian government's NELP (New Exploration License Policy), which allows even private-sector companies to participate in the drilling and development of offshore oil and gas, has led to an increase in new orders for Offshore Supply Vessel (OSV).

Besides, Indian Navy is recently placing a growing number of new orders for warships, including patrol boats, destroyers, submarines, etc, to strengthen the naval power amid territorial dispute with China.

The Indian government is modernizing both maritime and shipbuilding industry at the same time. Private-sector shipyards which have strong competitive edge, such as ABG Shipyard, Bharti Shipyard, Pipavav Shipyard, are vying for bigger slice of the ship repair market, while state-run ship-

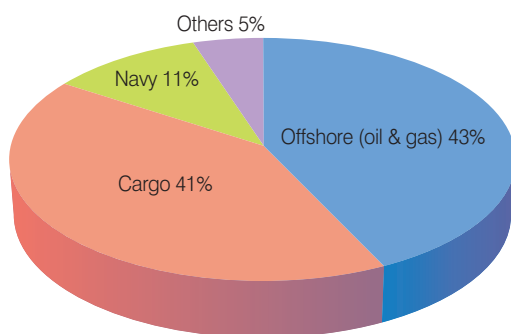
yards which went into decline have been revitalized. Despite the delay in the investment due to the declining volumes of newbuilds in the aftermath of global financial crisis in 2008, new shipyards, such as Pipavav Shipyard, Larsen Toubro (Ennore, Hazira), were built and have achieved remarkable growth to the extent that they are winning orders from European ship owners.

India is the world's 7 largest shipbuilder in terms of new orders. The combined orderbook for top 14 shipyards of India stands at 249 vessels of 4.9 million DWT as of June, 2009. They have accomplished unprecedented growth as their combined orderbook, valued at only USD 350 million in 2002, rose at an annual growth rate of 61% to reach USD 3.18 billion in 2006. Most orders have been awarded from the ship owners of Scandinavian countries, United States, and Europe.

Indian government is pushing ahead with the modernization of shipbuilding industry to stimulate growth of maritime and shipbuilding industries as part of effort to expand and upgrade the nation's industrial infrastructures. Private-sector shipyards plan to invest about USD 4.3 billion over the next 5 years for the modernization and expansion of shipbuilding facilities, while the India's Ministry of Shipping which is currently operating 4 state-run shipyards plans to inject USD 1.2 billion by 2012 for the expansion of shipbuilding capabilities. The annual delivery and shipbuilding capacity are expected to increase from 900,000DWT in 2010 to 2.5 million DWT.

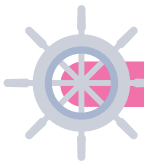
India has an advantage by virtue of its lower cost of labor and advanced industries in related sector, such as petrochemical, steel, mechanical, electric/electronic, engineering industries. Besides, India which has high reliance on imported energy and resources has dramatically increased the import of coals and raw materials for energy production, thereby laying the groundwork for the development of shipbuilding industry. India is expected to see a steady increase in demand for vessels, considering several factors such as the soaring demand for cargo ships, Indian government's policy to develop shipbuilding and logistics industries, expansion of Indian commercial fleets, naval buildup, growing demand for yachts among the wealthy class of India.

The development of inland waterways/offshore oil fields and expansion of drilling operations are expected to lead to an increase in demand for warships, offshore carriers, bulk carriers, passenger boats, fishing boats, general cargo carriers, mega yachts, oil tankers, inland carriers, boats, offshore oil



Source: Mantrana Maritime Advisory Pvt. Ltd. 2009

Fig. 2 Share of new orders received by Indian shipyards by purpose of vessel



and gas drilling rigs, etc.

With the discovery of natural gas in KG Basin off the coast of Andhra Pradesh, India, and Mumbai offshore gas field, new orders for OSV, etc, are expected to be awarded steadily from ONGC, Reliance Industries, etc. Particularly, 48.2% of OSVs are over 26 years old and over 35% of bulk carriers are over 20 years old, which raises the prospect for steady increase in the demand for replacement of vessels. Thus far, shipping companies of India placed new orders with China, Korea, Japan, and Norway. However, they began to award some newbuilding contracts to Indian domestic shipyards amid modernization and expansion of domestic shipyards. Indian commercial fleets rank 19th worldwide based on ship owners and have diversified the fleets with the tankers comprising 41% of total ships, the largest followed by bulk carriers (43%) and other types of ships (11%). The average ship age is 19.

Meanwhile, the Indian government's policy to pay subsidies to shipyards expired on August 14, 2007. Under that policy, 30% subsidy on the bid price was paid out to the shipyards

on export orders for all sizes of ships and domestic orders for ships measuring over 80m in length. The subsidy scheme was extended by another 5 years to help build up competitiveness of domestic shipyards in the global market. The Finance Ministry of India expects a payout of approximately Rs 35,000 to 40,000 crore in subsidy over the next 8 to 10 years if the current subsidy criteria continues to be used.

The tonnage tax relief has been extended to cover individual ship owners, so that Indian shipping companies can purchase ships. The Sagar Mala project, announced by Government of India (GOI), aims to develop new ports, modernize and expand existing ports, link all highways and major ports, etc, with a total investment of Rs 100,000 crore (USD 25 million) for the next 8 to 10 years.

Under the Sagar Mala project, foreign investment in shipbuilding and ship repair sector will be allowed up to 100%. Additionally, automatic approval system has been put in place to allow the obtainment of all types of ships. Indian government's support for domestic shipbuilding industry is expected to continue. 

National Instruments expands NI CompactDAQ Platform with single-slot chassis

National Instruments (NI) announced new 1-slot NI CompactDAQ chassis that support wireless, USB and Ethernet buses, giving engineers and scientists the portability of a data logger with the performance and flexibility of modular measurements recently. The NI cDAQ-9191, cDAQ-9181 and cDAQ-9171 chassis support all NI C Series modules for the NI CompactDAQ platform and can be used in conjunction with the existing 4- and 8-slot chassis. With modules designed for almost any sensor, the NI CompactDAQ platform eliminates the fixed functionality of traditional sensor measurement systems and gives engineers and scientists the ability to increase productivity while decreasing overall cost.

New metal enclosures make the chassis more resistant to environmental damage as compared to the previous plastic sleeves. The chassis operate in a temperature range of 0 to 55 degrees Celsius and can withstand up to 30 g shock and 3 g vibration, making NI CompactDAQ 1-slot chassis ideal for demanding test applications on the benchtop, in the field or on the production line.

“The addition of the new wireless, USB and Ethernet 1-slot chassis demonstrates our commitment to expanding the NI CompactDAQ modular data acquisition platform,” said Kevin Schultz, National Instruments vice president of research and development. “These chassis can be used with more than 50 C Series modules which make it possible for engineers and scientists to build flexible, scalable measurement systems for portable and distributed applications.”

More than 50 measurement-specific modules featuring multiple electrical and sensor connectivity options can be combined with any chassis to create customized systems specific to the needs of numerous applications. NI Signal Streaming technology delivers high-bandwidth capabilities that make it possible to achieve sustained high-speed and bidirectional data streams over USB, Ethernet and wireless buses. Zero configuration networking technology simplifies initial setup, eliminating the need for IT involvement in network setup and integration.

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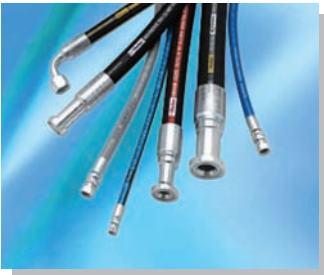
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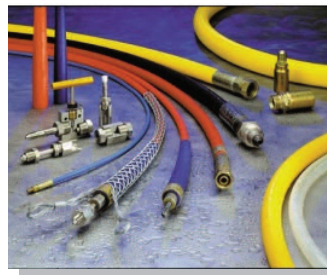
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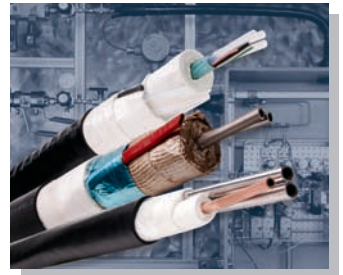
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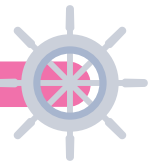
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3 major domestic shipyards experienced slowdown in the second quarter

3 domestic shipbuilding giants recorded an increase in sales and decrease in operating profit compared to the same period of previous year, according to the performance reports on the second quarter, 2011, which were published by these shipbuilders recently.

Recently, domestic shipbuilding giants such as Hyundai Heavy Industries (HHI), Daewoo Shipbuilding & Marine Engineering (DSME), and Samsung Heavy Industries (SHI), etc, published their sales performance for the second quarter of 2011. The combined sales of the 3 shipbuilders rose com-

pared to the same period of last year, but edged down slightly compared to the previous quarter.

Specifically, their operating profits declined at double-digit rates compared to the previous quarter, albeit difference depending on shipbuilders.

