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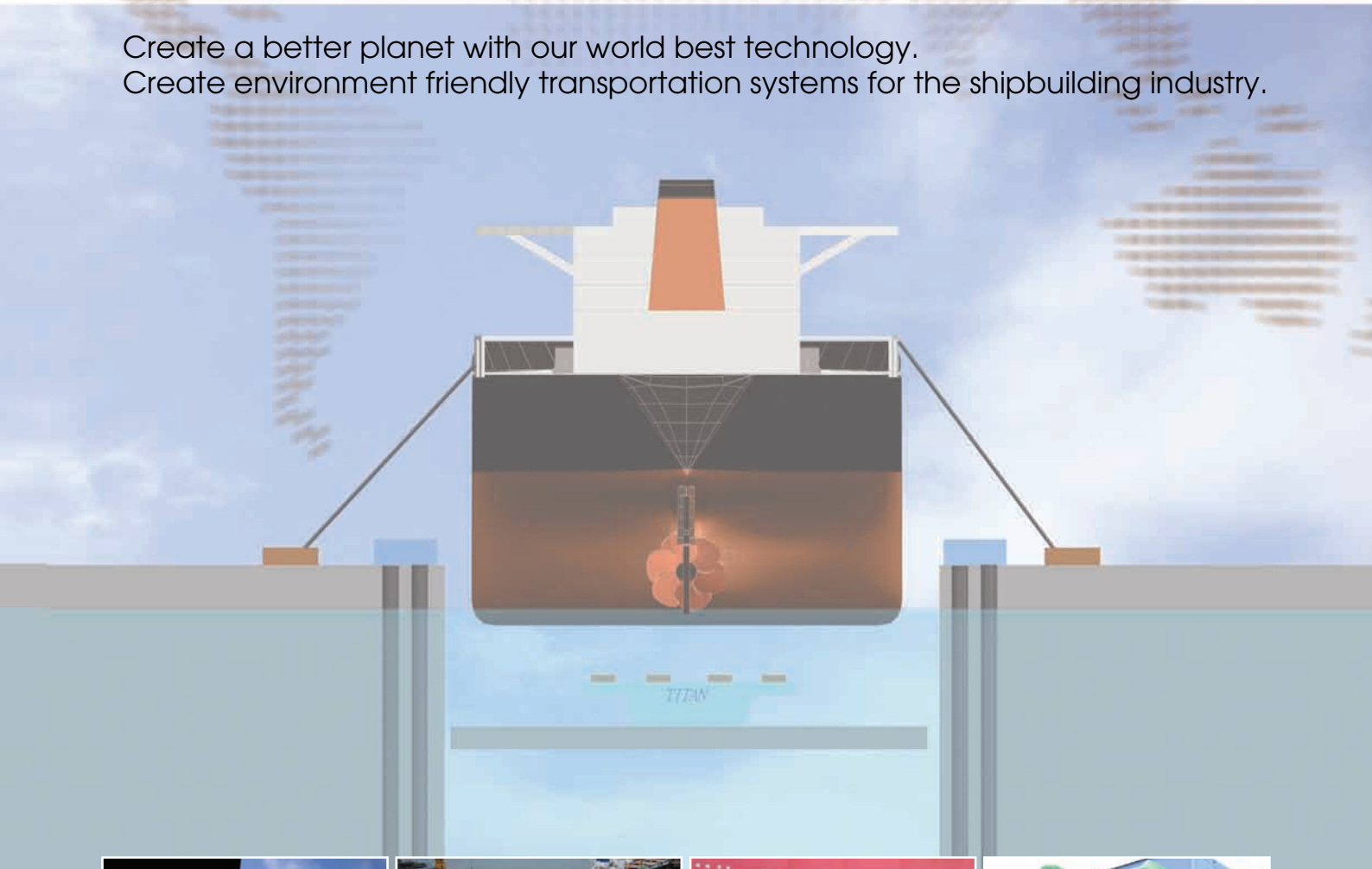

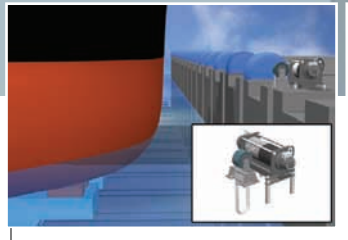

Shiplift System
CAPACITY: UP TO 35,000TON
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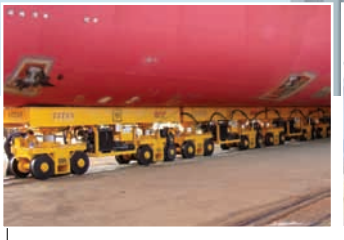
MTP (Module Transporter)
CAPACITY: 60TON ~ 1,000TON
FOR COMBINATIONS OF UP TO
OVER. 20,000TON



RTP (Transfer System)
CAPACITY: 100TON ~ 600TON
FOR COMBINATIONS OF UP TO
90,000TON

SSC (Ship Section Carrier)
CAPACITY: 50TON ~ OVER. 1,000TON
FOR COMBINATIONS OF UP TO
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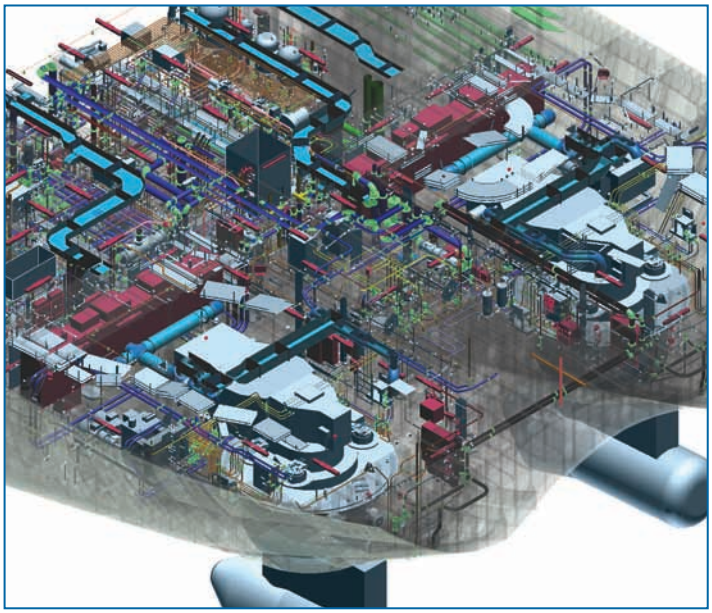

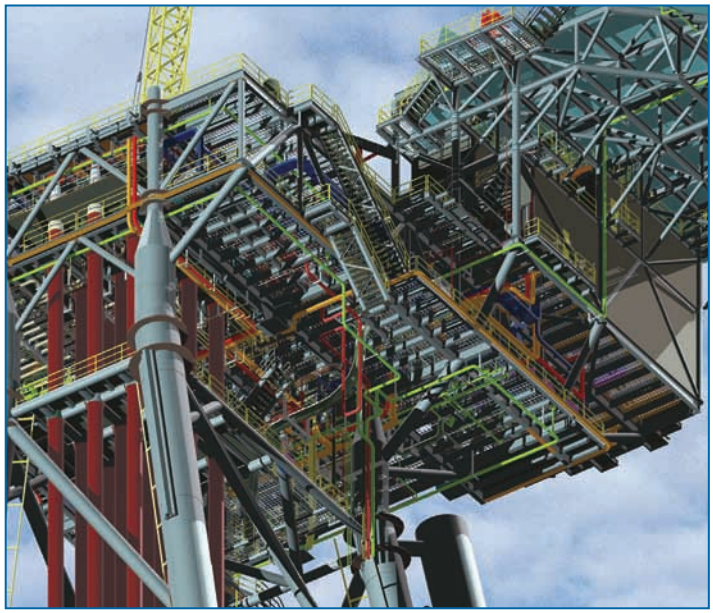

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Feb. 2007 Ranked as the world's 5th shipbuilder by Clarkson Report
Apr. 2006 Developed the world first GTS (Gripper-jacks Translift System)
Aug. 2001 Established

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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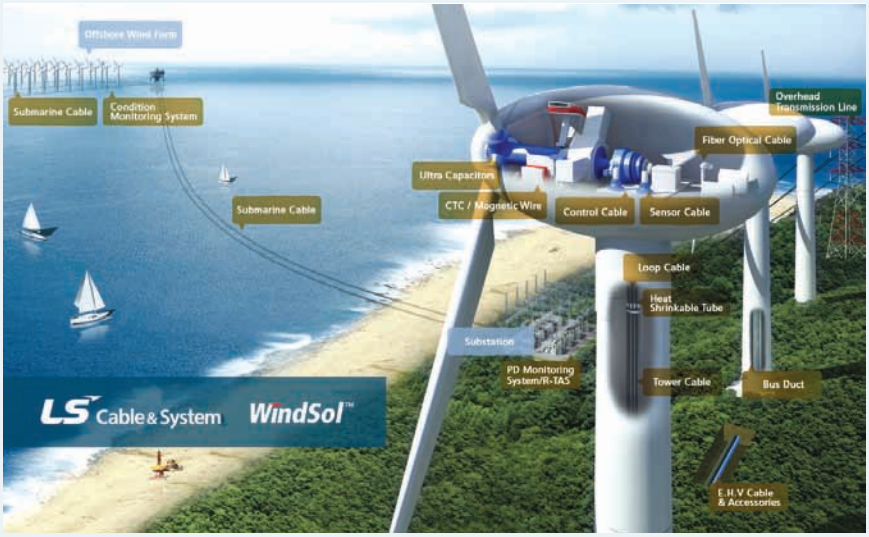
LS Cable & System, first in Asia to obtain international certification for a wind power generation monitoring system

LS Cable & System announced on the 9th that the company has become the first in Asia to obtain certification for a condition monitoring system (CMS), the company's own wind power generation monitoring system, from Germanischer Lloyd (refer to terminologies). This certification is the most highly regarded among international certifications for wind power generation. Currently, the market is being led by GE (U.S.A.) and SKF (Sweden). With this certification, LS Cable & System secures a bridgehead for entry into global markets.

In general, gearing and generator components of wind power generators are highly prone to breakdown due to the severe mechanical pressure they must withstand and the friction of the drive parts. In addition, wind power generators are mainly installed in mountainous regions or coastal areas subject to heavy winds which render accessibility and repair very difficult. As a result, operation and maintenance costs represent as much as 30% of the total installation cost.

The system developed by LS Cable & System provides real-time online monitoring of facility operation and component condition through vibration sensors and speedometers installed to monitor bearings, shafts, memory boxes and the generator. The objective is to recognize vibration patterns occurring when friction increases for the components being monitored. This enables engineers to better anticipate component failure so that the wind power generation facilities and the overall complex will operate more stably. In total, this system should lead to a reduction of operation and maintenance costs by 50% or more.

LS Cable & System succeeded in obtaining the certification after passing strict tests including document reviews and field surveys by Germanicher Lloyd over nine months from September last year to May this year. LS Cable & System, together with Korea Midland Power, applied the CMS in January 2010 to two of the 1.5MW level wind power generators in Yang Yang, Gangwon-do. The system is producing satisfactory results.



LS Cable & System's wind power generation solution overview

Among alternative energy sources, wind power is being commercialized at the fastest rate (67.2%) followed by geothermal (30.6%), photovoltaic (1.4%), solar thermal (0.5%) and tidal energy (0.3%). The World Energy Outlook 2010 forecasts that the capacity of wind power generation facilities installed in the world will increase from 120GW in 2008 to 477GW by 2020.

In particular, as of 2008 the market in China, on which LS Cable & System has been focusing as of late, had the world's fourth largest wind power generation capacity and is still growing. In terms of capacity of new facilities, China has grown rapidly to be ranked as second following the U.S. Forecasting a high level of demand for this system in China, LS Cable & System will commence marketing activities in full scale by showcasing its submarine, distribution, communication and control cables at 'Wind Power Asia 2011,' the largest such show in Asia that will take place from the 22nd to the 24th of this month in Beijing.

LS Cable & System's Executive Vice President of Technology Development Division Junhyeong Joh said, "This certification proves that LS Cable & System's expertise in wind power solutions is of the global standard." He added, "We will add monitoring systems to WindSol, our own solution consisting of cables and joints for wind power generation, and will further accelerate our entry into the global wind power market."

STX Group launched STX Future Institute

STX Group held an opening ceremony on May 23 for its think thank STX Future Institute which will play a leading role in establishing the systematic management - one of the 4 core strategies of STX Group for 'Vision 2020'.

STX Future Institute will be headed by Shin Chul-sik, Vice Chairman of the STX Group, and will be staffed with around 20 experts to start with and the number will increase up to 50 within this year.

STX Future Institute was founded as an independent organization, not an internal organization of holding company nor affiliate, and will be dedicated to reviewing STX Group's management system from objective perspective and supporting the development and implementation of strategies.

Particularly, STX Future Institute will recruit staffs from those with experience at global strategic consulting companies such as McKinsey, AT Kearney, Monitor, etc, so that it can function as a business-oriented think tank, rather than an academic economic research institute, and take on a leading role as a 'change agent' which serves as a catalyst for change within the STX Group.

An opening ceremony was held for STX Future Institute on May 23. During the ceremony, Kang Duk-soo (middle), Chairman of STX Group, Lee Hee-bum (right), Chairman of STX Energy and Heavy Industry, and Shin Chul-sik (left), Vice-Chairman of STX Future Institute are cutting the celebration rice cake.

STX Future Institute plans to support for the STX Group's vision primarily in 3 areas according to its mission statement, "We provide analytical perspectives necessary for the STX Group's essential and strategic decision-making process in a timely manner."

In the first place, STX Future Institute will set specific strategic direction for accomplishing Vision 2020. STX Future Institute will carry out a wide range of tasks, including the review of challenging issues from strategic standpoint within the Group, feasibility study on major projects and new business, direction-setting, and others.

In addition, STX Future Institute will identify optimal management systems for executing existing strategies and establish a variety of management processes of global standard in a bid to make valuable contribution to the STX Group's effort at systematic management.

Finally, STX Future Institute will build strategic market intelligence system. This new in-house think tank's research and intelligence functions are expected to help ensure swift and accurate decision-making in the rapidly-changing market environment.

Shin Chul-sik, Vice-Chairman of STX Future Institute, said, "As a group composed of young experts in quest for global standards, STX Future Institute will do its utmost to help achieve STX Group's mid and long-term vision and further advance the organizational culture."

HHI successfully completed the offshore trial run of its tidal current power facility

Hyundai Heavy Industries (HHI) is expanding its reach of green energy business into the tidal wind power sector, following its advancement into the solar power and wind power sector.

HHI announced that it successfully completed the installation and test run of a prototype tidal current power system with an installed capacity of 500kW at Uldolmok Strait, Jindo, South Jeolla Province on June 9.

Tidal current power refers to the technology converting the energy of tides into electricity using propeller-like turbines installed in the fast-running stream, has come into the limelight as the next-generation energy source which is recyclable, clean, all-weather, ensures and stable power capabilities.

HHI completed the onshore performance test of the tidal current power system at its Ulsan headquarters in September 2010

and successfully carried out the offshore test run this time, bringing the commercialization of the tidal current power system close to reality.

HHI's 1-month trial run of its tidal current power system showed that the system installed on May 1 has exceeded the performance target in terms of both per-flow output and efficiency. This tidal current power system, proven successful in the basin test at HHI's headquarters, is capable of stable power generation even in the changeable underwater environments and is closer to commercialization.

Additionally, this tidal current power system incorporated the world's first direct-link power transmission system which connects the hydraulic turbines, gear, and generator horizontally under water, thus reducing loss of power and increasing durability. Equipped with hydraulic turbines on both sides, it is capable of power generation without regard to the direction of tidal ebb and flow.

The key drive behind HHI's independent development of its tidal current power system is the excellent propeller manufacturing capability that HHI has built up while constructing approximately 1,700 ships and its world's best technology in power and electricity sectors.

Tidal site for current wind power system installed by HHI in Uldolmok Strait, Jindo

An official of HHI said, "We will closely examine the data obtained from this trial run process to increase the cost-effectiveness of power generation facility and strive to expand the current capacity into MW grade. We will actively participate in the tidal current power farm projects both at home and abroad."

Apart from that, HHI aims to complete its current development of tidal current power system for MW-grade tidal current power farms, a government project, by 2014.

DSME loaded a ultra large block using 2 offshore cranes connected in parallel

Daewoo Shipbuilding & Marine Engineering (DSME) successfully loaded an ultra large block on the ship for the first time worldwide using a new engineering procedure that connects 2 units of 3,600-ton offshore cranes on June 10.

This block equivalent to the size of a large bow of 7,090TEU containership measures 73m in length, 42.8m in width, 25.9m in height. It is a supersize block that weighs 4,360 tons, and one-fourth as large as this containership.

An ultra large block is loaded by connecting 2 units of 3,600-ton cranes in parallel

The centerpiece of this engineering procedure is to ensure the weight balance of heavy load while the offshore crane lifting the heavy load is being moved by tug boat. In 2009, DSME published the results of its joint research with Seoul National University, which was titled "Establishment of standard for applying the lifting load factor in the parallel operation of multiple offshore cranes and the simulation-based validation", laying the technological foundation for the parallel connection of offshore cranes.

Lee Yun-su, a manager at DSME, who designed this engineering procedure, explained, "Parallel connection of 2 offshore cranes has led to the reduction in the duration of works on the dock by around 3 weeks, improvement in the safety within the floating dock, and resolution of concerns regarding marine pollution. That is like killing 3 birds with 1 stone."

In 2009, DSME has become the world's second shipbuilder that connected 2 offshore cranes in parallel and lifted the block up as high as 78m to load a block on the ship.

This new and world's first successful engineering procedure attests to DSME's world's best shipbuilding expertise and production technology.

Korea will build IT-integrated Unmanned Surface Vehicle capable of autonomous navigation and control

The Ministry of Land, Transport and Maritime Affairs announced that it would embark on full-scale development of localized smart Unmanned Surface Vehicle (USV) for maritime research and surveillance, etc, which were previously carried out by manned vessels.

The Korea Ocean Research & Department Institute will undertake the project, which was selected after the Ministry's announcement of research institute selection process on March 15 and the review board's evaluation on June 10.

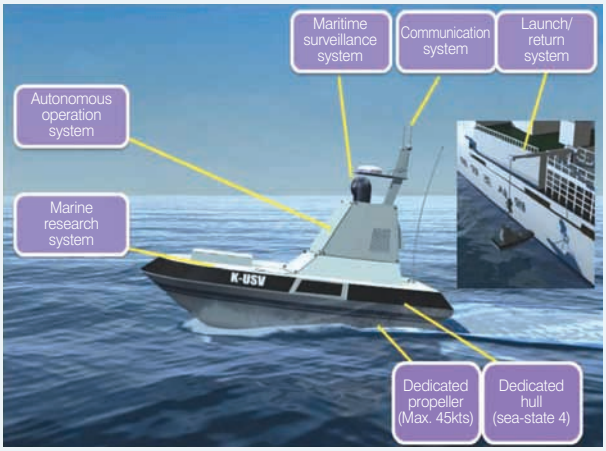
KRW 20 billion will be poured into the development of USV in 2 phases between 2011 and 2015, aiming to develop technologies for the self-operating USVs capable of autonomous avoidance of obstacles or collision or the USV that can be mounted on board ship.

In the first phase which is between 2011 and 2013, the Ministry plans to pump KRW 13.5 billion into the design of optimized hull model and automated return system of USV and the development of core technologies such as navigation and remote control systems. In particular, the USV will be designed to sail at a maximum speed of 90km/hr within an operation radius of 16km and navigate in the sea where waves reach 2.5m high.

Between 2014 and 2015, the Ministry plans to inject KRW 6.5 billion into the production of prototype and automated return system. This phase will focus on the test-run of prototype in the real sea, speeding up the commercialization.

USV will help prevent accidents arising from the fatigue build-up of crews and carry out missions such as maritime research and surveillance such as 24-hour maritime research and clampdown on illegal fishing, etc. USV is expected to be used for various missions, including the search and rescue mission in bad weather, and thus has attracted attention from both civil and defense sectors.

An official from the Ministry of Land, Transport and Maritime Affairs said, "We will secure the core technologies for USV by integrating the Korea's leading information technology (IT) and shipbuilding technology and build the infrastructure for future maritime industry such as the maritime surveillance, manned/unmanned maritime research, maritime leisure and others."



Schematic diagram of multipurpose smart unmanned surface vehicle

DSME completed wind turbine production plant in Canada

Daewoo Shipbuilding & Marine Engineering (DSME) held a grand ceremony to mark the completion of its new Trenton plant in Nova Scotia, Canada on June 14 (local time).

The opening ceremony was attended by many distinguished guests from home and abroad, including Nam Sang-tae, President &CEO of DSME, Lee Nam-gi, CEO of DSME Trenton (DSTN), a wind turbine production plant established in Canada, and Nova Scotia Premier Darrell Dexter.

DSTN is a joint venture established in March between DSME and the Province of Nova Scotia which have secured 51% stake and 49% stake, respectively, through investment. This new and modern wind power production plant has been converted from a railcar plant which DSTN acquired in March last year.

The DSTN wind turbine plant which was completed after about 1 year and 3 months of construction will become fully operational and produce up to around 200 wind blades and 250 wind turbine towers annually.

DSTN has already seen a robust inflow of new orders. DSTN clinched orders for about 30 units from DeWind, DSME's wind power subsidiary and Suzlon, India's largest wind turbine manufacturer, etc, even before it began operation.

Nam Sang-tae, President &CEO of DSME, said in his congratulatory address on the same day, "The wind power market which has registered a whopping 28% annual growth creates

another opportunity. We will reach our goal of increasing the annual sales to USD 150 million by 2015 through the solid partnership and collaboration with the Province of Nova Scotia."

Nova Scotia Premier Darrell Dexter also expressed his high expectation, saying "This new facility will directly create around 500 jobs and have far-reaching economic spill-over effect indirectly."

Meanwhile, DSME acquired the U.S. wind turbine maker DeWind in August 2009 and has added fresh momentum to its wind power business when it won orders for a total of 55 wind turbines in the North America, including the orders for 5 wind turbines from the Wind Energy Institute of Canada (WEICan), recently.

The wind turbine plant in Nova Scotia will be vital for DSME, along with DeWind, in gaining firm foothold in the North American market and making inroads into Europe, China, etc.

DSME aims to become one of the world's top 10 wind power companies by 2015 and capture 15% of global market share by 2020 and thus joining the ranks of the world's top 3.

Nam Sang-tae (the top left-hand corner), President &CEO of DSME, is delivering a commemorative address in the ceremony to mark the completion of new Trenton plant in Nova Scotia, Canada on June 14 (local time). The photo shows Nova Scotia Premier Darrell Dexter, Lee Nam-gi, CEO of DSTN, and Percy Paris, the Economic and Rural Development and Tourism Minister of Canada (from the second on the left).

