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Session Ⅱ Global Pioneer Strategy of Greenship & Offshore Plant Industries

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- Session Ⅱ-2 Asia Initiative in Marine Finance Market
- Session Ⅱ-3 Deep Sea Offshore Plants and Seabed

Session Ⅲ Factoring High Oil Prices into Logistics Industry Risk Management

Session Ⅳ Emerging Issues for Global Seafood Industry

Session Ⅴ Climate Change and Future for Marine Environment and Biotechnology

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- Seaweed Pulp
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Special Session Ⅱ Vision and Prospects of the Design in Marine Industries

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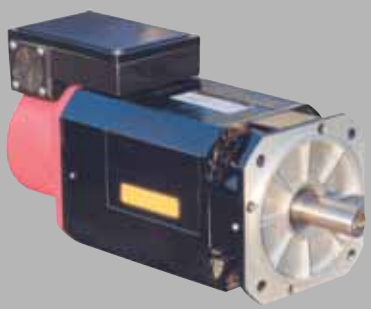

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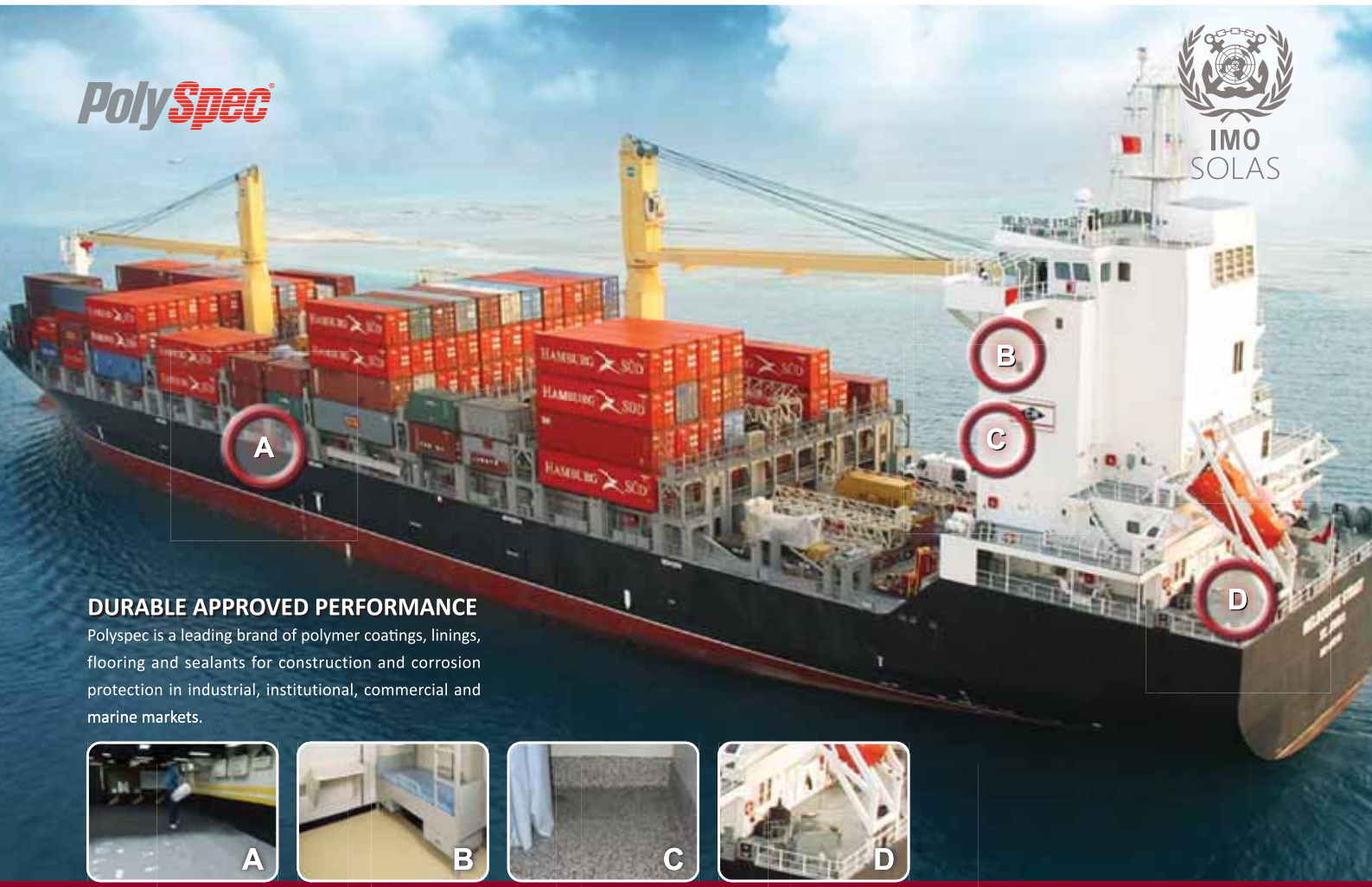

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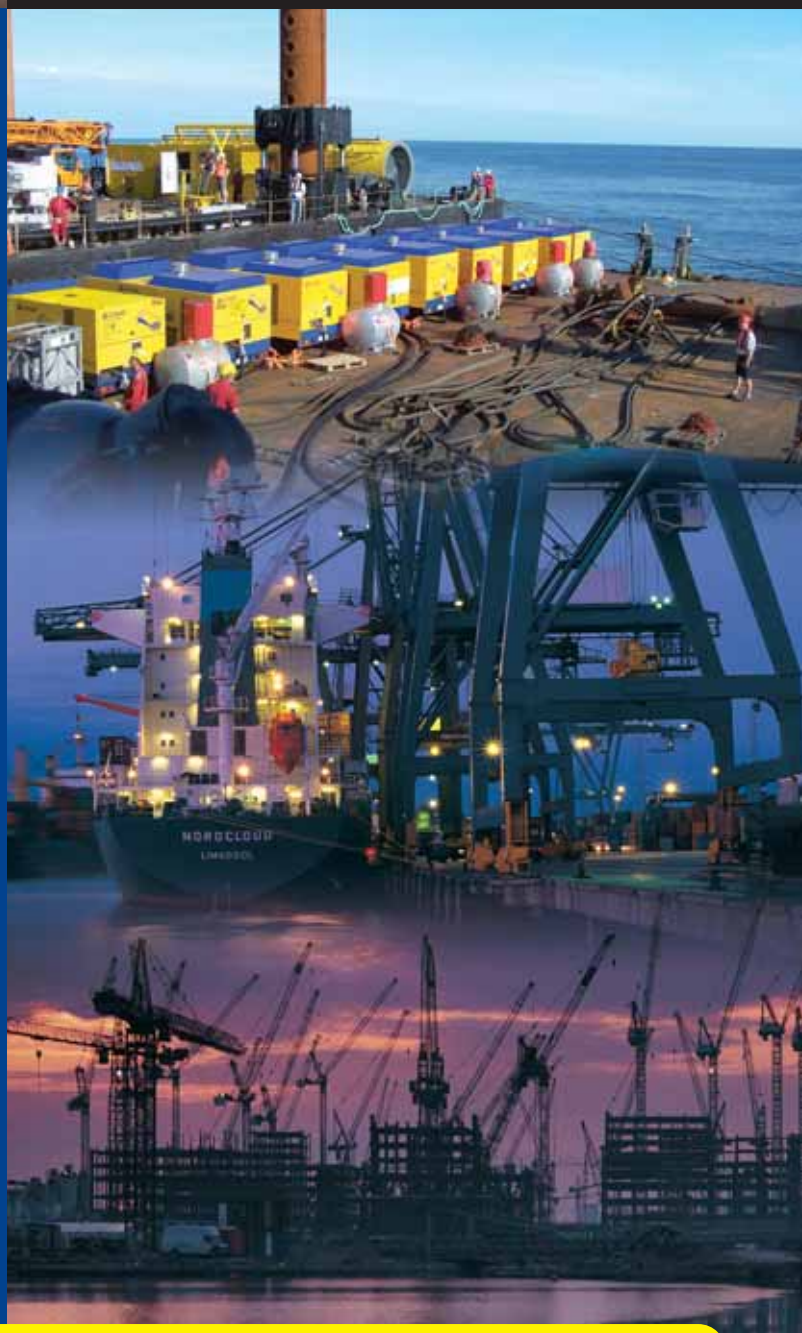

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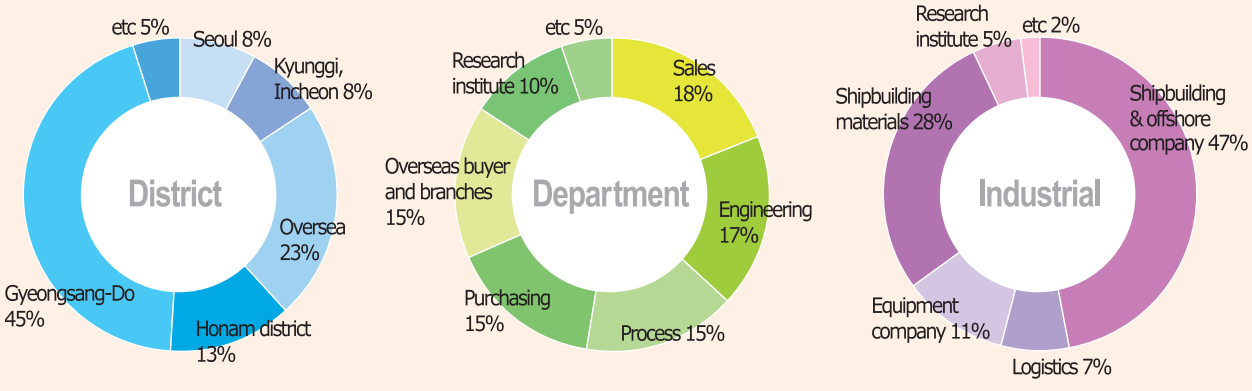

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DSME became the first shipyard to be certified to 'ISO 50001' based on EMS

Daewoo Shipbuilding & Marine Engineering (DSME), one of the eco-friendly frontrunners in the energy management, announced that it acquired the 'ISO 50001' international certification on the basis of its energy management IT system (EMS) on March 5.

ISO 50001 is an international standard for energy efficiency, which requires the companies to plan the energy-saving goals and implement the action plan. This certification attests to DSME's sustainable practices for eco-friendly energy management IT system combined with the business management strategy that goes beyond a one-time energy-saving plan.

Particularly, DSME has become the first shipbuilder to achieve certification to the ISO 50001 standard by integrating the energy management process and energy management IT system (EMS).

DSME has fully complied with the Framework Act on Low Carbon and Green Growth that went into effect to promote energy savings and mitigate global warming threatening the ecosystems worldwide, and has put the eco-friendly energy management system in place. DSME acquired the ISO 50001 certification through the test and certification processes of SGS (Societe Generale de Surveillance) which provides inspection, testing and certification services.

Officials of DSME and SGS are posing for photograph, showing the ISO 50001 certificate, at DSME's Okpo shipyard.

An official from DSME said, "I am delighted that DSME was certified to ISO 50001, the internationally recognized energy management standard. DSME's strategic energy-saving drives will be vital in maintaining its leading position in the global market, specifically when the greenhouse gas emission reduction becomes mandatory in 2013."

ABB Marine won $60m marine order for energy efficient propulsion system

ABB Marine won an order worth $60 million to provide complete power and propulsion systems for two new cruise ships to be built by Mitsubishi Heavy Industries at their shipyard in Nagasaki, Japan, for German cruise line operator AIDA.

ABB's delivery will help the ships maximize their fuel efficiency, speed and maneuverability, as well as provide a reliable power supply to improve the availability of onboard equipment. Each of the 125,000 ton cruise ships will have a passenger capacity of 3,250, and will be the largest ships ever constructed for AIDA, a subsidiary of Carnival Corporation. The new ships are scheduled to for delivery in March 2015 and March 2016.

"ABB's comprehensive solutions for our ship building customers include the most technologically advanced and energy efficient propulsion systems to help massive ships improve their maneuverability while using less fuel," said Veli-Matti Reinikkala, head of ABB's Process Automation division. "We also provide the reliable and efficient power systems needed to keep all onboard systems running at all times for optimum safety and passenger comfort."

ABB Marine will supply complete electrical systems for both ships; including generators, propulsion , engine room and distribution transformers, frequency converters, bow thruster motors, and other related power system equipment, as well as its latest generation Azipod XO propulsion systems. ABB's energy efficient Azipod propulsion uses less fuel than traditional systems, and provides greater maneuverability in all operating conditions.

HHIC makes full-fledged entry into overseas plant construction market to conquer current crisis

Hanjin Heavy Industries and Construction (HHIC) has mapped out a strategy to strengthen its overseas plant business by harnessing the competitiveness of Subic Shipyard equipped with the cutting-edge automation facilities.

HHIC announced that it entered into a contract on February 28 to build a steel structure for RMP-2 (Refinery Master Plan Phase 2) project of Petron Corporation, an oil refining and marketing company in the Philippines. This contract was awarded by Petron Corporation to Daelim Industry, and HHIC-Phil will build the steel structure of an oil refinery plant, the infrastructure facility, at its Subic Shipyard. The construction period is 15 months, and the contract is valued at approximately USD 38.4 million.

HHIC is expected to maximize the synergic effect between their mainstay sectors, i.e., the shipbuilding and construction sectors, in a bid to find a way out of the current crisis. The Subic Shipyard of HHIC-Phil, a subsidiary of HHIC, an ultra large dockyard occupying 700,000 pyong, was completed in 2009. It is highly recognized for both high competitiveness and productivity with skilled local manpower and state-of-art automation facilities.

HHIC plans to actively participate in the projects that aim to build various equipment and facilities for refinery plants, thermal power plants, and petrochemical plants which will be constructed in South East Asia and Middle East in the period ahead. Particularly, HHIC will leverage its know-how and technology related to construction and the advantages of Subic Shipyard to effectively target overseas plant market.

An official from HHIC said, "Shipyard in the Philippines will continue to give an impetus to the future growth of shipbuilding industry and play the role of an outpost for making inroads into the overseas plant construction market. HHIC will tide over current difficulties if it achieves robust order bookings for its shipyards, chiefly the Subic Shipyard that has far stronger cost competitiveness compared to other shipbuilders."

SWATH Boats to stay with GL in class

The Latvian Navy's new SWATH (Small Waterplane Area Twin Hull) patrol boats will be kept under Germanischer Lloyd (GL) class. GL surveyors will conduct periodic examinations throughout the life cycle of the vessels to verify that the vessels continue to be fit for purpose, technically reliable and seaworthy.

The five SWATH Patrol Boats are being built with GL class at German shipyard Abeking & Rasmussen (3 vessels) and at the Latvian Riga Shipyard (2 vessels). The first of these vessels, the "Skrunda" was delivered to the Latvian Navy in April of 2011. The Latvian Navy made the decision to maintain the vessels in class due to the advanced nature of the design. Following a tender process, carried out according to EU and Latvian law, GL was awarded the contract.

GL surveyors worked with the yards and with the Latvian Navy throughout the construction process to ensure that the vessels' construction complied with both GL rules and the applicable international regulations (e.g. SOLAS, MARPOL). Building vessels to classification society rules and keeping them in class is a growing trend, as navies look to reduce maintenance and monitoring costs while maintaining high safety standards, through compliance with international regulations.

The boats are noted for their exceptional stability and motion comfort, both in high seas and at high speeds. The Skrunda (GL + 100 A5 HSDE OC3, Patrol Boat, + MC Aut) has a length of 25.7m, beam of 13.0m and a draft of 2.7m. It is based on Abeking & Rasmussen's 25m SWATH Pilot boat design. In a shift from the Pilot boat design the Skrunda's engines have been placed in the lower hulls, which results in more room for the crew and additional passengers.

It is especially designed to undertake a range of operations through the provision of a mount for a modular mission module, which is positioned between the two bows.

The new Latvian Navy SWATH Boat.

This can be used to hold equipment or mount systems for conducting a variety of military missions, as well as for civilian tasks such as hydrographic surveys, environmental protection or diving operations.
The patrol boats' main duties will be to monitor and control Latvian and EU territorial waters and the exclusive economic zone (EEZ) and carry out search and rescue duties. They will also participate in international operations.

Honeywell and DSME successfully completes 24-month dynamic Positioning project

Honeywell and Daewoo Shipbuilding & Marine Engineering (DSME) have successfully completed a 24-month trial of Manoeuvring Aid Positioning System (MAPS), a new dynamic positioning system jointly developed by the two companies. In use at DSME, this system was completed on time and within a tight budget by the talented team from both companies.

New Dynamic Positioning system can help ships attain DP2 level certification; System offers new business opportunities for Honeywell

Dynamic positioning is a computer-controlled system to automatically maintain a vessel's position and heading by using her own propellers and thrusters. A computer program uses information from position reference sensors, wind sensors, motion sensors and gyro compasses to calculate the required steering angle and thruster output for each thruster.
This helps vessels navigate in areas where mooring or anchoring is not feasible due to various problems such as congestion at the bottom of the sea or deep water. Vessels with the system's ability to handle automatic and manual positioning and heading control, and redundancy could attain DP2 certification. Redundancy is a critical attribute for vessels in operations such as diving and heavy lifting where there are high risks of damage or injuries. For these vessels, the ability to maintain at least three position reference systems is important.
Honeywell provided the hardware and software technologies and application support while DSME developed DP application software. The project began in September 2008 at less than a quarter of the industry's standard dynamic positioning project costs with the core R&D team working on control logic, human and machine interface and communications program. The next step for MAPS R&D was to stabilize the system and enhance the software program. Trial run of the MAPS system began in first half of 2010. Today, the project team had successfully delivered a fully functioning system at DSME.
"MAPS, our new dynamic positioning system stood up well against an existing implementation by another DP supplier in terms of functionalities and capabilities," said Mr JungHan Lee, Vice President, Head of Ship & Ocean R&D Institute of DSME. "What really set us apart from the competition was Honeywell Global Support, the lower cost of implementation and the speed in which we were able to meet the ship owner's request. This project is testament to the professionalism of Honeywell people, quality of technology, and the depth of our relationship with Honeywell."
With MAPS, new opportunities in sea and on land are now available to Honeywell. Potentially, this new system can be applied in cable laying and pipe laying ships, on cruise lines, in crane vessels, diving support vessels, drill ships, floating production storage and offloading (FPSO), survey ships, shuttle tankers and in wind turbine installations.

KR held a ceremony to celebrate the construction of new building in Busan

Korean Register of Shipping (KR) performed the ceremony of putting up the ridge beam to commemorate the construction at the site of new company building in Busan on February 27. The ceremony was attended by 80 persons, including Oh Gong-gyun, Chairman & CEO of KR, officials of constructor, CM supervisors, presidents of vendor companies, etc., who wished for safe

and incident-free construction.

KR's company building in Busan, whose construction began in February 2009, will have 18 above-ground floors and 2 story basements with a total floor area of 30,502m^2. At present, the construction is 60% complete.

KR's relocation to Busan, which is home to the leading shipyards, equipment manufacturers, and shipping companies, is expected to help boost competitiveness of domestic shipyards, add vitality to the local economy of Busan, and create many jobs.

Oh Gong-gyun, Chairman & CEO of KR, said, "KR's relocation to Busan sets the stage for making a new start for the next century. We will step up efforts to join the ranks of the world's top 5 classification societies."

KR announced 'Eco-friendly green management' at the ceremony marking its 50th anniversary in 2010 and the 'Green management' to cope with the challenges for the next 50 years under the banner of 3G(Green Standard, Green Technology, Green Community). For that, KR plans to expand and reorganize its new industrial headquarters and research centers which will play a pivotal role in the green management.

The ceremony of putting up the ridge beam to commemorate the construction of KR's new building in Busan

Industry survey finds engineers are being deterred from railway careers due to requirements for early specialization

The present training and development programme for railway engineers encourages specialisation too early, a feature which is likely to limit career paths and could be deterring new entrants, according to a survey of professional engineers from the industry.

This is the overwhelming view of Chartered Engineers and IMechE Associate member engineers revealed by a survey of the future demand for training and skills conducted in December last year by Lloyd's Register and the Institution of Mechanical Engineers (IMechE).

"Young people are attracted to professions that do not appear to restrict choice and variety, so we need to demonstrate how a career in the railways offers a solid technical grounding with plenty of opportunities to follow specialist interests later as their experience develops," said John Stansfeld, Transportation Director, Lloyd's Register. "We must challenge the perception that engineers are 'locked in' to one discipline for life."

The survey also found strong support for training and qualifications to move away from present internal, self-accredited standards towards a regime that would place more emphasis on giving new engineering recruits a broader, more systems-focused approach.

"We need to encourage more people to pursue railway engineering careers and the fact that people are forced to specialise so early could deter some of the best engineering talent," said Philippa Oldham, Head of Transport at the Institution of Mechanical Engineers. "Government and industry need to work together to find ways to allow people to specialise later in their careers."

The key findings from the survey were:

- More than 80% of respondents agreed that current training and development encourages specialisation too early, a feature which can limit career paths and deter new entrants
- The industry would be well counselled to break down 'silos' between disciplines and focus on providing new recruits with a wider level of knowledge and better understating of system interfaces before they explore specialist interests
- More than 70% respondents felt that, while reducing costs and increasing capacity will continue to preoccupy boardrooms, the skills in highest demand during the next 10 years will relate to energy efficiency
- Future engineering leaders will need to demonstrate a more enterprising and innovative approach, and a willingness to challenge current practices

STX Europe has found a new owner of supersize cruise ship

STX Europe has successfully found a new owner of the supersize luxury cruise ship. STX France, a subsidiary of STX Europe, announced on March 13 that it sealed a contract with MSC Cruise to build a supersize cruise ship following the termination of the agreement with the ship owner last year in the aftermath of global financial crisis. This cruise ship is currently being built at Saint Nazaire shipyard of STX France and the construction is approximately 50% complete. It is scheduled for delivery to the ship owner by March 2013.