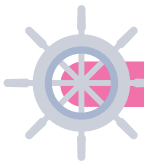


Table 1. Quarterly performance of 3 domestic shipbuilding giants

(Unit: KRW)

		2nd quarter, 2011	1st quarter, 2011	1st half, 2010	2nd half, 2010
HHI	Sales	6 trillion 55.3 billion	6 trillion 306.3 billion	12 trillion 361.6 billion	5 trillion 335.2 billion
	Operating profit	677 billion	9,918 billion	1 trillion 668.8 billion	770.7 billion
DSME	Sales	6 trillion 22.9 billion	3 trillion 51.7 billion	5 trillion 527.2 billion	2 trillion 835.5 billion
	Operating profit	760.4 billion	420.5 billion	341.8 billion	1,955 billion
SHI	Sales	3 trillion 152.7 billion	3 trillion 500.2 billion	6 trillion 652.9 billion	3 trillion 34.8 billion
	Operating profit	325.2 billion	378.7 billion	703.9 billion	259.8 billion

Analysis on the performance in the second quarter

HHI registered KRW 6 trillion 55.3 billion in sales, KRW 677 billion in operating profit, KRW 538.8 billion in current net profit, and 11.2% in the operating gain to revenue according to the report on the second quarter performance (provisional) published by HHI in late July.

That represents 14.6% growth in sales, 10.0% decrease in operating profit, and 16.5% decrease in current net profit, compared to the same period of previous year. HHI registered KRW 5 trillion 335.2 billion in sales, KRW 770.7 billion in operating profit, and KRW 910.5 billion in current net profit in the second quarter of 2010.

An official from HHI said, "This results from the diminishing profitability in the shipbuilding sector and declining operating profit from the offshore, electronic/electric sectors amid hike

in the prices of steel plates despite the growth in sales from the sectors such as the shipbuilding/plants, engine machinery, construction equipments, and others."

HHI saw its sales inch up 3.98% from KRW 6 trillion 306.3 billion while its operating profit slid by 31.7% from KRW 991.8 billion registered in the previous quarter.

DSME registered KRW 3 trillion 178 billion in sales, KRW 339.9 billion in operating profit, and KRW 223 billion in pre-tax profit in the second quarter according to its performance report generated on the basis of separate criteria as per the international accounting standards (K-IFRS).

That represents an 12.6% growth in sales from KRW 2 trillion 823 billion and a 218% increase in operating profit from KRW 106.9 billion registered in the same period of 2010 based on the report which was produced according to the international accounting standards.

In relation to that, an official from DSME stressed, "Based on stable relationship between the management and labor union, we have achieved higher operating profits compared to the same quarter of previous year as the new orders that we received for the construction of high value-added ships, such as containerhips and drillships, have been reflected in sales."

DSME recorded KRW 3 trillion 178 billion in sales in the second quarter, a 4.1% increase from KRW 3 trillion 51.7 billion registered in the previous quarter, while its operating profit slid to KRW 339.9 billion, a 19.2% decrease from KRW 420.5 billion registered in the previous quarter.

SHI recorded KRW 3 trillion 152.7 billion in sales in the second quarter of 2011, an increase by 5.4% (KRW 162.4 billion) from the same period of previous year.

SHI's operating profit decreased 7.2% (KRW 25.4 billion) year-on-year to KRW 325.2 billion, while its current net profit





increased 10.1% (KRW23.9 billion) year-on-year to KRW 260.3 trillion. That can be attributed to the growth in net profit prompted by the decrease in cost, despite the declining operating profit amid higher prices of raw materials such as steel plate compared to the same period of previous year. In the second quarter, SHI's sales shrank by 9.9% from KRW 3 trillion 500.2 billion, while its operating profit slid by 14.1% from KRW 378.7 billion registered in the previous quarter.

Overall performance in the first half

In overall way, 3 domestic shipbuilding giants saw their sales and operating profits increase slightly in the second half compared to the same period of previous year.

HHI's sales increased 15.8% year-on-year from KRW 10 trillion 677 billion to KRW 12 trillion 361.6 billion and its operating profit inched up 1.07% year-on-year from KRW 1 trillion 651.1 billion to KRW 1 trillion 668.8 billion.

DSME's sales rose 12.7% year-on-year from KRW 5 trillion 527.2 billion to KRW 6 trillion 229.7 billion and its operating profit jumped 122.5% year-on-year from KRW 341.8 billion to KRW 760.4 billion.

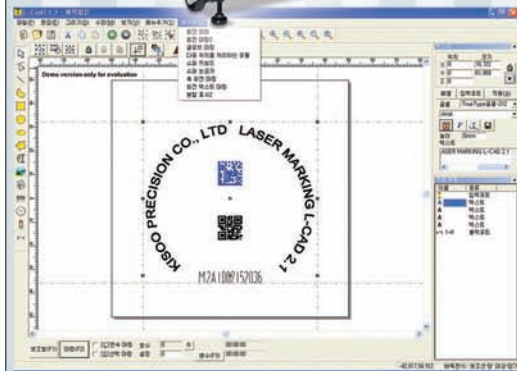
SHI recorded KRW 6 trillion 652.9 billion in sales in the first half, a 5.4% (KRW 339.6 billion) increase from the same period of previous year, and saw its operating profit rise 4.4% (KRW 29.7 billion) year-on-year to KRW 703.9 billion. ⚓

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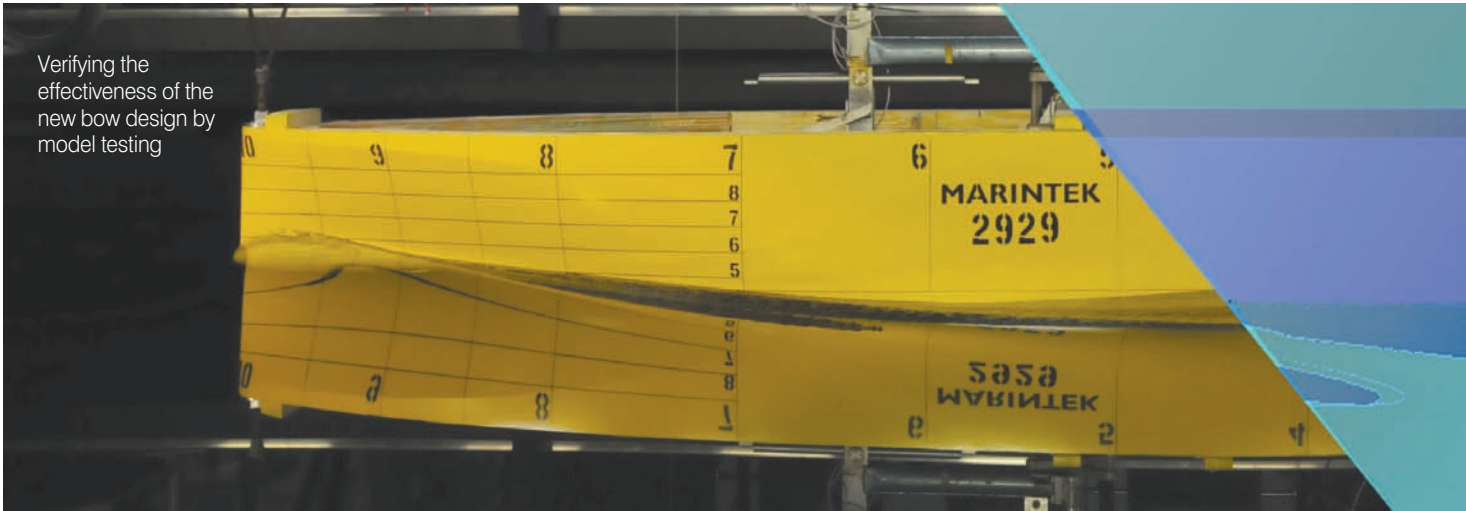
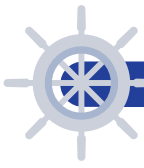


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Verifying the effectiveness of the new bow design by model testing

New bow design is efficient and enhances seaway performance

An innovative, low-resistance merchant vessel bow design improves efficiency and also delivers significant advantages in a seaway.

Rolls-Royce

The merchant ship market has always had a tendency to be conservative. It has not been as easy to introduce innovative solutions compared to other markets such as the offshore sector. Ship designs for the offshore market have recently been dominated by new and non-traditional solutions, in particular, new bow designs for better seakeeping.

Traditionally, merchant vessel design has concentrated on low hull resistance and high propulsion efficiency, where the verification process has been model tested in calm water conditions. Recently, it has become apparent that the market has begun to focus more on the vessel's behavior in real sea conditions. This activity is driven by the requirement to reduce emissions to the atmosphere, so the pressure is to optimize performance and minimize the power requirement in the actual sea states encountered within the vessel's normal operating profile and operating area.

For merchant ships on fixed routes, it is important to maintain a given speed to arrive at the scheduled port on time. Like

other vessels, they must often cut speed to avoid bow damage and unacceptable acceleration levels when seas are too great. As consequence, they frequently have to drive harder when the sea state permits to make up lost time. This in turn leads to an uneconomical operating mode, increased fuel consumption and more exhaust emissions.