KR taps into the marine fuel oil service market

Korean Register of Shipping (KR) entered into a cooperation agreement with the Singapore-based VISWA, the second largest fuel oil analysis organization, to provide marine fuel oil and lubricant testing and analysis service on June 15.

Under this cooperation agreement, VISWA will carry out the analysis of marine fuel oil and lubricant and the KR will guarantee the quality of the analysis service.

Unauthenticated low quality fuel oil can reduce combustion efficiency and causes various problems such as the damage to the mechanical system due to macroscopic sludge. Regular analysis of lubricant can help figure out the progress of wear on machine parts, combustion state and others.

Recently, accurate analysis of marine fuel oil has taken on added significance in dealing with environmental issues such as the restriction on the CO_2 emissions and use of low sulfur fuel and preventing marine accidents. Such analysis can be an effective tool that allows shipping companies to cope with mandatory convention as the ISM (International Safety Management) Code requires specific measures aimed at promoting reliability of equipments or systems which may cause hazardous situation from sudden operation failure.

Under the cooperation agreement with VISWA, a world-leading fuel oil certification organization, VISWA and KR will cooperate on the technology sharing in relation to the certification of fuel oil, training/education for technical manpower and also work closely to jointly host technical seminars for domestic and overseas shipping companies.

An official from KR said, "This MOU and the unmatched expertise of KR are expected to contribute to providing customers with more reliable and new value-added services. We will launch the service at the earliest time possible to provide accurate fuel oil analysis to customers and promote scientific ship management and safe operations."

VISWA, established in 1991, is a specialized lab and operates research centers in Singapore and Huston, United States. It is the world's second largest in the field of fuel oil certification.

HMD received the award of Best Company

Hyundai Mipo Dockyard (HMD) was honored with the award of Best Company in the '20th Corporate Economic Justice Awards' organized by the Citizens' Coalition for Economic Justice on June 10.

The Corporate Economic Justice Awards, which marks the 20th anniversary this year, was established in 1991 by the Centre for Social Justice under the Citizens' Coalition for Economic Justice to honor companies

highly recognized for excellent track record in returning the profits to society to fulfill corporate responsibility towards social communities and playing a key role in the advancement of society.

Importantly, this award was determined by the strict review in 3 phases (qualitative review, qualitative review, final review of candidates) based on 7 criteria such as soundness, fairness, social service, consumer protection, environmental protection, satisfaction of employees, and contribution to the economic growth.

HMD was given high scores in the review with regard to the soundness, social service, and environmental protection.

Particularly, HMD received well-deserved attention for its highly effective professional manager system and unmatched financial health built on the no-debt management.

Additionally, HMD was acclaimed for its company-wide dedication to improving the lives of the disadvantaged in the society, like providing financial support to the local senior citizen centers and child breadwinners, along with its participation in voluntary organ donation movement, group blood donation, etc.

Furthermore, HMD was given positive evaluation on the environmental protection, considering its acquisition of international certifications related to environmental protection, greenhouse gas inventory assurance statement and others.

Choi Weon-gil, President and CEO of HMD, said after winning the award, "All employees of HMD will redouble efforts to maintain continued growth and contribute to the advancement of the nation and society on the basis of the lofty entrepreneurship of Mr. Jung, Joo-young, the founder of Hyundai Group."

KR held a ceremony to mark its 51st anniversary

Korean Register of Shipping (KR) celebrated its 51st anniversary at the main conference room of its headquarters in Daejeon on June 16.

KR honored 62 employees with longtime service and employees who made significant contributions, and awarded prizes to 65 people from external organizations in recognition of their important contributions, including those from KLCSM which was selected as the best safety management shipping company, government, and those from the shipbuilding, shipping, and marine equipment industries.

Oh Gong-gyun, Chairman of KR, said, "The crucial efforts that you made, who received the awards today, have built the KR into what it is today. Let's further strengthen our capabilities to achieve unlimited growth of KR which has a legacy dating back a half a century and become a truly respected company."

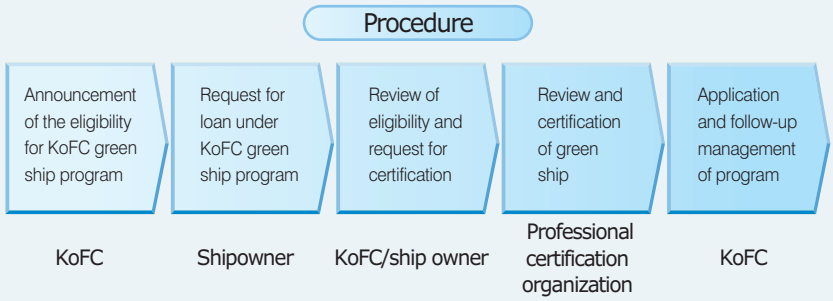
KR held a ceremony to celebrate its 51st anniversary at its headquarters in Daejeon on June 16.

KoFC offers green ship program

Korea Finance Corporation (KoFC) announced on June 1 that it would provide green ship financing to ship owners under its 'KoFC Green Ship Program' that offers incentives such as low interest rates if the related ship meets the standard of green ship.

Green ship refers to the ships equipped with the facilities that reduce the emissions of pollutants and greenhouse gases. Eligibility for the green ship financing will be determined through the certification of the authorized organization of government (DNV Korea).

This is the nation's first green ship program offered by domestic financial institute. KoFC expressed its hope that this green ship financing would pave the way for increased newbuilding orders for green ships and help speed up the development green and eco-friendly technologies in the shipbuilding industry.



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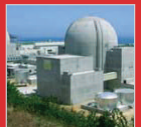
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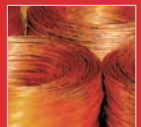
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Mission Statement

Korship helps not only to share informations and technologies of shipbuilding industry between users and potential suppliers but also introduce subscribers up-to-date shipbuilding related technologies and informations to become a shipbuilding industry technical journal.

Korship puts advertising domestic companies in touch with abroad buyers and tries to contribute development and growth of domestic shipbuilding industries by introducing world's new technologies, news, companies and products to superintendents, engineers, Korea branch of abroad companies, domestic shipbuilding companies and all related companies.

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World's up-to-date indispensible informations of shipbuilding companies, products and system technology described to help people who engage in the industry.

Special Focus

Provide articles deeply focusing on latest shipbuilding industry technologies, logistics and port etc.

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Introduce latest tendency and related news of industry through company interview.

Product

New shipbuilding industry products overview

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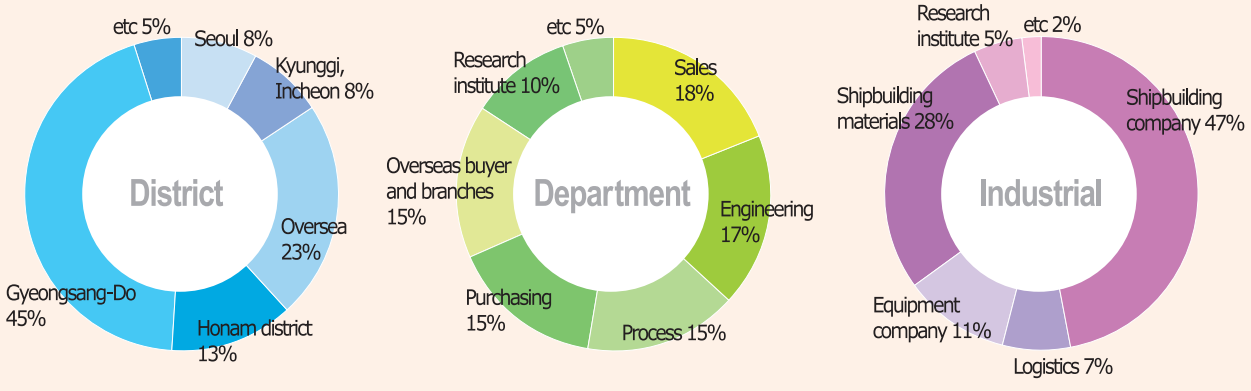
Issues and news articles from global shipbuilding companies and organizations

Detailed area breakdown



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LNG carrier market has bright outlook

The newbuilding orders for LNG carriers stood at 45 between 2004 and 2007 before plummeting to 3.3 in the period spanning from 2008 to 2010. However, the demand for liquefied natural gas as a source of alternative energy has been spurred amid more stringent CO_2 emission regulation, high oil prices, and on-going nuclear crisis in Japan, and resultantly, the market for LNG carriers is expected to experience stronger demand than the one witnessed in pre-2008 period.

In fact, the LNG carrier orders stands at 14 as of April 2011, 9 more compared to the previous year. As the LNG carrier market is rebounding, Samsung Heavy Industries (SHI) won an order for 6 LNG carrier from the U.K.-based Golar LNG Energy in April, the first newbuilding LNG carrier order this year in the nation's shipbuilding industry. Following that, Daewoo Shipbuilding & Marine Engineering (DSME) and Hyundai Heavy Industries (HHI) clinched orders for LNG carriers, raising expectations for additional orders.

'Al Gattara', a 216,000m^3 LNG carrier built by HHI

LNG carrier refers to the tank ship designed for transporting LNG, the nonpetroleum-based natural gas. The cargo tank of LNG carrier must necessarily be made of special alloy and are heavily insulated to carry LNG which is condensed into liquid by cooling to -162°C and compressed to 1/600 of its gaseous volume. This special cargo tank facility is the biggest contributor to the high price of LNG carriers, the most expensive in the category of commercial ships.

Characteristics of LNG carrier market

LNG carrier market is relatively less vulnerable to the market conditions because the marine transport of LNG is undertaken on the basis of project under the long-term charterage contract. In other words, an operator who will undertake the transport of LNG is selected when the exporter and importer enter into a long-term purchase contract, and LNG carrier order is awarded immediately upon commencement of gas field exploitation project in accordance with the long-term transport contract. As a result, the shipping company can enjoy a steady fixed-rate income stream and can avoid high costs arising from the construction of new vessel priced above USD 200 million per unit.

Recently, LNG carrier orders are often awarded even before the LNG vessel is employed under charter contract amid positive outlook for increased LNG carrier traffic over the long-term.

LNG carriers are categorized into moss type and membrane type, depending on the application of cargo tank. Moss type has a dual design and skirt structure that supports the aluminium spherical tank separated from the hull. The cargo tank has spherical shape, a relatively simple structure, which is capable of withstanding the pressure and has the advantage of high safety. Membrane type has the protective barrier that supports the structure made from thin metal membrane. The membrane type LNG carrier is relatively cheaper than the moss type LNG carrier and has the advantage of wider space on the upper side of deck. Another advantage is the changeability in shape depending on the tank capacity.

Recently, there has been an increasing preference for the membrane type which is relatively cheaper and enhances the cargo storage efficiency due to the structure of tank fully integrated into the hull. The prime contributor to the surge in demand for membrane type is the reduction in the costs incurred in passing through the Suez Canal.

Hyundai Heavy Industries (HHI) which previously focused on the construction of moss type is shifting towards the production of membrane type in line with changing trends in the market.

'Abdelkader', a LNG carrier built by HHI

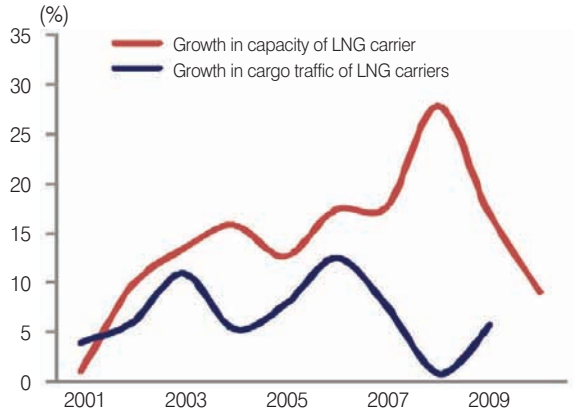
Global orderbook for LNG carriers

The capacity of LNG carriers has soared in the wake of the large-scale gas field exploitation projects in Qatar which began in 2002. The growth rate of capacity in LNG carriers has steadily surpassed that of cargo traffic volume since 2002. The growth of capacity has slided since the outbreak of the global financial crisis in 2008, but it was a relatively small drop. (down by 20% compared to the peak price recorded in 2008, as of the second quarter of 2010)

New orders for LNG carriers steadily fell after reaching the peak in 2004. In particular, the orderbook for LNG carriers shrank in the aftermath of the global financial crisis that began 2008, and did not show any signs of improvement until the first quarter of 2011. 25 LNG carriers were ordered in 2007, 5 in 2008, 0 in 2009, 5 in 2010, and 14 as of April 2011. The current orderbook stands at 2.2 million m^3, already exceeding the combined orderbook which stood at 1.6 million m^3 in the period spanning from 2008 to 2010.

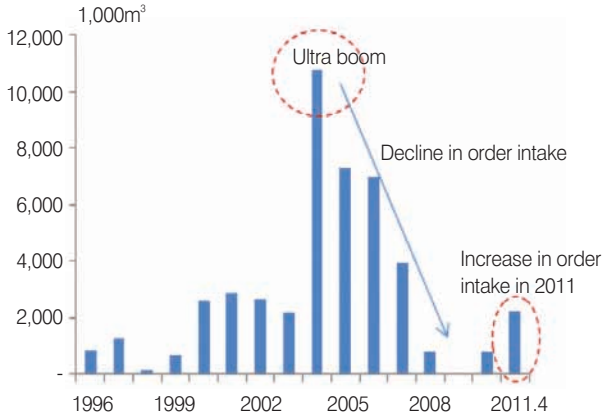
The proportion of order backlog for LNG carriers currently stands at 7.3%, which suggests that there will be less burden on the supply and demand. However, the supply glut (CAGR of 15% in capacity growth) which has accumulated since the period between 2001 and 2010 is somewhat burdensome.

Fig.1 Trend of capacity and cargo traffic of LNG carriers



Note: Based on 160,000m³, price of newbuild LNG carriers
Source: Clarkson

Fig.2 Trend of order intake of LNG carriers



Shipyard	Ship owner	No. of ships	Size (1,000m³)
Samsung Heavy Industries (Korea)	GasLog (Greece)	2	155
	Fredriksen (Cyprus)	6	160
Daewoo Shipbuilding & Marine Engineering (Korea)	Angelicoussis (Greece)	1	155
Hudong Zhonghua (China)	O.S.K. Lines (Japan)	4	170
Mitsubishi Heavy Industries (Japan)	Nippon Yusen Kaisha (Japan)	1	143

Note: Based on late April, 2011
Source: Clarkson, KDB Research Institute

A 137,000m³ LNG carrier built by HHI

According to the data released by the U.K.-based shipbuilding and shipping market research firm Clarkson, the growth in capacity of LNG carriers based on the current order backlog is expected to reach 1.9% in 2011 and 1.7% in 2012.
Based on the number of ships built by shipyards, Daewoo Shipbuilding & Marine Engineering (DSME) built 20% of the entire global fleet of 363 LNG carriers, the largest proportion, followed by Samsung Heavy Industries (SHI) (18%), Mitsubishi Heavy Industries (11%), and Hyundai Heavy Industries (HHI) (10%).
HHI which built mainly moss type LNG carriers has secured fewer orders for LNG carriers compared to DSME and SHI which have focused on building price-competitive membrane type LNG carriers preferred by ship owners. However, HHI discontinued construction of moss type LNG carriers with the delivery of its last moss type LNG carrier in June 2006 and embarked on full-scale competition to win orders for membrane type LNG carriers.
SHI's current order backlog for LNG carriers stands at 14, the largest number, followed by DSME with 7 units and China's Hudong Zhonghua with 5 units.

Prospect for LNG carrier market

LNG carrier market is expanding buoyed by the surge in demand for LNG

New orders for LNG carriers stayed flat from 2008 to 2010 amid the delay in construction of LNG terminal construction in the aftermath of global financial crisis, despite the surge in newbuidling orders for LNG carriers with the launch of LNG project in Qatar in 2002.

Electricity-powered LNG carrier of SHI


'Mozah', a 266,000m^3 LNG carrier built by SHI

However, the stringent CO_2 emission regulations on global energy companies and on-going nuclear crisis in Japan have sparked heightened interest in LNG as a source of alternative energy, and the demand for LNG is expected to soar as LNG has become more price-competitive amid high oil prices. Therefore, it is very likely that additional newbuilding orders for LNG carriers will be placed.

Usually, natural gas is supplied in the form of PNG (Piped Natural Gas) via pipelines or LNG through maritime transport. The demand for LNG carriers is sensitive to the demand for LNG in Asian countries such as Japan and Korea.

The proportion of LNG in the global primary energy use was only around 30% in 2007, but has been rising due to the constraints on the construction of pipelines, expansion of spot market, etc. IEA forecast that the proportion of LNG would jump to 50% of global primary energy use by 2030.

East Asian countries such as Japan, Korea, Taiwan, account for approximately 50% of entire demand for LNG. By contrast, countries situated close to the LNG producing areas prefer PNG to avoid the high cost of transporting LNG and therefore the growth in demand for LNG is not strong in countries importing PNG (e.g., the natural gas pipelines between United States and Canada, between Europe and Russia, and between Europe and Africa).

In particular, demand for LNG is expected to increase in Japan at a far greater rate than any other country in the wake of the catastrophic earthquake. Japan's import of LNG stands at 65 million tons as of 2009, and is expected to climb by 3.8 million to 10 million tons yearly if Japan's nuclear plants are replaced with LNG power plants. (3.8 million tons if No. 1 reactor at Fukushima is shut down, 7.7 million tons if No. 1 and 2 reactor at Fukushima are shut down, and 10.02 million tons if all troubled reactors and thermal power plants are shut down.) Demand for LNG, a green energy source, is expected to rise, considering that the tremendous damage to Japan's nuclear plants from the earthquake has prompted governments worldwide to have second thoughts about planning or continuing the construction of nuclear plants.

Over the short-term, an increase in demand for LNG carriers will depend on whether or not gas field exploitation will be carried out in the Asia Pacific region. As gas field exploitation must be preceded by the conclusion of long-term contract, the demand for LNG carriers will be directly influenced by whether or not the gas field exploitation will be pushed forward. In addition, the demand for LNG in Asian countries

Table 1. Major gas field exploitation project slated for final investment approval in 2011

Country	Project	Capacity (MTPA)	Production base
Australia	Santos Ltd-Gladstone project	7.8	2015
	QCLNG	8.5	2014
	Prdlude LNG Plant	3.5	2016
	APLNG T1&2	9.0	2015
	Pluto T2	4.3	2015
	Ichthys	8.4	2016
	Wheatstone LNG Project	10.0	2016
Indonesia	Donggi-Senoro	2.0	2014

Source: Hana Daetoo Securities

Table 2. LNG development projects expected to generate LNG carrier orders

Project title	Major investor	Country	Expected year of order placement	Expected no. of LNG carriers to be ordered
Shtokman	Gazprom, Total, etc	Russia	Second half of 2011	4 vessels + 4 vessels
Brass	NNPC, Total, etc	Nigeria	September, 2011	12 vessels
GLNG	Korea Gas Corporation, Total, Santos, etc	Australia	Expected in 2012	Korea Gas Corporation obtained authority to order 4 vessels
NLNG7	NNPC, Shell, Total, etc	Nigeria	Expected in 2012	12 vessels expected
Browse	Woodside, Shevron, BP, etc	Australia	Expected in 2015	vessels expected
Olokola LNG	Olokola LNG NNPC, Chevron, Shell, etc	Nigeria	Expected in 2015	12 vessels expected

Source: IEEJ, press release, HI Investment & securities

Table 3. Possession of LNG carriers among the world's top 30 LNG carrier operators

Rank	LNG carrier operators (ship owners)		DWT	Country	Expected LNG carrier order placement
1	MISC	29	2,068,921 DWT	Malaysia	Old ship can be replaced.
2	Qatar Gas (Nakilat)	25	3,248,965 DWT	Qatar	3 to 4 LNG carrier orders are expected.
3	Mitsui O.S.K. Lines	22	1,511,591 DWT	Japan	
4	NipponYusen Kaisha	22	1,674,146 DWT	Japan	
5	Shell Group	19	1,171,682 DWT	United Kingdom	
6	Teekay Corporation	15	1,279,418 DWT	Canada	
7	BW Ltd.	14	1,148,625 DWT	Singapore	
8	Kawasaki Kisen	14	1,080,083 DWT	Japan	
9	Nigeria LNG Ltd.	13	1,003,051 DWT	Nigeria	3 to 4 LNG carrier orders are expected.
10	BG Group Plc	12	970,687 DWT	United Kingdom	
11	Fredriksen Group	11	850,793 DWT	Cyprus	
12	Knutsen OAS Shipping	9	700,240 DWT	Norway	
13	Exmar N.V.	9	719,344 DWT	Belgium	
14	A.P. Moller	8	641,909 DWT	Denmark	
15	BGT Ltd.	8	580,719 DWT	United States	
16	National Gas Shpg.	8	603,610 DWT	U.A.E.	
17	Sonatrach	8	529,778 DWT	Algeria	
18	Nakilat, JC	8	924,179 DWT	Japan	
19	Hyundai M.M.	7	537,855 DWT	South Korea	
20	BP PLC	7	562,454 DWT	United Kingdom	
21	SCF Group	6	396,388 DWT	Russia	
22	China LNG Shpg.	5	365,827 DWT	Hong Kong	
23	Angelicoussis Group	5	423,499 DWT	Greece	VLCC → 3 LNG carriers are modified.
24	SK Shipping Co. Ltd.	5	373,711 DWT	South Korea	
25	Leif Hoegh & Co.	5	382,444 DWT	Norway	
26	ENI S.p.A.	4	122,314 DWT	Italy	
27	Hanjin Shpg Co.	4	296,822 DWT	South Korea	
28	Korea Line	4	325,205 DWT	South Korea	
29	Dynacom Tankers Mngt	4	323,768 DWT	Greece	
30	Tokyo LNG Tanker Co.	4	292,759 DWT	Japan	
Top 30 Total		314	25,110,787 DWT	86.50%	
Total		363	28,339,688 DWT		

Source: HI Investment & securities

Table 4. Age of medium-sized LNG carriers

Size (m^3)	Fleet Nos. (No. of vessel)						Over 20 years
	20 yrs +	15 - 19 yrs	10 - 14 yrs	5 - 9 yrs	0 - 4 yrs	Totals	
<1,000		0	0	0	0	0	0.0%
1-2,000	1	0	0	1	1	3	33.3%
2-5,000	0	0	0	1	1	2	0.0%
5-10,000	0	0	0	0	1	1	0.0%
10-20,000	0	1	3	0	3	7	0.0%
20-40,000	2	0	0	1	0	3	66.7%
40-60,000	3	0	0	0	0	3	100.0%
60-100,000	10	2	2	0	3	17	58.8%
100-140,000	44	16	31	44	3	138	31.9%
140,000+	0	0	0	11	169	180	0.0%
Total	60	19	36	58	181	354	16.9%

Source: Clarkson, HI Investment & securities

such as Japan, etc, is heavily dependent on the gas field exploitation projects in the Asia Pacific region for reason of transport cost, and as a result, the LNG trade among neighboring countries or regions comprises the largest proportion in Asian countries.