This vessel is a 140,000 tons supersize cruise ship that combines advanced technology and stylish design. It has a capacity of about 5,700 passengers and crews with 1,751 cabins. The cruise ship will have various entertainment facilities such as restaurants, spa, cinema, etc. In addition, the cruise ship will feature VIP lounge service and MSC yacht club exclusively for suite guests. Particularly, STX France will incorporate many eco-friendly elements, including the state-of-art system to dispose of waste water and contaminants, as requested by MSC Cruise, the ship owner.

This cruise ship, to be called' 'MSC Preziosa' is the last edition to the MSC Fantasia class of MSC Cruise and will operate in the most popular route of the Mediterranean Sea.

An official from STX said, "I am delighted that we finalize the contract with MSC Cruise, a prominent cruise operator, after long negotiation. We will successfully complete the construction of this cruise ship, using the world's best technology of STX France."

'MSC Splendida', a 140,000 ton cruise ship delivered by STX France in 2009

STX OSV standardizes on AVEVA Marine for all engineering and 3D design

AVEVA announced STX OSV has standardized its engineering and 3D design work on AVEVA Marine and purchased more than 100 additional software licenses. The technology, which STX OSV selected over Tribon and a competitive solution, will be implemented globally across ten shipyards.

"We are pleased to confirm our first project's critical path in the design process was reduced by 30%", added Magne Bakke, Chief Operating Officer, STX OSV AS. "AVEVA Marine has improved and reduced the time of our engineering design process. At the same time, for instance, we can integrate and work on a 3D model during initial vessel design as well as engineering tasks. We then reuse and refine this information during the detailed design and production engineering phases. With AVEVA Marine we achieve integrated hull-outfitting, global work sharing and it supports late design changes. This was key in our decision to standardise on AVEVA Marine for all engineering, hull 3D and outfitting 3D design work. As a result, we've made the strategic decision to roll AVEVA Marine out across ten shipyards

Magne Bakke, Chief Operating Officer, STX OSV AS and Richard Longdon, CEO, AVEVA with colleagues.

around the world".

"AVEVA Marine has been thoroughly tested in the engineering work of three Offshore Platform Supply Vessels. We encountered some challenges, but overall experienced great improvement over our old systems. AVEVA has an open approach and worked with us to improve the solution even further", said Stig Sandanger Riise, Senior Vice President Technology & Engineering, STX OSV AS.

"STX OSV has already demonstrated the 30% increased overall efficiency AVEVA Marine offers users compared to our older Tribon M3 software", added Helmut Schüller, Senior Vice President- Central and North EMEA, AVEVA. "The business value of Integrated Engineering & Design, offering increased quality, reduced man-hours and shorter project duration is a breakthrough in terms of integration and efficiency. STX OSV will quickly recognise these benefits across all of its shipyards".

AVEVA Marine is a set of integrated applications created specifically for the unique processes of the engineering and design of ship and offshore structures, design management and the generation of accurate production information.

Nexans completes the acquisition of AmerCable, solidifying its leading position

Nexans announced on February 29 that it completed the acquisition of AmerCable, one of the front-runners in the industrial cable market. This acquisition puts Nexans in a stronger position in the offshore and subsea sectors that have bright outlook and great profit potential and cement the leading position of Nexans in the market.

AmerCable has approximately 400 employees and is a leading manufacturer of special cables used in the mining, offshore and onshore oil/gas, renewable energy(subsea) industries. Moreover, it offers unique engineering support in this field. Currently, AmerCable maintains a leading position in North America (where it generates 77% of its sales revenue) and expanding its business into China, Latin America, and Australia.

For the year to 31 December 2011, Amer Cable sales revenue totaled around US$270m with an EBITDA - Before adjustment for copper fluctuations and excluding Quintana Energy Partners management fees - margin on sales at constant metal prices of around 13%. The consideration amounts to USD 275 million.

AmerCable's business complements Nexans' existing operations in resource cables, providing a new strategic and operational platform in North America.

Technip awarded an engineering contract for the Luva field development, offshore Norway

Technip awarded an engineering contract for the Luva field development, offshore NorwayTechnip was awarded a lump sum front-end engineering design (FEED) contract by Statoil ASA for the development of the Luva floating platform, offshore Norway, at a water depth of approximately 1,300 meters (4,265 feet).

The contract covers the design and planning for procurement, construction and transportation of a Spar - Spar: a cylindrical, partially submerged offshore drilling and production platform that is particularly well adapted to deepwater - hull and the mooring systems as well as the design of the steel catenary risers. (Riser: a pipe or assembly of flexible or rigid pipes used to transfer produced fluids from the seabed to surface facilities, and transfer injection or control fluids from the surface facilities to the seabed.) The award builds on the study work (including pre-FEED) that has been ongoing since early 2010 to document the suitability of a Spar platform in Norwegian waters.

This award confirms Technip's leadership in the design of Spar platforms, mooring systems and steel catenary risers, and further confirms that the Spar continues to be the platform of choice for certain developments, not only in Gulf of Mexico and the Far East, but also in new basins, in this case the Norwegian Sea.

Technip's operating center in Houston, Texas will execute the contract in cooperation with the Technip operation centers in Norway and Finland, further highlighting Technip's strength of executing projects using multiple engineering centers.

Technip is a world leader in project management, engineering and construction for the energy industry. From the deepest Subsea oil & gas developments to the largest and most complex Offshore and Onshore infrastructures, our 30,000 people are constantly offering the best solutions and most innovative technologies to meet the world's energy challenges.

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Cutting-edge deepwater offshore plant market rides high

Offshore energy development projects are gathering further momentum amid sustained high oil prices. The market for high-priced offshore facilities, such as the cutting-edge FPSO, FSRU, drillship, power generation plants, etc, is likely to show strong growth in view of the increasing exploration and production activities by the oil companies and offshore drilling facility operators. Domestic shipyards are expected to continue on their remarkable growth path in the offshore plant sector this year.

Domestic shipyards have seen their competitive edge in the small and medium-sized vessel sector being eroded by quantitative growth of Chinese rivals. Additionally, the glut in the market for commercial ships that has persisted for years has led to the overall reduction in orderbook, overshadowing the prospect for growth. Korean shipbuilding industry is focusing on high value-added ships incorporating cutting-edge technology, and shifted the focus to the offshore plant sector several years ago.

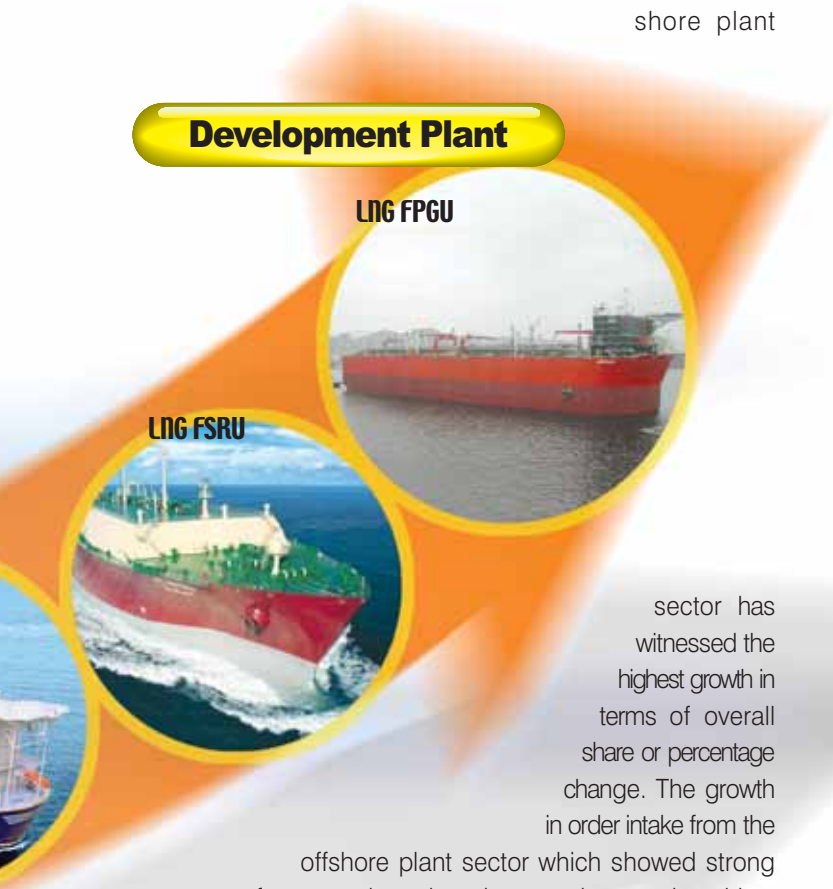
According to the data published by Korea Institute for Industrial Economics & Trade (KIET), shipbuilding industry has seen a slump in orders for most types of ships amid the downturn in the market since the second half of 2011 while new order for offshore plants is expected to increase sharply on the back of strong demand for drillship if high oil prices are sustained. In, 2012, the combined order backlog of domestic shipyards is expected to shrink approximately 13.1% year-on-year to 6.65 million CGT in the first half and decrease 8.7% year-on-year to 6.45 million CGT in the second half. The annual order backlog of domestic shipyards is expected to fall 10.9% year-on-year to 13.1 million CGT.

This year, the difficultly in financing large-scale off shore plant projects is likely to persist in the offshore plant market in the midst of global economic crisis. However, the offshore plant will continue to be on a steady growth path, spurred by the increasing number of offshore projects in line with the planned expansion of energy and industrial facilities in Middle East and developing countries.

Particularly, a great deal of interest in offshore energy development has been sparked among a growing number of countries, and European countries and Americas, which had been at the forefront of developing offshore plants such as drillship or FPSO (Floating, Production, Storage, Offloading), FSRU (Floating, Storage, Re-gasification Unit), have emerged from the grip of economic recession and started investing in earnest.

Domestic shipyards to register USD 70 billion in new orders in 2012

The Ministry of Knowledge Economy (MKE) and Korea Plant Industries Association(KOPIA) forecast that the domestic plant industry - which registered USD 65 billion in export last year, thus marking 8 consecutive years of robust growth since 2003 - will achieve USD 70 billion in export this year, a 7.7% increase compared to the previous year. This uninterrupted growth is driven primarily by the offshore plant sector. As shown in the Table 1 which illustrates domestic shipyards' order intake in the offshore plant sector, the growth rate in new orders for industrial facilities was the highest (562.4%), thanks to the contract (worth USD 4.3 billion) awarded in the fourth quarter last year to build CSP plants in Brazil. However, the offshore plant sector has witnessed the highest growth in terms of overall share or percentage change. The growth in order intake from the offshore plant sector which showed strong performance throughout last year has continued into the first half of this year.



Offshore plant sector drives the growth of shipbuilding market

Ministry of Knowledge Economy (MKE) and Korea Shipbuilders' Association (KOSHIPA) announced that Korea's 11 major shipyards - such as Hyundai Heavy Industries (HHI), Daewoo Shipbuilding & Marine Engineering (DSME), STX Offshore & Shipbuilding (STXOS), Sungdong Shipbuilding & Marine Engineering (SSME), etc - set new order target of USD 54 billion for 2012 and would accelerate their drive to win new orders.

According to the market researcher Clarkson, new orders placed worldwide is expected to decrease by 9.7% compared to the previous year due to the glut of new vessels coming on the market, global economic slowdown, decline in ship financing, etc. The prevailing view in the industry is that any improvements in the shipbuilding market will be overshadowed by the glut of ships in the market for the time being even if the market sends positive signals such as the recovery of global economy, alleviation of financial crisis, etc.

By contrast, placement of newbuilding orders for offshore plants and LNG carriers is expected to increase steadily, spurred by high oil prices and soaring demand for natural gas that has led to an increasing number of large-scale offshore resource exploitation projects, including Ichthys gas field off the coast of Australia, Arctic Shtokman gas field in Russia, Egina oil field in Nigeria, etc.

Based on the Clarkson data, Korean shipyards reclaimed the top spot in the global shipbuilding industry last year by winning 48.2% (13.55 million CGT) of all new orders placed worldwide after being overtaken by China in 2008. Importantly, Korea regained its status as the world's leading shipbuilding country despite unfavorable factors such as the glut of new ships in the market, decline in the ship financing due to the Eurozone crisis, sluggish economic recovery in developed countries, etc., which led to a 30.5% (28.11 million CGT) fall in new order placement worldwide in 2011 compared to the previous year.

Korean shipyards have swept all of the world's new orders for FPSO (1 unit, USD 680 million), LNG-FPSO (1 unit, USD 2.41 billion), LNG-FSRU (4 units, USD 1.06 billion). Besides, Korean shipyards won 77% of global orders for drillship (26 units, USD 14.22 billion), 84% of global orders for LNG carriers (38 units, USD 7.72 billion), and 74% of world's newbuilding orders for large containerships with a capacity beyond 8,000 TEU (80 units, USD 10.76 billion), thus cementing their strongest leading position in the fields of high value-added vessels and offshore plants.

Table 1. Domestic shipyards' order intake based on offshore plant facilities

Type		2010 (Cumulative)		2011 (Cumulative)		Percentage change (%)
		Performance (Unit: USD 1 million)	Share (%)	Performance (Unit: USD 1 million)	Share (%)	
Total		64,480	100.0%	64,984	100.0%	0.8%
Facilities	Power generation /desalination	35,914	55.7%	18,876	29.0%	-47.4%
	Offshore	8,860	13.7%	17,597	27.1%	98.6%
	Oil&Gas (Onshore)	11,964	18.6%	9,362	14.4%	-21.7%
	Petrochemical	6,066	9.4%	8,741	13.5%	44.1%
	Industrial facilities	1,498	2.3%	9,923	15.3%	562.4%
	Equipment	178	0.3%	485	0.7%	172.5%

Source: Ministry of Knowledge Economy (MKE)

3 domestic shipbuilding giants in heated competition to win orders

Korean shipyards, such as SHI, HHI, DSME, STXOS, etc., made good start to 2012 by clinching contracts to build large-scale offshore plants, solidifying their status as the world's leading shipyards. Offshore plants have already accounted for more than half of total new order intake of domestic shipbuilding giants since last year.

HHI set new order target of USD 24 billion for offshore plants in 2012, and SHI and DSME revised their new order target for offshore plants upwards to USD 12.5 billion and USD 11 billion, respectively. These 3 domestic shipbuilding giants expect that the offshore plants will comprise approximately 50% of their total new order intake. In particular, offshore projects are usually large-scale and characterized by high value-added production. Domestic shipyards, armed with proprietary technologies, are engaged in intense competition to clinch orders for offshore plants, such as FPSO, FSRU, drillship, LNG carrier, subsea production facilities and others.

HHI is focusing its efforts on winning the contract to build offshore plants in Brass gas field, Egina oil field in Nigeria, Ichthys gas field in the Browse Basin off the coast of Australia, offshore oil field in Congo, etc. Specifically, HHI developed its own LNG-FPSO model early this year and became the nation's only shipbuilder capable of building LNG-FPSO on turnkey basis that includes the engineering, procurement, and commissioning, as well as the design of both upper and lower part. HHI, which secured the orders for LNG carriers and LNG-FSRU from the beginning of this year, is expected to achieve strong growth in new orders for offshore plants used for the production of gas.

Meanwhile, DSME recently inked a contract with Danish state-run DONG E&P to build an offshore oil production platform. In addition, DSME received an order from Songa Offshore, the Norwegian offshore drilling operator, for the construction of a semi-submersible rig last month. DSME is also engaged in competition with domestic shipyards to clinch orders for offshore facilities deployable in deepwater

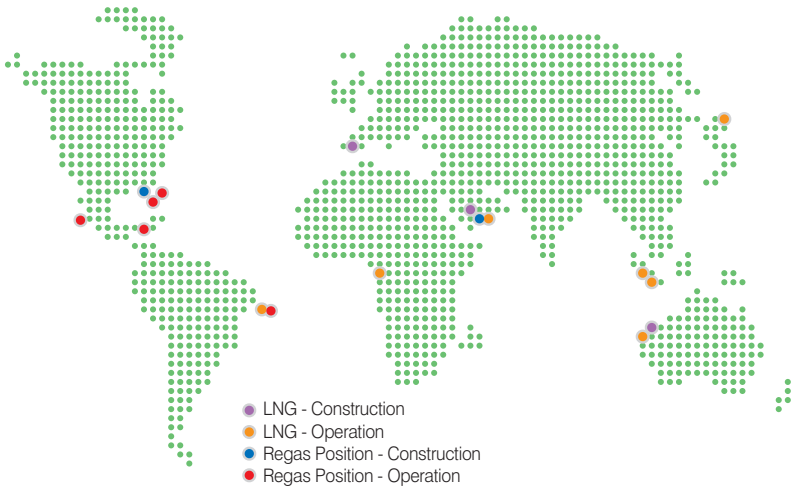


Figure 1. Expansion of offshore plant market

offshore oil and gas fields, such as FPSO for Ichthys gas field off the coast of Australia, FPU (Floating Production Unit) for Arctic Shtokman gas field in Russia, offshore plant for Vietnam Block B project, and FPU for the offshore oil field in Congo, etc. This year, Samsung Heavy industries was awarded a contract from INPEX to build a offshore central processing facility (CPF) that will be deployed in the Ichthys gas field off the coast of Australia. This contract is valued at approximately USD 2.7 billion that accounts for about 30% of SHI's total sales. Besides, SHI won an order from the Norway-based Seadrill for 3 ultra-deepwater drillships including optional vessels and another order from Golar for the construction of 2 LNG carriers.

Offshore plant facilities, such as drillship, FPSO, LNG-FPSO, which are high value-added products, have been thrust into limelight as the blue ocean in the shipbuilding industry. Offshore plant facility construction involves very large-scale project valued at between USD 500 million and over 2 billion. Thus, domestic shipbuilding giants have swept the entirety of the world's orders for offshore plant facilities which requires cutting-edge technology and design capability based on geographic maritime condition, construction works, etc. The prevailing view in the industry is that only 3 domestic shipbuilding giants are capable of incorporating these technological advances into the offshore plant facility construction.

Meanwhile, the local content level of offshore plant equipment remains as low as 10 to 15%, which has led to the increased need for long-term R&D and investment. Recently, the Ministry of Knowledge Economy (MKE) unveiled the measure to stimulate the growth of offshore plant equipment industry, putting the primary focus on increasing local content level of offshore plant equipment and building up competitiveness of the industry. Along with that, MKE set forth a roadmap, which aims to help domestic equipment manufacturers make inroads into foreign markets and develop essential core equipment, expand the support, and achieve 35% local content rate by 2020.

Figure 3. Ultra large semi-submersible drilling facility ordered to SHI from Seadrill

Figure 4. The splendor of LNG-FPSO. HHI developed its own LNG-FPSO model for the first time nationwide and recently received AIP (Approval In Principle) from DNV.

Table 2. Overseas offshore plant order intake based on region

Type		2010 (Cumulative)		2011 (Cumulative)		Percentage change (%)
		Performance (Unit: USD 1 million)	Share (%)	Performance (Unit: USD 1 million)	Share (%)	
Total		64,480	100.0%	64,984	100.0%	0.8%
Region	Middle East	38,122	59.1%	24,664	38.0%	-35.3%
	Asia	12,168	18.9%	15,010	23.1%	23.4%
	Africa	4,151	6.4%	4,101	6.3%	-1.2%
	Europe	6,261	9.7%	8,694	13.4%	38.9%
	Americas	3,778	5.9%	12,515	19.3%	231.3%

Source: Ministry of Knowledge Economy (MKE)

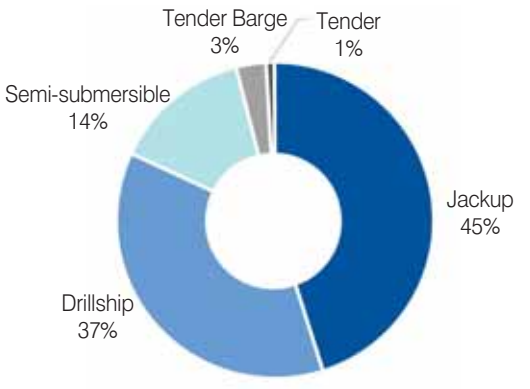


Figure 2. Share of floating rig production facilities

Global offshore plant projects make brisk progress

Although offshore plant projects made slow progress due to external factors, domestic shipyards have won newbuilding orders for large-scale offshore plants one after another this year. According to the shipbuilding industry, 3 domestic shipbuilding giants won new orders worth approximately 9 billion for the construction of ships and offshore plants as of March on the back of strong demand worldwide for offshore plants, among which the value of offshore plant order represented approximately USD 6 billion. The offshore plant sector is expected to see robust growth in new orders amid the increasing demand for oil and gas despite global slowdown in the shipbuilding and shipping industries.

- Egina project in Nigeria

The contract to build FPSO (producing 150,000 to 200,000 barrels of oil per day) worth USD 2 billion is expected to be inked in the first half of this year, which will be deployed for the offshore development of France's Total, one of the world's top 5 oil companies, in Nigeria.

- Brass LNG project in Nigeria

Brass LNG project in Nigeria aims to produce 10 million tones of LNG a year in Brass, Bayelsa State located in the Southern flank of Nigeria. This project is a comprehensive project that includes LNG production base, liquefaction and transportation facilities, etc (The total project is valued at approximately 15 billion).

- Ichthys LNG project in Australia

Ichthys LNG project is a joint venture between Japan's Inpex and France's Total. This project is designed to process the gas from the Ichthys field located in the Browse Basin about 200km off the coast of the Western Australia (this project will produce approximately 100,000 barrels of condensate per day and 8.4 million tons of LNG and 1.6 million tons of LPG yearly).