To address the challenge, the merchant solutions team developed a new bow form which gives a significantly better performance in a seaway, less speed reduction, reduced accelerations and less risk of hull plate deformation in the forebody in high seas. This bow design is the subject of a pending patent. It combines a vertical leading edge with a bulbous lower section and flares in the upper section.

Computer simulation was used extensively in developing the new design, based on realistic weather conditions in typical operating areas. The new bow demonstrates a reduction in resistance of between five and eight percent compared to an optimized conventional raked bow with bulb, with the precise

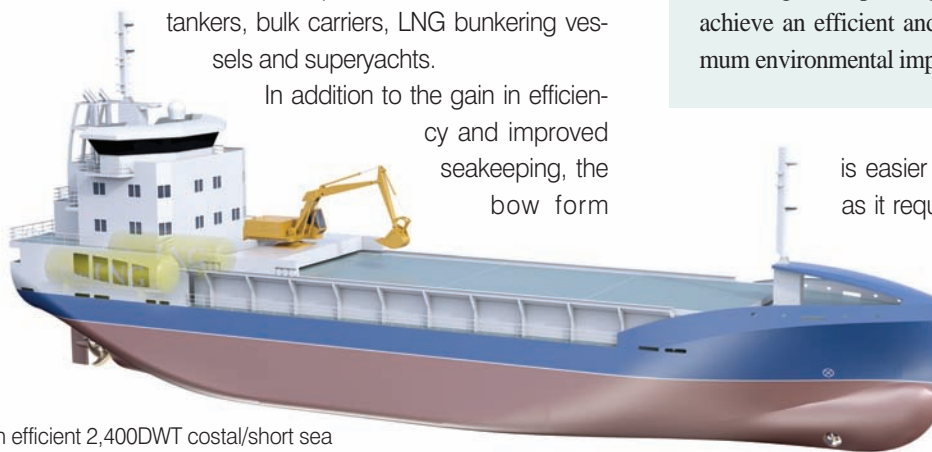


figure depending on the wave period. At the same time, accelerations in the forward part of the vessel are reduced by five to 10 per cent, again dependent on wave period. Computational fluid dynamics (CFD) analysis was also used to optimize the reduction in hull resistance in a seaway, indicating an advantage of about eight per cent.

Following the computer-based work, the findings were verified by tank-testing models. Propulsion tests in still water showed that the new bow produced three percent lower hull resistance than the optimized conventional bow. Tests in head seas corresponding to 2m significant wave height full scale with periods of from 5.5 to 12.5 seconds showed the new bow design had an average advantage of over 11 per cent.

Rolls-Royce is applying the bow design to a wide range of vessel types, such as passenger, ropax and roro ships, chemical and product tankers, LNG/LPG tankers, bulk carriers, LNG bunkering vessels and superyachts.

In addition to the gain in efficiency and improved seakeeping, the bow form



An efficient 2,400DWT coastal/short sea cargo vessel incorporating the new bow design

Part of a comprehensive ship system

To reap the greatest operational and environmental benefits, the new bow can be combined with Rolls-Royce hull design and power and propulsion integration skills.

The company's short sea cargo concept is a recent example and reduces CO₂ emissions by more than 40 per cent.


Included in the concept is the proven Promas integrated redder and CP propeller, which on its own improves propulsive efficiency by five to eight per cent.

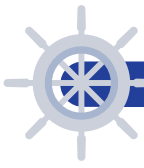
Then comes the hybrid shaft generator (HSG) which allows engine speed to be reduced while still getting the benefit of producing electrical power with the shaft generator instead of running auxiliary gensets. This means that the engine speed and propeller pitch can be optimized for the prevailing operating conditions, cutting fuel consumption and exhaust emissions.

The greatest saving in emissions is made if Bergen gas engines are specified instead of liquid fuelled or dual fuel units. The lean burn Bergen gas engines can handle large and rapid load variations and are suitable for mechanical transmission of power to the propeller, having a very flat specific fuel consumption curve down to 20-25 per cent load, with a high thermal efficiency. They emit 22-23 per cent less CO₂ per unit of power produced than a diesel engine NO_x is reduced by about 90 per cent, while Sox and soot emissions are negligible.

When these elements are combined with a Rolls-Royce hull design incorporating the new bow, the ship-owner can achieve an efficient and seakindly ship, which has minimum environmental impact.

is easier to build than conventional designs as it requires fewer double-curvature plates.

Since the bow impact from waves is much less it is also possible to use lighter construction in some cases. 



Debut for wave-piercing Bow Design

The first order for an offshore vessel with the innovative wave-piercing bow developed by Rolls-Royce has been received from a Norwegian customer.

Farstad Shipping has placed the first order for an advanced Rolls-Royce supply vessel with the new wave-piercing bow. The visually striking bow design was developed for strictly practical reasons—to enable the vessel to pierce through waves in extreme weather conditions, maintaining constant speed, reducing fuel consumption and enhancing safety.

The contract is for the UT 254 WP vessel design and a comprehensive integrated power and propulsion system and equipment package. It also includes an option for a second vessel of the same specification.

“Our wave-piercing designs have been specifically developed for the challenging offshore conditions in which our customers operate, and performance benefit”, say Svein Kleven, chief design manager, ship technology. “We are delighted that Farstad shipping has ordered the first of our new generation of offshore vessel designs and we look forward to working with them throughout the development and construction of this technologically advanced vessel.”

Wave-piercing technology is proven on high speed multihulls and Rolls-Royce is now applying similar principles to displace-



Farstad's new supply vessel will feature the wave-piercing bow

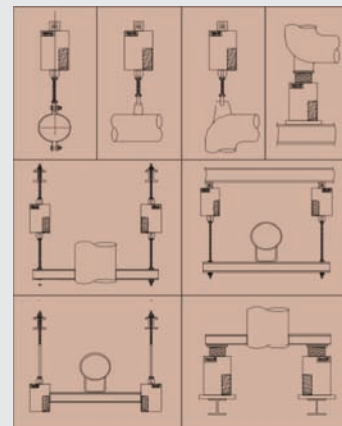
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Farstad's UT 754 WP will have a complete outfit of Rolls-Royce equipment and systems as well as its innovative wave-piercing bow hull design.

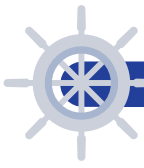
ment monohulls for the demanding offshore market, in which extreme operating conditions can pose serious challenges to vessel performance and crew safety.

Extensive research and computer-aided design methods, verified by tank testing, have enabled Rolls-Royce to reduce hull resistance substantially through the development of the wave-piercing hull form, which eliminates slamming and allows for a smooth ride even in rough weather conditions. The hull pierces through the water, rather than riding on top of the waves, allowing the vessel to run continuously at service speeds almost regardless of the sea state, reducing fuel consumption and improving crew comfort.

In addition to the new design, Rolls-Royce will supply the DP2 class dynamic positioning system.

Safety of crew on deck is always a priority and the contract includes an automated sea fastening system to effectively position and safely secure containers, pipes and other deck cargo with be fitted out by STX Offshore Norway at its Langsten shipyard.

In addition to wave-piercing designs for platform supply vessels, Rolls-Royce has developed wave-piercing hull designs for other vessel types including tugs, deep-sea anchor handlers, construction vessels and mobile offshore drilling ships.



Future technology (3): The electric ship

By 2020, a hybrid electric ship could contain diesel electric configurations, marine fuel cells, battery packages, solar panels or retractable wind turbines, and compact superconducting motors. Introducing the electric ship concepts can improve the ship's overall efficiency and enable incorporation of many types of renewable energy sources. The large number of embedded components will increase system complexity, and require carefully design, performance monitoring and power management. Hybrid concepts will be introduced first into specialised ship segments, such as offshore supply vessels and ferries.

DNV

Introduction

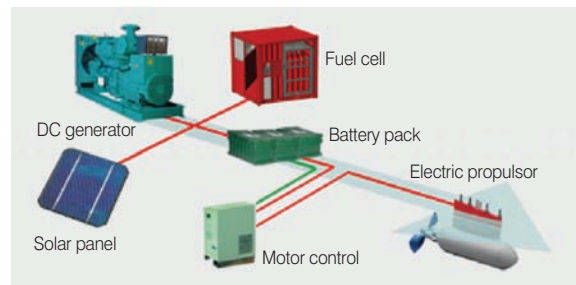
The use of hybrid powering systems in marine applications has the potential to offer more efficient and environmentally friendly ship power plants. These powering systems require design, operation, and control of energy production, and conversion in an integrated manner. The ship machinery will evolve into a more complex system, with a wide range of different energy conversion and storage sub-systems.

The equipment constellation will depend upon the operational profile of each ship, even more than it does today. Supply vessels and ferries with high fluctuations in power demand are the most suitable candidates for hybrid powering systems. The implementation of these new technologies could face significant challenges, and model-based assessment techniques are important for evaluating both technical and economic performance, and for ensuring safe operation.

Hybrid ships

Power generation works best when operating at a single, defined condition, and fluctuations in power demand or supply reduce efficiency. Switching to electric propulsion and powering will offer more flexibility at higher efficiency, as multiple power sources can be included.