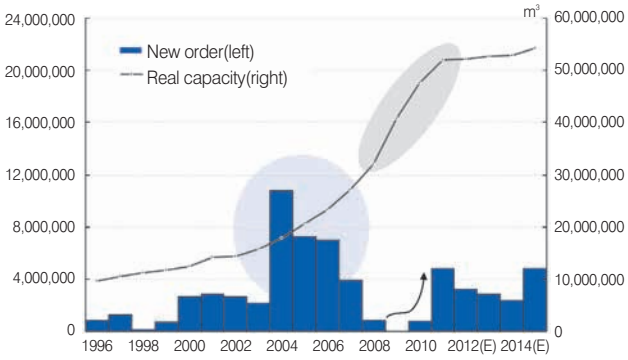
The project slated for final approval in 2011 in the Asia Pacific region will produce 53.5MTPA (Million Tonne Per Annum) of LNG, which is 73% of the global LNG production capacity (73MTPA) in 2011.

Gas field exploitation projects can generate demand for offshore facilities, as well as LNG carriers. Besides, gas field exploitation projects create demand for an array of offshore facilities such as the drilling facilities, LNG-FPSO for the liquefaction and storage of gas, FSRU for the regasification and storage of gas. Thus, gas field exploitation projects are expected to have far-reaching impact on shipbuilding industry, considering the high prices of offshore facilities and additional orders for platform supply vessels, etc.

Expansion amid the trends towards large vessels

Additional LNG carrier orders can be expected from the replacement of old vessels or current trend towards large vessels. The fleet of LNG carriers owned by the world's top 30 LNG carrier operators accounts for approximately 87% of all LNG carrier capacity. Most of those LNG carrier operators are Asian or European ship owners and intensively focus on

Fig. 3 Outlook of new LNG carrier orders and capacity



Source: Clarkson, HI Investment & securities

LNG carrier built by DSME

'Al Marrouna', a LNG carrier built by DSME

the transport of LNG. The majority of large vessels beyond 140K are under 10 years old and thus will not need to be replaced immediately with new vessels in the near future. By comparison, a growing number of old medium-sized LNG carriers will have to be replaced with large vessels in the period ahead.

LNG carrier market and Korean shipyards

Order intake of LNG carriers in 2011

SHI won a USD 1.2 billion order for 6 LNG carrier from Golar LNG Energy, a U.K.-based LNG carrier operator, in April, the first newbuilding LNG carrier order this year in the nation's shipbuilding industry. Following that, Korean shipyards clinched a wave of new orders for LNG carries.

These 160,000m^3 LNG carriers are eco-friendly electricity-powered ships which reduce exhaust gas emissions. These vessels are outfitted with DF (Dual fuel) engines that can operate on either natural gas or diesel fuel to generate power for propulsion of LNG carrier.

An official from SHI said, "Importantly, this order is the first one awarded to SHI by Golar LNG Energy which owns 9 LNG carriers and 4 LNG-FSRUs."

All these vessels are scheduled for delivery in the first half of 2014.

DSME won an order for 2 LNG carriers (including 2 optional vessels) from Awilco LNG AS, a Norway-based owner and operator of LNG carriers, on May 25. These vessels will be completely built at Okpo shipyard of DSME.

Importantly, DSME secured this order in 3 years and 4 months after it clinched an order for 2 LNG carriers from BCG, the state-run gas company of Brunei, in January 2008.

HHI received a USD 600 million order for 3 units of 155,000m^3 LNG carriers (including 1 optional vessel) from the Greece-based Dynagas on May 31.

These vessels are membrane type LNG carriers with the cargo tank positioned inside the hull and will be outfitted with DFDE (Duel Fuel Diesel Electric) system that can operate on both oil and gas depending on situation. HHI will deliver these vessels in the second half of 2013.

Following that, HHI inked a contract on June 10 with the Norway-based Höegh LNG, for the first time worldwide, to build a LNG carrier and 2 LNG-FSRUs (including 2 optional vessels). The contract is valued at approximately USD 500 million.

This facility, 3 times larger than a soccer field, measures 294m in length, 46m in width, and 26m in height and will be

An 173,600m^3 LNG carrier, delivered by STXOS in August last year

LNG carrier built by STXOS

deployed in the sea. It is capable of storing and supplying 70,000 tons of natural gas equivalent to the nation's daily consumption of LNG. These facilities will be delivered in the second half of 2013 and the first half of 2014, respectively.

An official from HHI said, "This contract for LNG-FSRU will pave the way for new global trend of building offshore LNG supply base. About 10 projects are now underway in Brazil, Indonesia and other countries, raising the prospect for additional orders."

STX Offshore & Shipbuilding (STXOS) was awarded a USD 800 million contract from the Russia-based SCF Sovcomflot on May 31 to build 4 units of 170,200m^3 membrane type LNG carriers (including 2 optional vessels).

These LNG carriers will be delivered in late 2013 and first half of 2014, respectively, and chartered to Gazprom LNG over the long-term after delivery.

STXOS has vigorously pushed ahead with development of the ship model suited for the resource exploitation projects in the Polar region and successfully clinched this order. STXOS developed Arctic Ice Breaking Shuttle LNG Carrier jointly with STX Europe early last year and successfully built and delivered 173,600m^3 LNG carrier, its first LNG carrier, to the Spain-based Elcano in August last year.

STX will apply the cargo tank heat preservation system which can minimize the loss of evaporative gas during the transit. In addition, these LNG carriers can generate vapor, using the high temperature waste heat from the engine, to power the turbine generator, which will dramatically save fuel costs.

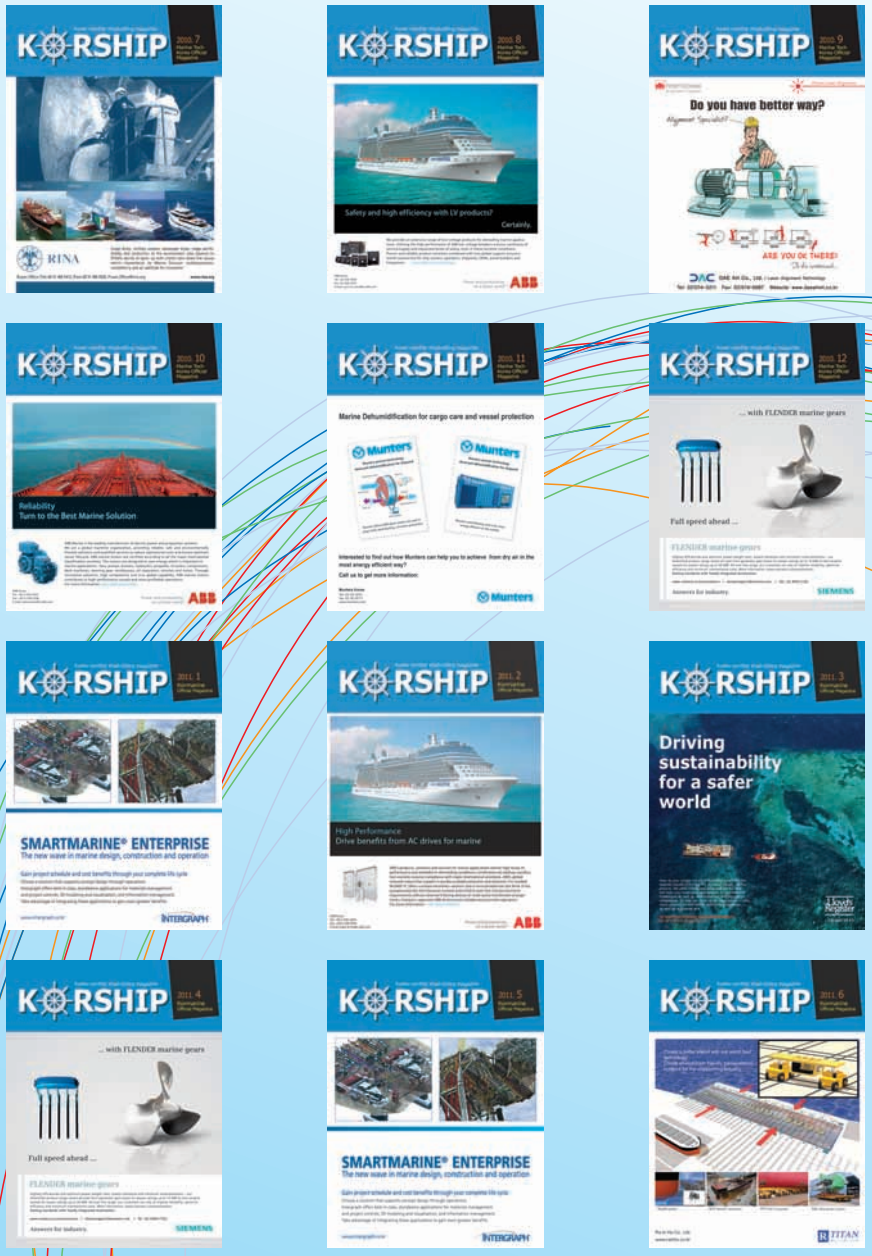
Additional orders for LNG carriers are expected to flow in the second half of this year

New orders for 20 LNG carriers are expected to flow from the projects driven by Gazprom and Brass LNG from the second half of 2011. About 30 LNG carrier orders will be awarded, apart from the LNG carrier orders already commissioned, if the 10 individual orders are placed as expected by ship owners, the LNG carrier operators. As 160K LNG carriers are priced at about USD 200 million per unit, additional orders worth appropriately USD 6 billion are expected to be placed this year.

Korea's large shipyards are expected to take up at least 65% of the 30 LNG carrier orders that will be placed in the period ahead. Since 2004 when the orders for LNG carriers began to dramatically increase, Korean shipyards has secured 78% of the global orders in the LNG carrier class.

Recently, Japanese shipyards lost price-competitiveness and have captured a declining proportion of LNG carrier orders, while Chinese shipyards - supported by the Chinese government's principle promoting the award of contracts to domestic shipyards for the construction of ships operating in China - has carved out a growing proportion of LNG carrier orders. The proportion of Chinese shipyards' combined order backlog for LNG carriers (22) stands at 23% as of March 2011.

The proportion of LNG carrier orders captured by the Chinese shipyards may climb to 25%, considering that China accounts for 25% of all global imports of LNG that has been produced since 2012. With 30 LNG carrier orders being placed yearly around the globe, it will be difficult for Chinese shipyards to win and deliver the orders which account for 25% as Hudong Zhonghua is the only shipyard that has the experience in building LNG carriers.



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LIFE MATTERS

Nor-Shipping 2011: More popular than ever

Nor-Shipping 2011 was more popular than ever with a record 16,235 visitors coming to the exhibition venue, an increase of 4 percent from the previous event two years earlier and the largest turnout since Nor-Shipping began in 1965.

Domestic shipyards that participated in this exhibition

A total of 17,298 exhibitor delegates from 54 countries participated in the four-day event, which closed on May 27. In addition to the 16,235 visitors, this resulted in a total turnout of 33,533 delegates to the exhibition, which also featured 22 national pavilions and 5 theme parks.

"This was the best Nor-Shipping ever," said Tollef Schiander, Director for Nor-Shipping. "This signifies the importance of Norway as a maritime nation and innovator in technology, and this year's conferences highlighted the enormous opportunities Brazil and other offshore hotspots have to offer the maritime industry."

The conferences

The Nor-Shipping 2011 conferences featured presentations by both new and established maritime leaders that drew standing-room-only audiences.

The Opening Conference on Tuesday, May 24, which attracted an audience of 675, featured heavyweights such as Tor Olav Trøim of Frontline, Peter Evensen of Teekay Corporation and Peter M. Anker of RS Platou as well as the new generation of leaders, including Thomas Wilhelmsen of the Wilhelmsen Group and Cecilie Fredriksen, the daughter of Norway-born shipping tycoon John Fredriksen.

José Sergio Gabrielli, CEO of Brazilian oil giant Petrobras, stole the show at the Agenda Offshore conference on

Wednesday, May 25, which drew an audience of 725. This was Nor-Shipping's first-ever offshore conference, signifying the increasing importance of the offshore oil and gas industry to shipping.

The theme of Nor-Shipping 2011 was "What's Next?" and award-winning journalist and CNN analyst Todd Benjamin led lively roundtable discussions on Next-Generation Business and Next-Generation Leaders on the first day and The Future After Deepwater Horizon and Next-Generation Technology on the second day.

Winners of awards that showcase industry excellence were also announced at the Opening Conference. The 2011 Clean Ship Award went to Vale S.A. for the Vale Brasil and the 2011 Next Generation Ship Award was awarded to Rolls-Royce Marine AS for its "Environship Concept".

The Korean pavilion was presented by KOTRA and KOMEA. 9 domestic companies related to the shipbuilding and marine equipment participated in the Korean pavilion.

The Campus Event

Nearly 10,000 people stopped by the four-day Campus event at City Hall Square in the heart of Oslo aimed at recruiting young, bright minds to the maritime industry. More than a thousand students a day attended this first-ever Nor-Shipping event to learn more about the career opportunities the industry has to offer.

Another first for Nor-Shipping was Brazil Day on Wednesday, May 25. In addition to Gabrielli's presentation, the day included a seminar on business opportunities for Norwegian suppliers in the country, a Brazilian tax forum and a speed-dating session. A Brazilian Party topped off the day.

"After closing the doors, we're going full speed ahead towards Nor-Shipping 2013. We're off to a good start with 50 percent of the exhibition space already sold," Schiander said.

Rolls-Royce recognised for innovative ship concept

Rolls-Royce has received the 'Next Generation Ship Award' for its Enviroship Concept. The winning ship design is for a short-sea general cargo vessel which integrates a highly efficient gas power and propulsion system with an innovative hull design to provide a significant reduction in emissions.

"We are pleased that our Enviroship Concept has been recognised by the maritime industry for its contribution to the ongoing development of environmentally friendly, fuel efficient ship designs," said John Paterson, President - Marine, Rolls-Royce.

"By combining our industry leading Bergen C-Series gas engine with a Promas integrated rudder and propeller system, ship operators will experience a significant decrease in fuel consumption and greater operational efficiency. When incorporated within a highly innovative hull design, as shown on our Enviroship Concept, further efficiency gains can be achieved, and CO_2 emissions reduced by more than 40%."

The concept is already being applied to a wide range of ship types including passenger vessels, chemical and product tankers, LNG/LPG tankers, bulk carriers, LNG bunkering vessels and superyachts.

The Next Generation Ship Award recognizes the yard, ship designer or vessel owner with the most promising concept, which demonstrates both technological advances and could be at sea in the coming decade. (For more details, see page 50)

Korean pavilion was presented by KOTRA and KOMEA

Meanwhile KOTRA and Korea Marine Equipment Association (KOMEA) presented the Korean pavilion participated by 9 domestic companies related to the shipbuilding and marine equipment in a bid to facilitate support domestic companies to make inroads into the European shipbuilding market.

During this exhibition, Japan and China set up their own national pavilions, each consisting of 22 and 15 companies, which reflected the great interest of Asian countries in the European shipbuilding market. Meanwhile, Korea made an impressive presence at the exhibition as the world's largest shipbuilding country. 8 large Korean shipyards participated in the exhibition, apart from the Korean exhibitors participating in the Korean pavilion.

The 9 domestic companies participating in the Korea pavilion presented by KOTRA showcased a dazzling array of products including offshore cranes, cargo loading surveillance systems, energy saving systems, drawing huge attention from European buyers. In particular, Scott Conradi of Cummins, a world-leading diesel engine manufacturer, who started visiting the Korean pavilion from the opening day, said, "I am convinced that the strict quality management and production process of small-to-medium Korean shipyards have been pivotal in helping Korea become the world's largest shipbuilding country. We will maintain a continuing business Korean companies."

The Korean pavilion was participated by Shinheung ENG, Haean Machinery Industry, NK, Hi Air Korea, Teccross, Donghwa Entec, Hanshin Electronics, Heartman, and Hanla IMS.

Our company, the publisher of MONTHLY KORSHIP, distributed free issues of MONTHLY KORSHIP, the only English shipbuilding magazine in Korea, to visitors during the exhibition to promote the show.

STX signed MOU to build a new shipyard in Russia

STX entered into a Memorandum of Understanding (MOU) with Russia's state-run United Shipbuilding Corporation (USC) on the project to build a new shipyard in Russia.

On June 17, STX signed MOU with the Russia's state-run USC on the annual international economic forum in St. Petersburg, Russia to construct a new shipyard in St. Petersburg, which is valued at approximately USD 1 billion.

This project will be carried out on a turnkey basis, where STX will undertake the entire processes ranging from the design to the construction of shipyard, and STX will transfer the expertise related to the shipyard operations.

STX is optimistic on the rates of growth in these projects worldwide in the period ahead in view of the fact that Brazil, UAE, etc, as well as Russia, have been discussing on the projects to build new shipyards.

Currently, STX is operating an ultra large shipbuilding complex in Dalian, occupying 5.5 million m^3, which it built independently.

STX Dalian Shipbuilding Complex in Dalian has established a specialized one-stop production system that enables the machining of basic materials such as casting and forging, engine assembling, block fabrication, shipbuilding and offshore structure construction, and has the optimized infrastructure that enhances the efficiency and productivity.

In addition, the award of this project can be also attributed to STX's differentiated know-how in shipyard operations as STX is operating 18 shipyards in 8 countries including Korea, China, and European countries.

An official from STX said, "We expect a slew of additional shipyard construction projects, considering that countries endowed with natural resource wealth are actively moving to build new shipyards.

STX has sharpened competitiveness to build shipyards tailored to the needs and purpose by harnessing its world-leading competitiveness in building ultra large shipbuilding complex and its operation know-how."

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Dream it, Live it, Experience it!

Dassault Systemes Korea hosted the 3DS Korea Forum from June 8 to 9 at Hotel Interburgo Exco in Daegu, providing an opportunity to share the cases of the 3D technology-powered innovation and a window into the future business trend.

1 2
3

1. Dassault Systemes hosted the 3DS Korea Forum from June 8 to 9 at Hotel Interburgo Exco in Daegu.
2. Dassault Systemes President and CEO Bernard Charles is delivering the keynote address at the opening of forum on the first day.
3. Cho Young-bin, President of Dassault Systemes Korea, attended the press conference held before the opening of the forum.

Dassault Systemes Korea, a global leader in 3D and PLM (Product Lifecycle Management) solution, has held the 3DS Korea Forum every year for the invited domestic and overseas representatives and customers, which provided a platform for sharing successful cases of 3D-poweres innovation and a window into the trend of future business.

This year, the event opened with fanfare at Hotel Interburgo Exco in Daegu for 2 days from June 8 to 9 under the slogan 'Dream it, Live it, Experience it!', drawing about 1,000 people.

Vision of 3D technology

Dassault Systemes put forth the vision of 3D technology which not only serves as catalyst for business innovation but also allows anyone to create and experience vivid and lifelike experience in a virtual environment.

Dassault Systemes President and CEO Bernard Charles emphasized in his keynote address on the same day, "The 3D lifelike experience can help drive business innovation and social communication."

In addition, 8 brands of Dassault Systemes were introduced during the event, including Dassault Systemes' V6 portfolio and 'Exalead', a search-based application, followed by demonstrations showing how these solutions can be applied to industries for the entire phases ranging from the early phase of product planning to the consumption.

Dassault Systemes' V6 rolled out in 2009 supports real-time collaboration, online design, versatile scalable open platform, quick configuration, and user-friendly interface. V6 portfolio which meets the demand for multi-disciplinary integration offers OOTB (Out-Of-The-Box) that can be used immediately upon installation, enabling quick configuration of unique work environment.

Exalead, a search-based application which can access 80 billion of web pages, enables users with at-a-glance understanding of potential complaints related to products (abnormality, consumer complaints and feedback, etc).

During the opening address on the same day, Dassault Systemes unveiled new 3D capabilities that would help build a bridge between the disabled and everyone else and fulfill corporate social responsibility.

Dassault Systemes President and CEO Bernard Charles said, "3D is a media that enables intuitive experience for anyone, transcending the gender, age, education background, and even physical disability. We will fully unlock the potentials of 3D technology which will also contribute to the innovation of business and the fulfillment of corporate social responsibility, using the 3D capabilities of Dassault Systemes."

Over the 3 decades, Dassault Systemes has provided solutions that enable web-based PLM for an array of industries (aerospace, national defence, automotive, consumer goods, energy, shipbuilding, construction, high tech and electronics, bioscience, etc) which incorporates 3D technology.

Specifically, Dassault Systemes is the only provider of PLM solution that integrates the entire sectors of PLM and provides integrated support using the power of 3D representation.

The Dassault Systemes' portfolio consists of CATIA for designing the virtual product, CATIA for virtual product design, SolidWorks for 3D mechanical design, DELMIA for virtual production, ENOVIA for global collaborative lifecycle management, 3DVIA for online 3D lifelike experiences, and SIMULIA for virtual testing.

Emphasis on corporate responsibility

This forum, organized by Dassault Systemes and sponsored by Daegu Gyeongbuk Free Economic Zone (DGFEZ) Authority, focused on the fulfillment of corporate social responsibility through the expansion of employment opportunities for the disabled, collaboration among industries, universities, and research institutes, and stimulation of support for small and medium-sized businesses.

This forum was attended by many representatives from various fields, including Dassault Systemes President and CEO Bernard Charles, DGFEZ Commissioner Park In-chul, delegation of Daegu Key Enterprise Group, major officials of Dassault Systemes' clients, professors, and member companies of Daegu-Gwangju Megapolis 3D Fusion Industry Forum, who actively discussed on the measures to ensure fulfillment of corporate social responsibility and expand collaboration among industries, universities, and research institutes.

Cho Young-bin, President of Dassault Systemes Korea, said, "Dassault Systemes entered into MOU with the Korea National College of Rehabilitation and Welfare, by which it has donated software licence and offered training courses for the disabled, including the job training program that incorporates 3D technology. Specifically, we will move beyond donation and work closely with the related industries, universities, and research institutes to increase the chances of employment for the disabled and their involvement in the society in an endeavor to fulfill corporate social responsibility."

He added, "I hope that this event will provide unique opportunity for many companies to mull over corporate social responsibility and collaboration among industries, universities, and research institutes."

Meanwhile, Dassault Systemes President and CEO Bernard Charles, stressed in a press conference before the opening of the forum, "Supporting the 3D-powered lifelike experiences in a virtual environment is the true PLM and our vision."

Dassault Systemes provided PLM 1.0 by starting with digital mockup in the 2D · 3D CAD system and began to offer PLM 2.0 called '3D Lifelike Experience' recently.

In addition, Dassault Systemes President and CEO Bernard Charles, said, "Dassault Systemes has strived to provide simple and easy 3D technology for many people, and will unveil the technology that enables 3D designing with fingers within this year."