- Shtokman LNG project in Russia

Gazprom, Russia's state-owned natural gas giant, is the world's largest energy company producing 20% of the world's natural gas. The contract to build FPU, which will be deployed in the Shtokman gas development, is valued at USD 3 billion, the largest single project ever awarded (this FPU is expected to have a production capacity of 110,000 barrels of oil per day).

- Block B project in Vietnam

Chevron, a U.S. oil company, plans to award a contract for a gas platform facility and FSO which will be deployed for the offshore development of Vietnam Block B gas project in the

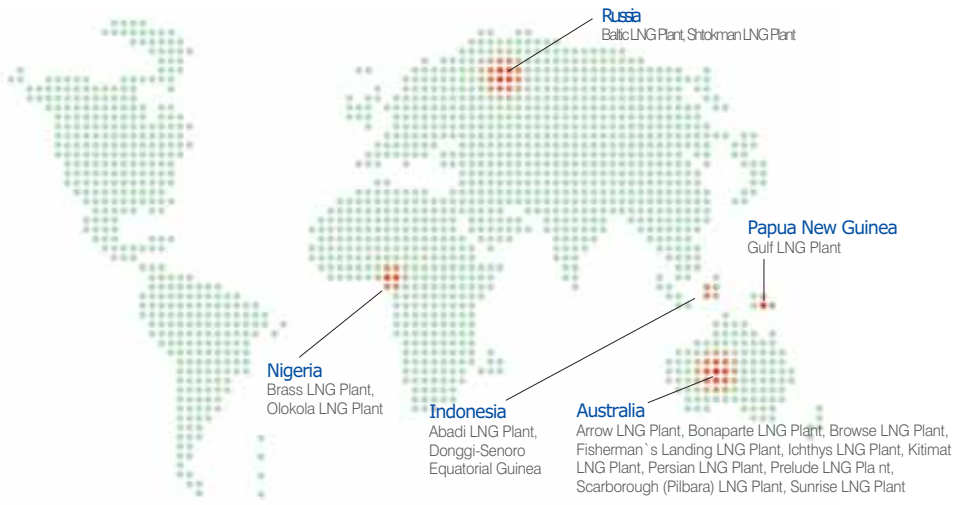
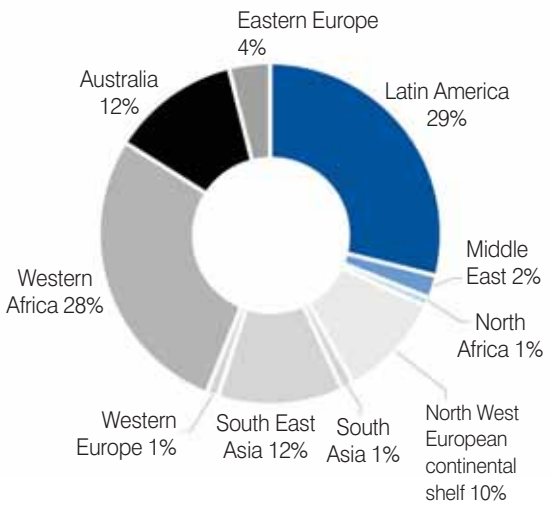


Figure 5. Global LNG liquefaction plant projects

The advent of the era of FPSO and floating production(storage) facilities;

- *Rising oil prices, environmental impact: expanded natural gas development*
- *LNG-FPSO, FSRU, FPGU*
- *Offshore oil and gas reserves currently being developed: approximately 70% of all reserves*
- *Increased placement of orders for FPSO, LNG-FPSO, FSRU, and FPGU*

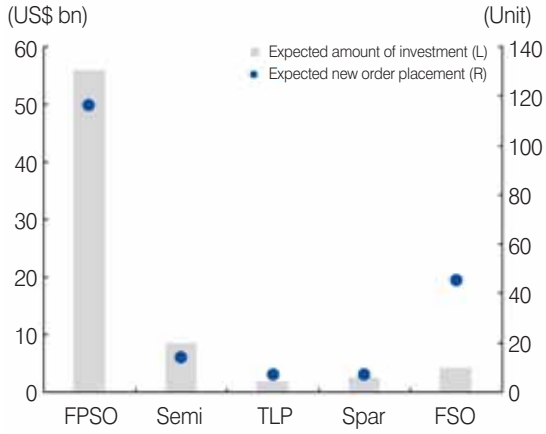


Source: Infield System Ltd, KDB Daewoo Securities

Figure 6. Share of FPSO installation by region (2011 to 2015)

Increased offshore investments amid sustained high oil prices;

- *Many offshore projects are currently underway in Australia, Vietnam, Russia, Nigeria, Norway*
- *Investments in offshore plant and storage facilities are expected to amount to USD 73 billion.*



Source: IMA, KDB Daewoo Securities

Figure 7. Placement of orders for floating production/storage facilities over the next 5 years

first half of this year. Vietnam Block B, which produces the largest amount of natural gas in Vietnam, is estimated to have 1 trillion 50 million m^3 of natural gas reserve. Top Side is undertaking the basic design with the first production slated for 2014 (the contract is valued at USD 4.3 billion).

Besides, the USD 1 billion contract to build offshore plant facilities, which will be deployed for developing Moho-Bilondo field in Congo, is expected to be awarded this year, along with Shell's Prelude FLNG Project. Moreover, offshore plant projects of varying size are currently underway in Australia, Nigeria, Norway, Egypt, etc.

Future of offshore & shipbuilding industries

The shipbuilding industry expects that a total of 36 offshore plants will be placed worldwide this year, including the offshore plants for developing Ichthys field off the coast of Australia, Brass field in Nigeria, Shtokman field off the coast of Russia in the Barents Sea, and others. Up to 46 newbuilding orders for LNG carriers are expected to be placed if orders for newbuild LNG carriers to replace old LNG carriers and speculative order placements are counted in.

The offshore energy exploitation activities have been significantly stepped up worldwide. The potential annual value of offshore resources is projected to be worth USD 22 trillion. It can be said that offshore plant industry has very bright outlook, unless the ardor for the offshore resource exploitation is chilled.

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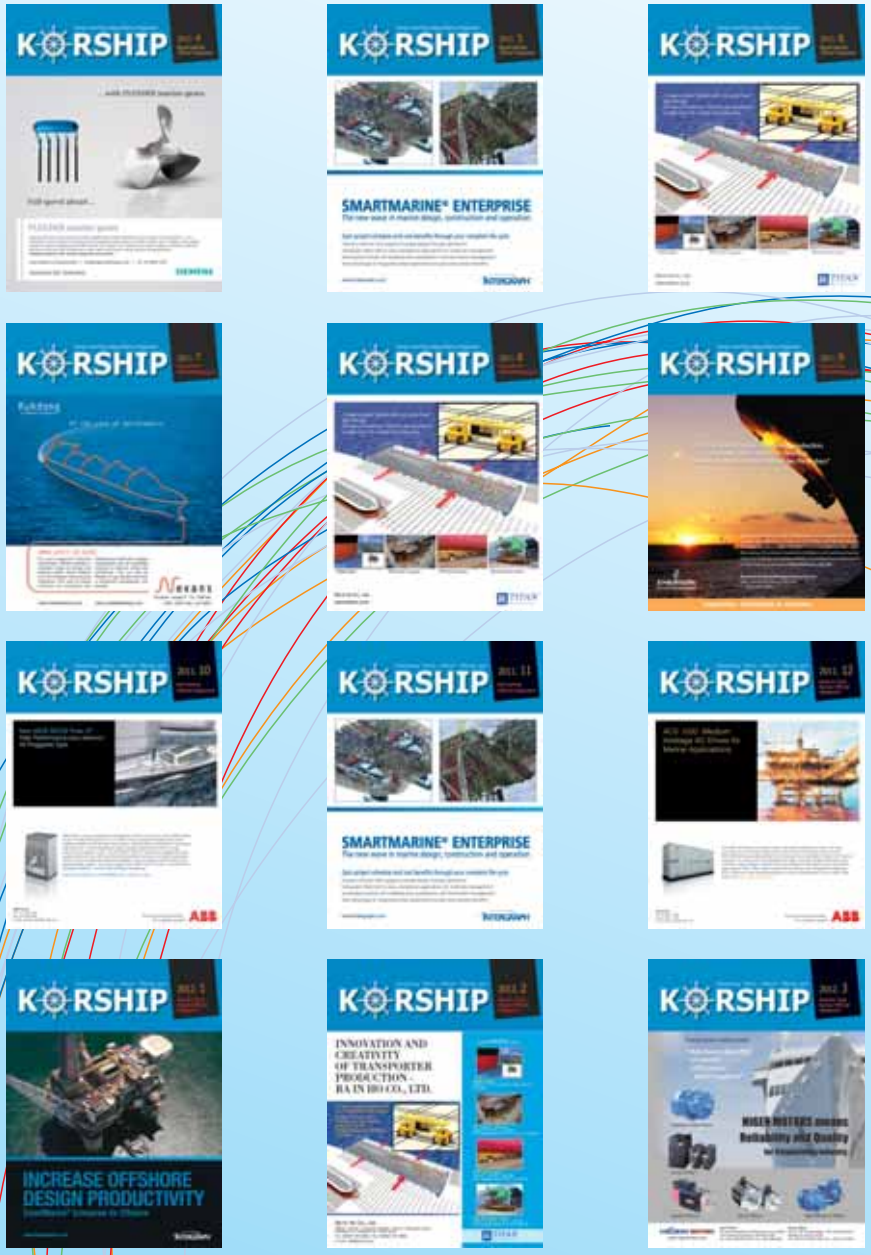

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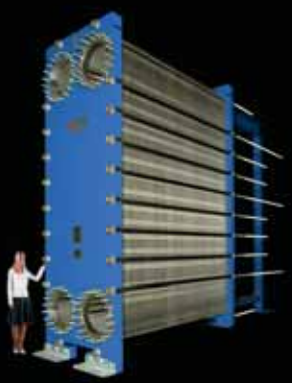

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IDEX Corporation

IDEX excellence in various industries

IDEX Corporation, headquartered in Lake Forest, IL, USA, is a leading company serving high growth specialized markets worldwide. Since established in 1987, IDEX Corporation has been an applied solution provider with four business segments to better serve our customers, Fluid & Metering Technologies, Health & Science, Fire & Safety, and Dispensing. With the world best known brands, IDEX wide range of product solutions make the unique position of completely solving customer applications by meeting most demanding application needs and finally provide the lasting value to the customers.

IDEX Corporation achieved USD1.84 billion in total net sales in 2011 and has operating facilities across five continents with more than 6,800 dedicated employees worldwide.

IDEX Fluid and Metering Technologies (hereinafter referred to as "IDEX FMT") is the IDEX largest business segment, accounting for 48% of IDEX's total revenue. IDEX FMT involves the moving and handling of high-value liquids and gases via IDEX's highly engineered processing technologies. IDEX FMT participates in a wide array of diverse niche markets (recognized as world leader in handling difficult fluid transfer and metering applications) including oil, gas, refined fuel, hydrocarbon processing, power generation, water and wastewater, chemical processing, industrial automation, food, pharmaceutical, and other relat-

Figure 1. IDEX Operating model

ed industries with more than 47 operation offices (including manufacturing) and 360 distribution channels around the world.

IDEX FMT offers the engineered pumps, flow meters, valves, and systems that move, measure and manage high-value liquids, gases and solids. In the marine and offshore industries, IDEX provides the complete product lines of the following brand names.

- *Pump: Viking (Internal/External Gear Pump), Warren Rupp/Versa-Matic/Blagdon (Air Operated Double Diaphragm)*
- *Flow Meter: Liquid Controls (Positive Displacement, Electromagnetic, Coriolis Mass), Faure Herman (Turbine, Ultrasonic), Sponsler (Turbine)*
- *Engineered Solution System: SAMPI (Fuel & Oil Metering, Custody Transfer, (un) Loading, etc.)*

IDEX FMT products are well known for high quality, reliability, and low total cost of ownership. They present trouble-free operations to reduce downtime and keep your process running at maximum efficiency and profitability.

IDEX Korea was established as a representative office of IDEX in Feb 1st, 2008, which is headquarted in Chicago, USA with four business segments;

- Fluid Metering Technologies
- Health & Science Technologies
- Dispensing Equipment
- Fire & Safety

Marine Gear Pump

: Nearly a century of pump application and manufacturing expertise

VIKING PUMP

Viking Pump has been a pump industry leader and innovator in the positive displacement pumping solutions since its initial introduction of the 'gear-within-a-gear' design back in 1911.

Viking has expanded its engineering knowledge and competency through the design and creation of innovative pumps for thousands of its customers using millions of Viking pumps in some of the world's toughest fluids applications.

Viking Pumps has been dedicated to the marine application with a full range of gear pump solutions. Viking's products are used in everything from oil production to various marine services including crude-oil treating, oil & gas extraction, hot water injection for well optimization, chemicals loading & unloading in the cargo as well as fuel & lube oil transferring on the ships.

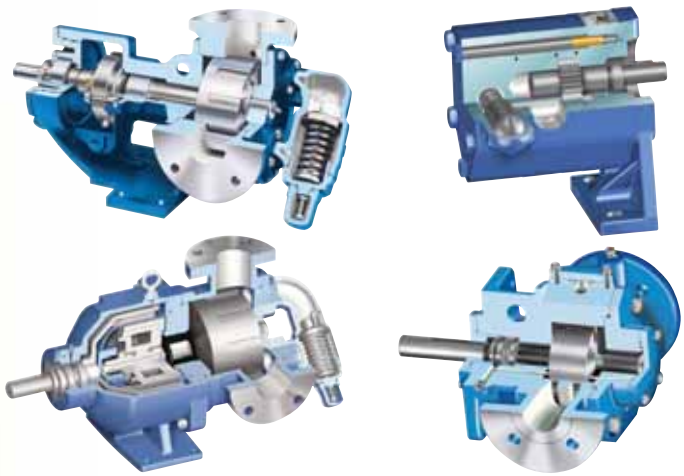


Figure 2. Kind of Viking pump: Internal Gear, External Gear, Rotary Lobe, Vane etc.

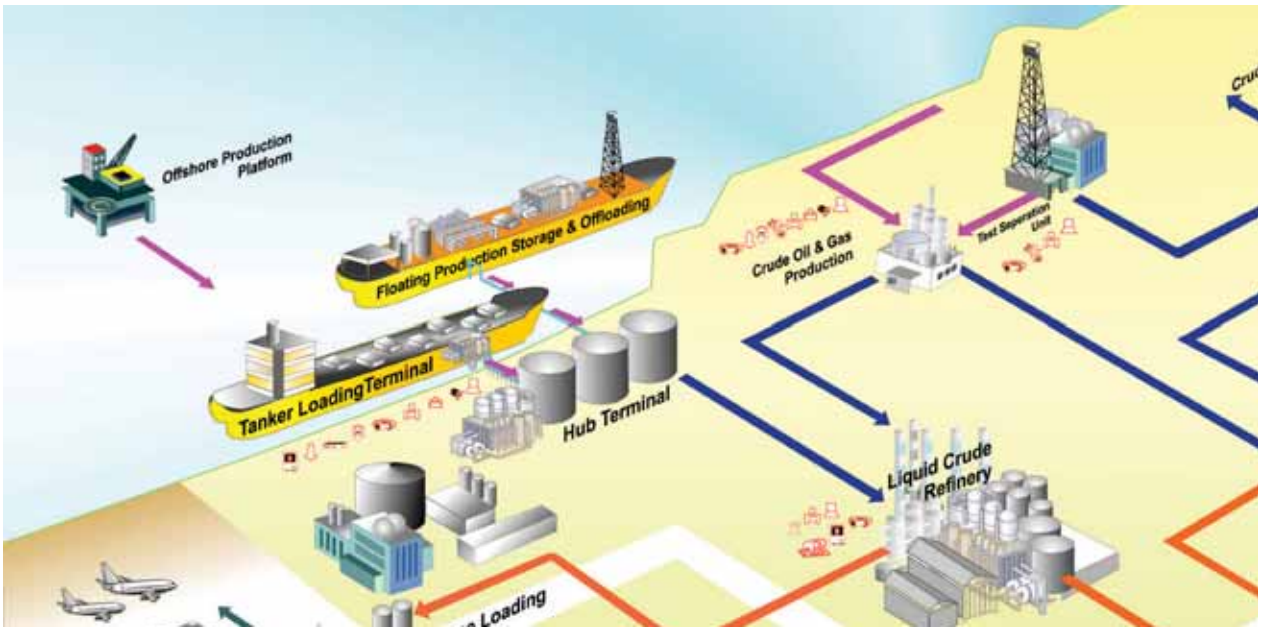
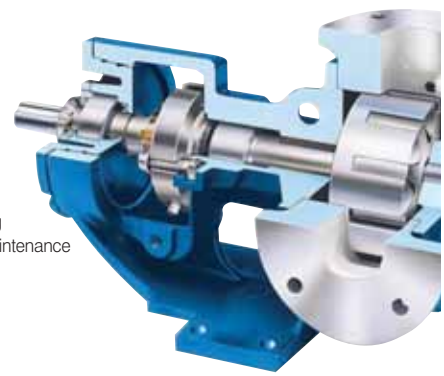


Figure 3. IDEX is a main player in the upstream sector of the oil & gas market with total solution products

For 100 years, Viking internal gear pumps have been known for reliability as the pump industry leader. For 35 years Viking external gear pumps have also followed in that proud tradition with advantages of higher developed pressure and higher speeds as well as longer seal and bearing life by minimizing radial and axial shaft movement.
Viking pumps are in compliance with most API 676 standards and accommodate the most marine application with a broad performance range, ultimate sealing solutions, material options matched to application, liquid integrity protection, quality manufacturing, and the custom designed solutions.



Industrial-Duty Pumps Offering
Design Flexibility and Easy Maintenance
Materials of Construction
- Cast Iron
- Ductile Iron
- Steel
- 316 Stainless Steel

Figure 4. Universal Seal Series Internal Gear Pump

Marine Diaphragm Pump

: World Best AODD pump brands in IDEX

Based on the field-proven experience, IDEX Air Operated Double Diaphragm (AODD) brands, Sandpiper (USA), Versa-Matic (USA), Blagdon (Ireland), have been delivering the superior quality and performance needed for the Oil & Gas industry in general.

Extensively, IDEX AODD pumps are widely used in the Marine industry as well. Main applications include: cargo clean-up, deck dewatering, cargo oil or lubricants transferring, sea water pumping, produced water/condensate transferring, etc. Also, Sandpiper's Natural Gas-Operated Double Diaphragm (NGODD) pumps have been applied for compressor station prelube & liquid transfer, hot glycol transfer, natural gas fields, offshore oil platforms, potentially explosive environments, service rigs, etc. For many applications, the use of AODD is never

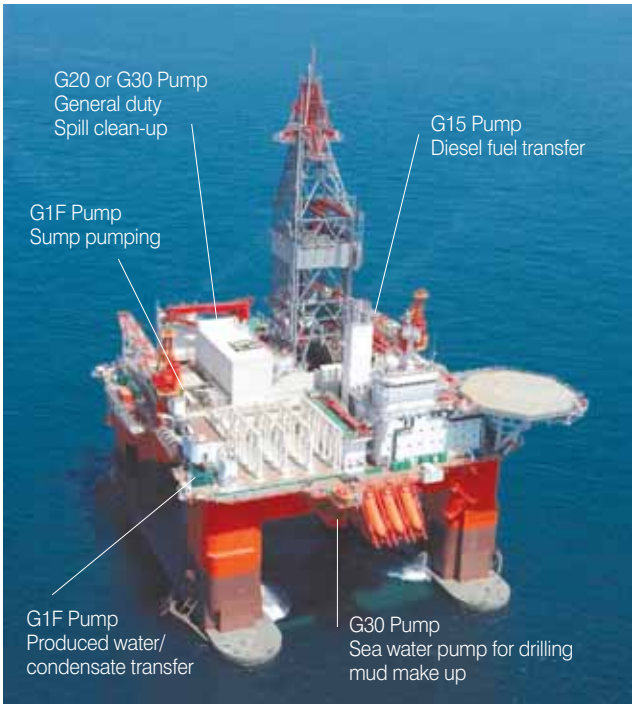


Figure 5. Various AODD applications on the offshore plants

limited. (Figure 5)

The wide use of AODD in the marine & offshore industries is due to the following reasons: explosion proof; portable; easy to operate compressed air source available; most cost-effective explosion-proof pump in the market; easy maintenance.

Marine Flow Meter

: Worldwide reputation for Quality, Accuracy, and Advanced Design

BLAGDON PUMP®

VERSA-MATIC®

SANDPIPER®
A WARREN RUPP, INC. BRAND

Liquid Controls

Liquid Controls offers a broad selection of positive displacement (PD), turbine, electromagnetic, and mass flow meters in the oil & gas industries. For Weights and Measures-approved (world-wide) custody transfer of petroleum products, petro-chemicals and other industrial products, Liquid Controls meters represent the best choice in overall value and lowest cost-of-ownership over time.

Liquid Controls PD meters are exclusively engineered with no metal-to-metal contact inside the measuring chamber. This proven design ensures minimal wear and sustained accuracy, so customers can count on longer intervals between meter calibrations. The benefits of LC meters are to provide years of accurate and trouble-free performance regardless of variations in temperature, volume, viscosity or pressure.

All LC products are backed by our established reputation for quality, accuracy and reliability with various global references including Exxon Mobil, Caltex, BP, Shell, Total. That's why Liquid Controls leads the industry in metering solutions and delivers world-class flow measurement.

Liquid Controls is best suited to marine application with PD, Turbine, Electromagnetic, and Coriolis mass flow meters for loading and unloading system, ship fueling, custody transfer, and various metering applications on the ships and offshore plants.