The hybrid electric ship of 2020 might contain a mix of conventional and superconducting motors and generators, fuel cells, and batteries. This concept easily integrates power from alternative renewable sources, e.g. solar panels or retractable wind turbines. Performance monitoring, power management, and redundancy will be key elements. These concepts will be applied to service, passenger, and small cargo ships by 2020. For large cargo ships, they



Layout a hybrid engine room

may only be used in auxiliary power generation. The high complexity of such a system will require maintenance strategies, control of grid stability, improved space utilisation, and weight minimisation.

Marine fuel cells

In order to increase efficiency in power production,



A 20kW solid oxide fuel cell running on methanol. (Source: Wärtsilä)

alternatives to combustion have to be considered.

Fuel cells convert chemical energy directly to electricity, at a theoretical efficiency of up to 80% (hydrogen), through a series of electrochemical reactions. They can be fuelled by natural gas, bio-gas, methanol, ethanol, diesel, or hydrogen. LNG fuel cells emit up to 50% less CO₂ per kW than diesel engines. Due to the establishment of Emissions Control Areas (ECAs), installation of LNG fuel cells will be favoured. Currently, a marine fuel cell prototype delivers power in the range of 0.3MW. Initially, fuel cells will provide auxiliary power, e.g. hotel loads. Ultimately they will provide supplementary propulsion power in hybrid electric ships. The main barriers against uptake are cost, weight, size, lifetime, and slow response to load variations. During the next decade fully commercial marine fuel cells will become available.

Batteries

The use of multiple electrical power sources in vessels with frequent load changes, and the requirement to operate at optimum efficiency, requires appropriate power storage.

Batteries are one way to address network power disturbances and overall balancing, resulting in smooth and uninterrupted operation. Batteries can store surplus energy when available, and provide supply at peak demands. For instance, battery power can compensate when fuel cells cannot fulfil fast load changes. Battery storage enables dual-fuel generators to run closer to optimal loads, avoiding fast load changes and additional ship emissions. In 2020, a battery pack of 0.4MWh, 4MW peak load, could weigh 2-4 tonnes and occupy approximately 1m³.

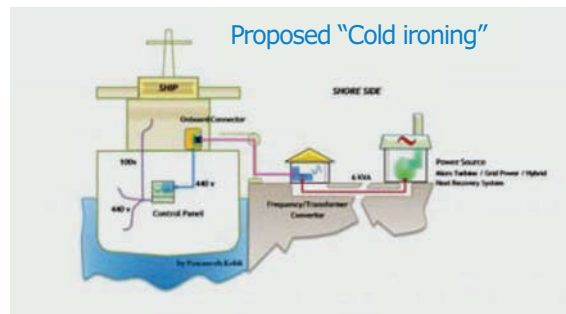
Limited availability of rare earth metals, e.g. Li, performance degradation, and prolonged charging times are the main barriers against widespread adoption.

It is expected that nano-technology may play an important role achieving a break-through in battery storage.

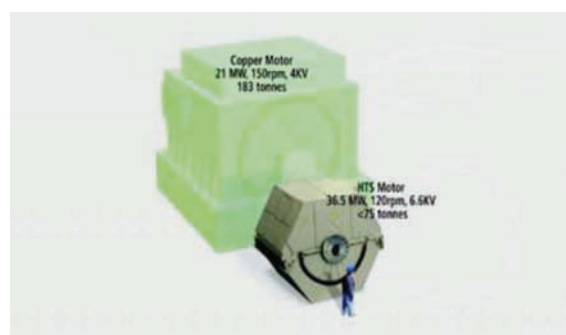
High-temperature superconductors

Electrical resistance results in energy losses from components such as generators, motors, transformers, and transmission lines.

High-temperature superconductors (HTS) have zero electrical resistance (at -160°C) and could enable significant reductions in the size of motors and generators as HTS wires allow 150 times more current than similar-sized copper wires. Storage of energy in HTS coils is another application. However, using these materials requires cryogenic cooling, by, for example, liquid nitrogen, and special thermal shielding; the main risk is failure of cryogenic cooling, resulting in loss of super conductivity. Redundancy will be a



Conceptual layout of shore power connection (Source: Pawanexh Kohli)



In 2009, the world's first 36.5MW HTS ship propulsion motor was successfully tested for the US army

major issue in designing ships that use HTS technology.

Cold ironing

About 5% of the world fleet's annual fuel oil is consumed in ports. As ports are often located in highly populated areas, emissions from ships contribute to local environmental and health problems.

By replacing onboard generated electricity with shore electricity supply, cold ironing, the detrimental health and environmental effects from emissions of SO_x, NO_x and particles are reduced. Furthermore, CO₂ emissions might also be decreased, depending on the availability of cleaner onshore power plants. Towards 2020, a standardised plug-in-connection, for use between ships and the shore electrical grid, will become available, both for existing ships and for new-builds. This connection will convert electricity to the appropriate voltage and frequency for the ship.

The main challenge will be availability of sufficient grid capacity in larger ports and the lack of infrastructure in smaller ones. ⚓



FLIR M-Series helps to avoid collisions and to ensure passenger safety at the Lisbon ferries

[Thermal imaging: the perfect tool for nighttime navigation and search and rescue situations](#)

The Portuguese capital Lisbon lies next to one of the busiest rivers of Europe: the Tagus. The Lisbon ferry service has the task to bring all of the commuters and tourists safely across the river. Hundreds of people use the Lisbon ferry service every day, both tourists and commuters alike. But on a busy river like this accidents can happen all too easily.

Several ferries are travelling up and down the river all day. But it's not just ferries crossing the river: ships of all sizes and shapes traverse the Tagus. And when darkness or smoke impedes vision this can lead to dangerous situations. To avoid collisions, the new Lisbon ferries have been enhanced with FLIR M-Series thermal imaging cameras.

FLIR Systems Korea

One of the new ferries that have been equipped with a FLIR M-Series thermal imaging camera is the Lisbonense. The ship's captain, Rui Sousa, is very glad with all of the new equipment installed on his ship. "We have everything we need: chart plotter, radar, anemometer, speedometer, there are sen-

sors everywhere making this one of the safest ships on the Tagus."

A key component in the ship's safety is the FLIR M-Series thermal imaging camera. Unlike visual light cameras a thermal imaging camera relies on thermal contrast instead of visual contrast. This allows the FLIR M-series thermal imaging camera to produce a crisp clear image regardless of lighting conditions. The FLIR M-Series can also see through smoke. The FLIR M-Series thermal imaging camera provides crisp thermal images even if the smoke is



The FLIR M-Series thermal imaging camera is mounted on a pole for a better situational awareness and a better range performance.



Rui Sousa, captain of the Lisbonense, on the bridge of his ship. A dedicated TFT monitor constantly displays the FLIR M-Series' thermal imaging footage.

so thick that normal eyesight is rendered completely useless.

Avoiding collisions

According to Sousa the top of the line equipment aboard the Lisbonense makes his ship about as safe as it can be. "If this ship will ever be involved in a collision it has to be due to some kind of human error, for this ship has contains some really good equipment to help us prevent such an accident."

The Lisbonense is a 47.5m long and 16m



The FLIR M-Series thermal imaging camera's control unit is seamlessly incorporated in the bridge.

wide steel catamaran that was built by the Portuguese ship manufacturer Navalia Shipyards. The two diesel engines provide 850 horsepower each, propelling the ferry to a maximum speed of 13 knots. It can carry 360 passengers and 30 vehicles and has a gross tonnage of 1,479 tons.

High vantage point for better situational awareness

The FLIR M-Series thermal imaging camera has been mounted on top of a pole to provide a better overview and enable a better range performance, for the higher the camera is located the better it can enhance the captain's situational awareness. The control unit is seamlessly incorporated in the ship's bridge and a dedicated TFT screen constantly shows the M-Series' thermal imaging footage.

FLIR Systems appreciates the professional and technical capabilities of the FLIR products distributor Observit demonstrated throughout this project. Observit provides complete video processing solutions and covers all of the project aspects from solution design, to installation and training through to sales assistance and service.

The FLIR M626L installed on the Lisbonense includes an uncooled microbolometer thermal imaging detector that produces thermal footage with a resolution of 640x480 pixels and a visual lowlight camera to provide the best possible vision in all conditions, presenting the ship's captain with the best possible situational awareness. This enables the captain to avoid collisions even if light fog, smoke or darkness impedes vision.



The FLIR M-Series thermal imaging camera enables the captain of the Lisbonense to avoid collisions even if light fog, smoke or darkness impedes vision.

Man overboard!


But the M-Series is more than just an aid to avoid collision with other vessels. There have been several cases in the past where a pas-

senger for some reason ended up in the water, especially in the summer during the nighttime ferry services, when alcohol consumption can sometimes lead to reckless behavior among the passengers. The strong currents in the Tagus make this a very dangerous situation, especially when the dark conditions make it difficult to spot the person that has fallen overboard. These situations have in past sometimes even had fatal results.

The FLIR M-Series is an invaluable tool in such nighttime man overboard situations. The high quality thermal imaging camera needs no light whatsoever to produce crisp clear images even in the darkest of nights. Since it relies on thermal contrast instead of color contrast a person that has fallen overboard stands out clearly in the thermal image, for the cold water and the warm person provide a very strong thermal contrast.