Export plaza for prominent shipyards in emerging markets

Korea Trade-Investment Promotion Agency (KOTRA) hosted the export plaza 2012 for the invited representatives of prominent shipyards in emerging markets at Novotel Ambassador Busan Hotel on May 26, assuring full support for domestic marine equipment manufacturers in making inroads into the shipbuilding market in emerging economies.

The export plaza 2012 was held for the invited representatives of prominent shipyards in emerging markets at Novel Ambassador Busan Hotel on May 26, hosted by KOTRA.

Korea Trade-Investment Promotion Agency (KOTRA) held the export plaza 2012 for the invited representatives of prominent shipyards in emerging markets at Novotel Ambassador Busan Hotel on May 26, co-organized by Korea Industrial Complex Corporation and Korea Marine Equipment Association (KOMEA).

This export plaza drew 21 companies from 9 countries, such as ABG of India, Colombo Dockyard of Sri Lanka, Dalian Shipbuilding Industry of China, Austral of Australia, etc, including 17 prominent shipyards of major emerging countries.

Austral of Australia, which had been lukewarm to the idea of importing Korean marine equipments, showed strong interest in purchasing Korean marine equipments in the field of engineering, electricity, interior materials. Meanwhile, Colombo Dockyard, the only shipyard of Sri Lanka which participated in the export plaza for 2 consecutive years, signed supply contract with the Korean manufacturers with whom they had explored business opportunities during the export plaza last year and reached an agreement to build up stable cooperative relationship with Korean marine equipment manufacturers.

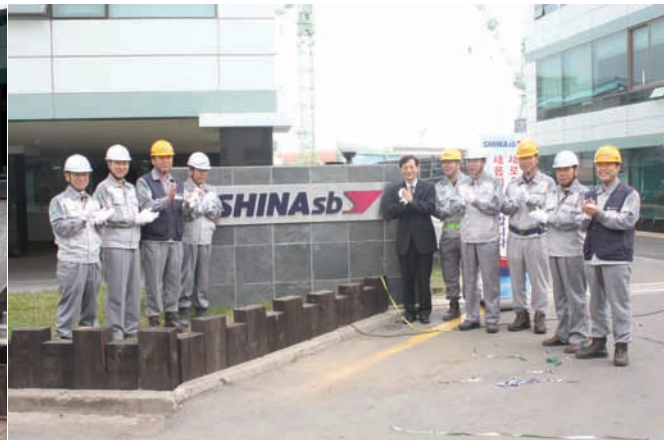
According to the data of KOTRA on the results of export plaza 2010 in the marine equipment sector, contracts entered into with shipyards of emerging shipbuilding countries such as India, China, Sri Lanka, accounted for 90% of all contracts during the export plaza. The emerging shipbuilding countries have won a growing number of newbuidling orders from overseas ship owners. By contrast, they have low ratio of localized marine equipments which creates opportunities for Korean companies to leverage their world-proven competitiveness to supply high quality marine equipments.

This may help lay the cornerstone to expand the co-growth opportunities of the domestic SMBs (small and medium-sized businesses) and large companies in the global market.

KOTRA plans to help domestic marine equipment manufacturers navigate their entry into the ever-growing overseas emerging markets for marine equipments based on the collaboration model and support continued growth of domestic marine equipment industry even if Korea may be eclipsed by emerging countries in the field of universal ship construction.

SLS Shipbuilding was renamed to 'SHINAsb'

SLS Shipbuilding was renamed to 'SHINAsb'. The renamed company is poised to become a leading specialized shipyard for medium-sized vessels in the global shipbuilding market by 2016.



SHINAsb vision announcement ceremony was held at SHINAsb's shipyard in Donam-dong, Tongyeoung City, South Gyeongsang on June 1.

SHINAsb held a ceremony to announce its vision 'SHINAsb' on June 1, which was attended by all its employees, in parallel with an inaugural ceremony for its new President & CEO Kim Young-guk.

SHINAsb renamed itself to build positive corporate image both internally and externally and wipe off the dishonor caused by the major shareholder change (Korea Trade Insurance Corporation) and work-out.

SHINAsb's President & CEO Kim Young-guk mentioned his ambitions in the vision announcement ceremony and inaugural speech, saying "Renamed to SHINAas, we are taking the first important step towards the goal of becoming a leading specialized producer of medium-sized vessels in the global shipbuilding market by 2016. To achieve KRW 1 trillion in sales in 2016, we will have to win and deliver more than 20 vessels yearly which necessitates strict production process, dramatic improvement in productivity and cost-saving." Besides, he urged all employees to steel themselves for the challenge and work closely.

Using the vision announcement ceremony as a springboard, SHINAsb plans to highlight its corporate image as community-friendly company that is fully committed to the community and plays key role in stimulating the local economy while focusing on regaining reliability and trust.

SHINAsb will position itself favorably in the global shipbuilding market by increasing competitiveness and earning the trust of overseas ship owners on the basis of technology and expertise amassed over many year of work in building high quality ships.

Meanwhile, SHINAsb held a contract signing ceremony on the same day for the construction of 2+2 chemical carriers with capacity of 51,000-DWT ordered by GESCO, India's largest shipping company, during the Nor -Shipping 2011 in Oslo, Norway in late May.

Technologies that will make a difference

DNV held a meeting themed 'Technology Outlook 2020' at the Seoul Training Center on June 16 to discuss the direction of future technology development and core technologies. In the meeting, DNV introduced future technologies in 4 fields such as shipbuilding/marine, oil/gas & coal, renewables and nuclear, and power system.

DNV held a meeting themed 'Technology Outlook 2020' at the Seoul Training Center on June 16 to introduce and discuss the findings of DNV's researches.

An official from DNV said, "Most people have curiosity about what technology will lead the world in the next decade. However, it has become increasingly difficult to predict the future due to the rapid development and progress of technologies. This meeting will provide a platform for introducing the findings of DNV's researches with regard to the direction for the future technology development and discuss core technologies of future."

DNV's presentation focused on the results of researches conducted by the DNV Research and Innovation Headquarters and covered the future technologies for 4 industrial areas such as shipbuilding/marine, oil/gas & coal, renewables and nuclear, and power system.

-Maritime: Low energy ship, green-fulled ship, electric ship, digital ship, arctic ship, virtual ship

-Oil, gas & coal: Offshore drilling technology, subsea production, arctic offshore development, unconventional oil & gas, future refineries, gas-fired power plants, coal-fired power plants, carbon capture & store

-Renewables and nuclear: Wind energy, solar heat and power, biofuels for future, geothermal energy, nuclear energy

-Power system: Integration of renewables, super grids, offshore transmission grids, Smart grid

DNV indicated that key drivers behind these future technology and their direction were the change in the global population, de-dollarization, expansion of information technology (IT), increase in energy consumption, natural resources, climate change, etc.

In addition, DNV stressed that technological advancement would play important part in resolving problems facing the global industries and more diverse and broad perspective would be required towards the future development technology to cope with future.

DNV held a meeting to introduce and discuss core technologies of future on June 15.

Meanwhile, the objective of DNV's strategic research is to enable long term innovation and business growth through new knowledge and services in support of the overall strategy of DNV. Such research is arrived out in selected areas that are believed to be of particular significance for DNV in the future. (See page 54 page for more details on the presentations)

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International standardization of IT convergence technology

The wired/wireless Ship Area Network (SAN) recently provided by Korea was adopted as IEC international standard (IEC 61162-450). IEC 61162-450 is the standard for ethernet-based interfacing between the navigation and communication systems.

Korean Agency for Technology and Standard (KATS) under the Ministry of Knowledge (MKE) announced that the wired/wireless Ship Area Network proposed recently by Korea was as adopted as International Standard by IEC (International Electrotechnical Commission (IEC) (IEC 61162-450).

IEC 61162-450 is the international standard for ethernet-based interfacing between shipboard navigation and radiocommunication equipment.

This SAN, adopted as standard, is the part of the protect pushed forward by MKE to develop fundamental technology necessary to combine the cutting-edge information technology (IT) and shipbuilding expertise. Upon its successful commercialization, 46 ships built by Hyundai Heavy Industries(HHI) and Daewoo Shipbuilding & Marine (DSME) have been outfitted with SAN system and will be delivered to shipping companies of Denmark. This international standard for interfacing between navigating ship and radiocommunication equipment is expected to expand its reach of application to the ships that will be commissioned by other shipping companies.

Technical standard of SAN

SAN, developed jointly by Electronics and Telecommunications Research Institute (ETRI) and HHI, provides onshore shipyards or shipping companies with capabilities for real-time monitoring and integrated management of navigation data transmitted from heterogeneous on-board systems, such as the conditions of navigating ship engines, propulsion, etc, via satellite link. Additionally, it enables the remote maintenance/repair without need for a technician to be physically on site in case of simple problem including upgrade of software, thus breaking open the door to the new era of smart shipyard building smart digital ships rooted in paradigm-changing innovations.

Previously, technicians or support engineers arrived on board the sailing ship by helicopter, etc, for on-site repair, which consequently pushed up the repair cost. For instance, annual cost of maintenance/repair for 4,000TEU containership was approximately USD 900,000. However, ships equipped with SAN system can save around USD 360,000 or 60% in the annual maintenance/repair cost.

Achievements of SAN standardization

- A technology has been developed which enables the monitoring of on-board systems from land-based location and remote repair of faults such as software failure, etc
- International standardization: Intraship messaging technology compliant with IEC 61162-450 standard (already adopt-

Fig.1 Schematic diagram of SAN of wired/wireless SAN

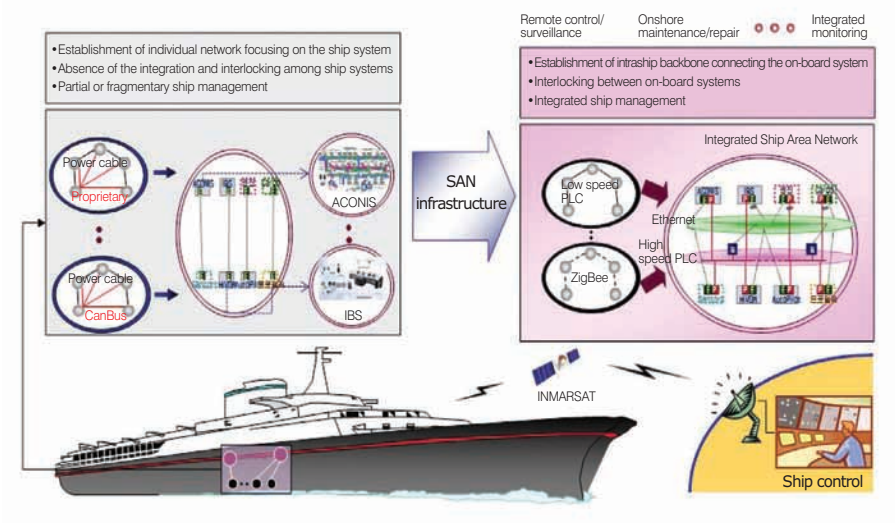


Table 1. Comparison on special features and advantages of SAN technology related to the maintenance/repair of ship

Type	Before development	After development
Accessability	Dispatch of repair technician to the site	Remote maintenance /repair via satellite link
Cost	USD 3,600 per service (cost of on-site visit)	USD 290 per service (communication cost)
Duration	2 days	0.5 hour
Service quality	Insufficient (service after incident)	Excellent (real-time service)

**Note: Refer to the data of STRATOS (a global provider of maritime communications)*

The world's first smart ship built by Hyundai Heavy Industries (HHI) in March, 2011

ed and published)

-Targeted systems: AMS (Alarm Monitoring System), VDR (Voyage Data Recorder), ISIG (Intra-Ship Integrated Gateway) (for Hyundai Heavy industries), BMS (Bridge Maneuvering System) (Nabtesco)

-Applications: Maintenance/repair of remote ship systems, administration service, ship-to-shore messenger

-Targeted ships: 28 ships (AMS/ISIG) for Hyundai Heavy Industries (HHI), 18 ships (AMS/BMS/ISIG) for Daewoo Shipbuilding & Marine Engineering (DSME)

-Core technology: Software connecting the on-board systems at the sea and the client at the land-based location (communication/management/service)

Expected effect of standardization of SAN

- Installation of ACONIS integrated management system on 46 ships, which incorporates SAN technology

-Stronger competitiveness against Germany's SAM Electronics in terms of order intake

-Stronger global competitiveness through partnership with marine equipment manufacturers of other countries

- Increased possibility of smart ships

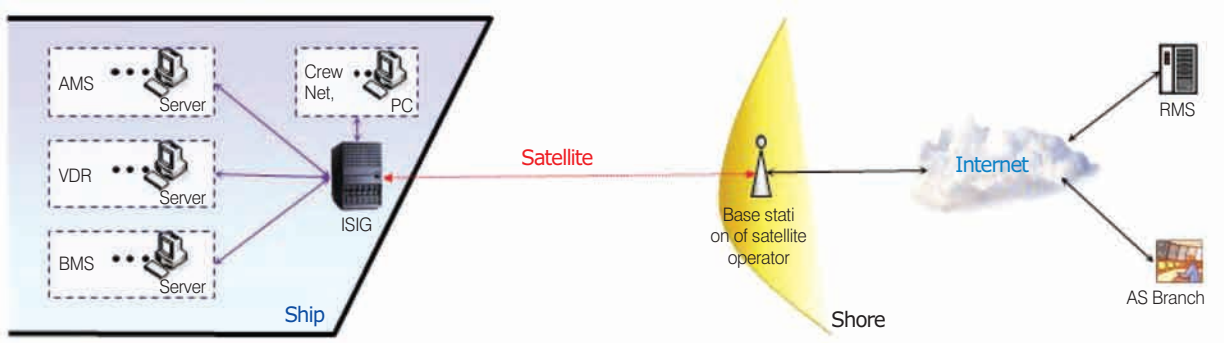
-Increased possibility of various ship services (remote maintenance/repair, messenger, administration)

-Upgrade of the concept of service in the shipbuilding industry

-Domestic and global promotion of Korea's leading technologies combining IT and shipbuilding expertise by adopting international standards

KATS plans to push ahead with further adoption of domestic technologies as international standards. For that, it is poised for horizontal collaboration with related industries and research institutes to converge the world's best shipbuilding technology with the state-of-art information technology and help domestic shipyards build up international competitiveness.

Fig. 2. Diagram of SAN communication based ship surveillance



*RMS: Remote Maintenance Server, AS: After Service

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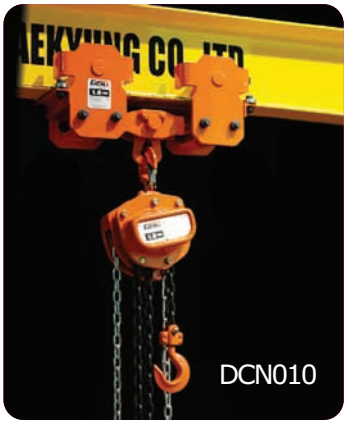
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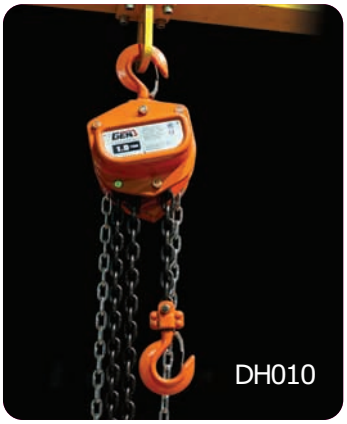
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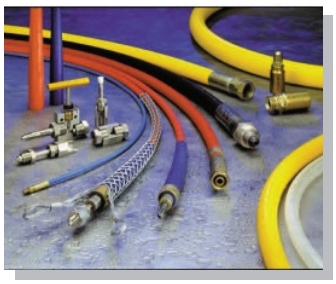
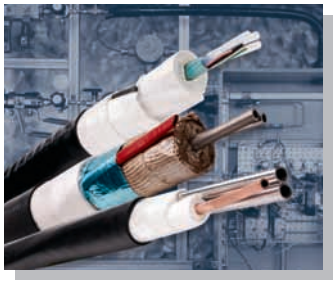


Multitube



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An oil and gas platform is an environment with strict spark prevention requirements. The motors used must pass a demanding certification.

Spark-free safety

Synchronous and induction motors and generators with guaranteed spark-free operation

Electrical motors and generators are the backbone of our industrial society, driving compressors and pumps and generating electricity. But because these appliances are electrical, they pose enormous risks when used in situations where explosive gases are present. The oil and gas extraction industries are one example. A spark, a hot surface or a high electrical field such as a corona (the buzzing sound that sometimes can be heard under a high-voltage power line) are all potential threats to safety in an explosive gas-rich environment. ABB's large synchronous and induction motors and generators are certified according to the latest and most stringent of safety requirements - the IEC international standards - guaranteeing spark-free operation.

Göran Paulsson, Johan Karlsson, Jussi Rautee

ABB Ltd.

For years, ABB has taken design and manufacturing steps to exceed official standards of quality and safety, both of which are paramount for its customers. In 2010, all of its large synchronous motors and generators were certified according to the most stringent international standards (IEC 60079-15:2010 and IEC 600797:2006); now, the company's complete range of low- and high-voltage motors and generators are certified for operation in hazardous areas. (Fig.1)

Customers using equipment that is not tested or certified usually equip the motor with a pressurizing system. This means investing in high-capacity air compressors, piping and a ventilation control unit. By testing and certifying its motors, ABB helps customers streamline their risk assessment processes.

Benefits of the ABB approach include reduced initial capital expenditure, lower operating costs and faster motor starting. Reliability also improves, as no additional components are required. Certification can greatly impact costs. For example, in a refinery, ventilating a motor for even 30 minutes costs enormous amounts of money in downtime and lost production. Using ABB's certified equipment makes it possible for customers to avoid such expenses.

The development of IEC 60079 standards began after several serious explosive incidents, which were related to motors

operating in hazardous areas in and around North Sea oil and gas fields, occurred in the 1980s and 1990s. (Fig.2) Together with the German national institute; Physikalisch-Technischen Bundesanstalt (PTB) and Shell, ABB presented a paper[1] at a large IEEE PCIC[1] Europe conference in 2008. The standards they presented in the paper were developed by the International Electrotechnical Commission (IEC), an over 100-year-old organization that Focuses on international regulations and standards. (Fig.3) Over the years, the organization's standards and tests have become something like a license for the electrical motor manufacturing industry to produce and sell electrical motors that are safe and efficient to use.

Fig.1 Principles of explosion protection

The atmospheres in which operations in the chemical, oil and gas industries are carried out are categorized as either hazardous or nonhazardous. Hazardous environments contain potentially explosive constituents such as gases, vapors, mists or dust. These atmospheres are classified into risk categories, based on the presence and concentration of explosive substances:

-Zone 0 - An explosive atmosphere is present continuously.

-Zone 1 - An explosive atmosphere is present less than 1,000 hours/year.

-Zone 2 - An explosive atmosphere is present less than 10 hours/year.

For a machine placed in a hazardous area, a different kind of protection is needed to prevent ignition of any explosive gas that may be present. International standards define the types of protection that make industrial operations possible in two zones - zones 1 and 2 - The aim of all protection is to avoid potentially explosive sources, which are typically hot surfaces and sparks.

Fig.2 Protection types "n" and "e"

IEC 60079-15:2010 specifies requirements for the construction, testing and marking for Group II electrical equipment with protection type "n" (nonsparking), intended for use in explosive gas atmospheres in zone 2. This standard applies to electrical equipment where the rated voltage does not exceed 15kV rms AC or DC.

IEC 60079-7:2006 specifies the requirements for the design, construction, testing and marking of an electrical apparatus with protection type "e" (enhanced safety), intended for use in explosive gas atmospheres in zones 1 and 2. This standard applies to electrical apparatus where the rated voltage does not exceed 11kV rms AC or DC.

Fig.3 IEC standards

On September 15, 1904, delegates to the International Electrical Congress in St. Louis, Missouri, USA, adopted a report that included the following sentence: "Steps should be taken to secure the cooperation of the technical societies of the world by the appointment of a representative commission to consider the question of the standardization of the nomenclature and ratings of electrical apparatus and machinery."

Accordingly, the IEC was officially founded in June 1906 in London. Since then, the IEC has been involved in developing standards, safety guidelines, testing and specification of components for the world's electrotechnical industries. The group's mission includes everything from capacitors, resistors, semiconductors, radio communication and electrical equipment to electric motors.

In 1930, the IEC was instrumental in establishing the Hertz (Hz) as a unit of frequency, the gauss (G) as a unit of magnetic flux density and the gilbert (Gi) as a unit of magnetomotive force, among other units.

In 2005, the IEC published a multilingual dictionary of more than 20,000 electrotechnical terms in 13 languages.

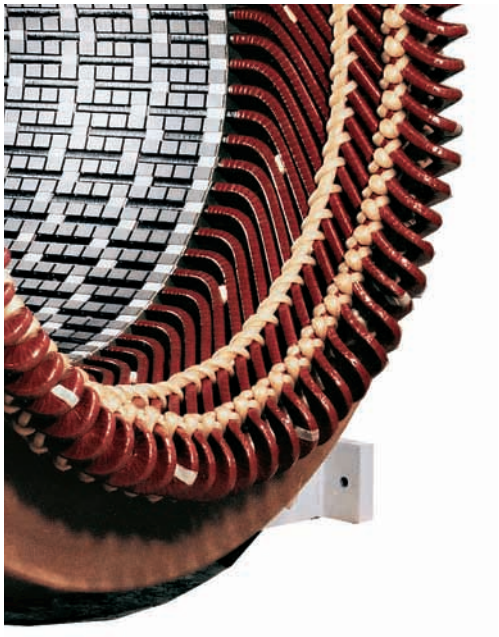
ABB and standards

ABB produces two types of high-voltage electrical motors - synchronous and induction - at factories in Sweden, Finland, Italy, South Africa, China and India. A synchronous electric motor is an AC motor distinguished by a rotational speed proportional to the frequency of the AC-voltage power supply; ie, the motor is running synchronously. The magnetization of the rotor is normally done by an external unit. These motors can be designed to run continuously in zone-2-rated atmospheres, classified as "Ex nA, non-sparking machines." An induction or asynchronous motor is an AC motor in which the rotor is magnetized by means of electromagnetic induction, but its rotational speed is slightly below the synchronous speed; ie, the motor is running asynchronously. These

1. IEEE PCIC are the Institute of Electrical and Electronics Engineers and the Petroleum and Chemical Industry Committee

Fig.4 Cross section of an insulated high-voltage coil

Fig.5 Wound and impregnated stator ready for further assembly



motors can be designed to run in zone 1, also known as "Ex e, increased safety machines."

On January 28, 2010, new IEC standards, for equipment placed in an explosive atmosphere, came into effect. Based on previous development and testing, the majority of ABB's product range of synchronous and induction HV motors and generators were compliant with these standards. The rest were made fully compliant during 2010.