Figure 6. The FH8500 is Metering Solution for Custody Transfer Applications

FAURE HERMAN

FAURE HERMAN designs and manufactures highly accurate helical turbine and ultrasonic meters for liquid measurement in the petroleum, petrochemical and aircraft industries.

The primary applications of Faure Herman include:

- *Production field: Fiscal metering & allocation (crude oil), Test separator (oil & produced water)*
- *FSO/FPSO: Off-loading and process*
- *Marine terminals: Ship loading & unloading*
- *Pipelines: Custody transfer metering station, Leak detection system*
- *Refineries & Petrochemical Plants*

Faure Herman plays in the upstream sector of the oil market, everywhere a fiscal transaction is requested when crude oil changes ownership. Faure Herman has many F(P)SO references including Chevron, Conoco, Exxon Mobile, Total, Shell. Faure Herman has additionally supplied to Hyundai Heavy Industries, Samsung, Daewoo, STX for crude oil application. All flow meters are calibrated on real oil products, using qualified proving systems and procedures, for a "Plug & Play" installation on operation site with quality certificated: ISO9001, PED (APAVE), ATEX, LNE (French Legal Metrology), MID (NMI), COFRAC.

Marine Engineered Solution

: Tailor made solutions

SAMPI has been dedicated to providing high quality engineered technologies since founding in 1937. With experience and expertise in fuel and energy business, SAMPI is able to offer innovative and customized solutions for Oil, Gas, Petrochemical, and Power plant industries through the wide range of products within IDEX FMT.

As a specialist and solution provider in handling liquids, SAMPI delivers the total engineering and design service with customized system solu-

tions and high flexibility for various applications:

- *Loading & unloading systems*
- *Custody transfer metering systems*
- *Pumping & measuring combined solutions*
- *Electrical heating systems*
- *Filtering systems*

SAMPI engineering solutions including engineering, design, project management, and complete packages provide the answer for the most advance requirements. SAMPI completely checks and manages every step, such as designing engineering, assembling, testing and start-up. This management guarantees measuring precision and reliability of SAMPI systems with the view to make the business of its customers more profitable and secure. Today SAMPI is proud to bring the market high quality Engineered Solutions with the most efficient performance.

Driven by Innovation

IDEX Korea is under the umbrella of Fluid Metering Technologies which owns 25 business units and IDEX-Korea has been notably successful in terms of market penetration and sustainable growth since its birth driven by IDEX core competencies which normally define market standard.

Based on Innovation, Diversity and Excellence as IDEX stands for IDEX Korea doubles its revenues in the span of four years and targets to reach U$15 million in 2012.

Gunny Lee, Country Manager of IDEX Korea, said, “To achieve this aggressive target under the unfavorable market environment where uncertainties are widely spread throughout the global economy, the importance of marine market can't be over-emphasized. IDEX Korea already added more headcounts who are fully dedicated to marine business and our effort to meet the various customer demands will continue without any pause.”

The specialties and competences of IDEX are not just limited our willingness and passion to meet customer demands but our ability to offer ‘Package Solutions’. Unlike other competitors who are normally able to offer single product or system while customers' demand is not just lied on single product, IDEX can offer multiple products or systems which will eventually provide additional value to customers.

And this endless effort to be ‘more competent package solution provider’ will be achieved by three IDEX tools; Talent Factory, Leveraged Expertise and M&A.

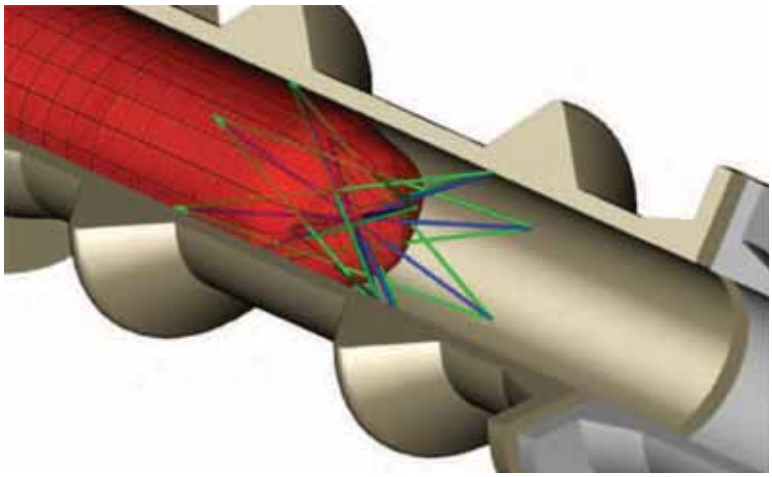
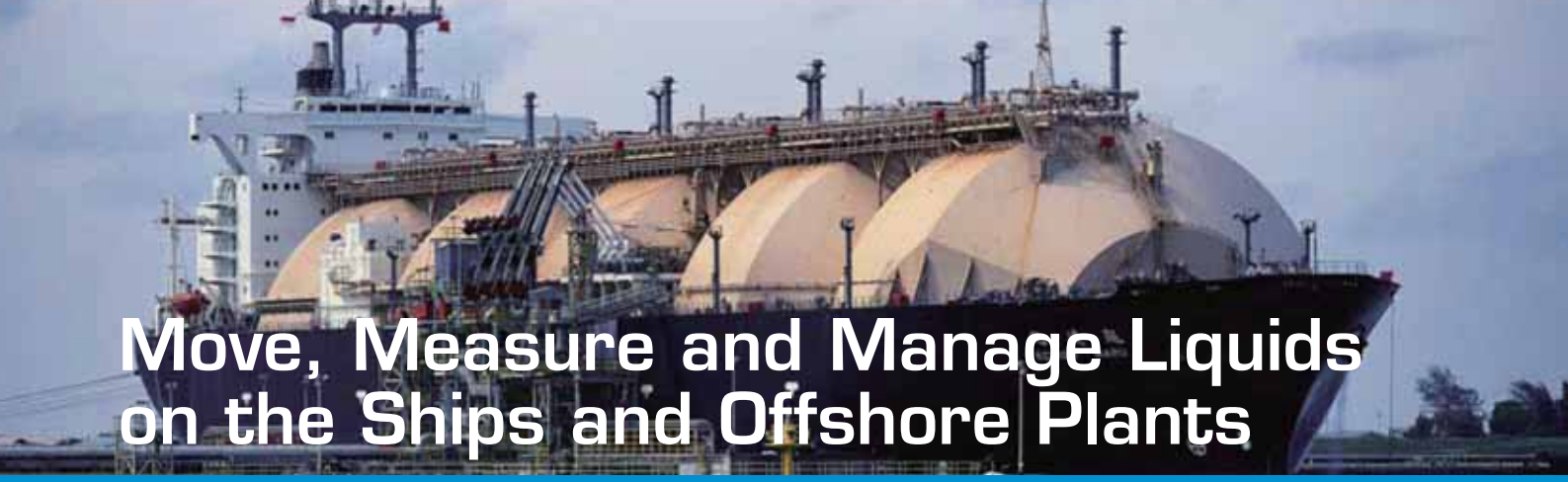


Figure 7. The FH8500 multi-path ultrasonic flowmeter is the only flowmeter that integrates 36 transducers generating 18 ultrasonic beams, providing a complete 3D view of the flow velocity profile.



Move, Measure and Manage Liquids on the Ships and Offshore Plants

IDEX Fluid & Metering Technologies

- Offers the best fluid and metering technologies with a wide product range to provide multiple solutions in handling critical fluids and gases
- Delivers trouble-free operations to reduce downtime and keep your processes running at maximum efficiency and profitability

MARINE GEAR PUMP

- **Product TYPE**
  - Internal Gear Pump
  - External Gear Pump
  - Industrial Rotary Lobe Pump
  - Mag Drive Pump
  - Rotary Vane Pump

VIKING PUMP

www.**vikingpump**.com

MARINE DIAPHRAGM PUMP

- **Product TYPE**
  - Air Operated Double Diaphragm Pump (AODD)

BLAGDON PUMP®

www.**blagdonpump**.com

SANDPIPER
A WARREN RUPP, INC. BRAND

www.**warrenrupp**.com

VERSA-MATIC®

www.**versamatic**.com

MARINE FLOW METER

www.liquidcontrols.com

1) Liquid Controls

- **Product TYPE**
  - Positive Displacement Flow Meter
  - Turbine Flow Meter
  - Coriolis Mass Flow Meter
  - Electromagnetic Flow Meter

2) Faure Herman

- **Product TYPE**
  - Turbine Flow Meter
  - Ultrasonic Flow Meter

www.faureherman.com

3) Sponsler

- **Product TYPE**
  - Precision Turbine Flow Meter
  - Cryogenic Transport Measurement System

www.sponsler.com

MARINE ENGINEERED SOLUTIONS

- **Product TYPE**
  - Loading & unloading systems
  - Custody transfer metering systems
  - Pumping & measuring combined solutions
  - Electrical heating systems
  - Filtering systems

www.sampi.it/en/

FLUID & METERING

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Overseas plant orders fueled by resource exploitation projects

A meaningful event was held at the Rosemary on the 4th floor of the Convention Center of 63 Building, a skyscraper on Yeouido island in Seoul, on February 21, which aimed at exploring the ways to stimulate the advancement of domestic plant industry. This event drew about 30 CEOs from the plant industry, providing a unique platform for discussing the measures to help domestic plant companies achieve growth in new orders for plants and make inroads into foreign markets in conjunction with overseas resource exploitation projects.

The Plant CEO Forum revolved around the theme, 'Foray into foreign markets based on the combination of plant and resource development capabilities', which was attended by about 30 officials including Hong Seok-woo, Minister of Knowledge Economy, Choi Seon-gil, Chairman of Korea Plant Industries Association, officials from the 4 public corporations, Export-Import Bank of Korea (Korea Eximbank), financial institutes such as Korea Trade Insurance Corporation, etc.

This forum provides a unique platform to discuss a series of measures that can help domestic plant companies seize the opportunities arising from the increased facility investment and resource development in Middle East, central and Latin America, etc, amid sustained high oil prices and accomplish steep growth in order intake as domestic public corporations expand resource exploitation activities abroad.

The Plant CEO Forum.

Korea National Oil Corporation, the national oil and gas company, and other public corporations mentioned that they were participating in 64 resource exploitation projects abroad and expressed their anticipation for active participation of domestic companies in related overseas plant projects. They expect that domestic plant companies will be able to involved in the power generation and infrastructure construction projects, FPSO and deepwater offshore plant projects, including Korea Electric Power Corporation's UAE nuclear power plant project, renewable energy project in Saudi Arabia and Mexico, Korea Gas Corporation's gas development and LNG projects in the Middle East, Korea National Oil Corporation's oil field devel-

opment project in Kurd, Iraq, and Korea Resources Corporation's projects to exploit 6 major mineral resources (coal, uranium, iron, copper, zinc and nickel).

Meanwhile, financial institutes, such as Korea Eximbank, Korea Trade Insurance Corporation, etc, unveiled the plan to funnel their financial support which is drastically increased compared to last year as part of effort to facilitate plant companies to clinch contracts.

Korea Eximbank said that it would boost its financial aid to domestic plant companies from KRW 15.6 trillion to KRW 16.5 trillion this year, increase growth in syndicated loan volumes through the council composed of 17 domestic financial institutes to help them aggressively penetrate overseas plant market, and increase in funding for loans in cooperation with other export credit agencies, Multilateral Development Bank (MDB), International Commercial Bank, etc, to fully utilize the Middle Eastern capital funds that have high level of liquidity.

Korea Trade Insurance Corporation will offer KRW 19 trillion in financial assistance to domestic plant companies, an increase by approximately 26% compared to the previous year. In addition, it will expand its support to small and medium-sized enterprise, including the performance guarantee, and step up cooperation with export credit agencies and financial institutes to assist domestic companies in winning contracts from overseas clients.

Hong Seok-woo, Minister of Knowledge Economy, said that he saw gigantic plants and related infrastructures being built in the Middle Eastern countries, such as Saudi Arabia, Qatar, etc, in preparation for the post-oil era, and urged domestic plant companies to make best use of these opportunities.

In the pre-forum event, 12 officials from Daelim Industry and other companies were awarded commendation from the Minister in recognition of their significant contribution to increasing the export of plants. Hong Seok-woo, Minister of Knowledge Economy, also urged the plant industry to play a pivotal role as Korea is advancing towards the goal of USD 2 trillion in export.

Alfa Laval wins SEK 130 million heat transfer order in Brazil

Alfa Laval has won a plate heat exchanger order from a big oil company in Brazil. The order value is approximately SEK 130 million and delivery is scheduled for 2012.

The Alfa Laval plate heat exchangers will be installed at offshore production platforms where they will be used for heat recovery in the main separation process.

"We have worked with the oil and gas industry in Brazil for over 40 years. During this time we have developed new products and process solutions to meet the heavy demands in deep sea oil production", says Lars Renström, President and CEO of the Alfa Laval Group. "This order confirms our ability to supply energy efficient solutions to this market."

Many of the offshore oil fields outside of Brazil contain heavy crude oil mixed with large amounts of water, which requires a lot of heat when separating the water from the oil. By using Alfa Laval plate heat exchangers, it is possible to recover heat from the process itself to heat up the heavy crude oil, resulting in a very energy efficient solution.

Alfa Laval is a leading global provider of specialized products and engineering solutions based on its key technologies of heat transfer, separation and fluid handling.

The company's equipment, systems and services are dedicated to assisting customers in optimizing the performance of their processes. The solutions help them to heat, cool, separate and transport products in industries that produce food and beverages, chemicals and petrochemicals, pharmaceuticals, starch, sugar and ethanol.

Alfa Laval's products are also used in power plants, aboard ships, in the mechanical engineering industry, in the mining industry and for wastewater treatment, as well as for comfort climate and refrigeration applications.

Global ticket

Jan Kik tells why certified bunkering measurement solutions have been adopted by operators and suppliers to ensure correct bunkering delivery.

Authors:
Jan Kik is the Business Development Manager for Marine in Europe at Emerson Process Management, which helps businesses automate their production, processing and distribution. A division of Emerson, Micro Motion, invented the first practical Coriolis flow meter in 1977.
Email: bunkering@emerson.com
www.micromotion.com/marine

'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'

Traditional bunker measurement relies heavily on look-up tables and manual dips, as well as laboratory tests to determine density measurements. These practices are labour intensive, inferential and can result in legal disputes between suppliers and customers with potential damage to business relationships.

Measurements are affected by changes to density and temperature, air entrainment, barge or vessel trim and/or list, adverse weather conditions and human errors. Historically, there has been a lack of trust in the quantities being transferred. In 2009, the number of official industry-wide global bunkering disputes was over 50,000, with complaints on shortfalls amounting to between 540,000 metric tonnes (mt) and 900,000 mt with a value of approximately $500 million.

Time-efficient bunkerings are vital for all stakeholders. Barge operators need a quick turn-around time to improve revenue and meet customers' strict schedules. Port authorities need to avoid congestion in order to remain attractive and shipowners/operators need to stay on schedule to avoid costly delays.

With today's bunker fuel costs amounting to between 50% and 70% of the total ship operating expense, even small inaccuracies in bunker measurements can have a major effect on operating costs. To ensure accurate and consistent measurement, the industry needed a transparent and traceable bunker measurement solution that meets international standards for custody transfer.

The process of marine bunkering presents challenges to any measurement device. Unlike gasoline or diesel fuel, the density and viscosity of heavy fuel oil (HFO) varies enormously and can even vary across a single bunkering as the fuel may stratify in the storage tank. Prices for bunkering are quoted in mt and invoices are settled based on the mt delivered. 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.

Consistent and accurate

Coriolis flowmeters deliver consistent, accurate mass measurement. Emerson's Micro Motion Coriolis meters for bunker measurement were first implemented by A.P. Møller-Maersk on a number of Maersk Line vessels in 2008. They were selected because they deliver consistent, accurate mass measurement and have no moving parts to break, wear or risk performance drift. Emerson's ELITE High Capacity Coriolis flowmeters are capable of handling flow rates over 1,500 mt an hour and 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.

While the initial results from the Micro Motion flowmeters were good, further work was undertaken by Emerson, with agreement from Maersk and its partners (which included the VT Group), to develop a deeper understanding of the challenges of bunkering fluid dynamics. This included addressing the issues to realise a direct mass-based, independently accredited, bunkering custody transfer solution for two-phase HFO.

The development work also included actual testing where Maersk, VT Group and Emerson worked together to validate the performance of the system. As more systems are being installed in different types of vessel, Maersk and VT Group continue to supply information to Emerson - helping to resolve any installation or operational issues.

Meeting standards

Working closely with Maersk, VT Group and other industry leaders in shipping, Emerson developed its bunker measurement system based on a Micro Motion ELITE Coriolis meter, Series 3000 transmitter with Marine Bunker Transfer Package, and bunker delivery ticket printer.

The Marine Bunker Transfer Package is a software application installed on a Series 3000 Transmitter that manages the specialised measurement, monitoring, and ticket printing functions.

Emerson's Certified Marine Bunker Measurement Solution has been independently proven and certified by Nederlands Meetinstituut (NMi), the notified body for testing to the guidelines of the European Measuring Instruments Directive (MID) and Issuing Authority for the International Organization of Legal Metrology (OIML). The Micro Motion meter meets the OIML standard R117-1 and the overall solution meets MID standard 2004/22/EC Annex MI-005.

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 provides highly accurate, transparent bunker fuel deliveries that will minimise the number of disputes between barge operators and ship operators, while enabling operators to very accurately monitor fuel and improve operational efficiencies.

The Certified Marine Bunker Measurement Solution is capable of handling the density and viscosity variation inherent in HFO. It has been specifically designed to handle high-viscosity, aerated liquids and offers an overall accuracy within 0.5% of mass. The transmitter posts an alert when the level of entrained air reaches a pre-set limit, allowing the operator to take steps to reduce aeration and ensure accurate delivery.

Increased efficiency

Emerson's Certified Marine Bunker Measurement Solution has already been installed on supplier and customer vessels to provide highly accurate, transparent bunker fuel deliveries. In December 2010, the Maersk Bulan became the world's first cargo vessel to be equipped with Micro Motion's Certified Marine

Bunker Measurement Solution.

'Emerson's Micro Motion certified bunker solution allows us to remove uncertainty and improve transparency on custody transfer of fuel oil, which is our largest cost item, while at the same time increasing our operational efficiency,' said Jesper Rosenkrans, Maersk Oil Trading. 'This makes our investment in Emerson's Micro Motion solution an attractive proposition.'

Suppliers are also seeing many benefits from the new technology and VT Group has successfully installed Emerson's Micro Motion Certified Marine Bunker Measurement Solution on the bunker barge MTS Vlaardingen. Testing of the system on the Vlaardingen ran in parallel with the Maersk installation in 2008.

'The possibility of quantity claims is an unacceptable liability for us that can damage our reputation and can tie us up in legal disputes,' said Yuri Ouweneel of VT Group. 'Certified Coriolis flowmeters support the existing VT business model of accurate quantity measurements.'

The solution provides the crew and the company's head office with real-time, accurate tracking of the HFO bunker deliveries, removing the need for manual soundings or calculations and enabling them to prove the quality and consistency of deliveries to VT's customers.

'Emerson's flowmeters allow us to differentiate ourselves as a top-tier bunker service company, further improving our reputation while illustrating this value clearly to our customers,' added Ouweneel.

Summary

The certification of Emerson's Micro Motion Marine Bunker Measurement Solution represents a major step forward for the industry. The measurement solution meets international standards for custody transfer and enables accurate, transparent and traceable HFO measurements that are accepted by fuel suppliers and customers alike. It provides real-time HFO bunker measurements that increase operational efficiency, minimise disputes, and provide automated electronic bunker delivery tickets.

Emerson's Micro Motion Coriolis mass flowmeter technology ensures that the deliveries made and paid for by the end user are proven.

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MEASURE IT

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NATIONAL INSTRUMENTS™

Busan turns itself into a hub of offshore

The importance of the specialized technology research complex cannot be overemphasized, considering its crucial role in creating the value-added and building up competitiveness of the nation amid heightened interest in offshore plant industry. Busan Metropolitan Government is adding fresh momentum into efforts to establish R&D center and technology center in tandem, which will play a key part in shaping the future offshore plant industry.

Busan Metropolitan City announced in early February that it would establish 'Korea Technology Center for Offshore Plant', in addition to the Offshore Plant Equipment R&D Center, a state-run research institute which is dedicated to R&D, localization of equipment, support of companies with an aim to promote the growth of offshore plant industry.

Although Korea's shipbuilding giants with technological competitiveness currently capture 70% share in the global market for offshore plants, they have heavy reliance on foreign technology in the high-value added sectors such as equipment manufacturing, etc.

In response to that, Busan Metropolitan Government has accelerated its drive to set up the R&D center by 2015 in a bid to meet its target of raising the local content level in manufactured products, which currently stands at less than 20%, by 2017. Particularly, Busan Metropolitan Government unveiled the roadmap to establish the Korea Technology Center for Offshore Plant, which comes on the heels of its announcement to set up the R&D center, in an endeavor to lay the cornerstone for Busan City to evolve into an international hub of offshore plant industry. Before beginning the process of setting up a full-fledged technology center, Busan Metropolitan Government plans to enact a Special Act that provides the legal basis for the foundation of the technology center in order to avoid duplication of functions among existing research institutes and take into account the competition with other local governments.

Busan Metropolitan Government has already secured KRW 5 billion from the government coffers earmarked to establish the R&D center. The R&D center's operations will be supervised by the Korea Institute of Industrial Technology (KITECH). The construction will start around in June next year, following the basic design and detail design processes from May this year to the same month of next year, and is scheduled for completion in September 2015.

Korea Technology Center for Offshore Plant will be built within the R&D zone of Mieum district (R&D hub complex) in Gangseo-gu, Busan, occupying 101,000m^2 (about 30,000 pyong).