'I'm glad we have the M-Series'

"Luckily such a situation has not yet occurred since the FLIR M-Series thermal imaging camera has been installed, so I have not been forced to use it for that purpose yet", says Sousa. "I hope that it stays that way, that we never have to use the FLIR M-Series thermal imaging camera for that purpose, but if we do have a man overboard situation I am sure that I will be very glad that we have it."

The top of the line equipment installed in the Lisbonense helps to prevent accidents and to ensure passenger safety. Every day the captain of the Lisbonense brings hundreds of people safely across the Tagus, secure in the knowledge that when needed, the FLIR M-Series thermal imaging camera is there to help him save the lives of his passengers. 

Rolls-Royce wins EUR 15m Brazilian order for offshore supply vessels

Rolls-Royce won an order to design and equip two UT 735 SE offshore supply vessels for Brasil Supply recently. The order is worth EUR 15 million to Rolls-Royce. The contract includes vessel design and an integrated Rolls-Royce equipment system including propulsion, deck machinery, bulk handling and vessel control systems.

The vessels will be chartered by Brazil's state oil company Petrobras and are designed specifically for carrying fluids and solid cargo to and from offshore oil and gas platforms. This is the second order from Brasil Supply this summer, and the company now has four Rolls-Royce designed offshore vessels on order, all of which will be built at Estaleiro Ihla S.A in Brazil.

Atle Gaasø, Rolls-Royce, General Manager Sales - Offshore Service Vessels, said, "With this contract Rolls-Royce further strengthens its presence in Brazil, and we look forward to working with both the owner and the yard throughout the construction of these custom made vessels." The vessels will be ready for delivery in 2013.

To provide support for a growing installed base of equipment in Brazil, Rolls-Royce opened an advanced marine repair and overhaul facility in Niteroi in 2009. This forms part of an expanding network of Rolls-Royce Marine Service Centres, three having been opened already this year in Gdynia (Poland), Walvis Bay (Namibia) and Rotterdam (Holland).



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Rolls-Royce won EUR 50m deck machinery contract for deep water anchor handling vessels in Singapore

Rolls-Royce was awarded a EUR 50 million contract by Swire Pacific Offshore to supply advanced anchor handling systems for 4 offshore vessels, currently under construction in Singapore.

The systems are developed for the safer handling of large anchors on deck, such as the torpedo anchors used in the deep water oil and gas fields off the coast of Brazil.

Arne Tande, Rolls-Royce, Senior Vice President - Offshore Deck Machinery, said, "Rolls-Royce supplies world leading marine technology that enables our customers to operate safely in challenging conditions, such as the deep water oil and gas fields. We are delighted that Swire Pacific Offshore has again selected our safety-critical technology, which demonstrates that our focus on research and development, and advancements in the technical

capabilities of our products, continues to position Rolls-Royce as the market leader for specialist handling equipment in the offshore industry."

Rolls-Royce will supply a complete deck machinery system to each of the four vessels, which are being built at the ST Marine Singapore shipyard. At the heart of the system is a low-pressure hydraulic winch for anchor handling and towing, with a pulling capacity of 500 tons.

Breakthrough for large engine manufacturing in China

Traditionally, MAN Diesel & Turbo K98-type engines have been used as prime movers by 8,000-10,000TEU capacity container vessels. Following efficiency optimisation trends in the market, where container ships have increasingly adopted lower ship speeds, the engine designer evaluated the possibility of using even larger propellers with a view to using engines with even lower speeds for propulsion.

Investigations revealed that container ships are indeed compatible with propellers with larger propeller diameters than current designs, and the high efficiencies that follow an adaptation of the aft-hull design to accommodate the larger propeller.

The new, higher-powered, super long-stroke S90ME-C9 engine type meets this trend in the market. MAN Diesel & Turbo investigations indicate an overall efficiency increase of about 7% when using the S90ME-C9, compared with existing main engines, depending on the propeller diameter used.

Canada based Seaspan Shipmanagement entered a close dialogue with MAN Diesel & Turbo to decide upon main engines for its expanding fleet of newbuilding container ships. The owner initially considered the MAN B&W K98ME-C engine, but ultimately settled for the super long-stroke 10S90ME-C9 type on account of its superior fuel savings, a choice that required a redesign of the newbuildings' aft-ship to accommodate the lower engine rpm and larger propeller diameter. The yard and its design partner changed the design accordingly.

Seaspan has previously built ships at YangZiJiang Shipbuilding with 6K80MC-C engines built by CMD in China.

Ole Grøne, Senior Vice President Promotion & Sales, MAN Diesel & Turbo said, "We continuously keep a close eye on developments and trends within the shipping sector and have watched with interest the increasing demand for lower engine speeds and larger propeller diameters within the container segment. While our portfolio of engines already matches a broad reach of requirements, we have specifically introduced the super long-stroke S90ME-C9 to market to satisfy current trends and are very happy with its immediate adoption in the major shipbuilding markets."

The MAN B&W 10S90ME-C9.2 engines to be installed in Seaspan's newbuildings will in addition feature MAN TCA turbochargers built in Augsburg, Germany.

DSME secured an order for 4 LNG carriers, setting out in earnest to increase order intake in the second half

Daewoo Shipbuilding & Marine Engineering (DSME) has received an order for 4 LNG carriers, accelerating its drive to further increase its order intake in the second half of this year.

DSME signed a contract with George Economou Group in Athens, Greece, on July 28 to build 4 units of 159,800m³ LNG carriers.

The contract is valued at over USD 850 million. These vessels will be built at Okpo shipyard in Geoje and delivered to the ship owner by 2014. Both companies agreed upon an option for 2 more ships in addition to the 4 orders that have been firmed up.

These vessels, which can carry up to 160,000m³ liquefied natural gas, will have Dual Fuel Diesel Electric (DFDE) propulsion system which can operate on both oil (diesel) and natural gas, depending on situation. Thus, these vessels represent energy efficient, cost-effective and eco-friendly shipping solution, ensuring both cost-effectiveness and convenience in operation.

Economou Group, one of the largest shipping groups in Greece, signed this LNG carrier contract with DSME as its first partner since its establishment. Thus, DSME which penned a contract with Angelicoussis this year has made a splendid achievement of securing LNG carrier orders from both major shipping groups of Greece.

Nam Sang-tae, CEO & President of DSME, said, "This contact is meaningful in that we proved our world-class technological prowess in LNG carrier construction. We will cement our status as the world's best shipyard based on



Goh Jae-ho (right), Vice President of DSME, is shaking hands with Christos Economou (left) of Economou Group after signing the contract in Athens, Greece, on July 28 to build LNG carriers.

the solid cooperative relationship with the new ship owner."

This order brings DSME's total orders for vessels and offshore facilities to 34 units worth USD 7.98 billion this year, achieving 72.5% of its annual target of USD 11 billion for 2011.

SPP Shipbuilding received an order for medium-sized tanker

SPP Shipbuilding announced on August 2 that it was awarded an order for 20 medium-sized MR product carriers (PCs). This accounts for 50% of the global order in this category this year and is worth USD 760 million.

SPP Shipbuilding secured an order for the construction of a total of 20 PCs, including 2 units from Admore of Ireland, 2 from Socatra of France, 6 from Latin America, and 10 from Europe and Asia. These PCs which are 50,000DWT class will be delivered to the ship owners on a staggered basis from 2013 to 2014.

An official from SPP Shipbuilding said, "Our continuous focus on building green ships with enhanced fuel efficiency has resulted in the positive reaction of ship owners amid sustained high oil prices. We owe this success to our focus on the markets for PCs when the 3 domestic shipbuilding giants, such as Hyundai Heavy Industries (HHI) and Samsung Heavy Industries (SHI), have been concentrating their capabilities on winning orders for ultra large

ships and offshore plants."

The official from SPP said, "This sort of order has been rare recently, considering that there have been few new orders for MR product carriers placed worldwide. This contract awarded to us attests to the global recognition of our competitiveness in the medium-sized MR product carrier, our flagship product."

Meanwhile, SPP Shipbuilding has proceeded with R&D related to green ships, like improving the fuel efficiency. Its current order backlog stands at a total of 146 ships worth approximately USD 5.5 billion.