Despite great advances in automation, making an electric

Fig.6 The test

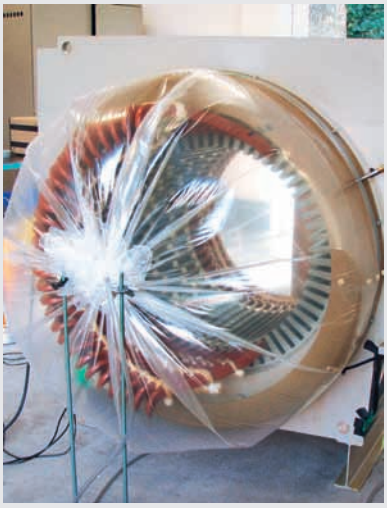
Compliance with the IEC 60079-15: 2010 standard for nonsparking motors and generators requires a three-minute test of the stator in an explosive gas environment. The test is mandatory for motors with a rated voltage of more than 1kV operating in environments where there is a presence of, for example, hydrogen, ethylene or acetylene, and above 6.6kV for motors working in environments where there are traces of propane, diesel fuel, acetone, ethane, ammonia or any of a dozen other explosive gases and vapors.

During the test, a stator winding is covered with a layer of plastic, which is then filled with an explosive gas such as hydrogen mixed with air, as shown in the picture on the right. The stator is then subjected to varying and increasing voltages (sinusoidal) up to the specified test level. If a gas explosion happens, caused by a small spark in the stator winding, the plastic will break and let the pressure wave escape. The specified test voltage is 1.5 times the rated voltage. To pass the test, ignition of the explosive gas mixture must not occur.

According to the test performed in Germany at the Physikalisch-Technischen Bundesanstalt (PTB) in 2004 and 2009, ABB's stators are spark-free up to and including 13.8kV for hydrogen (representative for gas group IIC) and 15kV for both ethylene and propane (representative for gas groups IIB and IIA).

For an induction motor with a cage rotor, the rotor is also tested in an explosive gas environment for possible sparking from the rotor bars. Such a rotor ignition test is not needed for a synchronous rotor, due to its different construction.

The same standard, IEC 60079, also specifies the respective test for induction motors of the enhanced safety protection type.



motor that weighs up to 80 tons is still a manually intensive job. At the ABB factory in Vasteras, Sweden, for example, about 200 motors and generators are tailor-made each year to customers' precise specifications. There, workers use a machine to painstakingly bend index-finger-sized strands of mica-insulated copper into the required exact shape. (Fig.4) In the next step, the ready-formed coils are insulated with an additional layer of mica before being placed in the stator.

The physical of electrical motors are relatively basic and are well understood by many; where it gets tricky, however, is in the insulation of the stator and tied together with fiberglass rope. The whole stator is subsequently impregnated with an epoxy resin, or VPI. After impregnation, the stator is curved in an oven to get its final electrical and mechanical properties. (Fig.5)

This Micadur-Compact Industry (MCI) insulation system ensures sealed and homogenous insulation, resulting in low dielectric losses, high electrical and mechanical strength and excellent heat transfer inside the stator. While this insulation is a tried and proven system, one of the most important considerations when placing the coils inside the stator is to allow enough space between them to avoid corona discharges. If the coils are too near each other, there is risk of a corona buildup. Having enough air between the coils and optimizing the way they are laid out enables maximum use of the machine. The use of corona-suppressing materials is also essential.

The design and certification of ABB's large high-voltage synchronous and induction motors brings faster startup times and reduced maintenance requirements. While faster payback time and reduced maintenance costs are certainly beneficial, what is essential is that ABB's certified motors also offer proven safety, as testing represents the only way to verify that equipment really is safe. (Fig.6)

Reference

[1] Rautee, J., Lienesch, F., Liew, T. (2008). Safety improvements of non-sparking and increased safety motors. Petroleum and Chemical Industry Conference Europe - Electrical and Instrumentation Applications, Weimar, Germany.

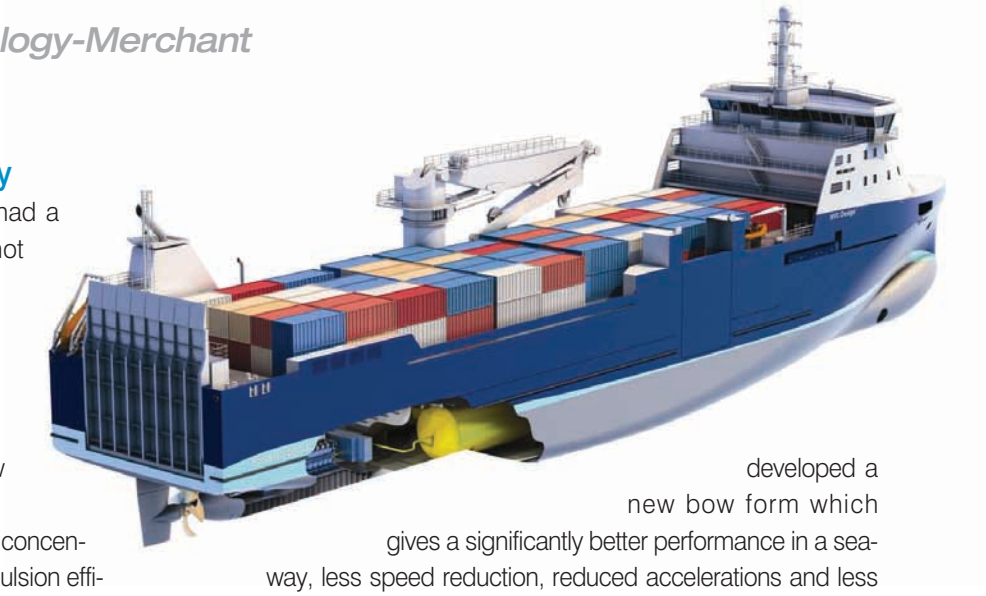
Environship Concept

A new and innovative Rolls-Royce design with significant emission reduction and improved Performance In a Seaway

The new bow design in combination with an innovative propulsion line based on new developed technology by Rolls-Royce, will give an significant contribution to emission reduction. The company's 'Enviroship Concept' combines these elements to give a reduction in CO_2 emissions of more than 40%.

Per Egil Vedlog

Rolls-Royce, Ship Technology-Merchant



Introduction - Design philosophy

The merchant ship market has always had a tendency to conservatism, and it has not been as easy to introduce innovative solutions there as it has been in other markets, for example offshore vessels. Ship design for the offshore market has in recent years 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 testing in calm water conditions. But recently we have seen that this market has begun to focus more on the vessel's behaviour under real sea conditions. This activity is driven by the requirement to reduce emissions to atmosphere, so the pressure is to optimise performance and minimise the power requirement in the actual sea states encountered in the vessel's normal operating profile and operating area.

For merchant ships operating fixed routes it is important to maintain a given speed to arrive at the scheduled time. Like other vessels they must often cut speed to avoid bow damage and unacceptable acceleration levels when seas are too great. The consequence is that frequently they 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.

Ship Technology -Merchant in Rolls-Royce has therefore 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. This bow design is the subject of a pending patent. It combines a vertical leading edge with a bulbous lower section and strait lined sections with no flear in the upper section.

The bow design is protected through an application for patent - No. PCT/IB2010/050695.

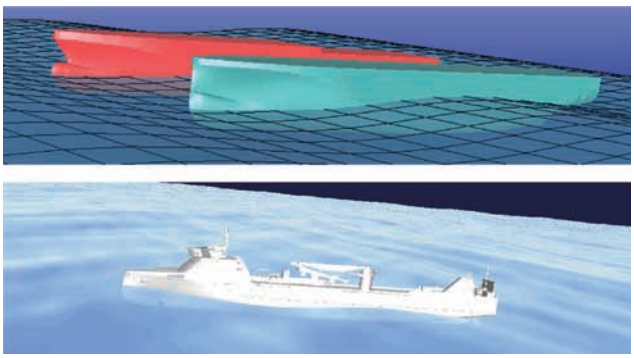
The new bow design in combination with an innovative propulsion line based on new developed technology by Rolls-Royce, will give an significant contribution to emission reduction.

The company's 'Enviroship Concept' combines these elements to give a reduction in CO_2 emissions of more than 40%.

Hydrodynamic Simulations

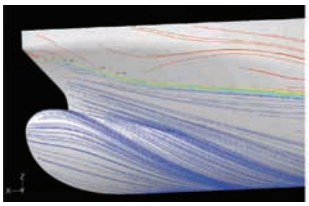
Computer simulation has been used extensively in developing the new design, including WaveRes, VERES and VeSim in the Marintek ShipX software, based on realistic weather

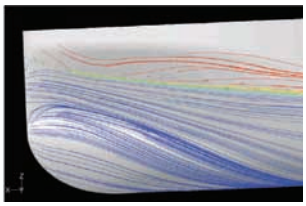
conditions in typical operating areas. The new bow demonstrates a reduction in resistance of between 5 and 8% compared with an optimised conventional raked bow with bulb, the precise figure depending on the wave period.
At the same time, accelerations in the forward part of the vessel are reduced by 5 to 10%, again dependent on wave period.



CFD Analysis

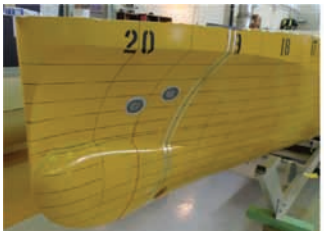
Computational fluid dynamics (CFD) analyses have also been extensively used to optimise the reduction in hull resistance in a seaway, indicating an advantage of about 8% in favour of the new bow.

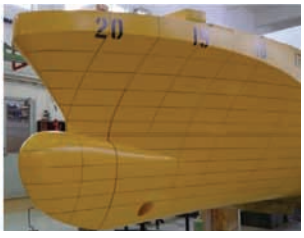


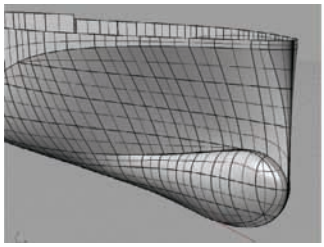


Model tests in towing tank

Following the computer based work, the findings were verified by tank-testing models. Propulsion tests in still water showed that the new bow produced 3% lower hull resistance than the optimised conventional bow. Tests in head seas corresponding to 2m significant wave height in full scale with







periods of from 5.5 to 12.5 seconds showed the new bow design had an average advantage of over 10%.

Area of applicability

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 seakeeping, the bow form is easier to build than the conventional, requiring fewer double-curvature plates. As the bow impact from waves is much less, in some cases it is possible to use lighter construction.

Combinations of innovative technologies gives great environmental benefits

To reap the greatest environmental and operational benefits the new bow can be combined with Rolls-Royce design and integration skills and hull, engine and propulsion elements.
The company's Enviroship Concept combines these elements to give a reduction in CO_2 emissions of more than 40%.
Included in the concept is the proven Promas integration of rudder and CP propeller which on its own gives an improve-

ment in propulsive efficiency of 5 to 8%. 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 optimised for the prevailing operating conditions, cutting fuel consumption and exhaust emissions.

The greatest saving in emissions is made if Rolls-Royce gas engines are specified instead of liquid fuelled or dual fuel units. The lean burn 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% load and a high efficiency.

The flat consumption curve on low load in combination with the HSG means that it is possible to do a full gas fuel solution without starting aux. engines, even in harbour mode. That means in practise for this concept that the aux.engines will never run.

The main engine emit 22-23% less CO_2 per unit of power produced than a diesel engine. Lately it has been claimed in the media that methane release through exhaust on gas engines are reducing the CO_2 reductions.

The new generation gas engines from Rolls-Royce do have extremely low CO_2 release through exhaust system. When 22-23% less CO_2 is claimed, the methane release through exhaust system is already counted for.

NOx is reduced by about 90% while SOx and soot emissions are negligible.

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

The basis concept described in this paper is a General Cargo Vessel optimised for carrying a cargo combination typical for roundtrips along the Norwegian coastline and central Europe/North Sea basin.

The vessel consist of an upper cargo deck (Weather Deck) with a garage in front to give sufficient cargo protection and maximum deck area utilisation. Typical cargo for this deck are containers, trailers, part loads and single heavy items. Trailers will be handled by a trailer lift from drive-in deck (Main Deck). Containers and other part loads will be handled by a heavy duty deck crane.

Main Deck (drive-in deck) is optimised for ro-ro cargo but can also be used for dry cargo/pallets. At stern the vessel is equipped with a full width stern ramp for handling cargo over the stern.

Tween Deck and Tank top is designed with 5 freezing holds, capable for individual freezing. These holds can also be used for dry cargo.

A side door including a double lift arrangement is arranged and designed to do cargo handling for all decks.

The vessel is designed with gas fuel capacity to do 10 days endurance (3,500nm) and with 3 days spare in addition, at service speed. This represents a typical Norwegian coastline and North Sea basin roundtrip with good margins.

This concept is close to be contracted for an Norwegian owner at a number of 2+2 vessels.

Principal particulars

Environship

Length oa	120.0m
Beam	20.8m
DWT	5,000 tonnes
Draught	6.0m
Area of ro-ro deck	approx 1,650m^2
Volume ro-ro deck	approx 11,200m^3
Area reefer holds	approx 1,660m^2
Volume reefer holds	approx 4,150m^3
Area of weather deck	approx 1,570m^2
Lane-metres ro-ro deck	approx 5,10lm
Lane-metres weather deck	approx 4,80lm
Main engine four-stroke medium-speed gas engine	
Output (MCR)	3,940kW
HSG(hybrid shaft generator)/PTI/PTO	1x1,400kW
Speed	14.3kt
Class	DNV 1A1, E0, Gas Fuelled, Dk (+), RoRo, TMON, General Cargo carrier, RM (-27°C/ 32°C sea), DG-P, Ice C or BV Hull Mach, Ro-ro cargoship, Unrestricted navigation, AUT-UMS, Ref-Cargo, ICE, Mon-shaft, Gas fuel

Save fuel? GL shows you how. In three simple steps.

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GL
OPERATING 24/7

Future technology (1): The low energy ship

DNV announced 'Technology Outlook 2020' recently. It is the culmination of DNV's continued research and offers an overview on the major wold-leading technologies of future and provides a window into the direction of their development.
Here, major technologies related to shipbuilding and offshore plants are introduced.

DNV

High bunker costs, new market realities, the crossindustrial focus on the environment, along with stricter regulations regarding emissions and ballast water, will result in radical changes in ships. Technological developments in materials science, drag reduction, propulsion, and energy efficiency, will provide the basis for the key specifications of new ship concepts.
The applicability of different, new concepts needs to be considered for each ship type, based on technical and economic assessment. New concepts could play important roles for all vessel types.

Introduction

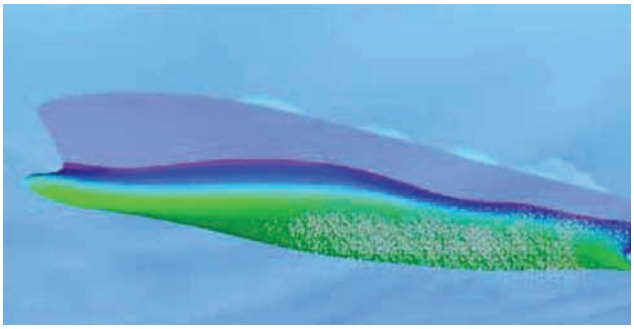
The main triggers for innovation are market forces, technological advances, safety considerations, and regulatory changes. Presently, rising fuel prices, market uncertainties, intense competition, climate change, and societal pressures for greening are driving the introduction of new technologies and concepts into the world fleet towards 2020. Multifunctional ship types and/or technological advances in drag reduction, propulsion, and materials herald new ship concepts. These are not necessarily new ship types, but offer innovative solutions to "newly posed" problems in ship design.
Novel technologies and demanding objectives regarding emissions, efficiency, strength, and speed or cargo flexibility, necessitate holistic designs and use of risk-based methods. In order to manage the complexity and risk inherent in new solutions, large-scale demonstrators are needed, as well as advanced, model-based
techniques.

Maritime

Mature and emerging economies will become increasingly dissimilar in terms of demography and development as the world population approaches 7.5 billion in total by 2020.
In a world with more resource-intensive lifestyles and increased population, demand for maritime transport is bound to grow.
The world fleet will continue to expand, but demand will vary among regions and ship types.
As the industry is facing pressure to offer more sustainable transport solutions, new ships with improved environmental, safety and security performance will be needed. This will require more focus on developing and implementing innovative technical and operational solutions, with particular attention to achieving greater environmental performance and energy efficiency.

Air bubble lubrication

Although the wave-making resistance of ships can be minimised by careful hull design, friction drag is more important for large, slow speed, commercial ships.
Air bubble lubrication systems are based on the powered injection of air beneath the ship. Several small holes on the hull's bottom are used for injection of micro air bubbles into the flow stream. By interfering with the generation of vortices, the transition to the highly dissipative turbulent flow regime, which typically occurs around the hull, is delayed. Friction drag is reduced due to the lower friction forces associated



Visualisation of an installed air-bubble injection system. (Source: DNV)

with laminar flow, compared with turbulent flow.
Uncertainties in the physical mechanisms, and the scaling and technical feasibility of this system, need to be solved by 2020. In particular, the potentially negative interactions of the dispersed bubbles with the propeller must be eliminated.

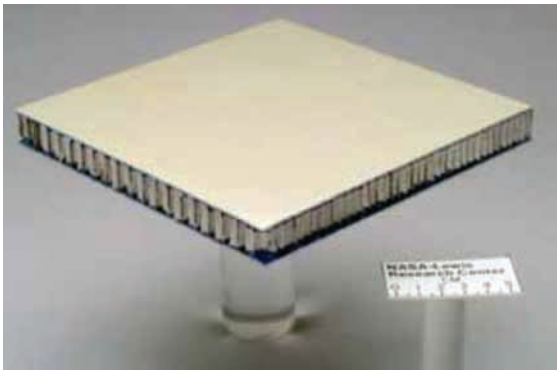
Air cavity system

The injection of air beneath a ship's hull can have an alternative embodiment, but one that also results in friction drag forces being decreased.
In air cavity systems, large indentations are opened on the hull's bottom. Compressed air is pumped in to fill the void space and establish a continuous air cavity. The steel-seawater interface is thus replaced by a more slippery air-seawater interface, effectively reducing the hull's wetted surface and thereby the friction forces. A decrease in fuel consumption of around 10 % is possible. As air will inevitably escape from the cavity, it has to be continuously replaced.
Negative side-effects include the generation of a destabilizing free surface under the hull. Energy will be lost, both by the formation of gravity waves on this free surface and by dispersion of bubbles into the propeller inflow.

Illustration of the P-MAXair cavity ship by STENA. (Source: STENA)

Hybrid materials

Reducing the weight of a ship's hull can decrease emissions and save fuel. Lightweight materials are used in smaller vessels and secondary structures, e.g. fibre reinforced plastics, aluminium, and titanium.
Hybrid materials can be formed from multiple layers of metal sheets and piles of polymer composite laminates. Fibre-metal laminates combine the qualities of metals (high impact resistance, durability, flexible manufacturing) with those of composites (high strength and stiffness to weight ratio, good resistance to fatigue and corrosion).
The metal layers can be of either aluminium or steel plates, whereas the polymer core can be reinforced with carbon or glass fibres. The application of these materials in the aeronautical industry and in specialised ships provides an opening for introducing these materials into shipping. However, widespread adoption by 2020 is unlikely. The main obstacles include high costs, manufacturing and recycling challenges, and fire resistance issues.



Composite sandwich construction made of GLARE-skins and honeycomb core. (Source: NASA)

Hybrid propulsors

The high efficiency of the screw propeller is restricted to one design speed, large blades, 2-stroke diesel engines, and direct drive propulsion.
Hybrid propulsion concepts consist of combinations of shaft propellers, pods, and efficiency enhancing devices, such as pre- and post-swirl fins. Hydrodynamic optimisation can enable efficient arrangements of a contra-rotating pod propeller behind a main controllable pitch propeller, and of a

A multi-component Azipod installation (Source: ABB)

feathering centreline propeller with steerable side pods. These systems capitalise on the hydrodynamic advantages of their components, while also extending the range of efficient operation by utilising the optimum engine load.

Although design and manufacture of hybrid propulsors are expensive, this technology is expected to provide fuel savings up to 10 %, depending on utilisation and ship types, e.g. container or multipurpose ships.

Ballast water free ships

Ballast water ensures sufficient draft, strength, and stability when ships sail unloaded. However, when ballast water is discharged untreated, the marine ecosystem may be threatened with the introduction of invasive species contained in the ballast water.

A trapezoidal hull with a transversely raked bottom can maintain sufficient stability and draft when unloaded, without requiring ballast water. In order to achieve the displacement of standard designs, the breadth and length are increased. The bow and stern are now critical for regulating trim under all load states. Such ships incorporate more steel, both due to their larger size and also to obtain sufficient strength under partial load conditions. Hybrids, with two small ballast tanks to aid the adjustment of trim, seem preferable.

Even after 2020, ships that do not use ballast water will be more expensive to build and have various construction challenges. Competing solutions include onboard treatment of ballast water and in-port receiving facilities.

Changwon Human Resource Development Center to operate the authorized training program for the shipbuilding and design field

Changwon Chamber of Commerce & Industry will operate the authorized training program for shipbuilding design jointly with the Pusan Human Resources Development Institute of Changwon Chamber of Commerce and Industry. The authorized training program for ship design can be instrumental in saving time and costs incurred in the development of manpower at shipyards and is a systematic training program to develop professional and working-level design manpower in the field of ship design.

In particular, this training program which integrates the training curriculum of AVEVA will be offered at the Changwon Human Resource Development Center on the first floor of Changwon Chamber of Commerce & Industry building with the help of professional instructors. Along with that, supportive measures are being ironed out to reduce financial burden of member companies. All these are expected to dramatically increase productivity and competitiveness of companies by facilitating the development of design specialists and capabilities.

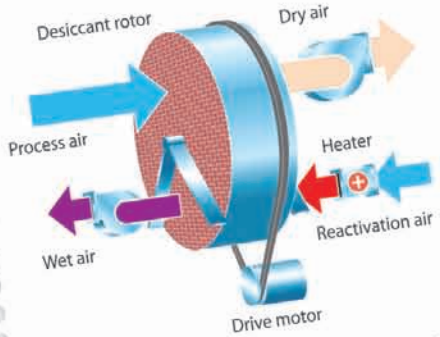
Currently, 'TRIBON[M3] & VAEVA MARINE[AM]', a software system for ship design is used by the world's prominent shipyards such as STX Offshore & Shipbuilding (STXOS), Hyundai Heavy Industries (HHI), Daewoo Shipbuilding & Marine Engineering (DSME), etc, and their vendors. However, they have not opted for external professional training programs and thus often encounter problems in developing and retaining skilled design manpower. Specifically, high turnover rate among skilled designers is posing risk to small and medium-sized shipyards and professional design firms are facing problems in securing a steady supply of design manpower.