In addition, Korea Technology Center for Offshore Plant will be built with a capital injection of KRW 200 billion within the special R&D zone of Mieum district (R&D hub complex) in Gangseo-gu, Busan, occupying 101,000m^2, and will house R&D section, technology support section, equipment performance test section, training center, etc. In particular, Korea Technology Center for Offshore Plant will be dedicated to R&D related to offshore plants, localization of equipment, technological support, etc, and is expected to play a significant part in bringing the domestic offshore plant industry to an internationally advanced level. Busan Metropolitan Government will embark on full-fledged construction as soon as the funds flow from the government coffers, and aims to open the Korea Technology Center for Offshore Plant by 2017.

Busan Metropolitan Government expects that the Korea Technology Center for Offshore Plant will create synergic effect with large shipyards in Ulsan and South Gyeongsang Province, helping increase the local content level in equipment, as well as marine equipment manufacturers in Noksan Industrial Complex in proximity to Mieum district.

KR-Bioneer signed a MOU to collaborate in the development of technology

KR and Bioneer agreed upon joint development of bio/nano technologies applicable to marine fields and will also work together to develop nano filter system for marine engines.

KR (Korean Register) announced that it entered into a memorandum of understanding (MOU) with Bioneer Corporation, a company which specializes in genetics and nano technology, on March 13 at its Daejeon headquarters to promote mutual cooperation in bio/nano and marine technologies.

Park Han-oh, President of Bioneer Corporation, said in the signing ceremony, "This MOU will create huge synergy effects that enable broader success through the combination of the advanced technology of Bioneer and extensive expertise that KR has accumulated by many years of work in the marine field."

Oh Gong-gyun, Chairman of KR, said, "Having signed this MOU, KR is poised to seize opportunities to further develop its technology. We will work closely with Bioneer in developing the nano filter for marine engines, which will lead to the development of cost-effective filters that provide better performance than existing products."

The nano filter for marine engines, made of carbon nano tube and metal hybrid nano element, removes fine particles and is expected to be highly effective in extending the useful life of lubricant products and filter exchange cycle compared to conventional products.

CNT Oil Filter System consists of nano filter unit, pre-treatment filter unit, high temperature oil transfer pump, heating coil, temperature controller, pressure gauge, etc.

KR and Bioneer signed a MOU to promote mutual cooperation.

Particularly, CNT-Metal Nano Composites element technology was introduced from KAIST (Korea Advanced Institute of Science and Technology), which enables the manufacturing of nano composites powders through the molecular level mixing process that evenly mixes the carbon nanotube and metal ion.

This patent technology allows the high temperature transfer pump and heating device to be installed in the nano filter unit, enabling the operation at high temperature. Thus, the filtration efficiency will be enhanced because the oil viscosity decreases at high temperature.

This CNT filter offers a flow rate 3 times greater compared to nano ceramic filter (CNT Filter: 600 Liter/m^2 hr bar, Nano Ceramic Filter: 200 Liter/m^2 hr bar). Although CNT filter has similar flux rate compared to micro oil filter system (CJC System), it is more effective in removing fine particles, specifically, nano particles and has excellent durability at high temperature and pressure.

KR and Bioneer plans to collaborate in the development of the technique for quantitative analysis of microorganisms in ballast waters, using the genetics diagnostic technology, in the field of biotechnology.

HHI became the world's first to surpass100 million GT in ship deliveries

Hyundai Heavy Industries (HHI) set a new milestone in the history of shipbuilding. HHI has delivered a total of 1,805 vessels over the last 4 decades since it held its groundbreaking ceremony in 1972, and became the world's first shipyard to reach the record level of 100 million GT (Gross Tonnage). This new record reaffirms HHI's position as the world's leading shipyard.

HHI became the world's first shipyard to pass the 100 million GT mark. HHI held a ceremony to celebrate the new milestone of 100 million GT in ship deliveries on March 8 at its Ulsan headquarters, which was attended by about 90 officials.

This new milestone represents decades of hard work by HHI over the last 40 years since it held its groundbreaking ceremony on March 23, 1972. HHI is the first shipyard to hit this milestone around the globe. HHI has delivered a total of 1,805 ships of various types to 258 ship owners in 49 countries. The great strides that HHI has made is attributed to the relentless expansion of its shipbuilding capability, driven by its development of breakthrough engineering methods such as ground-build method, tandem shipbuilding process, T-shaped dry dock, etc.

The 1 million GT in cumulative delivery, which was surpassed by HHI, is close to 140 million GT in global shipbuilding output recorded in 2011 and 2 times larger than the world's total order bookings that stood at 51.30 million GT in the same year. 1 million GT is equivalent to the amount of water that fills up 3.2 million urban buses and 59 Seoul World Cup Stadiums.

HHI achieved fast growth in 1970s and 1980s, the period when the nation's shipbuilding industry was in its embryonic stage, and has been on a steep growth path since the boom year of 2000. HHI reached the milestone of 171.7 million GT in ship deliveries in March 2012.

HHI delivered 210 ships to Germany, the

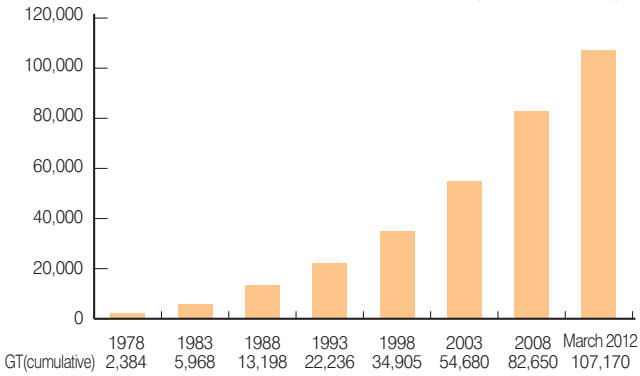
HHI had a ceremony at its Ulsan shipyard to mark its new milestone of 1 million GT in ship deliveries, which was attended by about 90 officials including Lee Jae-sung, President & CEO of HHI, and Kyle Washington, Vice-President of Canada's Seaspan, the ship owner.

Table 1. HHI's delivery by year

Gross Tonnage(GT)	Date
10 million	December 1986
20 million	August 1992
30 million	February 1997
40 million	April 2000
50 million	October 2002
60 million	January 2005
70 million	January 2007
80 million	August 2008
90 million	December 2009
171.7 million	March 2012

Naming ceremony for 'Cosco Faith'

(Unit : 1000 GT)



GT(cumulative)	1978	1983	1988	1993	1998	2003	2008	March 2012
	2,384	5,968	13,198	22,236	34,905	54,680	82,650	107,170

Table 2. HHI' s delivery by year (cumulative)

largest number, followed by 209 to Greece, 116 to Japan, 96 to Denmark, and 85 to the United States. Based on the type of ship, HHI delivered 510 containerships, the largest number, followed by 351 oil tankers, 342 bulk carriers, 124 product carriers, and 109 LPG carriers.

HHI held a ceremony to name the 'Cosco Faith', a 13,100TEU containership ordered by Seaspan of Canada, as the shipbuilder was celebrating to mark the new milestone of 100 million GT in ship deliveries. The naming ceremony was broadcast via satellite simultaneously along with other naming ceremonies in Ulsan and Yeongam for twin vessels built in Yeongam, South Jeolla Province by Hyundai Samho Heavy Industries (HSHI).

An official from HHI said, "This new milestone of 100 million GT reaffirms HHI's technological prowess and international competitiveness and further raises the status of Korea as the world's largest shipbuilding country."

HHI has 11 dockyards in Ulsan and Gunsan, building more than 100 vessels yearly. The annual shipbuilding capacity of HHI stands at 13 million tons, the largest worldwide.

HHI has positioned itself at the forefront of the world's shipbuilding industry with intensive focus on the technological development. Specifically, HHI became the nation's first shipbuilder to develop an indigenous model of LNG-FPSO (Floating Production Storage and Offloading) in January. Furthermore, it won the world's first order for LNG FSRU (Floating Storage and Regasification Unit) in June last year and built the world's first smart ship in March last year.

| Correction |

The product number of the Explosion-Proof Motors of HIGEN MOTORS, which was published in the 'New Product' section of the March issue, 2012, should be corrected as follows:

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280M ~ 315M

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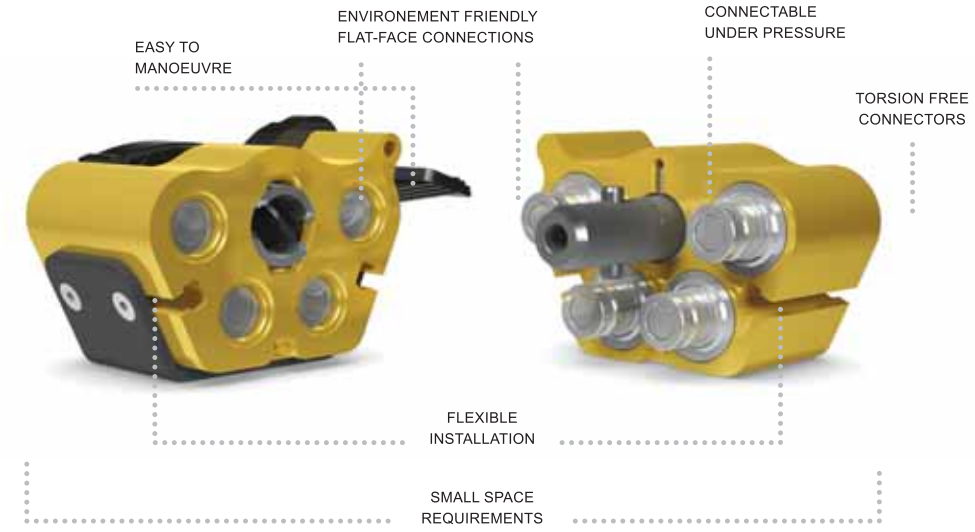

Products

- MultiX Duo 10 = 2x 3/8" (DN10)
- MultiX Duo 12.5 = 2x 1/2" (DN12.5)
- MultiX Quattro 10 = 4x 3/8" (DN10)
- MultiX Quattro 12.5 = 4x 1/2" (DN12.5)
- MultiX Quattro 10/12.5 = 2x 3/8" (DN10) + 2x 1/2" (DN12.5)
- MultiX Quattro 12.5/19 = 2x 1/2" (DN12.5) + 2x 3/4" (DN19)

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Onboard DC Grid: The step forward in Power Generation and Propulsion

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ABB

In its simple way the Onboard DC Grid is just an extension of the already multiple DC-links already existing in all propulsion and thruster drives accomplishing for usually more than 80% of the electrical power consumption on electric propulsion vessels. This extension means that we keep all the good and well proven products already used in today's electric ships like AC generators, inverter modules, AC motors, etc. All main AC SWBDS and transformers are however no longer needed and you have the most flexible power and propulsion system to date. The main innovations with this new Onboard DC Grid are the design and control of the protection system and optimized energy flow.

This technical note describes the design and configuration of the Onboard DC Grid system, with a discussion of the various benefits.

Figure 1: Platform Supply Vessel with Onboard DC Grid

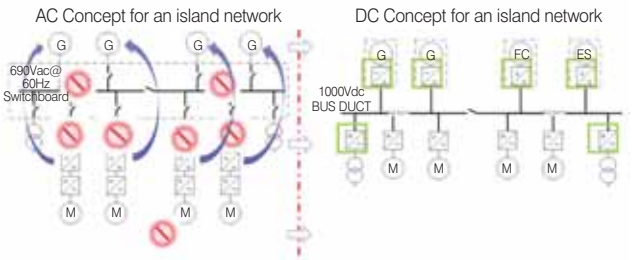

Figure 2: From AC to DC (single line old vs. new design)

Onboard DC Grid

There are several ways of configuring the Onboard DC Grid from a multi-drive approach (Figure 3) to a fully distributed system (Figure 4). In the multi-drive approach all converter modules are located in the same lineup within the same space layout as today's main AC switchboard. For the distributed system each converter component is located as near as possible to the respective power source or load.

Common for both alternatives is that the main AC SWBD and all thruster transformers are omitted in the new concept. Instead all generated electric power is fed directly or via a rectifier into a common DC bus that distributes the electrical energy to the consumers. Each main consumer is then fed by a separate inverter unit. The 220V AC distribution (e.g. "hotel load") will be fed using island converters, specially developed to feed clean power to these more sensitive circuits. Further converters for energy storage can be added to the grid. This energy storage could for example be batteries or super capacitors for leveling out power variations.

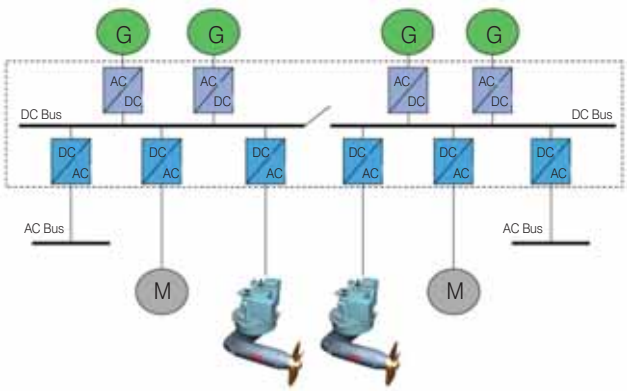

Figure 3: Onboard DC Grid; Multi-drive approach

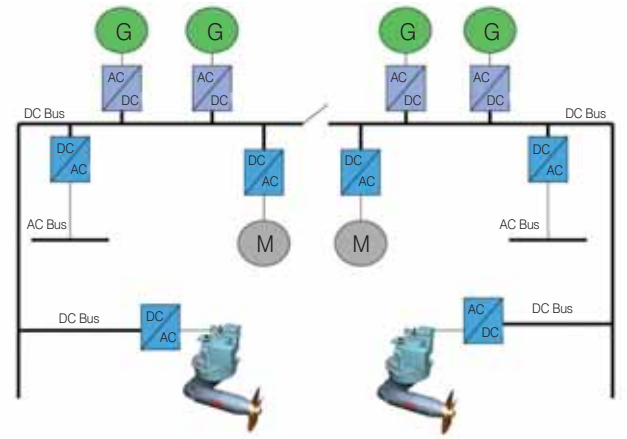

Figure 4: Onboard DC Grid; Distributed approach

The main benefits of this approach are, besides an efficiency increase of up to 20%, space and weight savings by up to 30% and flexibility of placement of electrical equipment. This allows for significantly more cargo space and a more functional vessel layout, where the electrical system is designed around the vessel functions and not vice-versa.

The main traditional challenges with DC distribution in general have been to achieve full selectivity and equipment protection in similar way as for AC distribution. AC currents are by nature far simpler to break because of their natural zero crossing every half cycle. DC circuit breakers do exists to some extent but are more complex, larger and more expensive than comparable AC circuit breakers.

By designing the Onboard DC Grid we have looked at the whole concept and layout from a totally new perspective, instead of just replacing component by component. Keeping in mind class rules and regulations as the frame, the design is based on following two main principles:

- *Equipment shall be protected in case of failures.*
- *Proper selectivity shall be ensured in such a way that safe operation is maintained after any single failures.*

Onboard DC Grid is a new electric power distribution concept that, while utilizing the well proven AC generators and motors, opens new opportunities for efficiency improvements and space savings. The efficiency improvement is mainly accomplished by the fact that the system is no longer locked at a specific frequency (usually 60Hz on ships), even thought any 60Hz power source also would be connectable to the Grid. The new freedom of controlling each power consumer totally independently opens up numerous ways of optimizing the fuel consumption. Today almost all energy producers on electric ships are combustion engines, most operating on liquid oil (HFO/MDO), some on gas (from LNG mainly), and even some with Dual Fuel capability (liquid fuel or gas). When operating these engines at constant speed the fuel consumption is lowest at a very small operating window around 85% of rated load. With the possibility to adjust the speed this operating window can be extended down to 50% without any increased fuel consumption (Figure 5).

In the most distributed version of the Onboard DC Grid, each power converter is located as close as possible to the respective consumer or producer. Each production unit has the possibility of an integrated rectifier mounted directly on the unit itself or alternatively in a separate cabinet close by. There are no needs of collecting all these units in a centralized “switchboard room” as in a classic design.

Since the main AC SWBD with its AC circuit breakers and protection relays is omitted from the new design, it has been essential to devise a new protection philosophy that fulfills class requirements for selectivity and equipment protection. In doing so it has also been a key requirement to minimize use of expensive and space consuming DC circuit breakers. Proper protection of the Onboard DC Grid is achieved by a combination of fuses and controlled turn-off of semiconductor power devices. Since all energy producing components have controllable switching devices (either thyristor rectifier for AC producers and DC/DC converters for DC producers) the fault current can be blocked much faster than what is possible with traditional circuit breakers with associated protection relays.

Exploring the benefits

1. Efficiency

Figure 5 shows the test results of fuel consumption as a function of applied torque and RPM for a small test engine. It can be clearly seen from this picture that it is possible to run this type of engine with the lowest possible fuel consumption at least down to 50% loading. This is especially beneficial for vessels operating in Dynamic Positioning, where average electric thruster loads are normally low due to low propeller speeds and normal weather conditions, but number of running engines is higher than really needed because of safety reasons. The pure electrical efficiency will also contribute to the improved efficiency with less installed components (no main switchboard and thruster transformers).

However, the biggest fuel savings potential lies in the ease with which energy storage devices, like batteries or super capacitors, can be added to the system. In this area the technology has developed quite much the in the last decade and is expected to develop further. Energy storage will help the engines level out load variations from the thrusters and other large loads. No real measure data is ready available for this type of comparison but it can be somehow compared with the difference of driving a car in a busy city centre and motorway. Similar effects of fuel consumption savings are expected by installation of energy storage and together with above benefits the total yearly fuel consumption reduction is expected as high as 20%.

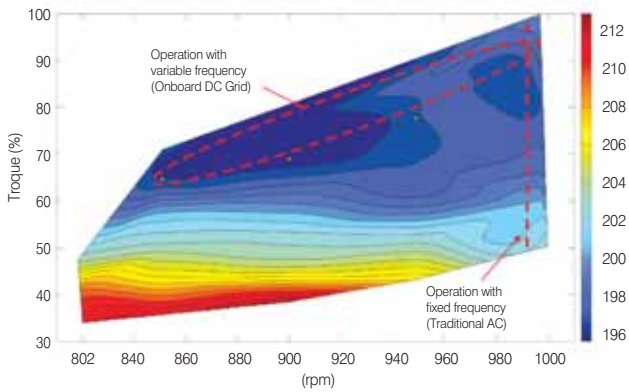

Figure 5: Engine fuel tests at variable speed (color scheme indicates Specific Fuel Oil Consumption (SFOC) in g/kWh.

The exact savings will of course depend on vessel type and operation profile, but as an example a Platform Supply Vessel (PSV) with DP capabilities is one ship type that has the potential for utilizing the full capability of the new Onboard DC Grid.

2. Weight and space arrangement

One obvious benefit with Onboard DC Grid is the reduced weight and footprint of the installed electrical equipment. The exact figures will of course vary depending on ship type and application, however a summary of a study done for a PSV is shown in Table 1.

The figures in Table 1 give the savings by comparing installed HW only. Further savings are expected as a result of more flexible equipment placement and we believe that with careful design a more functional vessel with increase space for payload can be achieved.

3. Operations

Onboard DC Grid enables new ways of thinking for operational optimization. As the system is flexible by combining different energy sources like engines, turbines, fuel cells, etc., there is a huge potential for implementing a real energy man-

Table 1: Comparison of weights for installed electrical equipment for an example PSV. Traditional AC concept vs. Onboard DC Grid.

Equipment	Q'ty	Rating	Weight Traditional	Weight Onboard DC Grid
Generators w/aux	4	2500 kVA	38000 kg	39000 kg
Main AC SWBD	1	690 VAC	4450 kg	0 kg
Main DC distribution	1	1000 VDC	0 kg	2400 kg
Distribution AC	1	450 V / 230 V	14490 kg	16530 kg
Propulsion drives	2	3500 kVA	31980 kg	13680 kg
Thruster drives	3	1200 kVA	26600 kg	13750 kg
Total			115520 kg	85360 kg

agement system, taken into account varying fuel prices and availability of different fuel. This kind of optimization may be some years ahead, but with Onboard DC Grid the vessel is prepared for the future and any electricity producing energy technology that may be available within the next 5 to 10 years.

What is available today and would help in solving the traditional challenge for DP operation is the fuel efficient running of engines at part load. In the most severe DP operations today the electrical plant is operated by a minimum of 2-split configuration for safety reasons. This gives the vessel possibility to keep its position even if one side of the power plant is failing. However, running in split mode does not utilize the full benefits of electric propulsion in general as a total optimization of running engines is not possible. With Onboard DC Grid the split mode operation can be run more efficiently as the engine speed can be adjusted and optimized to the required load without the need for changing the number of generators online.

4. Protection and safety

As already mentioned, the protection philosophy is based on a combination of fuses and controlled switches. In short; fuses are used to protect and isolate inverter modules in case of serious module faults. This is no different to current LV frequency converters. In addition, input circuits separate the inverter modules from the main DC bus and afford full control of reverse power, both in fault and normal conditions (as for example in propeller braking mode). This means that faults on a single consumer will not affect other consumers on the main DC distribution system. In the event of severe faults on the distributed DC bus, the system is protected from generators by means of a controllable thyristor rectifier which also doubles as a protection device for the generator. Isolators are installed in each circuit branch in order to automatically isolate faulty sections from the healthy system.

In sum, the Onboard DC Grid fully complies with rules and regulations for selectivity and equipment protection. Further; any fault current will be cleared within maximum 40ms. This result in a drastic reduction in Onboard DC Grid fault energy levels as compared with traditional AC protection circuits where fault durations can reach up to 1s. This low energy fault protection schemes enables the Onboard DC Grid system to be used for installed power up to at least 20MW.