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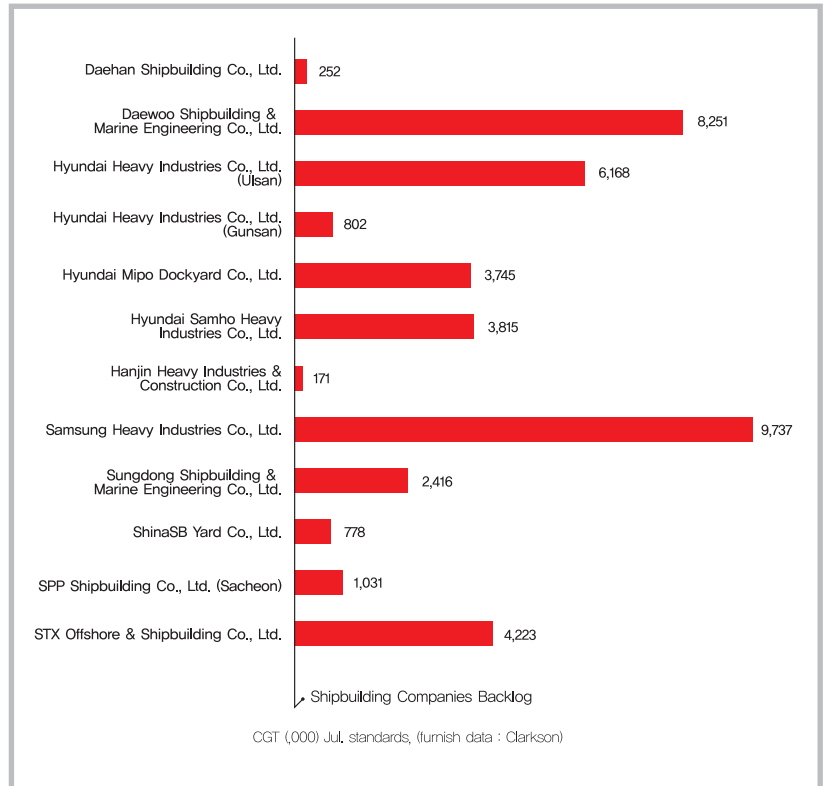
Korean shipyards reclaimed the top spot in the global shipbuilding orders/order amount in 2011 after being overtaken by China in 2010 by a slight margin in terms of new orders, shipbuilding volumes and order backlog, thus cementing the status of the country as the world's largest shipbuilder.

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

sectors have continued to win a wave of new orders since the beginning of the year.

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

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





Offshore plant orders awarded to domestic shipyards in 2011

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

*Note : 1. Based on the press release and public announcements of each shipyards, internal estimation of Monthly KORSHIP (estimation until August 15, 2011)

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





LNG carriers

No new order for LNG carrier was placed worldwide in 2009 as the investment in liquefied natural gas (LNG) facilities at new production sites was delayed in the aftermath of the global financial crisis that started in the United States in 2008. However, the market for LNG carriers is showing strength recently. Specifically, orders for a total of 20 LNG carrier newbuildings are expected to be placed from this year, which will join the fleets of the Russian gas giant Gazprom's LNG vessels and be put into operation of the Brass LNG project in Nigeria. In addition, Korea Gas Corporation which acquired 15% stake in the GLNG (Gladstone Liquefied Natural gas) project in Australia has secured the right to order 4 LNG carriers. Furthermore, additional orders for LNG carriers are expected amid expectation of growing LNG tanker traffic after the massive earthquake that hit Japan in March.

Often project-based LNG shipping is undertaken based on long-term transportation contract and therefore LNG transportation poses low risk depending on the fluctuations in LNG market conditions. Recently, LNG carrier orders are being placed even before charters are confirmed because of the optimism on the growth in LNG tanker traffic for the upcoming period. Moreover, demand for large LNG carriers is expected to increase due to the replacement of old ships, reduction in the number of small ships as part of fleet expansion. Domestic shipyards such as Hyundai Heavy Industries (HHI), Samsung Heavy Industries (SHI), Daewoo Shipbuilding & Marine Engineering (DSME) - which have secured cutting-edge technology related to LNG carriers - won consecutive orders in the first half of 2011. Thus, Korea retook the status as the world's largest shipbuilder after being overtaken by China. ⚓

- **Hyundai Heavy Industries (HHI)**







- Daewoo Shipbuilding & Marine Engineering (DSME)



- Samsung Heavy Industries (SHI)





- STX Offshore & Shipbuilding (STXOS)



- Hyundai Samho Heavy Industries (HSHI)



- Hanjin Heavy Industries & Construction (HHIC)



Coupling relays

Weidmüller Korea

Weidmüller has extended its 'Riderseries' with a further relay version. The new 16-mm slim width 'Riderseries FG' are coupling relays equipped with forcibly guided contacts designed to monitor signals in safety-relevant circuits. With a diagnostic accuracy rate of 99 per cent relays equipped with forcibly guided contacts belong to the tried and trusted components utilised in safety technology. A forcibly guided contact consists of at least one normally closed and a normally open contact with a designed-in mechanism to prevent both the normally closed and normally open contacts being closed simultaneously.

This mechanism guarantees the signalling contact maintains the same switching status should a failure occur. By constantly monitoring the status of the signalling contact and comparing actual with setpoint values the safety controls ensure appropriate measures can be implemented to safeguard man and machine if a failure occurs.

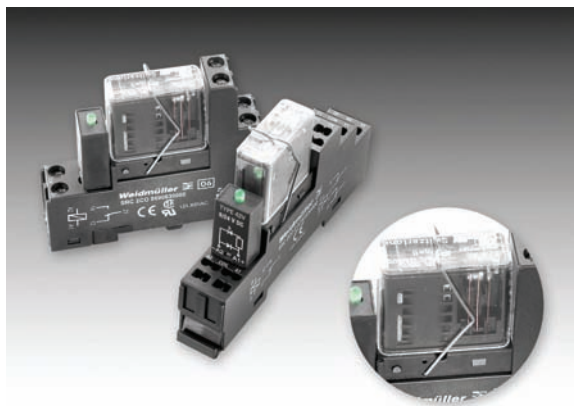
Users are able to build an efficient, safety-oriented control circuit in accordance with the architecture specified in the standard EN ISO 13849-1 (categories 3 and 4) by interconnect-

ing two coupling relays in conjunction with a safety-oriented controller or with safety switching devices.

Riderseries FG relays are designed to be robust and resistant to vibration: a metal retainer clip ensures they remain securely in position even in harsh environmental conditions. In the event a failure occurs users are able to conveniently and rapidly replace the affected module, without having to first disconnect the wiring. To facilitate simple on-site diagnostics the coupling relay is equipped with a clearly visible LED display module with an integrated free-wheel diode, which protects the series-connected electronics. The Riderseries FG with forcibly guided contacts (2 changeover contacts, DC coil) comprises a relay base for mounting rail installation, a plug-gable relay and markers. To suit requirements they are available with either tension clamp or screw connections.

Designed to withstand harsh environments and offer a long service life the added technical value excels in all points: rated voltage of 24 VDC, switching voltage of 250 VAC, an maximum switching current of 6 A, two

changeover contacts made of AgCuNi contact material and a mechanical service life of 50×10^6 switching cycles. Safe isolation to VDE 0106 Part 101 is assured. It is possible to deploy Weidmüller coupling relays in ambient temperatures ranging from -40°C to $+70^{\circ}\text{C}$ without restrictions.



Riderseries FG

-TEL: +82-2-516-0003
-http://www.weidmuller.co.kr



NI LabVIEW 2011

System design software; LabVIEW 2011

National Instruments Korea

Recently National Instruments (NI) unveiled NI LabVIEW 2011, the 25th-anniversary version of its award-winning system design software. LabVIEW accelerates the productivity of engineers and scientists who develop and deploy measurement and control systems to solve some of the world's greatest engineering challenges.

LabVIEW 2011 can dramatically increase development efficiency through new engineering-specific libraries and its ability to interact with almost any hardware device or deployment target, including the new multicore NI CompactRIO controller and the NI PXIe-5665, one of the highest performing RF vector signal analyzers in the industry. It also supports assemblies built in the latest Microsoft .NET Framework and includes numerous features driven directly from user feedback. With these and other advantages, LabVIEW 2011 helps engineers integrate individual system components into a single, reconfigurable platform so they can do their jobs faster, better and at a lower cost.

"Twenty-five years ago, we created LabVIEW to help engineers focus on innovating instead of wrestling with complicated programming and system integration issues, and today, it has become the ultimate system design software for measurement and control," said Jeff Kodosky, National Instruments business and technology fellow, cofounder and inventor of LabVIEW. "With each new version, whether by ensuring integration with the latest hardware, introducing new libraries and APIs or implementing engineer-requested features, our primary objective remains to increase productivity in any engineering situation."

LabVIEW 2011 makes it possible for engineers to achieve significant productivity gains in a variety of tasks, including the following time-saving functions:

- Quickly develop visually striking, contemporary user interfaces with a new Silver palette of controls and indicators
- Reuse code with support for the latest .NET assemblies, .m structures and new Xilinx IP for the LabVIEW FPGA Module
- Achieve up to five times faster loading, wiring, editing and compiling of FPGA code
- Programmatically build and distribute executables to targets
- Spawn asynchronous threads to create multithreaded applications more quickly with a new communication API

With its stability for mission-critical applications, as well as its simplified integration with hardware from many industry leaders, LabVIEW 2011 gives measurement and control system designers the confidence to innovate efficiently within a proven support infrastructure.

"By using LabVIEW, we decreased our system development time by one-third compared to the time we spent with traditional approaches," said Glenn Larkin, engineer for the National Ignition Facility (NIF) at Lawrence Livermore National Laboratory, home of advanced fusion research and one of the world's most powerful lasers. "We plan to extend our use of LabVIEW and NI hardware in many facilities that support NIF so we can realize these same productivity gains in future projects."