AVEVA will enter into a cooperation agreement with the Pusan Human Resources Development Institute of Changwon Chamber of Commerce and Industry to support the supply of skilled and professional design manpower to the offshore plant sector in Busan and establish a system supporting the development of human resources customized to the needs of shipbuilding and maritime industries. The authorized training under this agreement will be offered at the 8 training centers nationwide.

Marine Dehumidification for Cargo Care and Vessel Protection

Munters

Munters proven technology desiccant dehumidification for shipyard



Munters dehumidification system are used in cargo hold, sand blasting, corrosion prevention

Munters

Munters proven technology desiccant dehumidification for shipyard

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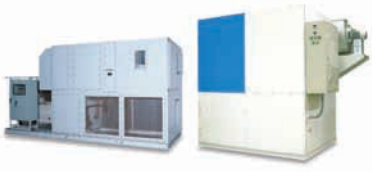
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Globally certified, mass-based measurement system for marine bunkering

The Micro Motion Certified Marine Bunker Measurement Solution provides measurement accuracy and trace ability with third-party certification.

Emerson Process Management Co.

Micro motion

Emerson's Micro Motion Certified Marine Bunker Measurement Solution is the first traceable, transparent, mass-based measurement system with third-party certification for heavy fuel oil (HFO) bunkering. Installed on a vessel, barge, or at a terminal, the Certified Marine Bunker Measurement Solution monitors the bunker delivery, reports final totals, and provides a ticket that can be used for custody transfer. This globally-certified bunker custody transfer system meets international standards and provides highly accurate, transparent bunker fuel deliveries that will minimize the number of disputes between barge operators and ship operators, while enabling operators to very accurately monitor fuel and improve operational efficiencies.

While bunker transfers are billed based on mass, measurements are calculated using volumetric-based methods. Traditional bunker measurement relies heavily on look-up tables and manual dips, as well as laboratory tests to determine density measurements. The practices are labor intensive, inferential, and can result in legal disputes and potential reputation damage. With bunker fuel costs amounting to 50-70% of the total ship operating expense, even small inaccuracies can have a major effect on operating costs.

Emerson worked with industry leaders in shipping, supply, and barge operations to develop its certified bunker measurement system. The Certified Marine Bunker Measurement Solution includes a Micro Motion ELITE Coriolis meter, Series 3000 transmitter with Marine Bunker Transfer Package, and bunker delivery ticket printer. The solution is capable of handling the density and viscosity variation inherent in HFO and was certified by Nederlands Meetinstituut (NMi), the notified body for testing to the guidelines of the European Instruments Directive (MID) and Issuing Authority for OIML (International Organization for Legal Metrology). The Micro Motion meter meets the OIML standard R117-1 and the over-

all solution meets MID standard 2004/22/EC Annex MI-005.

The process of marine bunkering presents challenges to any measurement device. Unlike gasoline or diesel fuel, the density and viscosity of HFO varies enormously and can even vary across a single bunkering as the fuel may stratify in the storage tank. This means that measurement systems based on volume need a correction factor applied to determine the mass of the fuel that has been delivered. In addition, the fuel being delivered can become aerated, which will affect the volume measurement.

Micro Motion Coriolis meters deliver consistent, accurate mass measurement. The Certified Marine Bunker Measurement System has been specifically designed to handle high-viscosity, aerated liquids and offers an overall accuracy within 0.5% of mass. The transmitter post alerts when the level of entrained air reaches a pre-set limit, allowing the operator to take steps to reduce aeration and ensure accurate delivery. A printed bunker transfer receipt includes the time, date and the total quantity transferred, and can be used as a legal (Weights & Measures) document.

The Certified Marine Bunker Measurement System can be installed on either barges or the vessel itself. The system has been specifically designed to handle high viscosity, aerated liquids and offers an overall accuracy within 0.5% of mass. The system has been independently proven by NMI (a participating member of OIML) for aerated HFO.

Micro Motion Coriolis meters, with no moving parts to break, wear or risk performance drift, deliver the highest accuracy and performance possible. ELITE High Capacity meters are capable of handling flow rates over 1,500 ton/h and delivers reliable performance and the highest flow rates of any Coriolis meter available today. ELITE High Capacity Coriolis meters have been tested with crude oil and other liquid and gas hydrocarbons in accordance with American Petroleum Institute (API) and American Gas Association (AGA) guidelines.

Micro Motion Coriolis flowmeters lead the process manufacturing industry in quality, measurement performance, and reliability, and are part of Emerson's broad range of intelligent, digital field devices that power the PlantWeb digital plant architecture. Further cost savings, increased plant availability, and enhanced safety and environmental compliance are achieved when the flowmeters are integrated into the PlantWeb architecture.

The combination of excellent image quality and an affordable price makes the FLIR M-Series perfect for commercial applications.

Inland skippers use thermal imaging to navigate through tight spots at night

Inland skippers are faced with the daunting task of navigating their long bulky barges through the tight locks and bends that they need to traverse to deliver their cargo to its destination. When darkness or light fog impedes regular vision, bright searchlights are commonly used to enhance the skipper's situational awareness. But now there's another tool on the market: FLIR thermal imaging cameras.
One of the commercial skippers that recognized the potential FLIR thermal imaging cameras have for commercial shipping is the German inland skipper Rolf Bach. "The first time I saw thermal imaging cameras demonstrated on the barge of one of my colleagues I immediate knew I had to get one for my own barge combination 'El Niño', 'La Niña'."

FLIR Systems Korea Co., Ltd.

The FLIR products distributor responsible for the presentation and the subsequent installation on 'El Niño' is the Wulsbüttel, Germany, based Trauthoff Infrarot- & Sicherheitstechnik GmbH. Bach purchased an M-Series model that includes a thermal imaging camera and a lowlight camera to provide the best imaging possibilities in every lighting condition imaginable. "Before I had seen the product I thought the price was maybe a bit steep, but when I saw the FLIR M-Series in action I immediately saw that it is good value for money."
The FLIR M-625L incorporates a thermal imaging camera with an uncooled Vanadium Oxide microbolometer detector that provides thermal footage at a resolution of 640x480 pixels. The combination of a sensitive high resolution detector and the advanced thermal image enhancing algorithms that have been included in the FLIR M-Series, enables the FLIR M-Series thermal imaging cameras to provide industry leading image detail and range performance.

Avoiding collisions

In the short time that Bach has been using the FLIR M-Series thermal imaging camera on his own ship it has certainly proved its worth. "Europe's network of rivers and canals can be quite challenging. There are locations where the fairway is only just wide enough for two ships to pass each other by. Even during the day such situations require your full attention, but when it's dark it really turns into a challenge."

According to Bach the FLIR M-Series is a great help. “It really gives a great overview of the situation. You can immediately see how much room there is left to maneuver. Before I had the FLIR M-Series I looked at the radar and out of the window. At night the lack of visual information makes this a stressful situation. Nowadays I find that I hardly look outside or at the other screens in such situations. The FLIR M-Series tells me everything I need to know to avoid a collision, which not only makes it safer, but also less stressful.”

Blinding lights

In the area where Bach operates there are many navigational challenges. “I mainly operate in the Danube and the Rhine, Europe’s two longest rivers. In all, the river network runs through 17 countries, covering most of Europe. In that territory there are countless tricky locks, challenging corners and tight fairways. At night most vessels switch on their powerful searchlights to be able to navigate these locations safely, but that means that if there’s an oncoming vessel, both of the skippers will be effectively blinded by each other’s lights. Obviously this situation can be very dangerous.”

“Now that I have the FLIR thermal imaging camera I don’t need to switch on the lights”, continues Bach. “I just use the FLIR M-Series to navigate and the oncoming vessel can safely switch on the lights. Since the M-Series thermal imaging camera detects thermal radiation instead of visible light, the searchlight of the oncoming vessel will not blind me when I’m using the FLIR M-Series thermal imaging camera to navigate.”

Recorded thermal footage as evidence

Bach has not been involved in an accident since the FLIR M-Series was installed, but if an accident does occur he can use the thermal imaging footage from the FLIR M-Series thermal imaging camera as evidence.

“Waterway traffic is similar to road traffic. If an accident occurs it is often difficult to prove who was at fault. I therefore connected the FLIR M-Series thermal imaging camera to a digital video recorder and I’m constantly recording the live thermal video footage.”

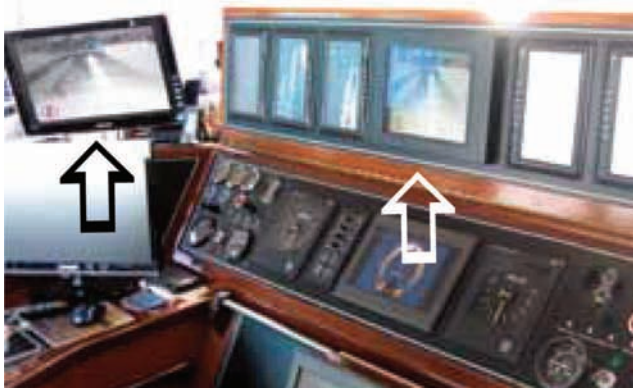
If no accidents occur the recorded video is automatically deleted after a week. But if there is an accident, Bach can prove which party was at fault. “The FLIR M-Series provides crisp thermal video footage regardless of lighting conditions, so this system also works perfectly at night; and that is when

When commercial skipper Rolf Bach saw a demonstration of the FLIR M-Series he immediately knew he had to buy one for himself.

Not only does the FLIR M-Series allow Bach to safety navigate and dock his barge combination, it also helps to detect intruders while he is docked in the harbor.

The FLIR M-Series thermal imaging camera is mounted on top of the bridge to provide maximal situational awareness.

From this vantage point the FLIR M-Series thermal imaging camera can make the most of its wide field of view and excellent range performance.



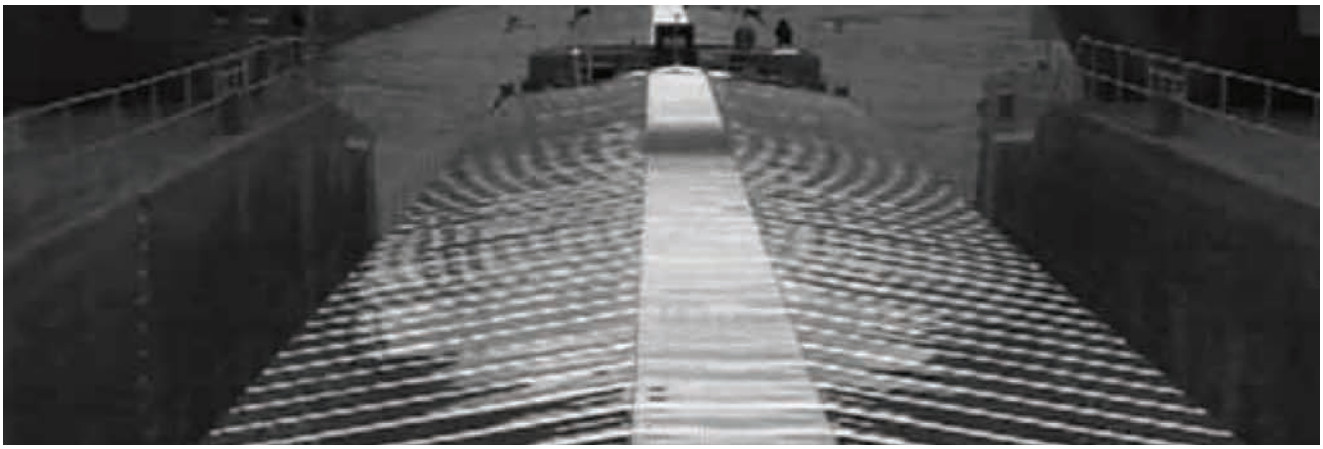
The thermal imaging footage from the FLIR M-Series is continually displayed on one dedicated screen and one multifunctional screen on the bridge of 'El Niño'.

Bach admits that he mainly looks at the thermal footage of the FLIR M-Series when crossing an upcoming vessel at night.

most accidents occur due to the limited vision. Hopefully I will never be involved in a collision but if an accident does happen I will be very glad to have this thermal imaging system."

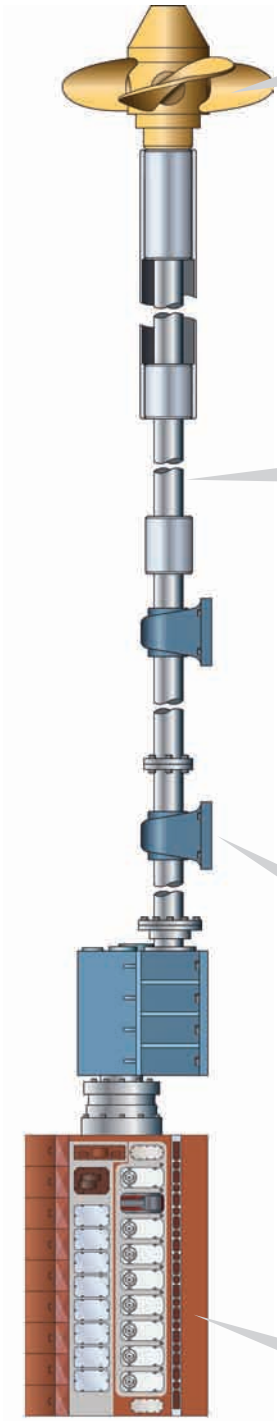
Easy to use

The FLIR M-Series' Joystick Control Unit (JCU) is esthetically incorporated in the bridge. The JCU presents all of the camera's commands right underneath your fingertips and with a simple tap of the finger you can easily pan and tilt the camera to employ the camera's 360° pan and +/-90° tilt reach.
The ergonomic design of the JCU allows easy and intuitive operation, according to Bach. "The FLIR M-Series thermal imaging camera is very easy to use, especially if you compare it to other navigational tools like the radar. Operating a FLIR thermal imaging camera is very intuitive, whereas radar can be more complicated at times."



According to Bach navigating through tricky locks, passing under tight bridges and cornering difficult bends is made easier, safer and less stressful by the FLIR M-Series thermal imaging camera.

Marine industry moves forward thanks to laser precision alignment

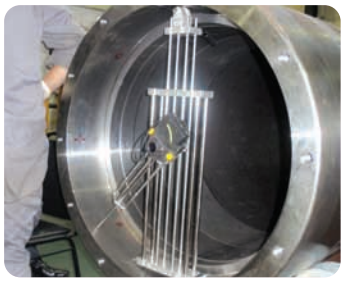


PROPELLER

LEVALIGN Ultra

STERN TUBE

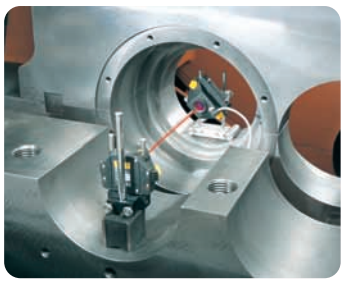
CENTALIGN Ultra
(unmounted shaft)



LONG SHAFT

ROTALIGN Ultra
(mounted shaft)

CENTRALIGN Ultra
(unmounted shaft)



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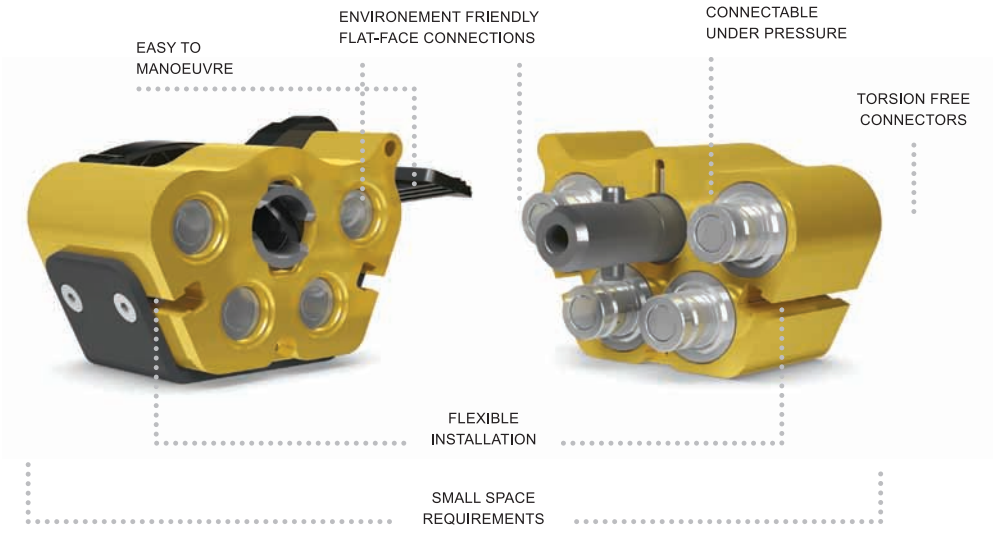

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DSME clinched an order for 2 LNG carriers

Daewoo Shipbuilding & Marine Engineering (DSME) won a contract on May 25 (local time) for the construction of 2 LNG (Liquefied Natural Gas) carriers from Awilco LNG AS, the major shareholder of RCCL (Royal Caribbean Cruises Ltd.), the world's largest cruise shipping company, and the Norway-based owner/operator of LNG vessels intended for international trade.

This contract includes an option for two additional ships. All these vessels will be built completely at Okpo shipyard of DSME.

In particular, this contract represents the first newbuilding order for LNG carriers in 3 years and 4 months after DSME was awarded an order from BCG, Brunei's state-run gas company, in January 2008 for 2 LNG carriers.

Nam Sang-tae, CEO & President of DSME, flew to Norway on May 23 to participate in the Norshipping, an international shipping exhibition and conference, and is know to have shown special interest in winning this contract and played a leading role in pulling off the deal for LNG carriers in 3 years and 4 months.

Currently, Nam Sang-tae, CEO & President of DSME, is actively engaged in sales activities and having a series of meetings in Oslo with other prominent global ship owners, which raises the prospect for additional contracts. Additionally, he supervised events as Chairman of Korea Shipbuilders' Association (KOSHIPA) and vigorously promoted Korean shipbuilding industry on the 'Day of Korea' during the Norshipping.

Nam Sang-tae, CEO & President of DSME, said, "DSME is the global leader in the field of high value-added ships such as LNG carriers, ultra large containerships, drillships. This year, I anticipate further orderbook growth as the LNG carrier market is expected to be put on track to recovery."

Winning this year, DSME has won orders for a total of 16 ships, including offshore plants, worth USD 4.35 billion so far this year, which is approximately 39.5% of its annual target of USD 11 billion and represents a significant increase compared to the same period of last year (USD 1.6 billion).

Nam Sang-tae (right), CEO & President of DSME, and Sigurd E. Thorvildsen (left) of Awilhelmsen Management AS, are shaking hands after signing the contract to build LNG carriers in Oslo, Norway on May 25 (local time).

HHI signed a USD 600 million order for 3 LNG carriers

Hyundai Heavy Industries (HHI) was awarded an order to build 3 LNG (Liquefied Natural Gas) carriers (including 1 optional vessel).

HHI announced on May 31 that it recently entered into a contract with Greece-based Dynagas to construct 3 units of 155,000m^3 LNG carriers worth a total of USD 600 million.

These newbuilds will be the membrane type LNG carriers with cargo hold inside the hull and incorporate DFDE (Dual Fuel Diesel Electric) system which can run on both oil and natural gas depending on situation.

These LNG vessels are scheduled for delivery to the ship owner by the second half of 2013.

The shipbuilding industry anticipate that the recent increase in newbuilding order placements for LNG carriers will gradually usher in the recovery of the LNG carrier market which was mired in stagnation over the last years.

Arctic Securities, the Norwegian investment bank, forecast that the global import of LNG carriers will increase by 30% annually to 286 million tons by 2015. In addition, U.K.-based shipbuilding and shipping market research firm Clarkson forecast that a total of 120 LNG carriers would be ordered by 2015.

The LNG order placement is expected to gain momentum as the daily rates to rent a LNG carrier has soared above USD 85,000 after

Abdelkader, the LNG carrier built by HHI, selected as the ship of the year in 2010

having fallen to USD 20,000 in May 2010.

An official from HHI said, "LNG newbuilding orders are expected to increase naturally, considering more stringent regulations on CO_2 emissions, growing demand for LNG as an alternative energy of nuclear power in the wake of the ongoing nuclear crisis in Japan, stronger price competitiveness of natural gas amid high oil prices."

HHI has actively invested in LNG technologies. In 2010, HHI embarked upon the development of the world's first-ever tank welding technology for LNG carriers operating in the polar regions to capitalize on the surge in the demand over the long-term for LNG carriers and LNG-FPSO (Floating, Production, Storage, and Offloading) which are suited for the operation in the polar regions.

This order brings HHI's total orders in the shipbuilding/offshore plant sectors this year to a total of 42 vessels, worth USD 10.5 billion (including the order intake of Hyundai Samho Heavy Industries), approximately 53% of its annual target of USD 19.8 billion.

SHI signed a USD 3 billion contract to build LNG-FPSO

Samsung Heavy Industries (SHI) announced that it accepted the NTP (Notice-to-Procede) for the LNG-FPSO (Floating, Production, Storage, and Offloading) ordered from Royal Dutch Shell, a global oil and gas company, and signed a contract worth USD 3.026 billion (KRW 3 trillion 275.2 billion) for this project on May 31.

The value of the contract includes the amount of the hull and topside which was announced on April 15.

This deal brings the total value of the contracts awarded to SHI so far this year to USD 10.5 billion, approximately 91% of its annual order target.

Meanwhile, Royal Dutch Shell held the NPT signing ceremony for the construction of the world's first LNG-FPSO with Technip-SHI Consortium on May 30.

This consortium will undertake the engineering, material supply, construction and installation of LNG-FPSO to be deployed in the Royal Dutch Shell's Prelude gas field off north-west Australia.

Moored far out at sea, some 200km from the nearest land, the Prelude FLNG facility will produce gas from offshore fields and liquefy it onboard by cooling. Detailed design of the innovative facility will be undertaken by TSC at Technip's operating centers in Paris, France, and Kuala Lumpur, Malaysia, and it will be built at the SHI shipyard in Geoje, Korea, where the Notice to Proceed signing ceremony took place.