Concluding Remark

The Onboard DC Grid system is a new way of distributing energy for LV installations in ship. It can be used for any electrical ship application up to at least 20MW and operates at a nominal voltage of 1000V DC. The power distribution can be arranged with all cabinets in a single line up (multi-drive approach) or distributed throughout the vessel by short-circuit proof DC busbars.

For the ship-owner following main benefits are expected:

- *Up to 20% fuel saving if taking full advantage of all features including energy storage and variable speed engines.*
- *Reduced maintenance of engines by more efficient operation.*
- *Improved dynamic response by use of energy storage, which may give a better DP performance with lower fuel consumption or more accurate positioning.*
- *Increased space for payload through lower footprint of electrical plant and more flexible placement of electrical components.*
- *More functional vessel layout through more flexible placement of electrical components.*
- *A system platform that affords simple "plug and play" retrofitting possibilities to adapt to future energy sources.*

Benefits for shipyards and designers can be summarized as follows:

- *More flexible placing of electric components.*
- *Reduced footprint and weight of electrical equipment by up to 30%.*
- *Less cabling and cabling connection, by means of reduced number of components and use of bus ducts.*

Even though use of bus ducts is a relative new type of installation work for many ship yards, several benefits can also be listed for this; such as: Reduced cross section, no bending radius, and drastic reduction of fire load compared to traditional cables.

Onboard DC Grid is here now; it combines the best of both AC and DC components/systems available, it is fully compliant with rules and regulations, and is the choice for the future with low emission and low fuel consuming ships.

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2.3 CREATING A SPRINT BACKLOG

At this point, the product owner has identified the maximum level of automation, and used this to define items in the backlog. However, before the product owner can start reviewing individual backlog items with the Scrum team, the team must first decide how much work can be completed within one sprint cycle.

To do this, the team will agree on the difficultly level for two sample backlog items that have been selected by the Scrum master. These items represent a very simple case and a more complex case, which all members are familiar with. Then, the team uses a known Scrum practice of quantifying effort by representing the item with a point scale based on the Fibonacci sequence (1, 2, 3, 5, 8, 13, 20, 40, 100). Using this scale, a 1 point is a very simple item to complete, a 13 point item is more complicated, but can complete without problems and a 100 point item is too large to be worked within one sprint. For these cases, the product owner will be requested to break the item up into smaller items.

After the team has agreed on a base level of difficulty for the two items that the Scrum master has selected, the team will then select an estimated velocity based on how many similar tasks they can complete, collectively, within one sprint. For example, let's assume that the team has determined that they can work 45 points worth of items within one two week sprint cycle.

Now, they are ready to review the product backlog with the product owner and assign points to the items in the product backlog.

For the example of the brackets, the team will review all 2S, 3S, 4S and 5S development items. During the review the team sets the initial point level for the items that were added into the product backlog as follows:

- *2 Support (including selection and parameter logic automation) : 8 points*
- *3 Support (including selection and parameter logic automation) : 13 points*
- *4 Support (including selection and parameter logic automation) : 13 points*
- *5 Support (including selection and parameter logic automation) : 21 points*

At this time, the team has already identified items that have an accumulated difficulty level of 55 points, 10 points over what they feel comfortable completing with in one sprint.

Since full automation is not required for initial start-up, the product owner is asked to review the requested level of automation to determine what will provide the highest return value.

In this case, the product owner knows that the 85% of the brackets currently used in production projects are two and three support brackets. Therefore, it is decided that they will have to be completed within the next sprint.

Next, the product owner reviews the requested automation level for the four and five support brackets. After review with other in-house experts in the shipyard, it is determined that the parameter logic requirements for setting the default settings is more important than having automated rules for selection, since all items can always be manually selected by the user as desired.

As a result, the product owner creates a new item for automation of four and five support selection logic, to be worked in a future sprint. He also modifies the current items to remove the selection logic. Then the team re-estimates the items as follows:

- *4 Support (including parameter logic automation) : 8 points*
- *5 Support (including parameter logic automation) : 13 points*

At this time, the team has identified items that have an accumulated difficulty level of 42 points. Now the team has a set

of items to start work on, and they are comfortable that they can deliver a high quality, complete solution within the two week sprint cycle.

Once the sprint is started, the team meets in a daily Scrum meeting to review, identify and clarify any issues that may arise due to misunderstanding of requirements or other obstacles to the development process. During this meeting they will report on their current progress for the work being done. Progress is tracked through a chart known as a Burndown Chart shown in Figure 10. The burndown chart maintains a high level of visibility of the team progress for the product owner.

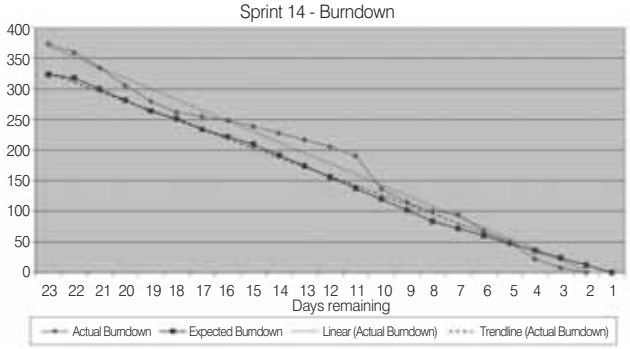

Figure 10: Sprint Burndown

In addition to reviewing any issues with the requirements, the team and product owner can monitor progress and choose to add or remove work from the sprint as needed.

2.4 COMPLETION OF A SPRINT

At the end of the sprint, the remaining work points equal 0 and all items in the sprint can be delivered to the shipyard for acceptance testing. Once the shipyard has confirmed that all items meet the predefined Conditions of Satisfaction, then the delivered items can be used in production.

Now, if desired, the product owner can review the product backlog, re-prioritize and modify any existing items to be worked in the upcoming sprints.

3. CONCLUSIONS

The goal for most shipyards after purchasing a new CAD solution is to be in production as soon as possible. Customization and the resulting enhanced design automation that will improve business processes.

For the implementation project noted in this paper, Intergraph was able to help the customer achieve their goals through the application of Agile Development methods noted in this paper to automate selection rules, parameter logic, and automated feature creation within SmartMarine3D.

To meet this objective, the product owner identified the most common shipbuilding practices of his shipyard, and created a set of backlog items to automate those practices. For the less common shipbuilding practices, the customer simply used delivered content provided by SmartMarine3D as well as a set of predefined interactive steps. This flexibility supports the benefits and advantage outlined by the "Agile Manifesto" and reflects the practical approach to prioritization based on business value.

The level of automation achieved will vary from shipbuilder to shipbuilder, however, by applying the Agile Development methodology explained in this paper, shipyards can create a product backlog of items that can account for a complete set of automation rules for all shipbuilding practices. Prioritization of the product backlog based on the highest return on investment allows the shipyard to create a plan, including a short, mid and long range set of goals that will lead to achieving full automation in a compressed timeframe.

AUTHORS' BIOGRAPHIES

Patrick McFadden holds the current position of Senior Support Engineer at Intergraph Corporation. He is responsible for user customization and reference data development in the areas of early-stage design, detailed design and planning. His background includes a B.S in Computer Engineering from Old Dominion University and over 14 years of marine design experience with specialization in the creation of customized CAD solutions.

S. Yamauchi, holds the current position of Senior consultant of Intergraph Japan K.K. He is responsible for Manufacturing customization and local support lead. His background is 15 years Shipbuilding Engineering and 6 years CAD system support.

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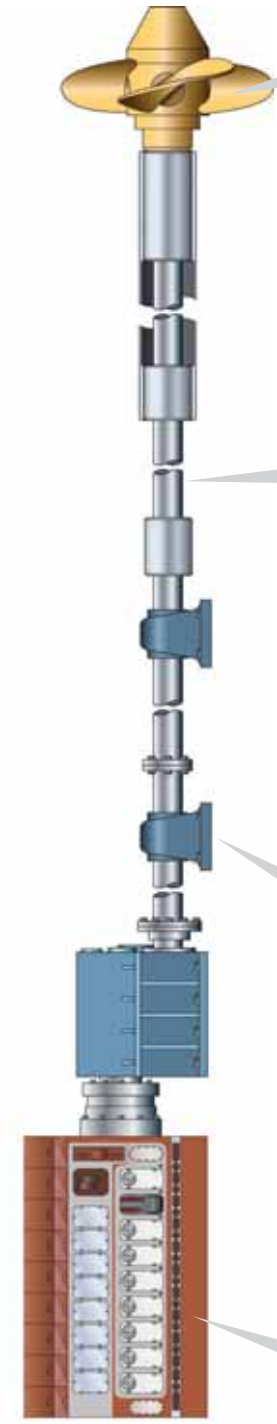

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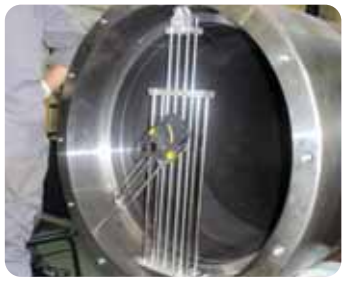

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Future technology (9): Arctic offshore development

Several assessments indicate a large potential for oil and gas production in the Arctic. Although Arctic production today represents only a small fraction of the total and is mainly concentrated onshore, it is expected that offshore Arctic activity will increase, particularly where reserves are located in areas with seasonal or year-round sea ice. The activity will most likely be strictly regulated, with considerable focus on zero environmental impact and reducing the footprint.

DNV

Introduction

The growing focus on Arctic oil and gas exploration has raised the need for adequate standards and industry practices. Equipment and personnel functionality in a cold, remote, and dark situation will present significant challenges that will necessitate the development of appropriate and reliable solutions.

Additionally, the continued focus on environmental protection will mean that regulatory regimes will be tightened, such as shifting from a limited impact towards no impact. Similarly, the functional or performance-based requirements will be maintained and constricted by regulators and class societies, with an expected increase in demand for documentation to prove that demands are being met. It will also be necessary to demonstrate an adequate and increased level of redundancy, escalating the complexity and scope of Arctic operations and production.

Working conditions

Knowledge on working safely in the Arctic is critical for personnel, the environment, and assets. To ensure that people and equipment are able to operate and function as required, focus on winterization will increase. For example, the ventilation challenges for production and drilling facilities may be solved by 2020 by incorporating operational experience.

Maintenance, repair, and operation will be increasingly conducted by remotely operated robots, replacing integrated operations (IO) with remote operations (RO).

Materials for the arctic

Material for the use in the cold climate need acceptable toughness properties, in particular, new high strength steels to prevent brittle fracture. These requirements will be governed by installation operating conditions in arctic areas. Hydrophobic paintings and coatings with insulation, corrosion protection, anti-icing or de-icing properties will be devel-

Oil spill exercise: burning of oil in water is an option for combating oil spills in arctic waters. (source: SINTEF)

Harsh arctic environment requires specifically designed drill ships for field development. (source: STENA)

oped for cold climate and that are also tolerant to large temperatures variations.
Light weight structures made of glass fibre reinforced plastic composites, aluminium and other light weight materials may be an option in cold climates. Common is the need for reliable specification and qualification criteria for welding procedures, safe and cost-effective application of materials for hydrocarbon exploration and production in Arctic regions.

All-Year arctic drilling

Exploration drilling will continue to be performed during the ice-free, light summer season, but new, submerged, almost autonomous drilling solutions have become attractive, changing the way resources are found, proven and possibly tested. These innovations will not solve mobilisation and intervention of the drilling operation by 2020, but the solutions will require less surface presence, and remote surveillance and control of drilling operations will become possible.
Arctic production drilling requires new solutions that enable yearround operation, pushing for larger rigs that minimise logistical support requirements. Ice management will be incorporated into the overall system reliability by 2020, and use of available rig space will be optimised, whilst maintaining the requirements for material handling and safety. Stricter regulations are expected with respect to regular emissions to air and to sea, and to reduce the possibility of large-scale oil spills.

Extreme distance tie-ins

Subsea production from Arctic oil fields will become a reality, even for fields located far offshore, thanks to developments in flow assurance. This has been possible due to advances in control and monitoring of long-distance, multiphase-flow pipelines and improvements in our understanding of the association between pressure drops and a wide range of fluid properties.
Although the challenges of intervention, repair, and maintenance of subsea production facilities, for which surface vessels are still needed, have not been solved, the need has been reduced as subsea and pipeline systems have become more reliable.
Subsea separation and compression will be widely used in more benign waters and have been shown to be reliable solutions that will also be considered for Arctic conditions, especially for deeper waters with heavy ice conditions.

Winterized oil rig in Beaufort Sea.

Offshore Production

Despite the expected advances in long distance tie-ins and subsea production, the need for Arctic surface production facilities offshore will continue as large-scale burial of facilities has not been feasible. This is particularly expected to be true for the shallow, icecovered waters in the Pechora, Kara, Chukchi, and Beaufort Seas, which will be developed ahead of deeper waters. The foundations for surface facilities will differ from conventional ones by being unique solutions, thus adding to the field development costs, which are expected to be high.
Areas with milder sea ice conditions, such as the Barents Sea and West of Greenland, will see more conventional field development solutions utilising ice management. After 2020, the next step in offshore production could be the burial of the whole production facility below the sea-bed, completely avoiding surface installation in shallow waters.

Oil spill recovery

The development of several Arctic oil fields has pushed the development of reliable detection, mapping, mitigation and recovery of possible oil spills in ice covered waters. Although there is a continued focus on oil spill prevention, effective spill recovery technologies have been developed. Biological dispersants for cold water will be available and replace chemicals by 2020. A large scale mechanical recovery technology is now available after a collective development by the major oil companies. Both the use of biological dispersants and mechanical recovery has shown to be successful and have been benchmarked in controlled field experiments.
Even though the recovery technology will be available in 2020, prevention of oil spills will still receive much attention from the public, authorities, operators and NGO's.

The FLIR M-Series seamlessly detects ice in total darkness, in all weather conditions.

Iceberg ahead!

The earth's Polar Regions are considered by many seafarers to be among the most challenging environments in the world. The combination of extremely long nights, harsh weather and icebergs can make a trip through Arctic and Antarctic waters dangerous. Nowadays these trips can be made safer by using a thermal imaging camera from FLIR Systems. Thermal imaging can help seafarers to find the safest path through the ice.

FLIR Systems Korea

Glacier ice is difficult to track by marine radar as the radar signal is scattered by air bubbles and other imperfections in the ice. Many experienced seafarers can attest to the difficulty of detecting ice with radar. Even the radar signal returns from large icebergs are much lower than from ship targets because of the lower radar reflectivity of ice (and especially snow) if compared with steel. Detection of ice targets is therefore rather difficult, especially if they have low or smooth profiles.

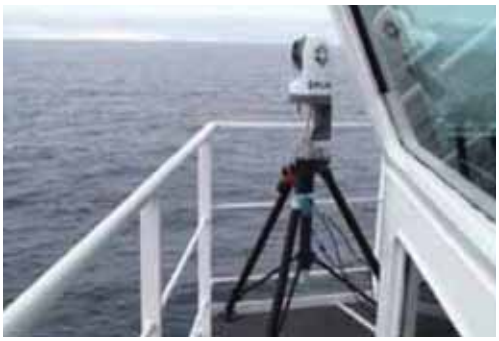
Pieces of ice also break off from icebergs. The larger pieces are known as bergy bits, and the smaller pieces are known as growlers. These smaller pieces are even harder to detect by radar. This is particularly true in heavy sea conditions where the radar returns from ice floes may be lost in the so-called 'sea clutter', which means that the waves show up on the radar image, making it difficult to distinguish between ice and the waves.

During the daylight hours the inability of radar to detect ice in certain conditions can be compensated by visual inspection. This requires good visibility, however. In the long polar nights this task becomes very difficult due to the lack of light and even during those scarce hours of daylight the visibility might be restricted by fog or snow. Fog is common in the Arctic during the open water period and during the winter snowstorms regularly occur. In the nighttime the combination of darkness and fog or snow can limit the capability of regular eyesight to detect ice hazards even further.

Ice detection with thermal imaging

The solution to this problem can be found in

Traversing the Arctic waters becomes much safer with the help of a thermal imaging camera.


For the test two models of the M-Series were mounted on a tripod next to the bridge of an ice strengthened vessel that traverses the Arctic waters of Greenland.

using a thermal imaging camera. Thermal imaging cameras record the intensity of electromagnetic radiation in the infrared spectrum. All matter emits infrared radiation, even objects we think of as cold, such as ice, emit infrared radiation. In a thermal imaging camera the infrared radiation is focused by a lens onto the detector. The intensity of the recorded infrared radiation is translated into a visual image.

Because thermal imaging cameras rely on thermal contrast instead of color contrast they do not need lighting to produce crisp images during the night. They provide a good overview of the situation giving a much better idea of the surroundings than the narrow beam of a searchlight. Also, searchlights are of limited use in snow and fog. Its light beam does not reach far in such conditions. When fog or snow impedes vision thermal imaging cameras can also help the ship's captain and navigators to see farther.

Field test in Greenland

FLIR Systems set out to determine how its maritime cameras perform in the field. For this field test two versions of the FLIR M-Series thermal imaging camera were mounted on a tripod next to the bridge of an ice strengthened vessel traversing Greenland's ice filled waters to deliver fuel to its remote settlements. In this extreme environment, arguably one of the most dangerous maritime areas in the world with its floating chunks of years old dense glacier ice, FLIR's thermal imaging cameras were put to the test. They passed the field test with flying colors.

The test clearly showed that thermal imaging cameras are capable of detecting ice in total darkness and even during snowfall. In total darkness, the visual light of a search beam is reflected by the snowflakes, impeding vision. Thermal imaging cameras perform much better under these circumstances, as the test clearly showed, maintaining a good range performance despite the snowfall.


The cameras were tested on this ice strengthened vessel traversing Greenland's ice filled waters.


The JCU and the screen were installed on the bridge.


Thermal imaging cameras need no light whatsoever to produce crisp high contrast thermal images, making it the ideal tool for those long Arctic nights.

Thermal imaging detects ice in all sizes and shapes

During the test thermal imaging cameras were successfully used to detect pieces of ice of different sizes and shapes. These are generally divided into

The searchlight only illuminates objects in the narrow path of its lightbeam. A thermal imaging camera presents a much wider view, resulting in better situational awareness.

three categories: icebergs, bergy bits and growlers. Icebergs are floating chunks of ice with more than 5 meters of its height exposed above sea level. Bergy bits are pieces of icebergs showing 1 to 5 meters above sea level. Growlers are pieces of icebergs showing less than 1 meter above sea level. With the thermal imaging camera all of those three categories were detected.

Due to their size icebergs are usually relatively easy to detect by radar. In most occasions using radar should suffice in detecting them. The bergy bits are smaller than full-grown icebergs, making them harder to detect, both by radar and visually. Even the large bergy bits can be difficult to detect using marine radar, due to their shape. The sides of bergy bits are often oriented in such a way that radar energy is deflected away from the antennae. Combined with sea clutter this bergy bit characteristic can make it really difficult to spot them on the radar. During the test many bergy bits were observed with the thermal imaging camera, they showed up very clearly in the thermal image.

Growlers, being the smallest category, are the most difficult form of ice to detect both visually and on radar. Though small, growlers can still pose a serious threat even for ice strengthened vessels. Growlers made out of ice less than one year old should not be able to cause much damage to such vessels, if they maintain a safe speed. Due to its pressurized environment ice from glaciers and multi-year sea ice can have a much higher density, so growlers made of multiyear ice can be a lot heavier than those made out of the less dense 'younger' ice.

Avoiding damage and saving fuel

Even the hull of ice strengthened vessels can be damaged in case of a collision with a multi-year ice growler. Also the fuel consumption of a vessel is higher if it is slowed down due to the impact of such collisions. It is therefore much safer and more efficient to avoid all growlers and bergy bits. Growlers can easily be obscured by the sea clutter on the radar screen, especially if they have a smooth relief that deflects radar energy away from the antennae. In clear conditions it may be possible to detect growlers visually, but at night and in bad weather that becomes increasingly difficult.

With the thermal imaging camera very small growlers can be detected from distances of over 800 meters.

Do not trust on radar alone

Governmental authorities warn seafarers that traverse Arctic waters not to trust on radar alone to detect icebergs, bergy bits and growlers in

These bergy bits deflect radar signals away from the antennae, but they show up clearly on a thermal image.

The narrow beam of the searchlight needs to be pointed directly at this bergy bit to illuminate it.

These bergy bits show up clearly on these thermal images.

fog and darkness. Given the fact that the force of impact in case of collision varies as the square of the speed the authorities advise to lower the speed of the vessel. The prudent speed in a given ice condition is a result of the visibility, the ice type and concentration, the ice class, and the maneuvering characteristics of the ship. With a thermal imaging camera on the prow you can not only avoid collisions with icebergs, bergy bits and growlers, using a thermal imaging camera can also help increase the speed at which the vessel can safely move through waters where ice collision hazards are suspected. Since thermal imaging cameras help increase the visibility drastically, the speed at which the ship can safely move through ice filled waters is much higher. This increases the overall efficiency of the vessel.

Detecting ice with thermal imaging

Thermal imaging cameras can be used to detect ice because the ice is generally much colder than the surrounding ocean. Not only do the temperatures of the ice and the seawater differ, in most cases there is also a difference in emissivity. Emissivity can be described as the ability of a material to emit energy by radiation, more specifically the ability to emit thermal radiation. Two objects at the same temperature but with different emissivity will present different levels thermal radiance to the thermal imaging camera.