When combined with modular hardware, LabVIEW 2011 is the centerpiece of the NI approach to graphical system design, which provides a unified platform for designing, prototyping and deploying applications with maximum efficiency. Engineers and scientists in virtually every industry are using graphical system design, from basic measurement applications to the most complex, advanced research projects.

-TEL: +82-2-3451-3400
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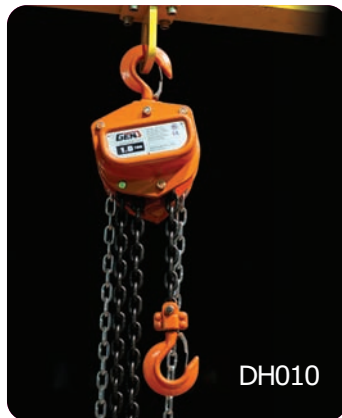


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ILDO MACHINE ELECT CO., LTD.

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.jwjoint.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 : Yeungdo-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-mgms.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 : Electric 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 : Navigation/Signal LT, EX-Plision 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 Addresser 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 Separator, 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/Overflow 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 Vessel
 TEL : +82-51-831-7474

NAMSUNG SHIPBUILDING CO., LTD.

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

NAMYANG METAL.

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

NARA CORPORATION CO., LTD.

Head Office : Saha-gu Busan
 Homepage Add. :
 Main Products :
 TEL : +82-51-790-7505

NAVUTEC.

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

NEW-OHSEUNG CO., LTD.

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

NK CO., LTD.

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

NOKSAN FLANGE CO., LTD.

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

OBOK ELECTRIC CO., LTD.

Head Office : Gangseo-gu Busan
 Homepage Add. :
 Main Products : Transformer
 TEL : +82-51-832-1751

OK KWANG ENG CO., LTD.

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

OK KWANG METAL CO., LTD.

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

ORIENTAL PRECISION & ENGINEERING CO., LTD.

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

ORIENTAL PRECISION MACHINERY CO., LTD.

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

O.S.C.G CO., LTD.

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

PACO HITEC CO., LTD.

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

PAL MI METAL IND CO., LTD.

Head Office : Jinhae Gyeongsangnam-do
 Homepage Add. :
 Main Products : Valve, Yoke, Fork, Knuckle, Carrier

TEL : +82-55-552-3840

PANASIA CO., LTD.

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

PI PLUS CO., LTD.

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

POONG JIN METAL CO., LTD.

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

PSM CO., LTD.

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

SAEJIN INTECH CO., LTD.

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

SAMBOO METAL CO., LTD.

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

SAMGONG CO., LTD.

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

SAMJOO ENG. CO., LTD.

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

SAMJUNG MACHINERY.

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

SAM KWANG HI-TEC CO., LTD.

Head Office : Gangseo-gu Busan
 Homepage Add. :
 Main Products : Rectangle Windows
 TEL : +82-51-832-0177

SAMSUNG NONFERROUS METAL CO., LTD.

Head Office : Kimhae Gyeongsangnam-do
 Homepage Add. : www.metalsamsung.co.kr
 Main Products : Bushing, Liner, Sleeve, Pintle Bush
 TEL : +82-55-329-1067

SAMYANG METAL IND. CO., LTD.

Head Office : Saha-gu Busan
 Homepage Add. : www.cuniship.com
 Main Products : W-NT 90/10 Flange, Elbow, Tee
 TEL : +82-51-266-6655

SAMYOUNG FITTING.

Head Office : Gangseo-gu Busan
 Homepage Add. :
 Main Products : Elbow, Tee, Coupling
 TEL : +82-51-832-0211

SDK CO., LTD.

Head Office : Gangseo-gu Busan
 Homepage Add. :
 Main Products : Winch, Hatch
 TEL : +82-51-832-1882

SEAPLUS CO., LTD.

Head Office : Gangseo-gu Busan
 Homepage Add. : www.sea-plus.co.kr
 Main Products : Low Pressure CO2, Fire Extinguishing Sys
 TEL : +82-51-831-0119

SEBO METAL CO., LTD.

Head Office : Gangseo-gu Busan
 Homepage Add. : www.sebometal.co.kr
 Main Products : Pump Tower for LNG, Vent Mast
 TEL : +82-51-970-0200

SEBO TECH CO., LTD.

Head Office : Gangseo-gu Busan
 Homepage Add. :
 Main Products : Windwall, Heat Shield, Manual Hatch
 TEL : +82-51-831-4171

SEIL SERES CO., LTD.

Head Office : Gangseo-gu Busan
 Homepage Add. : www.seilseres.com
 Main Products : VRC system, ODM
 TEL : +82-51-831-1858

SEJIN BOLT CO., LTD.

Head Office : Gangseo-gu Busan
 Homepage Add. :
 Main Products : Bolt, Nut & Be, Double Nut, Chard Nut, Hinge Bog
 TEL : +82-51-831-9832

SEUNG JIN E.N.G.

Head Office : Gangseo-gu Busan
 Homepage Add. :
 Main Products : Pipe Spool (Steel)
 TEL : +82-51-831-9050

SEUN STEEL CO., LTD.

Head Office : Jin-gu Busan
 Homepage Add. : www.seunsteel.co.kr
 Main Products : CR, HGL, CGL, EGL
 TEL : +82-51-639-3200

SEWOONG PRECISION MACHINERY CO., LTD.

Head Office : Gangseo-gu Busan
 Homepage Add. :
 Main Products :
 TEL : +82-51-831-0595

SEYANG HIGH-TECH

Head Office : Gangseo-gu Busan
 Homepage Add. :
 Main Products : Water & Oil Strainer, Condensate Chlorination Tank
 TEL : +82-51-831-9125

SHILLA E&T CO., LTD.

Head Office : Gangseo-gu Busan
 Homepage Add. :
 Main Products : Spot Cooler, Heat Exchanger, Pressure Yeses
 TEL : +82-51-831-7705

SHINDONG DIGITECH CO., LTD.

Head Office : Dong-gu Busan
 Homepage Add. : www.shindong.com
 Main Products : Navigation Communication, Satellite Communication
 TEL : +82-51-461-5000

SHINHWA INTERIOR & TECHNOLOGY CO., LTD.

Head Office : Saha-gu Busan
 Homepage Add. :
 Main Products : Marine Furniture
 TEL : +82-51-441-1294

SHINKWANG ACE ELECTRIC CO., LTD.

Head Office : Kimhae Gyeongsangnam-do
 Homepage Add. : www.skace.com
 Main Products : Cable Tray, Accessories

TEL : +82-55-332-3315

SHINMYUNG INDUSTRIAL CO., LTD.

Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Cable Tray Joint, Hanger
TEL : +82-51-831-5061

SHIN SHIN HEAVY INDUSTRIES CO., LTD.

Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Deck Machinery, Hydraulic system, Surface Treatment
TEL : +82-51-832-0734

SHIN SHIN MACHINERY CO., LTD.

Head Office : Kijang-kun Busan
Homepage Add. : www.sspump.com
Main Products : Centrifugal Pumps, Gear Pumps, Screw Pumps
TEL : +82-51-727-5300

SHINWOO METAL CO., LTD.

Head Office : Gangseo-gu Busan
Homepage Add. : www.shinwoometal.net
Main Products : Flange, Forging
TEL : +82-51-831-2830

SHIN YOUNG AIR CLUTCH.

Head Office : Gangseo-gu Busan
Homepage Add. : www.airclutch.co.kr
Main Products : SY-CB Type, SY-VC Type, SY-E Type
TEL : +82-51-831-7072

SILLA METAL CO., LTD.

Head Office : Gangseo-gu Busan
Homepage Add. : www.sillametal.com
Main Products : PROPELLER(F.P.P), C.PPROPELLER Blade & Hub
TEL : +82-51-831-5991

SIN HUENG FLANGE CO., LTD.

Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Flange for ship
TEL : +82-51-831-6167

SINWEOOL GRATING CO., LTD.

Head Office : Sasang-gu Busan
Homepage Add. : www.steelgrating.net
Main Products : Steel Grating for Ship
TEL : +82-51-323-7000

SM POWER TEC CO., LTD.

Head Office : Gangseo-gu Busan
Homepage Add. : www.smpo.co.kr
Main Products : Vacuum Pump for Shipping Bldc, AC,DC Motor & Generator
TEL : +82-51-973-0267

SNP CO., LTD.

Head Office : Saha-gu Busan
Homepage Add. :
Main Products : Galley Equipment, Cold Chamber, Catering Furniture
TEL : +82-51-261-7711

STACO CO., LTD.

Head Office : Gangseo-gu Busan
Homepage Add. : www.staco.co.kr
Main Products : Wall Panel, Ceiling Panel, Unit Toilet, Marin Door
TEL : +82-51-831-7000

STA-JH CO., LTD.

Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Welding Fittings (Butt Welding)
TEL : +82-51-831-1274

STASB CO., LTD.

Head Office : Jinhae Gyeongsangnam-do
Homepage Add. :
Main Products : Marine Furniture, Door
TEL : +82-55-544-8070

STAUFF KOREA LTD.

Head Office : Saha-gu Busan
Homepage Add. : www.stauff.co.kr
Main Products : Hyd' System & Engineering, Hyd' Clamp & Test
TEL : +82-51-266-6666

STBEND CO., LTD.