Thierry Pilenko, Chairman and CEO of Technip, commented, "Once again Technip is a key partner of a visionary customer pushing back together the limits of technology. This great project is a real breakthrough for the energy industry and a true revolution for offshore natural gas developments. Technip is extremely pleased and proud to bring all the expertise, know-how and skills of its three business segments -Subsea, Offshore and Onshore- all of which will be instrumental in the success of Prelude FLNG. Within our long term relationship with Shell and SHI, we hope

that this project will be the first of many."
In-sik Roh, CEO, President and Director at SHI, says, "We are very excited to participate in the Prelude FLNG project, which will be the world's first floating LNG production facility. SHI believes in the strength of the partnership with Shell and Technip, which will allow us to complete this project successfully. We are confident that this project will help us solidify our position as a clear leader in FLNG construction and development."
Dr. Matthias Bichsel, Projects and Technology director of Shell, added, "We are tremendously pleased to move ahead with the Prelude Floating LNG project. In the development of the FLNG concept, Shell's FLNG team has drawn on five decades of expertise in the areas of LNG technology, LNG shipping and engineering of offshore floating oil and gas installations. Our innovative mindset, integrated approach to technology development and mega project delivery expertise allowed us to distil these decades of experience into the development of what will be the largest offshore floating facility on earth."
"The TSC is essential to the success of the Prelude FLNG project," Matthias Bichsel continued. "We have longstanding relationships with Technip and SHI, with both companies providing expertise to numerous projects world-wide. The TSC combines the strengths of each company to enable the delivery of an integrated FLNG facility."
The Shell Prelude FLNG facility will be the largest floating offshore facility in the world, with 488m from bow to stern - longer than four soccer fields laid end to end. When fully loaded, it will weigh around 600,000 tonnes - roughly six times as much as the largest aircraft carrier. Some 260,000 tonnes of that weight will consist of steel - around five times the amount of steel used to build the Sydney Harbour Bridge. Floating LNG is a revolutionary innovation that will allow the production, liquefaction, storage and transfer of LNG at sea, helping to open up new offshore natural gas fields that are currently too costly or difficult to develop.

HHI secured USD 1.1 billion order for 2 drillships in the United States

Hyundai Heavy Industries (HHI) signed another contract for 2 drillships in the United States, accelerating the drive to win new orders.
HHI entered into a USD 1.12 billion contract in Huston, United States on May 31 (local time) with Rowan, a U.S.-based drilling company, to build 2 drillships.
This contract includes an option for 1 optional vessel, raising the prospect for additional order. This year, HHI has won a total of 9 drillships (apart from 3 optional vessels) worth USD 5 billion in all, which is the largest order intake of drillship in the shipbuilding industry worldwide.
Particularly, this drillship order is the first one placed by Rowan which recently expanded its reach into deepwater drilling and expressed deep trust in the unmatched performance and technology of HHI's drillship.
HHI has consecutively won orders from the world's top drilling companies in the North America and Europe. It successfully delivered its first drillship to Transocean, the world's largest offshore drilling company, in November 2010 and won 3 drillship orders from Noble Drilling Holding, the world's second largest oil and gas producer, which attests to HHI's unrivalled competitiveness worldwide in terms of economic efficiency and technology in the drillship sector.
The secrete behind HHI's undisputed strength in drillship sector is the differentiated drillship design and the world's best drilling capability. HHI has strictly applied drillship-specific design that optimizes the drillship size and enhances fuel efficiency. Furthermore, HHI's drillship has the world's most advanced drilling capacity and can drill up to 12.2 km under water.
In addition, thruster, the core facility of drillship, enables on-board repair without disrupting drilling operation, which significantly pulls down the cost of maintenance and repair.
HHI's drillship is equipped with various state-of-art systems including the positioning controlling system that can automatically control the vessel's position in the sea with high

Signing Ceremony: Kim Oi-hyun, senior executive vice president & CEO of HHI (left) and W. Matt Ralls, president of Rowan Companies Inc. (right)

waves, computer propulsion system, etc. Furthermore, 7 blowout preventers (BOPs), instead of current 7 BOPs, will also be outfitted in HHI's drillship to enhance safety.

An official from HHI said, "The drillship order is expected to increase over the mid and long-term amid expansion of investment in resource exploitation to capitalize on high oil prices, coupled with the gradual shift in the focus of oil field exploitation to deepwater."

The vessels, measuring 229m in length and 36m in width, are rated for operations in water 12,000ft (3,657m) deep. They are scheduled to be delivered by the second half of 2013.

Meanwhile, HHI has shown strong performance in the high value-added drillship sector, clinching drillship orders in a row, including the recent 3 LNG carrier orders. HHI has won orders for a total of 44 offshore plants worth USD 11.7 billion (including the order intake of Hyundai Samho Heavy Industries), which is approximately 60% of its annual target of USD 19.8 billion.

HHI will construct the world's first LNG-FSRU

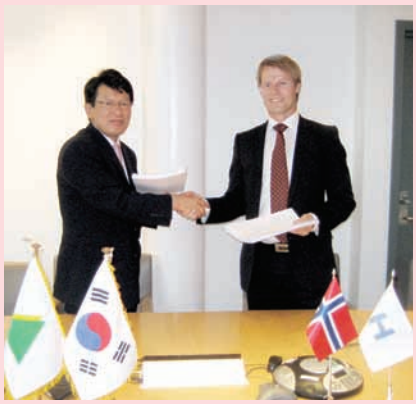
Hyundai Heavy Industries (HHI) is set to become the world's first shipbuilder to construct LNG-FSRU (Floating Storage & Regasification Unit), the offshore LNG supply base.

HHI signed a contract with Höegh LNG on June 10 in Oslo, Norway, to build 2 units of 170,000m^3 LNG-FSRUs. This contract, valued at USD 500 million in all, includes an option for 2 more ships and raises the expectation that additional orders will follow.

This facility, 3 times larger than a soccer field, measures 294m in length, 46m in width, and 26m in height and will be deployed in the sea. It can store and supply 70,000 tons of natural gas equivalent to the nation's daily consumption of LNG. The design work will commence in June, and these facilities will be delivered in the second half of 2013 and the first half of 2014, respectively.

LNG-FSRU refers to the facility that stores liquefied natural gas offloaded from LNG carriers and then transfers the gas to the land-based location via subsea pipelines by regasifying the gas whenever necessary, and this will become the world's first newbuild LNG-FSRU.

The pace of awarding the contract gained momentum when Sveinung Stohle, President of President & CEO of Höegh LNG, directly commissioned



Kang Young-seok (left) head of HHI's regional affiliate in Oslo, Norway, shakes hands with Vagard Hellekleiv, senior executive for the Norway-based Höegh LNG, after signing the contract.

HHI to build the LNG-FSRU during the GASTECH, a global gas conference and exhibition held in March in Netherlands. Höegh LNG is said to have lauded HHI for its extensive experience and expertise in the construction of LNG carriers and its many design specialists who can satisfy even the challenging demands of design alteration.

LNG-FSRU shortens the construction duration by 1 year and requires half the cost of construction compared to conventional onshore LNG supply base. For these advantages, the demand for LNG-FSRU has skyrocketed worldwide, specifically in the Central/Latin American and South East Asian countries that want to build LNG supply bases in a short time and overcome serve energy shortage.

Deployed in the sea, LNG-FSRU will trigger few complaints from residents in the vicinity. LNG-FSRU has another advantage that it is self-propelled and can be moved to other locations, depending on the energy demand of country or region.

HHI has applied special design for the construction of this LNG-FSRU, extending the cycle of maintenance/repair on the dock to 10 years from the current 5 years and reducing the loss caused by the disruption of works, thus drawing acclaim from ship owners.

An official from HHI said, "This contract for LNG-FSRU will pave the way for new global trend of building offshore LNG supply base. About 10 LNG-FSRU projects are now underway in Brazil, Indonesia and other countries, raising the prospect for additional orders."

Meanwhile, HHI secured an order for 1 shuttle tanker from the Norway-based KNOT on June 8 and a newbuilding order for 1 unit of 84,000m^3 LPC carrier in Norway on June 10.

Recently, HHI has expanded its leading position in the market for specialized vessels related to the oil and gas field exploitation, such as LNG/LPG carriers, LNG-FSRU, shuttle tanker, etc, and won orders for a total of 53 ships worth USD 13.5 billion (including the order intake of Hyundai Samho Heavy Industries) in the shipbuilding and offshore plant sectors this year.

STX OSV clinched orders for 2 Platform Supply Vessels

STX OSV, a subsidiary of STX Europe, announced on June 9 (local time) that it won an order worth an approximately KRW 150 billion for the construction of 2 Platform Supply Vessels (PSVs) from Island Offshore.

These 4,800DWT PSVs will measure 96.8m in length, 20.0m in width. The hulls of the vessels will be built at the STX OSV's Braila shipyard in Romania and the remaining work will be completed at the Brevik shipyard in Norway. These PSVs are scheduled for delivery in the first quarter of 2013 and the third quarter of 2013, respectively.

Platform Supply Vessels of STX OSV

These newbuilds will adopt UT 776 CD design developed by Rolls Royce. PSV is a ship specially designed to supply fuel necessary for the drilling operation of offshore plant, food/beverage, drilling equipments/manpower, etc, to the offshore oil platform which drills into the sea floor and extracts crude oil from oil reserves. It is a type of ship that has come into the limelight along with offshore plants as new life has been breathed into deepwater resource exploitation projects recently.

Meanwhile, STX OSV has an order backlog of 58 ships, including this order.

STXOS landed a USD 550 million contract for LNG carriers, etc, in just one day

STX Offshore & Shipbuilding (STXOS) clinched newbuilding contract worth a total of a USD 550 million in just one day.

STXOS signed a USD 400 million contract with Russia's SCF Sovcomflot on May 31 to build 2 units of 170,200m^3 membrane-type LNG carriers.

The contract includes an option for 2 more vessels, and is valued at USD 800 million in all if the optional vessels are included.

These LNG carriers will be delivered in late 2013 and the second half of 2014, respectively, and chartered out to Gazprom LNG over the long-term after delivery.

So far, STXOS has actively pushed ahead with development of ship model suited for the resource exploitation projects in the polar regions. This effort paid off when STXOS won this contract.

STXOS developed Arctic Ice Breaking Shuttle LNG Carrier jointly with STX Europe last year and successfully constructed and delivered 173,600m^3 LNG carrier, its first LNG carrier, to the Spain-based Elcano in August last year.

STXOS plans to apply the reinforced cargo hold heat preservation system which can minimize loss of vapor gas generated during the transportation of LNG with LNG carrier.

Additionally, STXOS plans to adopt energy-saving propulsion system that can save energy cost by over 5% compared to the existing electricity-powered LNG carriers.

STXOS concluded a contract to build 2 LNG carriers on June 17 in a signing ceremony attended by STX Group chairman Gang Duk-soo (back row, first from right), Sergey Frank (back row, second from right), Sovcomflot President, Nikolay Kolesnikov (left on the backrow), Sovcomflot CFO, etc.

These LNG carriers to be built under this contract can generate vapor which powers the turbine generator by using the high temperature waste heat from the engine.

Meanwhile, STXOS received a contract for 4 product carriers worth USD 150 million on the same day. On May 31, STXOS signed a contract with the Denmark-based Norden Shipping to build 4 units of 50,000-ton product carriers. This contract includes an option for 2 more vessels of same model, raising the prospect for additional orders.

These vessels will measure 183m in length, 32.2m in width, 19.1m in height and can sail at a maximum speed of 14.5 knots. They will be capable of carrying up to 50,000 metric tons of petroleum products such as crude oil, refined oil, chemical products, etc, and built at Jinhae shipyard of STXOS and delivered on a staggered basis to the ship owner from January 2013.

Specifically, these vessels will be outfitted with high efficiency engine functioning as main engines which can electronically control fuel spray amount, according to the request of ship owner, and enhance fuel efficiency by about 15% compared to existing vessels. More than 4 tons of fuel will be saved daily if the vessels sail at an average speed.

An official from STXOS said, "STXOS successfully clinched newbuilding orders worth around USD 550 million in just one day after winning 4 product carrier orders last week. We will bring a fresh impetus to our sales activities aiming to win more orders in the offshore plant sector, as well as in the merchant

ship sector."

Meanwhile, STX Group chairman Gang Duk-soo concluded a contract to build LNG carriers on June 17 at the Lenexpo Convention & Exhibition Center in St. Petersburg, Russia during the International Economic Forum in a signing ceremony attended by Sergey Frank, Sovcomflot President and CEO, and officials of Gazprom, etc.

On the same day, STX Group chairman Gang Duk-soo meet with Russian President Dmitry Medvedev, Russian Deputy Prime Minister Igor Sechin, etc, to discuss a wide range of issues including the direction for the development of Russia's shipbuilding industry and measures for cooperation related to the resource exploitation projects.

In addition, STX Group chairman Gang Duk-soo met with Mikhelson, Chairman of Novatek (Russia's independent natural gas producer currently carrying out gas field exploitation project in Yamal peninsula, Western Siberia) to discuss joint development of LNG carriers, etc.

STXOS inked a contract to build 4 product carriers

STX Offshore & Shipbuilding (STXOS) was awarded a USD 150 million (approximately KRW 162.4 billion) contract from the Greece-based Thenamaris to build 4 product carriers.

STXOS signed this contract in a signing ceremony attended by about 20 related officials, including Shin Sang-ho, President of STXOS, Ben Goodhead, President of Thenamaris, at STX R&D Center located in Changwon City, South Gyeongsang Province, on May 27.

These vessels will measure 183m in length, 32.2m in width, 10.1m in height, and can sail at a maximum speed of 14.5 knots. They will be capable of carrying up to 51,000 metric tons of petroleum products such as crude oil, refined oil, chemical products, etc.

STXOS signed this contract to build 4 product carriers in a signing ceremony attended by about 20 related officials, including Shin Sang-ho (left), President of STXOS, Ben Goodhead (right), President of Thenamaris, at STX R&D Center in Changwon City, South Gyeongsang Province, on May 27.

These vessels will be built at Jinhae shipyard of STXOS and delivered to the ship owner on a staggered basis from the second half of 2012. Thenamaris, the ship owner, will determine the purpose of related vessels and make decision on whether to charter them out, depending on the market conditions at the time of delivery.

Thenamaris, established in 1970s, is headquartered in Greece and a medium-sized shipping company that operates a fleet consisting of about 40 ships. Particularly, Thenamaris is focusing on tankers of various sizes ranging from small vessels to ultra large vessels. Recently, it has attempted to make inroads into the market for container ships, to begin with the entry into the market for small containerships.

An official from STXOS said, "We plan to make foray into the market for small and medium-sized product carriers based on our differentiated shipbuilding technology. We will focus on building up cooperative relationship with new ship owners, while strengthening relationship with existing ship owners, to steadily win newbuilding orders in the related sector."

Nexans supplies the special power cables for plug shoreside power system to NG²

Nexans will supply specially-designed cables to NG² for its innovative plug shoreside power system enabling high voltage power link between land-based location and ship through the pushbutton operation. Nexans' Buflex Plug cable will be used in NG²'s pilot project that connects the Port of Oslo, the largest cargo port in Norway, and Color Line A/S, supplying the power to its RoPax ferry while it is anchored in the port.

A/S's ferry of Color Line navigates between Port of Oslo and Port of Kiel in Germany, a multi-purpose and economically-efficient port in the Baltic Sea. Nexans is supplying 3 cables to NG² and each has a conductor with the cross-section of 150mm².

The PLUG shoreside power system, which implies the power generation during loading and unloading, enables automated connection processes between ships and onshore power supply base because they shifted from diesel power generation to the use of quayside power in order to operate necessary ship systems.

The plug system will enable cold-ironing connection, which will remarkably slash CO_2 emissions and noise while the vessel is anchored, within approximately 1 minute if the button is pressed.

The Nexans cable designed for the application to this plug system is the Buflex Plug 6/10 (12) kV cable. The cable requires similar characteristics to the reeling cable used in applications for handling materials, and both must be essentially strong and flexible.

These characteristics are important in the STS (Ship-to-Shore) power cables because the cable provides link between the ship and the port. In NG² system, the cable is lifted upwards from a portside casing and linked to the ship that will be powered. Particularly, the cable needs to be highly durable to withstand a high tensile load caused when very heavy object is lifted.

The flexibility of cable is essential due to the tremendous intensity of movement between the ship and quay which is caused by the movement of ship at sea. The length of cable required by the entire plug system is approximately 150m, and the cable is flame-resistant in compliance with IEC 60332-1 standard. In addition, the cable also has to be able to stand up to the severely cold temperatures such as the extremely cold weather in the Port of Oslo and the regions where Color Line A/S operates.

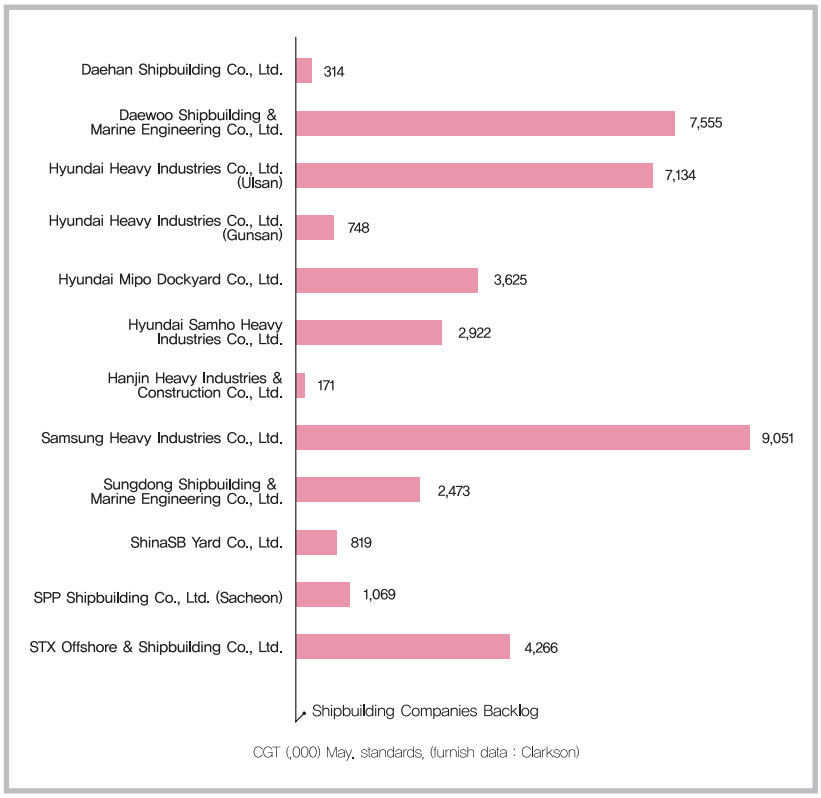
Alexandre Lhuillier, Nexans Corporate Business Development Manager for Ports Infrastructures, says, "We are proud that we can support NG² which developed this innovative solution. Nexans' cable is making an important contribution to the success of NG²'s shoreside power system. We hope that we continually collaborate with NG² which developed this niche market and successfully developed the plug shoreside power system. Nexans has a strong heritage rooted in innovation. Nexans supplies the reinforced systems used in the port infrastructure industry, and furthermore, supports all links in the power supply network, ranging from substations to large-scale power grid, as well as provide the connection between ships and port."

Damien Féger, inventor of the PLUG concept, says, "Nexans provided full support during the development of this plug system, specifically when we received an order for the system incorporating the first plug technology. The delivery had to be made within 4 months after the order was placed because this shoreside power system had to be installed while Color Line A/S was anchored in the port of Oslo, and we sent the shipment on time thanks to the swift response of Nexans."

Recently, Nexans announced that it would supply specially-designed power cable to NG² for its plug shoreside power system enabling high voltage power link between onshore location and ships through the pushbutton operation.

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

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



Particularly, domestic shipyards which have high competitive edge in those 2 sectors have continued to win a wave of new orders since the beginning of the year.

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

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

Photo: ShinaSB Yard Co., Ltd.

Offshore plant orders awarded to domestic shipyards in 2011

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

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

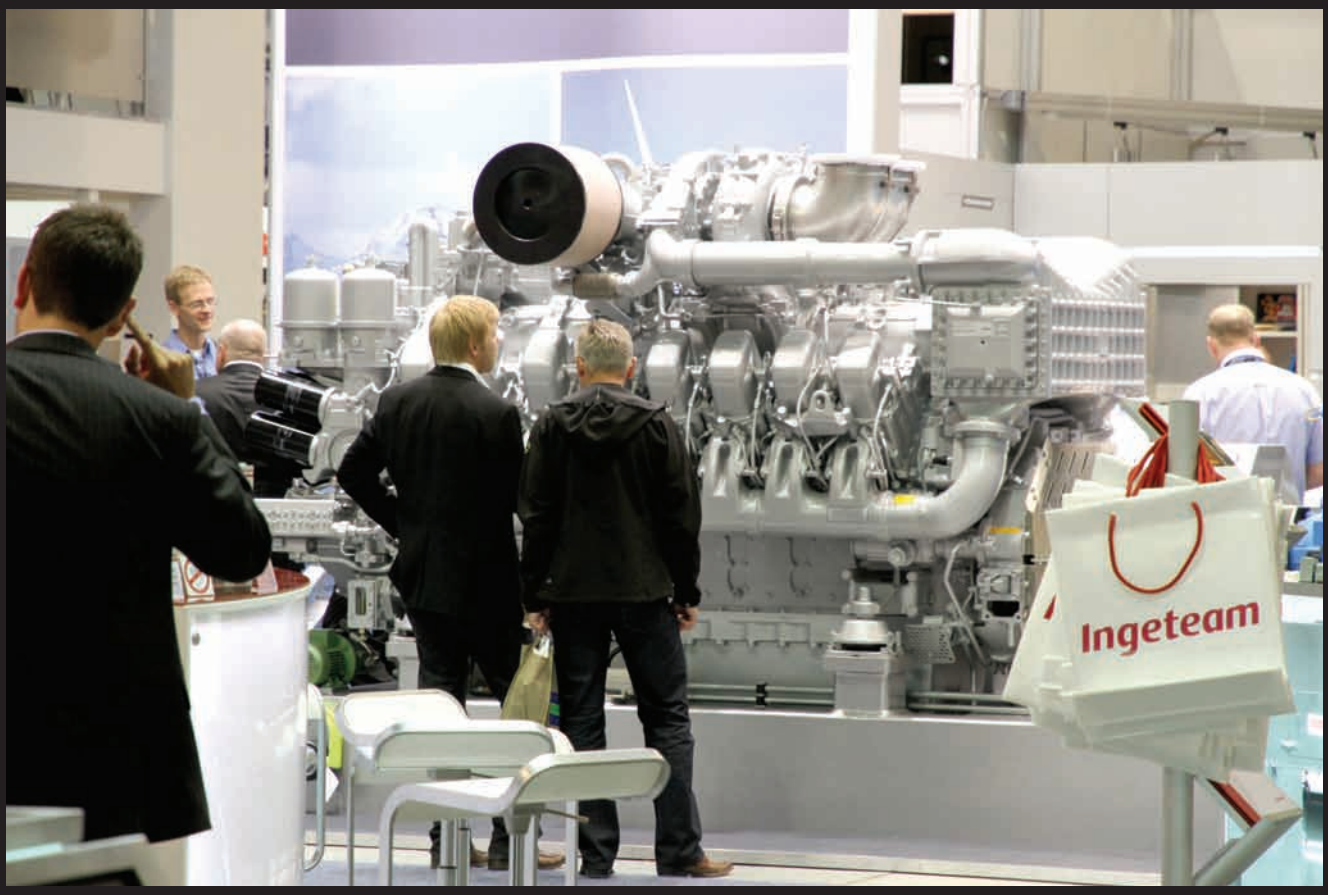
Delivery	Shipyard
Mid 2013	Hyundai Heavy Industries
Late 2013	Hyundai Heavy Industries
On a staggered basis until late September 2013	Hyundai Heavy Industries
Second half of 2013	Daewoo Shipbuilding & Marine Engineering
October, 2012	Hyundai Heavy Industries
Early 2015	Hyundai Heavy Industries
2012	STX 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