Most of the ice in the sea surrounding Greenland originates from glaciers and therefore mostly consists of fresh water. The exact emissivity differs slightly depending on the circumstances, but generally speaking fresh water has a higher emissivity than the salty sea water. This means that even if the temperature of the ice and the seawater are the same temperature, there will still be a contrast between the two in the thermal image. Another factor is the movement of the surface. The surface of the seawater is ever moving, rippling and churning, while the surface of the ice is solid, still. Even when the amount of thermal radiation emitted to the thermal imaging camera is more or less the same, which means that the ice and the water have more or less the same color in the thermal image, the ice will stand out in the thermal image due to this difference.

FLIR M-Series thermal imaging camera

The FLIR M-Series thermal imaging camera is available with a variety of sensors and resolutions to meet a wide range of maritime needs. For the ice detection test the models M-612L and M-625L were used. Both of these models include a thermal imaging camera with an uncooled Vanadium Oxide (VOx) microbolometer detector that produces thermal images at a resolution of 640 x 480 pixels and a 100µl x Lowlight CCD camera, mounted in a rugged waterproof housing capable of 360° pan and ±90° tilt that is waterproof and contains internal heating to ensure its performance even in such cold environments as the Arctic. The difference

This sequence of thermal images shows the approach of two bergy bits.

between the two is the optics and resulting field of view. The lens of the M-625L gives it a field of view of 25° x 20°. Although this gives an excellent situational awareness, the range performance is better with a narrower field of view. The M-612L has a field of view of 12° x 10°, which is narrower, allowing for a better range performance.

Even these small pices of ice slush show up clearly in the thermal image.

In average conditions the thermal imaging camera incorporated in the M-625L is capable of detecting a small vessel (2.3m x 2.3m) at a distance of over 2 km (over 1 nautical mile). The M-612L's thermal imaging camera can be used to detect the same size target at a distance of over 3 km (over 1.7 nautical miles). The test conclusively showed that thermal imaging cameras are able to detect bergy bits of similar size in real life situations from roughly equivalent distances, despite snowfall reducing their range performance. This makes FLIR thermal imaging cameras an ideal addition to conventional ice detection tools, filling in the gaps where radar and searchlight underperform.

Man overboard

In the crisp high contrast thermal images the smallest of details are shown, regardless of lighting. This not only allows these thermal imaging cameras to aid the captain and navigators with ice detection, it can also prove invaluable in man overboard situations. In these cold waters hypothermia can prove to be deadly within minutes, so if a man overboard situation does arise then finding the fallen crewmember swiftly is of paramount importance. Thermal imaging cameras have shown their value in such search and rescue operations all over the world, but in the cold waters and long dark nights of the Arctic using thermal imaging can make an even bigger difference. The large temperature contrast between the cold water and the warm person allows the camera operator to swiftly locate the waterborne person regardless of lighting. Due to the freezing temperatures in the Arctic waters the time saved by using a thermal imaging camera can easily make the difference between life and death.

Installing a FLIR thermal imaging camera on vessels traversing Arctic waters will help avoid collisions, increase efficiency and help safeguard the safety of the crew in case of man overboard situations regardless of lighting conditions and in all types of weather.

NEW

Thermal imaging cameras for maritime applications

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DSME sealed a contract to build 4 aircraft-carrier auxiliary ships, expanding its market reach

Daewoo Shipbuilding & Marine Engineering (DSME) finalized a deal for 4 aircraft-carrier auxiliary ships with U.K. Ministry of Defense on March 9.

These vessels will measure approximately 200m in length and 28m in width with full load displacement of about 37,000 tons. They will supply oil, food, ammunition, water and others necessary for the warship, and help maintain the combat capability of aircraft carrier fleet. This contract represents a significant step for DSME to emerge as a strong player in the global market for warship and carve out larger slice in related market.

The contract is valued at around KRW 800 billion (GBP 450 million). The 4 newbuildings will be built at DSME's Okpo yard and delivered to Royal Fleet Auxiliary of U.K. Navy in 2016.

DSME inks a contract for UK defense ships

Nam Sang-tae, President & CEO of DSME, said, "This contract is significant very much, considering that an overseas shipbuilder would export a warship for the first time to the world's strong U.K. Navy. Also, this contract signifies the world's leading position of DSME in warship sector in terms of delivery, price competitiveness, performance, etc, as well as commercial ships and offshore facilities."

This warship contract awarded by the U.K. Ministry of Defense is hailed as a significant step forward in taking Korea's defense industry to the next advanced level, along with the submarine deal finalized with the Indonesia government last year.

Meanwhile, including the four newbuilding auxiliary vessels, DSME has secured a total of 11 vessels/units worth USD 3.5 billion year-to-date, which accounts for 32% of 2012's overall new order target of USD 11 billion.

STXOS clinched a USD 100 million order for a heavy-lift ship

STX Offshore & Shipbuilding (STXOS) announced on March 8 that it signed a contract with Scaldis Salvage & Marine Contractors NV of Belgium to build a Heavy-lift ship.

This Heavy-lift ship will be built at STX Dalian Shipbuilding Complex in China and delivered by the first quarter of 2014. This vessel will be used to install and dismantle offshore structures, such as oil/gas production facilities, offshore wind turbines, etc, in deep water after delivery. This heavy-lift ship will measure 108m in length and 50.9m in width. It will be equipped with 2 cranes with a lifting capacity of about 2,000 tons and can sail at a maximum speed of 7 knots. In addition, it is equipped with a helipad and carry 78 crews. Moreover, this ship has an extra carrying capacity of 3,000 tons.

Particularly, the 2 heavy-lift cranes with a working range of 25m from the ship can rearrange the cargo placement after transport. Besides, this heavy-lift ship is fitted with 4 Azimuth thrusters - installed beneath the bottom of the ship to change the direction of propeller and maintain the ship's position during operations - and DP2 system (Dynamic Positioning System 2), making it unnecessary to attach an anchor to the ship.

An official from STXOS said, "This heavy-lift ship is a state-of-art vessel incorporating various technologies to ensure efficient operations at sea. We will exert more efforts to increase our order intake from the offshore plant sector based on our technology."

DSME signed a USD 2 billion contract to build 1 supersize FPSO

Daewoo Shipbuilding and Marine Engineering (DSME) signed a contract with Inpex to build 1 FPSO (Floating Production, Storage & Offloading) on March 8. This contract is valued at approximately USD 2 billion (approximately KRW 2.2 trillion), the second largest FPSO order placed at DSME after Pazflor FPSO worth USD 2.1 billion which was awarded to the shipbuilder in 2007.

This facility, named 'Ichthys FPSO', measures 336m in length, 59m in width, and weighs about 110,000 tons. Ichthys FPSO will be designed to be capable of producing 85,000 barrels of oil and storing up to 1.14 billion barrels of oil per day. DSME will deliver this newbuild FPSO by April 2016, which will be operated in Ichthys field situated in 800km northwest of Australia.

This FPSO project was awarded on a turn-key basis. DSME will undertake entire processes encompassing the design, procurement, production, installation, and commissioning of both hull and topside.

Many of DSME's affiliates will be involved in this large-scale FPSO project. Shinhan Machinery will build the accommodation block, while DSME Shandong Corporation will build the flare tower. SAMWOO Heavy Industry will build the pipe-rack.

Nam Sang-tae, President & CEO of DSME, said, "Building a high value-added FPSO on a turnkey basis requires a combination of various expertise in construction of related structures including the hull and topside. This contract attests to the extensive track record of DSME in successfully completing many FPSO projects and the unmatched breadth of our capabilities."

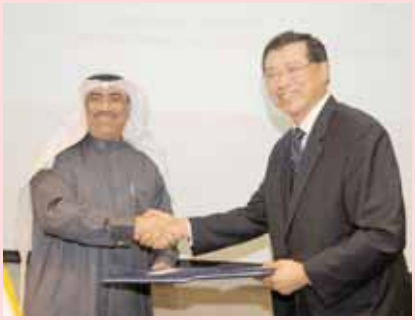
DSME is sailing smoothly, winning orders for 7 vessels and offshore facilities worth approximately 2.76 billion so far this year.

Pazflor FPSO, the world's largest, delivered in January last year

HMD penned a USD 250 million contract with Kuwait's KOTC to build 4 PCs

Hyundai Mipo Dockyard (HMD) clinched a large-scale order for the high valued- added tankers (product carrier/chemical tankers). HMD announced that it won an order worth approximately USD 250 million from the Kuwait's state-owned shipping company KOTC (Kuwait Oil Tanker Company) for the construction of 4 tankers with the capacity of 46,500 tons in late February.

Hyundai Mipo Dockyard (HMD) is expected to maintain its leading position in the global market for medium sized vessels. HMD, which set a new order target of USD 3.2 billion for 2012, has won orders for 8 vessels worth approxi-



HMD President Choi Won-gil(left) and KOTC Chairman Nabil M. Bourisly(right) signed a contract which paves the way for closer relations between both companies.

mately USD 400 million so far. These vessels measure 189m in length, 32.2m in width, 18.5m in height, and can sail at a maximum speed of 15.2 knots. The construction will begin in May 2013, and the newbuild vessels will be delivered to the ship owner on a staggered basis by August 2014.

Particularly, HMD will incorporate state-of-art technologies into these vessels that will be optimally designed and equipped with high-efficiency engine, along with the fuel-saving features, to meet the needs of the market amid sustained high oil prices.

HMD and KOTC began the negotiation on this deal from 2010, which was accompanied by several inspection of the shipyard and close talk between chief executives of both companies. Significantly, this contract was successfully concluded despite the market downturn in the aftermath of the global financial crisis.

KOTC, a state-owned shipping company of Kuwait, handles the majority of Kuwait's oil exports and has approximately 20 vessels of varying purpose, such as tankers, the mainstay of its fleet. KOTC is expected to place additional orders as the high oil prices improve the country's financial indicators.

DSME won an order to build an oil production offshore platform from Danish client

Daewoo Shipbuilding & Marine Engineering (DSME) announced that it was awarded a contract on February 27 from Technip consortium, a world's leading offshore plant design company, and Danish state-owned energy company DONG E&P A/S to build 1 unit of offshore platform used for the oil exploration and production.

This contract is valued at approximately USD 560 million. Under this contract, DSME will design and build the topside. The platform includes 11,500 tons topsides supported by a 6,500 tons jacket, and is designed to process high pressure and high temperature hydrocarbons fluids. The platform, which also comprises a living quarter to accommodate 70 people and a flare, will be capable of producing up to 76 million standard cubic feet of gas per day and 35,000 barrels of oil per day. This offshore platform will be built at DSME's Okpo shipyard and scheduled for delivery by April 2015.

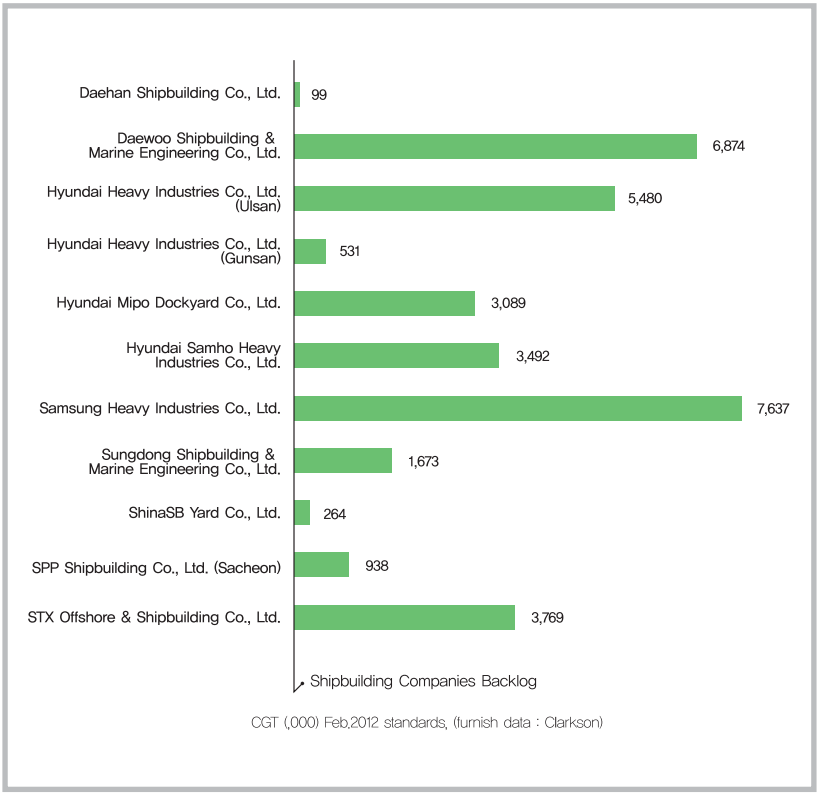
Particularly, this offshore platform, which will be deployed in the North Sea under a rough climate and marine environment, should be made to conform to the rigorous NORSOK Standard of Norway which requires the time and cost-saving method of production and operation, as well as adequate safety. In this regard, the world-recognized track record of DSME in offshore projects and the engineering capability of Technip consortium led to this contract award.

An official from DSME said, "Many oil field exploitation projects are currently underway in the North Sea amid the instability in the Middle East and the resultant high oil prices. DSME will fully leverage its offshore plant project capability to carve out large slice of offshore platform market."

Meanwhile, DSME has won a total of 6 vessels and offshore facilities worth USD 760 million so far this year.

DSME President & CEO Nam Sang-tae (second from the right), DONG E&P A/S CEO Anders Eldrup (third from the right), DONG E&P A/S Executive Vice President Soren Gath Hansen (first from the left), and Technip CEO Jean Mark Aubry(first from the right) are shaking hands after signing the contract to build an offshore plant in Denmark on February 27.

Domestic shipyards saw declines in new orders for commercial ships in the first half of 2012 due to the rising freight rates amid sustained high oil prices and reduction in ship financing worldwide. Fortunately, major domestic shipyards have continuously won new orders for FPSO, offshore oil/gas production offshore platform, product/chemical tankers, the high value-added products, showing stronger performance than expected in terms of new order intake. 3 domestic shipbuilding giants are winning large-scale contracts one after another in the offshore plant sector. In addition, offshore energy exploitation activities will gather momentum with new projects worldwide from the second half of this year, which is expected to lead to increased competition among domestic shipyards.



According to the Clarkson data, domestic shipyards have secured a significant portion of the world's orders and maintain world's leading position.

Here, we take a close look at the performance of major domestic shipyards, such as Hyundai Heavy Industries (HHI), Daewoo Shipbuilding & Marine Engineering (DSME), Samsung Heavy Industries (SHI), STX Offshore & Shipbuilding (STXOS), etc., in terms of order backlog.

Photo: Hyundai Heavy Industries Co., Ltd.

Offshore plant orders awarded to domestic shipyards in 2011-2012

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

2011	July	Drillship	2 vessels	USD 1.1225 billion	Maersk, Denmark	July 2014	Samsung Heavy Industries
	August	LNG-FSRU (Floating Storage and Regasification Unit)	1 vessel	USD 280 million	Excelerate Energy, U.S.A	First quarter of 2014	Daewoo Shipbuilding & Marine Engineering
	September	Semi-submersible Rig	2 units	USD 1.1 billion	Songa Offshore, Norway	Second hallf of 2014	Daewoo Shipbuilding & Marine Engineering
		Well Intervention Vessel	2 vessels	USD 420 million	Eide Marine Services AS, Norway	2013	STX Finland
		Drillship	1 unit (optional vessel awarded on January 19)	Approximately KRW 600 billion	Noble Drilling, U.S.A	Second half of 2014	Hyundai Heavy Industries
	October	Fixed Offshore Platform	–	USD 1.4 billion	Chevron, U.S.A	Second half of 2014	Daewoo Shipbuilding & Marine Engineering
		Drillship	1 unit	Approximately USD 550 million	Offshore drilling company, Americas	–	Daewoo Shipbuilding & Marine Engineering
		Platform Supply Vessel	1 unit	–	Troms Offshore Supply AS, Norway	First half of 2013	STX OSV
		Offshore Plant Module	2 units	–		First half of 2012	STX Finland
		Platform Supply Vessel	4 units	KRW 2 trillion	Island Offshore, Norway	Consecutively from the 3rd quarter of 2013 to the 1st quarter of 2014	STX OSV
	November	Pipe Laying Support Vessel	2 units	USD 500 million	Odebrecht, Brazil	August of 2014	Daewoo Shipbuilding & Marine Engineering
	December	Offshore facilities (Gas platform and various facilities)	–	USD 900 million	Major multinational oil companies	2nd half of 2014	Hyundai Heavy Industries
2012	January	CPF (Central Processing Facility)	–	KRW 2.6 trillion	Australia / INPEX	4th quarter of 2015	Samsung Heavy Industries
		Semi-submersible rig	1 unit	USD 620 million	Norway / Odfjell	by mid 2014	Daewoo Shipbuilding & Marine Engineering
	February	LNG-FSRU		–	Norway / Hoegh	–	Hyundai Heavy Industries
	March	Offshore Platform	1 unit	USD 560 million	Danish / DONG E&P A/S	April 2015	Daewoo Shipbuilding & Marine Engineering
		FPSO	1 unit	USD 2.0 billion	INPEX / Australia	April 2016	Daewoo Shipbuilding & Marine Engineering

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

Shinhan Machinery, a leader in the shipbuilding & offshore support sector

Shinhan Machinery, established in 1990, developed into a subsidiary of Daewoo Shipbuilding & Marine Engineering (DSME), a shipbuilder with the world's leading technology and shipbuilding expertise, in September 2007. It has achieved splendid growth and established a leading position as the world's largest living quarter module manufacturer for offshore facilities.

Specifically, Shinhan Machinery has relentlessly developed technologies and secured competitive edge in major areas of shipbuilding and offshore support business, playing a key role in the advancement of Korea's shipbuilding and offshore industries.

The living quarter module is meant for the accommodation and living of crew members who have to spend long periods time on transportation vessels and drill ships, etc, at sea.

The finished living quarter module is the result of much effort and sweat of 200 technicians on the production line for several months. Here, we take a close look at the technology and know-how that Shinhan Machinery has accumulated over many years.

History

For the past 20 years, Shinhan Machinery has manufactured high quality products based on high technology, know-how & high ability of production in offshore works.

1990	Shinhan machinery Co., Ltd. is established
1997	Moved headquarter to Woobong Coastal complex
1999	Constructed Yard no.2
2001	Acquires ISO 9001
2003	Awarded ExxonMobil Kizomba B TLP L/Q
2005	Acquires OHSAS 18001 Won $ 20 million Export Tower Award
2006	4 Yard expansion starts
2007	Become a wholly owned subsidiary of DSME
2008	Acquires ISO 14001
2009	Established Technical Education Institute Succeed in building TOTAL PAZFLOR FPSO L/Q
2010	Acquires ASME U, S and U2 stamp Constructed yard no. 3
2011	HHI/Goliat Living Quarters order

Information

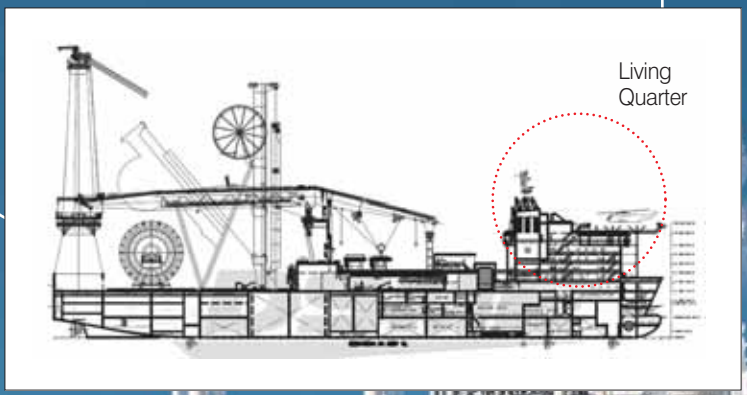
- Client: Heerema Marine Contractor
- Vessel Type: Pipe Lay Vessel
- Weight: 913 Ton
- Mission Equipment:
  - · RJ-Lay system (including tower & reel system)
  - · 4000 ton Heavy lift offshore crane
  - · Multi joint & Pipe handling system
  - · A&R / DWL system
- Dimension: 210M (L) x 46M (W) x 16M (D)
- Class: LR

Feature

- Weight · Hull: 1760 tons
  · Outfitting: 1030 tons (Estimated)
  · Total: 2763 tons
- Block Quantity: 35 EA
- Dimension: 41.9M (L) x 45.6M (W) x 23.6M (D)
- POB: 305 person

The steel cutting ceremony
for HEEREMA. Living Quarters
Project July.04.2011

HEEREMA NEW MONOHULL VESSEL






CLOV Load Out - Jan.28.2012

Information
- Project Name: CLOV FPSO
- Project Number: H6049 L/Q
- Contractor: Daewoo Shipbuilding & Marine Engineering Co., Ltd.
- Prime Subcontractor: Shinhan Machinery Co., Ltd. (SMC)

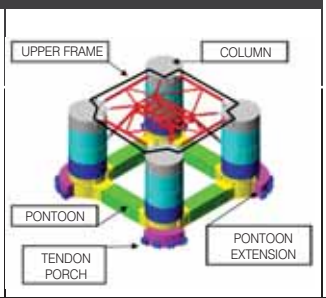
Information
- Weight: 3200 Ton
- Class: BV
- Type: 2.0M
- Dimension: 34.0 x 47.8 x 17.3(90A) / 35.0 x 45.8 x 15.0 (90B)

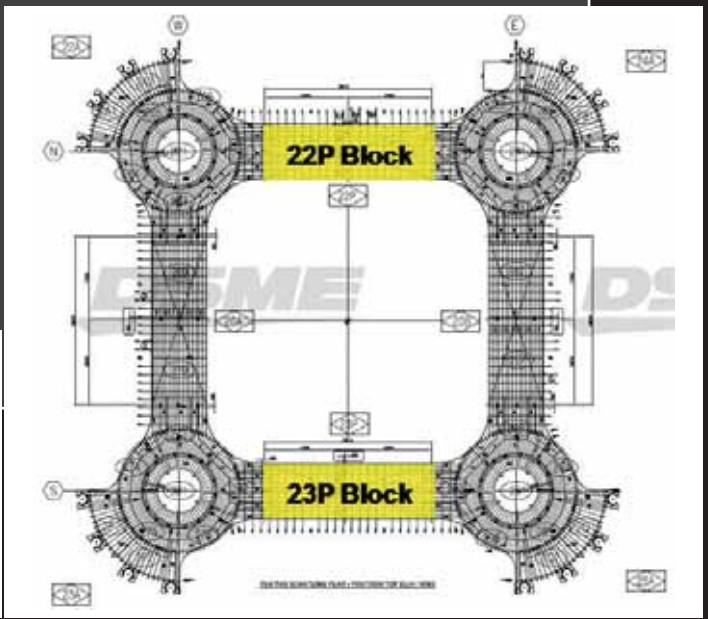
Information

- Client: Chevron North American Exp. & Prod. Co.
- Project Type: Extended Tension Leg Platform (ETLP)
- Operation Field: Big Foot' Field development in Gulf of Mexico
- Water Depth: 1585 m (5200 ft)
- Class: ABS

Big-Foot ETLP Pontoon

- Weight · Hull: 1880 MT
  · Outfitting: 116 MT
  · Total: 1996 MT
- Block Quantity: 8 EA (227/228/267/268 : 22P)
  (237/238/277/278 : 23P)
- Dimension (L x B x H): 12.1m x 36.9m x 10.3m





Information
- Client : HAMBURG
- Weight : 1,505 Ton
- Class : GL
- Type : 7090 TEU CONT

Information
- Client : MESSINA
- Weight : 913 Ton
- Class : RINA
- Type : 2080 UNIT RORO CARRIER

Living Quarters (FPSO)
- Owner: Star
- Weight: 2605 ton
- Year: 2006

New Product

Gyro-stabilized High Resolution Thermal Night Vision

FLIR Systems Korea

The new gyro-stabilized M-618CS.