Head Office : Gangseo-gu Busan
Homepage Add. : www.stbend.co.kr
Main Products : SUS Pipe Fitting, SUS Bend
TEL : +82-51-831-5131

STEEL KOREA CO., LTD.

Head Office : Jinhae Gyeongsangnam-do
Homepage Add. :
Main Products :
TEL : +82-55-541-2212

SUHHEUNG ENGINEERING CO., LTD.

Head Office : Gangseo-gu Busan
Homepage Add. : www.shge.co.kr
Main Products : Steel Grating
TEL : +82-51-831-1811

SUNBO IND CO., LTD.

Head Office : Saha-gu Busan
Homepage Add. : www.sunboind.co.kr
Main Products : Tank Top Unit, Engine Room unit, Sater Strainer Silenser
TEL : +82-51-261-3454

SUNG CHANG CO., LTD.

Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Non-Asbestos Gasket, Spiral Wound Gasket, P.T.F.E Gasket
TEL : +82-51-316-6300

SEOUNG HYUP MACHINERY.

Head Office : Sasang-gu Busan
Homepage Add. :
Main Products : White Metal, Piston Lo
TEL : +82-51-303-4112

SUNG IL CO., LTD.(SIM)

Head Office : Gangseo-gu Busan
Homepage Add. : www.sungilsim.com
Main Products : Pipe Spool Pre-Fabrication, Induction Pipe Bending
TEL : 82-51-831-8800

SUNG KWANG M/C.

Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Oil Press, Pipe Vending, Pipe Fitting Unit
TEL : +82-51-831-0620

SUNGWON ELECTRIC CO.

Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Cable Tray, Starter, Panel, Cable Way
TEL : +82-51-831-9230

SUNG WON ENTERPRISE. CO., LTD.

Head Office : Gangseo-gu Busan
Homepage Add. : www.sungwontent.co.kr
Main Products : V-Flow Swing Check, Valves, Manifold Unit
TEL : +82-51-831-2140

SUNIL INSTRUMENT CO., LTD.

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Homepage Add. : www.suniltech.co.kr
Main Products : Tank Level System, Viscosity System
TEL : +82-51-831-1994

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Homepage Add. :
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Homepage Add. : www.snwcorp.com
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Head Office : Seocho-gu Seoul
Homepage Add. : www.thi.co.kr
Main Products : Reciprocating & Screw, Compressor Unit, Brine/Water Chiller Unit
TEL : +82-2-598-1126

TAEHWA KALPA SEAL.

Head Office : Gangseo-gu Busan
Homepage Add. : www.taehwa1.com
Main Products : TH3000, TH3000W
TEL : +82-51-831-9944

TAE KWANG INDUSTRIES.

Head Office : Gangseo-gu Busan
Homepage Add. : www.tkc.co.kr
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TEL : +82-51-831-1801

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Head Office : Gangseo-gu Busan
Homepage Add. : www.taeshin.co.kr
Main Products : Co2 / Mag, Mig Arc Welding, Machine, Air Gouging
TEL : +82-51-831-1100

TAESUNG MACHINERY CO., LTD.

Head Office : Gangseo-gu Busan
Homepage Add. : www.taesungmc.co.kr
Main Products : Manufacture of Structures, for Shipbuilding(LNG,LPG) and plant
TEL : +82-51-971-4006

TAEWON CO., LTD.

Head Office : Gangseo-gu Busan
Homepage Add. : www.twubc.co.kr
Main Products : Flange, Strainer, Pressure
TEL : +82-51-831-0310

TAEWOONG CO., LTD.

Head Office : Gangseo-gu Busan
Homepage Add. : www.taewoong.com
Main Products : Piston Rod/ Crown/ Head, Cross Head Pin
TEL : +82-51-329-5000

TAEWOONG TECH CO., LTD.

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Homepage Add. :
Main Products : Main Shaft, Connecting Rod, Inter Shaft, Propeller Shaft
TEL : +82-51-831-6685

TANKTECH CO., LTD.

Head Office : Gangseo-gu Busan
Homepage Add. : www.tanktech.co.kr
Main Products : High velocity valve
TEL : +82-51-979-1600

TK CORPORATION CO., LTD.

Head Office : Gangseo-gu Busan
Homepage Add. : www.tkbend.co.kr
Main Products : Fittings (Elbow, Tee, Reducer, Cap)
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TMC CO., LTD.

Head Office : Kimhae Gyeongsangnam-do
Homepage Add. : www.besttmc.com
Main Products : Membrane Sheets, Heavy Steel Corner, Anchor Strip
TEL : +82-55-340-3000

TYCO MARINE SERVICES KOREA CO., LTD.

Head Office : Sasang-gu Busan
Homepage Add. : www.dbefire.com
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TEL : +82-51-633-9100

U-YOUNG PRECISION IND. CO., LTD.

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Homepage Add. : u-nex.com/
Main Products : Elec/Hyd. Windless, Elec/Hyd. Winch, Steering Gear
TEL : +82-55-326-9691

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 Homepage Add. : u-nex.com/
 Main Products : Elec/Hyd. Windless, Elec/Hyd. Winch, Steering Gear
 TEL : +82-55-326-9691

WON KWANG VALVE CO., LTD.

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 Homepage Add. : www.wonkwangvalve.com
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 TEL : +82-51-831-9932

WOONG CHEON OUTFITTING CO., LTD.

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 Homepage Add. :
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Service
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Head Office : Gangseo-gu Busan
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 TEL : +82-51-831-5246

YOOWON INDUSTRIES CO., LTD.

Head Office : Saha-gu Busan
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 Main Products : Steering Gear, Deck Machinery, Auto Filter
 TEL : +82-21-205-8541

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Head Office : Saha-gu Busan
 Homepage Add. : www.yoowonmtech.com
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 Main Products :
 TEL : +82-51-831-9547

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 Homepage Add. : www.younginele.com
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YOUNG NAM IND.

Head Office : Saha-gu Busan
 Homepage Add. :
 Main Products : Wire lope drum, BASE PLATE ASS'Y

TEL : +82-51-264-7983

YOUNGSHIN BEND CO., LTD.

Head Office : Gangseo-gu Busan
 Homepage Add. :
 Main Products : Welding Fittings (Butt Welding)
 TEL : +82-51-831-0316

YOUNGSUNG AIR SYSTEM.

Head Office : Gangseo-gu Busan
 Homepage Add. : www.ys-airssystem.co.kr
 Main Products : Heat exchanger, Plant
 TEL : +82-51-832-0510

YOUNHAP FASTENERS CO., LTD.

Head Office : Kimhae Gyeongsangnam-do
 Homepage Add. : www.younhap.co.kr
 Main Products : Carbon Steel Precision, Tybe for Hydraulic Line Service
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 Homepage Add. : www.yujincometal.com
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 TEL : +82-51-314-0757

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Daily News of KORMARINE 2011

(Korea International Shipbuilding and Marine Exhibition)



Monthly KORSHIP, the Korea shipbuilding monthly magazine, will launch daily news service to keep your finger on the pulse of the KORMARINE 2011.

KORMARINE 2011 will be open with great eclat at Busan Exhibition & Convention Center (BEXCO) , and Monthly KORSHIP will keep you updated with the latest news swiftly during the show as the official media of KORMARIE 2011 and we appreciate you cooperation in advance.

KORMARINE 2011 will run from October 26 to October 29 Busan Exhibition Convention Center (BEXCO) .

Our daily news will have a circulation of 10,000 every day during the show.

Contact Monthly KORSHIP or K. Fairs for inquiries or suggestions for the daily news article related to KORMARINE 2011 or advertisement in the print Edition. (Deadline Date: September 20th 2011)

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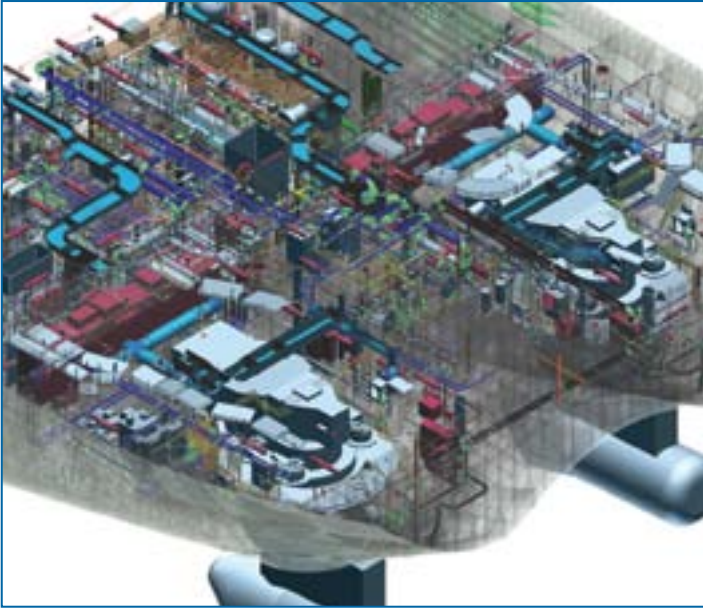
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