Nor-Shipping 2011

Nor-Shipping 2011, the largest international shipbuilding and maritime exhibitions in Europe, was held at Norges Varemesse in Oslo, Norway for 4 days from May 24 to 27.
Nor-Shipping which began in 1965 marks the 23rd anniversary this year. It drew 1,100 exhibitors representing 53 countries, the largest event in its history. In particular, approximately 34,500 people from the shipbuilding industry came to the exhibition venue, the largest turnout ever since Nor-Shipping was launched. Shipyards from the world's major shipbuilding countries such as Korea, Norway, Japan, China, United States, etc, participated in the national pavilions and presented their cutting-edge shipbuilding technologies.
This exhibition showcased a vast array of equipments, parts, materials, etc, related to the shipbuilding, maritime designing and manufacturing. Major products and technologies presented at the Nor-Shipping include the followings:

- Shipbuilding, designing, construction, marine machinery, communication ship and ship equipments
- Software and engineering related to shipbuilding and maritime industry
- Desalination system, port-related programs, security and disaster prevention products
- Boiler, steering gear, heat exchange machine, intermediate equipments such as valve and welding materials, etc, and ship loading programs

*Photos: Nor-shipping 2011/ Norway Trade Fairs

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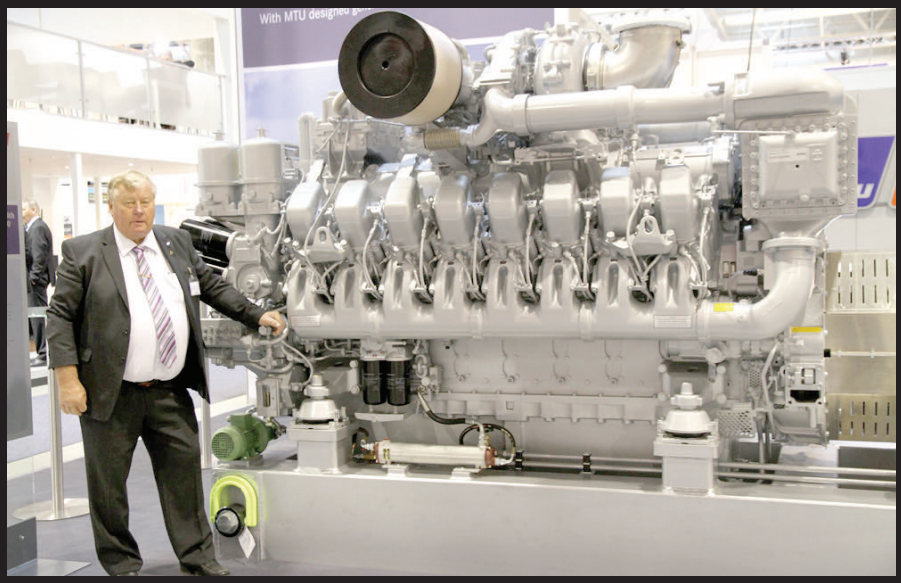

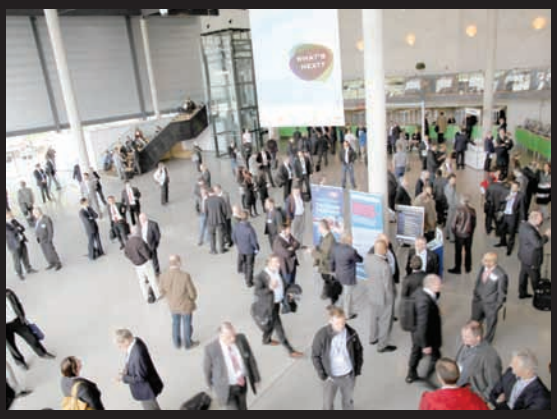


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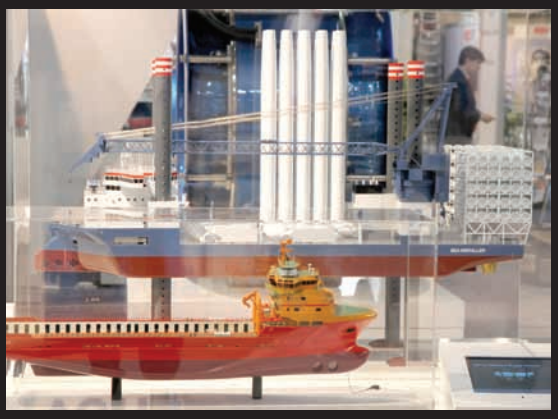


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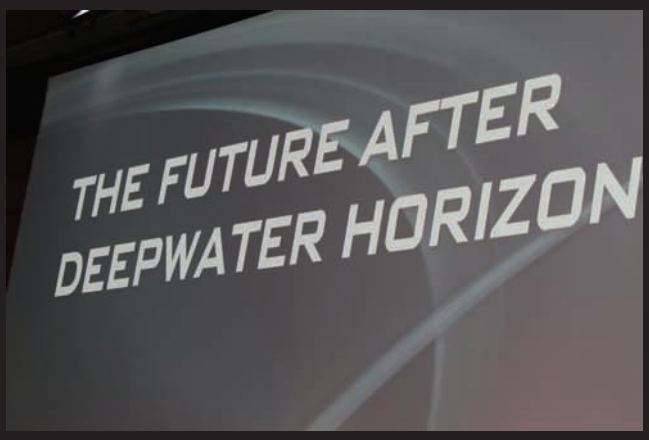
• Agenda Offshore



• Opening Conference

• Campus 2011

New Product

Processing tool for POF cables

Weidmüler Korea Co. Ltd.

Automation technology consistently requires ever greater amounts of data and demands ever lower transmission losses, which is why polymer optical fibres (POF) are today being used more and more. Simple connection technology and standardised transmission protocols are distinguishing features of these polymer fibres. Weidmüller now offers an optimum and, to date, unique solution to what is otherwise a complicated process to prepare and terminate POF connectors: With just one tool, the HTX-IE POF, it is possible to strip and crimp 1-mm polymer optical fibres specifically for PROFINET and EtherNet/IP SC-RJ connectors. A rotating blade cuts the fibres precisely at the ferrule so that a subsequent polishing process is no longer necessary.

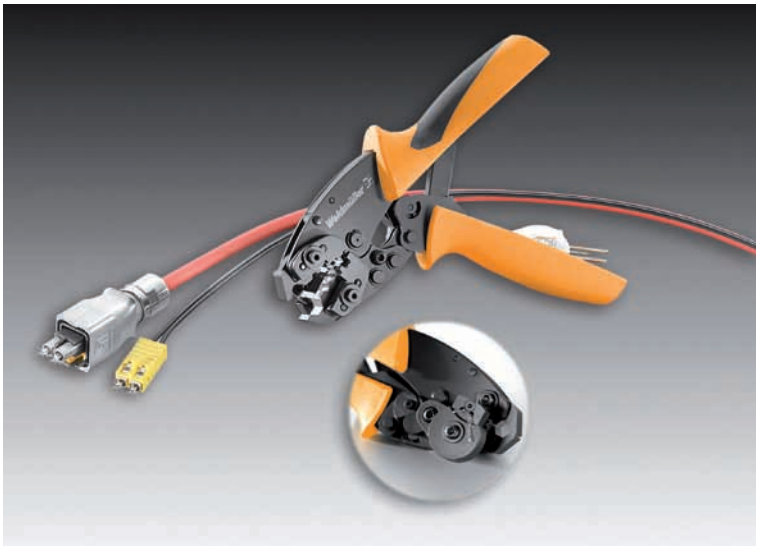
Weidmüller developed its new processing tool for POF cables complying with IEC 60793-2 A4A (1,000μm/980μm POF).

In addition, Weidmüller offers a complete programme of tools for processing cables and POF fibres: The PSC 80 assortment case holds everything necessary for preparing and terminating IP67 rated POF connectors. This includes a pair of scissors known as 'Scissor Kevlar' specifically to cut aramid fibres, the multi-functional HTX-IE POF and the insulation stripping tool multi-stripax IEPOF.

Cost-effective and robust polymer fibres are playing an increasingly significant role in industrial automation solutions thanks to simple connection technology and standardised transmission protocols. However, preparing and terminating SC-RJ connectors has to date been an extremely complicated and time-consuming process, with secure and reliable processing quality depending on the user's skill and dexterity. It is against this background that Weidmüller developed a multi-functional cutting, stripping and crimping tool for POF interfaces that facilitates quick, reliable and simple preparation and connection of IP20 and IP67-rated POF connectors.

The innovative HTX-IE POF multi-functional tool allows users to carry out the complete preparation and termination of SC-RJ connectors (IP20) for Profinet and Ethernet/IP to 1mm POF fibres - all in just one tool. The HTX-IE POF serves to both strip and process duplex POF fibres at one and the same time. The processes of crimping the connectors and suitably cutting the POF fibres are completed in a single work procedure. And because a rotating blade cuts the fibre precisely at the ferrule polishing the cut surfaces in a subsequent, time-consuming process is no longer necessary. A locator (positioning and placement aid) in the tool handle enables users to position the SC-RJ connector precisely. The HTX-IE POF tool ensures highly accurate and repeatable results to support reliable, user-independent working results for consistently high quality connections. The first class form, material and surface structure of the ergonomic tool handles are designed to meet on-the-spot demands in the field.

Weidmüller offers a robust and perfectly harmonized assortment of tools for processing polymer optical fibres. The multi-stripax IEPOF, the multi-functional tool HTX-IEPOF and the pair of Kevlar scissors make it possi-



HTX-IE POF tool/expanded area have the rotating blade cut shape

IE-POF tool sets. Kevlar scissor, multi-stripax IE POF, and HTX-IE POF (from the left)

ble top repare and terminate IP67-rated connectors injust three steps. First, remove the buffer from the POF fibre; second, crimpandcut; third, crimp the strain relief. Thanks to the specific tool geometry the Scissor Kevlar cable cutter has been specially designed to cut aramid fibres. Aramid fibres act as strain relief in fibre optic cables.

The tool set IE-POF - a complete programme of tools - is used to strip, crimp and cut POF fibres and cables. The PSC 80 assortment case holds everything necessary for preparing and terminating IP67-rated POF connectors including a pair of Kevlar scissors to cut aramid fibres, the multi-functional HTX-IE POF and the insulation stripping tool multi-stripax IEPOF.

All of the tools used to process POF fibres comply with the standard IEC 60793-2 A4A Fibre (1,000μm/980μm POF). Weidmüller tools are predestined to last for a long service life. This is assured by best-possible workmanship, high-quality components and a production process designed to provide the highest quality for optimum work results, no matter how often the tools are used.

To prepare and terminate SC-RJ connectors requires just two (IP20) or just three (IP67) steps:

-Step 1 Strip the buffer from duplex fibres: Place the POF fibres into the tool and close. The POF cables are stripped in the process.

-Step 2 Crimp + cut-off the duplex fibres: Place the SC-RJ connectors into the locator on the tool. Insert the POF cables into the connectors and close the tool completely. This ensures both connectors are crimped in parallel and both POF fibres are cut off flush at the connectors. The IP20 connector is finished.

-Step 3 Crimp the strain relief (for IP67 connector): Place the duplex connectors and stain

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New Product

3D type mold transformer

ABB Korea Ltd.

ABB Korea announced that it developed the 3 dimension type mold transformer revolutionizing the concept of transformers with the support of the Development Center, the R&D arm of ABB's global Transformers business unit.

This new-concept transformer called 'TriDry Transformer' is slated to begin rolling out in the domestic market in August.

The 3D type transformer technology has seen great improvements over the last century since its first development in late 1800s, and is widely known as one of the design technologies that ensure no-load losses and reduce noise emissions. For these advantages, 3D type transformer technology has been steadily researched by many designers and manufacturers of transformers.

ABB has systemized the production techniques to ensure practical application of the theoretically-substantiated technologies to the manufacturing. In particular, ABB resolved many constraints arising from the commercialization and successfully completed the vacuum casted mold transformer.

Specifically, ABB introduced this brand new TriDry transformers at Hanover Fair in April this year, attracting huge attention from visitors.

3D type mold transformer

Major features of TriDry transformer

TriDry transformer applies the vacuum casting process which ensures the highest electric stability and reliability. In addition, TriDry transformer which incorporates the technically challenging oval or round shaped core reduces the loss. It may be no exaggeration to say that this TriDry transformer is the world's most technically advanced transformer technology.

3D Type transformer adopts a triangular core construction as shown in Fig. 1, unlike conventional 3-phase power transformers containing 3 wires wound around the core for each phase (U,V, W) which have had a linear design. Furthermore, 3D Type transformer incorporates the most magnetically stable and symmetric oval or round core, thus providing various advantages compared to conventional transformers. 3D Type transformer has the following advantages:

•Compact size

The triangular core construction reduces the width of transformer's enclosure by about 30% compared to conventional transformers. Besides, the footprint is over 30% more compact (Fig. 2), which lead to many different installation options such as the installation in the limited space of ultra high-rise

Fig.1 Symmetric round core

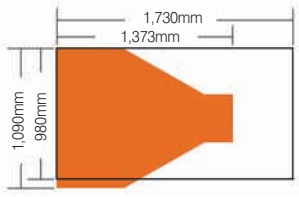

Fig.2 Comparison of volume

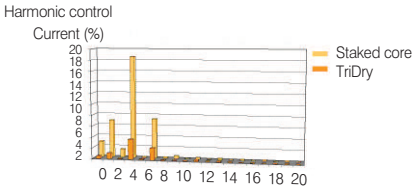

Fig.3 Measured harmonic in secondary current (100% excitation, dry-connection)

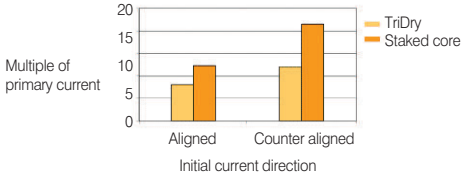

Fig.4 Inrush comparison

buildings in city or the narrow space in the electric room of factory.

• Excellent efficiency

Incorporating the cutting-edge technology, TriDry transformer is built with minimum number of materials. Thus, it is smaller, saves weight, and improves cost-effectiveness than comparable conventional transformers. TriDry transformer makes important contribution to the cost-saving in manufacturing, transportation, and installation, and enhancement of efficiency in using resources.

• Stability and scalability

TriDry transformer can maintain the attenuation and output of harmonic content at a constant level (Fig. 3). In addition, it significantly reduces the magnetizing inrush current (Fig. 4) and increase stability of the quality of power system. TriDry transformer enables highly precise configuration of protective system, and thus can provide excellent support for all sorts of loads, including the receptors that require elaborate network system.

ABB TriDry transformer is compliant with the Regulation on Energy Efficiency Labeling and Standards that was enacted in 2011 and will come into force from July in 2012, as well as the current Regulation pursuant to the Promotion of the High Energy Efficient Equipment Distribution. Furthermore, ABB TriDry transformer meets the high efficiency standards of advanced countries or Japan's Top Runner regulation which require high efficiency rating, raising the prospect that ABB TriDry transformer will gain ground in the global market.

ABB Korea's factory in Cheonan, one of the ABB's 5 factories worldwide that manufactures dry type transformers, is the focused factory for Asia and Australia.

An official from ABB Korea said, "ABB Korea's factory in Cheonan, one of the focused factories manufacturing the TriDry transformers, will play a key role in expanding the supply to Asia, Australia, and Europe, as well as Korea, and contribute to the domestic export industry."

Transformer business of ABB Group

The transformer business unit of ABB Group has maintained an unrivalled position in the global market for transformers by developing a wide range of products including the EcoDry which provides optimized high efficiency transformer solutions based on the load characteristics of customers, High-Dry which has the product range from 72kV (highest) to 63MVA (maximum), wind turbine transformers that require high electric and mechanical reliability, and inverter transformers for solar power generation, as well as TriDry transformer.

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

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

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

DINES CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. :
Main Products : Provision Crane, Tilting Radar Post
TEL : +82-51-971-0972

DK INDUSTRIAL CO., LTD.
Head Office : Saha-gu Busan
Homepage Add. : www.dk-ind.com/
Main Products : Silencer, Fire Damper, Lashing Bridge, Rudder
TEL : +82-51-832-1436

DK TECH CORPORATION CO., LTD.
Head Office : Kimhae Gyeongsangnam-do
Homepage Add. : www.dklok.com
Main Products : Instrument TuBe Fitting, Instrument Valve
TEL : +82-55-338-0114

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

DSK CO., LTD.
Head Office : Youngdo-gu Busan
Homepage Add. : www.dskworld.com
Main Products : Piston Crown
TEL : +82-51-417-7800

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

MYTEC CO., LTD.
Head Office : Gangseo-gu Busan
Homepage Add. : www.imytec.com
Main Products : Heat Exchanger, Pressure Vassel
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Main Products :
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Head Office : Kijang-kun Busan
Homepage Add. : www.navutec.com
Main Products : Fire fighting & Safety, equipment for marine & Offshore
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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.
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Homepage Add. :
Main Products : Transformer
TEL : +82-51-832-1751

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Homepage Add. :
Main Products : Emergency Shut-Off Valve, Veneral Bronze Casting Valve
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Homepage Add. : www.psminc.co.kr
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Main Products : Catering Furniture, Galley Hood, Laundry Equipment
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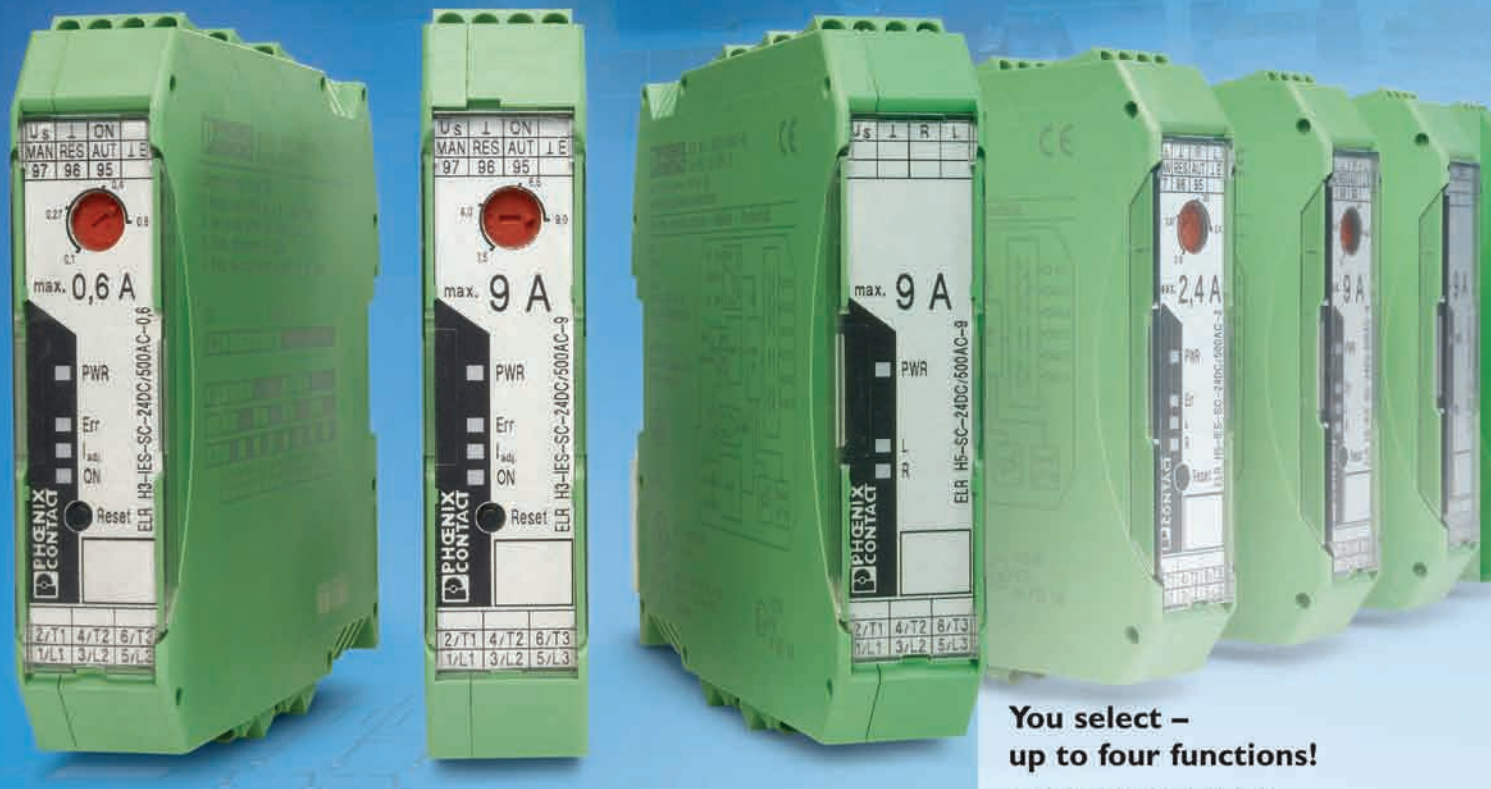

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Model		SM 2000	SM 3000	SM 4000	SM 5000	SM 6000	SM 7000	SM 8000
Capacity	m^3/hr	750 ~ 3,000	3,000 ~ 5,500	5,000 ~ 8,500	8,000 ~ 15,000	14,000 ~ 23,000	22,000 ~ 47,000	51,000 ~ 122,000
Motor	HP	125 ~ 20,000						
Discharge Pressure	Bar A	4.5 ~ 25						
Dimension(W x L x H)	M	1.5x 2.6 x 1.9	2.1 x 4.4 x 2.1	2.1 x 4.7 x 2.2	2.2 x 5.2 x 2.1	2.3 x 5.8 x 2.6	4.4 x 8.0 x 4.3	6.5 x 13 x 7.0
Weight	Ton	3.4	7	9	12	18	40	140

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SPX designs and manufactures products that deliver superior processing performance and dependability.
We offer a complete line of Heat Transfer Technologies for today's modern processing facilities.
From the quality of our components to the dedication of our technical support staff, you can have confidence in our process solutions.

APV provides you more value, performance, flexibility and choices for all of your processing needs.

APV

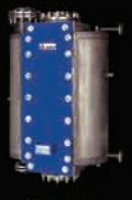

Dual Head Heat Exchanger

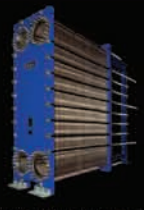

ParaFlow Plate Heat Exchanger


20" Port PHE Sirius Plate


Paramine Gasket


ParaTube


Hybrid


APV XL Plate Heat Exchanger 5380

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