FLIR Systems announced the release of the latest addition to its industry-leading M-Series family of thermal night vision cameras at the Miami International Boat Show: the new gyro-stabilized M-618CS.

This exciting new M-Series camera offers powerful new features, including: High resolution thermal night vision -640 x 480 resolution, along with 2x and 4x E-Zoom, provide clear, detailed images from farther away than you ever thought possible, even in total darkness.

The M-618CS's 35 mm thermal lens can detect small vessels from over 2 miles away, giving you more time to see and avoid potentially dangerous situations.

Specifically, active gyro-stabilization provides steady imagery even in rough seas. This is critical for getting the most out of the M-618CS's long-range cameras. Additionally, continuous zoom can match the thermal camera's e-zoom for easy operation when switching between cameras (Color TV camera with 10x optical zoom).

Housed in a rugged, waterproof gimbal enclosure that provides continuous 360° pan and +/-90° tilt capability, the M-618CS provides horizon-to-horizon coverage, and incorporates cutting-edge Ethernet connectivity for easy installation and control.

-TEL: +82-2-565-2714
-http://www.flir.com

Vacon enhances Vacon NXP for premium performance

Vacon Korea

The global AC drive manufacturer Vacon announces the renewal of its entire Vacon NXP premium product range. The update involves improvements to both the air-cooled and liquid-cooled units in the complete power range from 0.55 kW to 5,300 kW. The Vacon NXP will maintain its strong position in Vacon's product portfolio and in the highly competitive AC drives market.

"The Vacon NXP is a high-performance product range, and with this update we have further improved its performance, robustness and reliability," reports Heikki Hiltunen, Executive Vice President. "As a dedicated AC drives company, we are committed to pioneering trends in product design and provide innovative solutions for demanding industry applications and high power ranges."

One of the most significant improvements concerns the control circuit boards, which have been significantly redesigned and conformally coated. Certain critical components have been replaced in order to increase their temperature sustainability. However, the range of functionality and compatibility of the circuit boards remain unchanged.

Varnished cards and option boards, which are provided as standard in the power modules above 72 A, improve protection against dust and moisture. Performance and durability have also been enhanced via improved cooling channels for optimal cooling and experience-based optimization of protection limits. In the air-cooled Vacon NXP, new fans improve the reliability of the drive, thus ensuring a longer lifetime. Thanks to the new cooling concept, fan efficiency has been improved by more than 50%.

In the liquid-cooled high-power modules, new options, such as an integrated brake chopper, have been implemented to minimize cabinet size and cost.

"The processor in the control card has also been changed, boosting calculation power by 15%. This benefits especially OEM customers who make their own software for applications," says Kurt Hofman, Product Marketing Director, Liquid Cooled Drives.

NXP premium product range

The Enhanced Vacon NXP range has been tested extensively, and HALT (Highly Accelerated Life Test) tests have been carried out to assure excellent product performance.

Vacon in brief:

Vacon is driven by a passion to develop, manufacture and sell the best AC drives and inverters in the world - and to provide efficient life-cycle services for its customers. Our AC drives offer optimum process control and energy efficiency for electric motors. Vacon inverters are a key component in producing energy from renewable sources. We have R&D and production units in Finland, the USA, China and Italy, and sales & service offices in 27 countries. In 2011, Vacon had revenues of EUR 380.9 million and globally employed approximately 1,500 people. The shares of Vacon Plc (VAC1V) are quoted on the main list of the Helsinki stock exchange.

-TEL: +82-2-790-3352 (Seoul),
+82-51-784-6668 (Busan)
-http://www.vacon.com

New Product

High performance Skil 3220 Cut-off Saw

Bosch

Easy adjustment for ±45° bevel cut

Designed for tough jobs

Efficient clamping system for quick & fine adjustments

The high speed cut-off saw 3220, the highest-performance machine of its class, incorporates over 87 years of SKIL's experience and expertise in electric power tools and motor technology. This high speed cut-off saw 3220 provides high durability and powerful cutting performance, and increases work efficiency.

The high speed cut-off saw 3220, weighing 16.8kg, is lightweight and convenient to use, compared to existing products. Specifically, this product has a strong base, minimized the vibration, and is highly durable and withstands heavy duty work. In addition, it provides adjustability up to 45°, thus enabling perfect completion of various works. The ergonomic easy-locking pin and spark protection guard increase the safety of operators even in unpredictable situations.

SKIL is launching a promotional campaign, offering free exchange at customer's site for 6 months after purchase for customers who register the product until March 31, 2012.

Major Specification of 3220 is as follows:

- *Power input: 2000 Watt*
- *Voltage: 220~240 V*
- *Frequency: 50/60 Hz*
- *RPM: 3800*
- *Base thickness: 1.2 mm*
- *Fixed guard thickness: 1.2 mm*
- *Movable guard thickness: 1.5 mm*
- *Abrasive wheel: Yes*
- *Power cable: 2.5 m rubber*

-TEL: +82-31-270-4680
-http://www.skiltools.co.kr

Cost-Effective Coordinated Motion System

Rockwell Automation

Kinetix® 350 single-axis servo drive

The Allen-Bradley Kinetix® 350 single-axis servo drive provides motion scalability. It connects and operates with the new family of CompactLogix™ controllers, supporting Integrated Motion on EtherNet/IP™.

CIP Sync and CIP motion technologies provide real-time, closed-loop motion control on standard Ethernet. This topology-independent network provides a simplified integration of the entire control solution on one network, including programmable automation controllers (PACs), human-machine interface, I/O and motion.

With its compact design, the Kinetix® 350 requires less panel space and can be connected easily. In addition, users can reduce design, installation and commissioning time by reusing code across the Logix control platforms.

Programmed with RSLogix™, 5000 software, the servo drive provides a scalable motion system to be used with ControlLogix® and CompactLogix PACs. What's more, it is equipped with embedded safe torque off.

The CompactLogix PACs are designed to meet the growing need for a higher performance controller in a compact and affordable package. As part of the Rockwell Automation Integrated Architecture™ system, the controllers use the same programming software, network protocol and information capabilities as all Logix controllers, providing a common development environment for control disciplines.

Its scalable platform is optimised for lower axis count systems. The Kinetix® 350 supports 100V and 200V single phase and 200V and 400V 3-phase class voltage models. Power ranges from 400W to 3kW. Users can reduce commissioning time with the automatic drive identification of the MP-Series™ and TL-Series™ motors and actuators.

Applications

Typical applications for Kinetix® 3 Servo Drives include:

- Intermittent form fill and seal
- Indexing tables
- Laboratory automation equipment
- Medical technology and manufacturing
- Solar panel tracking
- Light manufacturing
- Electronics assembly
- Semiconductor processing

-TEL: +82-2-2188-4400
-http://www.rockwellautomation.co.kr

KOMEA (Korea Marine Equipment Association)
Member List

AMS CO., LTD.
head office : SAHA-GU, BUSAN
homepage add : www.albatros.co.kr
main products : universal machine
TEL : +82 51-293-8641

BUMHAN INDUSTRIES CO., LTD.
head office : Changwon Gyeongnam
homepage add : www.bumhan.com
main products : air compressor, high pressure air compressor, high pressure air dryer & reducing stations
TEL : +82 55-251-6070

BOYANG HARDWARE CO., LTD.
head office : Gimhae Gyeongnam
homepage add : www.byhd.co.kr
main products : stairway body, ladder, handrail & stormrail, other outfittings, sanitary & furniture hardware
TEL : +82 55-345-1951/3

BY CONTROLS INC.
head office : Gimhae Gyeongnam
homepage add : www.bycontrols.com
main products : control valves, hydrauric & pneumatic actuator, valve remote control sys
TEL : +82 55-345-6110

BC TAECHANG IND. CORP.
head office :
homepage add : www.bcinternational.co.kr
main products : water jet power pump, marine tape, petro tape, corroshield bt
TEL : +82 55-333-1985

CHK CO., LTD.
head office : Gangseo Busan
homepage add : www.chkj.co.kr
main products : fire damper, junction box, steel furniture, pilot chair, cable box
TEL : +82 51-831-9500

CMR KOREA CO., LTD.
head office : Geumjeong Busan
homepage add : www.cmrkorea.com
main products : Marine Telephone, Marine CCTV, Anemometer,
TEL : +82 51-521-2883

CAPE INDUSTRIES LTD.
head office : Yangsan Gyeongnam
homepage add : www.capeind.com
main products : cylinder liner-man b&w, sulzer(wartsila)
TEL : +82 55-370-1234

Emerson Process Management Marine Solutions Korea Co., Ltd.
head office : Saha-Gu, Busan
homepage add : www.emersonprocess.com/marine
main products : Valve Remote Control Systems, Tank Level Gauge Systems, Marine Tank Management Systems
TEL : +82 51-602-5555

DAEYANG INSTRUMENT CO., LTD.
head office : Saha-Gu, Busan
homepage add : www.daeyang.co.kr
main products : precision instrument-anemometer rudder angle indicator, engine monitoring system, temperature sensor
TEL : +82 51-200-5303

DAE JIN IND. CO., LTD.
head office : Gangseo Busan
homepage add : www.daejinqc.co.kr
main products : aluminium/steel/wooden furniture, catering furniture, fire & gas damper a60
TEL : +82 51-831-4551

DAE JIN DAMPHA CO., LTD.
head office : Ulju Ulsan.
homepage add :
main products : ceiling panel, wall panel
TEL : +82 52-225-2361

DAECHUN INDUSTRIAL CO., LTD.
head office : Gimhae Gyeongnam
homepage add : www.daechun.co.kr
main products : multi core tube, stainless steel tube
TEL : +82 55-345-2288

DAIHAN ANCHOR CHAIN MFG. CO., LTD.
head office : Nam-Gu Incheon
homepage add : www.dhac.co.kr
main products : anchor chain grade 2, anchor chain grade 3, mooring chain r3, (stud & studless)
TEL : +82 32-862-0091/4

DONG KANG M-TECH CO., LTD.
head office : Kangnam-Gu, Seoul
homepage add : www.dkmtech.com
main products : water jet,(hj212, hj292, hj322, hm461, hm817), night navigator(nn-9000, nn-3000)
TEL : +82 2-553-0181

DONG WOO MACHINERY & ENGINEERING CO., LTD.
head office : Changwon Gyeongnam
homepage add : www.hanyang-p.co.kr
main products : provision crane, hose handling crane, cargo m/r room, center frame
TEL : +82 55-295-3261

DONG-I INDUSTRIAL CO., LTD.
head office : Chin-ju Gyeongnam
homepage add : www.e-dongi.com
main products : marine gear box, hyd. steering system, power take off
TEL : +82 55-755-9928

DONGHWA ENTEC
head office : Gangseo Busan
homepage add : www.dh.co.kr
main products : e/r heater & cooler, plate cooler, frash water generator, charged air cooler, lng cargo handling system,
TEL : +82 51-970-1000

DOOSAN ENGINE CO., LTD.
head office : Changwon Gyeongnam
homepage add : www.doosanengine.com
main products : marine diesel engine, diesel power plant
TEL : +82 55-260-6000

DONGNAM MARINE CRANE CO., LTD.
head office : Gimhae Gyeongnam
homepage add : www.dmcrane.co.kr
main products : hose handling crane, hose handling crane, provision crane, engine room crane, offshore crane
TEL : +82 55-720-3001

DAEMMSTOFF INDUSTRIE KOREA LTD.
head office : Saha-Gu, Busan
homepage add : www.daemmstoff.com
main products : KVM Sealing Compound, Mangana Retaining Compound, Durasin Chocking Compound, Panda-90
TEL : +82 51-261-7073

DAEYANG ELECTRIC CO., LTD.
head office :
homepage add : www.daeyang.co.kr
main products : lighting fixture, main switch board, fan, precision instrument,
TEL : +82 51-200-5303

DAE HEUNG COOLER CO., LTD.
head office : Pocheon Giyeonggi
homepage add : www.cooler.co.kr
main products : heat exchanger, gas cooler, oil cooler, air cooler, water chiller
TEL : +82 31-532-9667/9

DONG-A VALVE IND. CO.
head office :
homepage add :
main products : gate valves, globe valves, check valves(swing, dual, single), strainer(basket, y-type)
TEL : +82 51-831-1500

DK TECH CORPORATION
head office :
homepage add : www.dklok.com
main products : Instrumentation Fitting & Valve-Compression Tubing Fitting, Pipe & Weld Fitting, Needle, Check, Ball, Plug
TEL : +82 55-338-0032

DAE HEUNG MARINE CORP. LTD.
head office :
homepage add :
main products : rudder, block, bolster
TEL : +82 55-346-3663

DONGJIN M.P. TECH CO., LTD.
head office :
homepage add : www.epmp.net
main products : parts for marine engine, shaft systems for ship, power generation facility, industrial machines
TEL : +82 55-346-0303

DAECHANG METAL CO., LTD.
head office : Saha-Gu, Busan
homepage add : www.dcm.co.kr
main products : chain wheel, main bearing support, uec center piece, piston crown
TEL : +82 51-264-0831/5

FINETEC CENTURY CORPORATION
head office : Kangnam-Gu, Seoul
homepage add : www.century.co.kr
main products : Air Conditioner, Chilling Unit, Air Conditioning Equipment
TEL : +82 2-2185-7000

GENERAL MARINE BUSINESS INC.
head office :
homepage add : www.gmbmarine.com
main products : ship shore communication sys. emergency shutdown sys. trim/list indicator
TEL : +82 52-254-5215

G.S HIGH TECHER CO., LTD.
head office : Gangseo-Gu, Busan
homepage add : gshightecher.koreasme.com
main products : Air vent heads, Auto air vent heads, Pipe coupling, Expansion joint
TEL : +82 51-832-0456

GS-HYDRO KOREA LTD.
head office : Gangseo-Gu, Busan
homepage add : www.gshydro.com
main products : Hydraulic Pipe, High Pressure Pipe, Steering Gear Hydr. Pipe
TEL : +82 51-266-8221/5

HY-LOK CORPORATION
head office :
homepage add : www.hy-lok.com
main products : HY-Lok Tube Fittings, Bite Type (DIN 2353, JIS b2351) Fittings, 37¡Flared Type(SAE J514) Fittings
TEL : +82 51-9700-800

HANKUK MIBOO CO., LTD.
head office :
homepage add : www.hankookmiboo.co.kr
main products : Spiral Duct, Cold Chamber, Deck Covering
TEL : +82 51-263-3621

HI AIR KOREA Co., Ltd.
head office :
homepage add : www.hiairkorea.co.kr

main products : Air Conditioning System, Refrigeration Plant, Package A/C, Ventilation Fan
TEL : +82 55-340-5000

HAN KOOK FLEXIBLE CO.
head office :
homepage add : www.hkflex.com
main products : Flexible, Expansion Joint, Rubber Compensator
TEL : +82 51-508-6291/3

HANLA LEVEL CO., LTD.
head office :
homepage add : www.hanlalevel.co.kr
main products : Cargo Tank Monitoring Sys. Tank Romote Sounding Sys. High Level Alarm Sys.
TEL : +82 51-605-3000

HALLA INDUSTRIAL CO., LTD.
head office :
homepage add : www.hallaiq.co.kr
main products : Refrigeration Pumps (NH_3 , R22, NHO_3 , CO_2), Volute Pumps, Turbine Pumps
TEL : +82 51-264-2201/5

HANSHIN ELECTRONICS CO., LTD.
head office :
homepage add : www.ehanshin.com
main products : Public Address System (hpa-9600, hpa-9200, hpa-7300), Marine Telephone
TEL : +82 51-412-5551

HAN JO CO., LTD.
head office : Yeongdo Busan
homepage add : www.hanjoms.co.kr
main products : expansion joint. Fuel Injection Pipe. Air Filter
TEL : +82 51-414-7201

HAEAN MACHINERY IND. CO., LTD.
head office :
homepage add : www.haean21.com
main products : Marine Crane, Deck Machinery(Outfitting). Special Equipment
TEL : +82 55-345-2024

HYUNDAI LIFEBOATS CO., LTD.
head office :
homepage add : www.hdboat.com
main products : Life Boat & Rescue Boat
TEL : +82 52-237-4850/4

HYUNDAI MARINE MACHINERY CO., LTD.
head office :
homepage add : www.hmmco.kr
main products : Hyundai-Atias Incinerator. Hyundai-Jowa 15ppm Bilge Separator, Auxiliary Blower, Ventilation Fan
TEL : +82 32-583-0671

HYUNDAI ELEVATOR CO., LTD.
head office :
homepage add : www.hyundaielevator.co.kr
main products : Elevator, Escalator, Auto. Parking System
TEL : +82 31-644-5114

HYUNDAI WELDING CO., LTD.
head office :
homepage add : www.hdweld.co.kr
main products : Covered Electrode ARC Welding Consumables, Sub-Merged ARC Welding Flux & Wire
TEL : +82 2-6230-6010/2

HYUN DAE FITTING CO., LTD.
head office :
homepage add : www.hdfco.co.kr
main products : Flange, Stainless Steel, Duplex Stainless Steel, Forged Carbon Steel
TEL : +82 51-831-0891

HYUN JIN CO., LTD.
head office :
homepage add : www.hyunjinn.co.kr
main products : Control Colsole, Light Signal, Column, Control Panel
TEL : +82 51-263-9841

HYUNJIN MATERIALS CO., LTD.
head office : Gangseo Busan
homepage add : www.hjmco.co.kr
main products : Marine Engine Uses-Camshaft & C/Flange, Connecting Rod, Cross Head
TEL : +82 51-602-7700

HOSEUNG ENTERPRISE CO., LTD.
head office : Gangseo Busan
homepage add : hoseung.koreasme.com
main products : Package Unit for Engine Room, Portable Tank, Ventilator, Cable Box
TEL : +82 51-831-2233/4

HOCHANG MACHINERY INDUSTRIES CO., LTD.
head office :
homepage add : www.hoc21.com
main products : Deck Machinery, Hose Handling Crane, Provision Crane, Cell Guide
TEL : +82 52-255-2000

HAE WON INDUSTRY CO.
head office :
homepage add : haiwon1.koreasme.com
main products : marine diesel engine parts(water seal, inflatable ring, mating ring, compact seal, cr-liner)
TEL : +82 51-831-4600

HODU INDUSTRIAL CO.
head office :
homepage add :
main products : ups & rectifier sys. hull stress monitoring sys. waste compactor
TEL : +82 51-291-9512

I.M.E. CORPORATION
head office :
homepage add : www.promarine21.com
main products : engine valve & seat, all type engine
TEL : +82 55-346-1127

IL SEUNG CO., LTD.
head office : Gimhae Gyeongnam
homepage add : www.ilseung.co.kr
main products : Sewage treatment plant. Biological type, Frash water generator. Plate. tubular type,
TEL : +82 55-345-4114

IL-SUNG IND. CO.
head office :
homepage add :
main products : Hot water calorifier, Silencer(for m/e, g/e, fan), Mist eliminator, Washable air filter
TEL : +82 51-312-4056

JUNG GONG IND. CO., LTD.
head office :
homepage add : www.jung-gong.com
main products : Ordinery window & side scuttle, Heated window, Fire resistant window & side scuttle, Window for passenger ship, Window box, Roller blind
TEL : +82 51-261-2911

JUNG-A MARINE CO., LTD.
head office :
homepage add : www.jung-a.co.kr
main products : Accommodation ladder, Wharf ladder, Window wiper
TEL : +82 51-831-4147

DONGHWA PNEUMATIC TECHNOLOGY CO., LTD.
head office :
homepage add : www.jptec.co.kr
main products : marine reciprocating air compressor, industrial air compressor, screw type air compressor
TEL : +82 51-831-3227

JUNGSAN ENTERPRISE CO., LTD.
head office :
homepage add : www.jungsan.com
main products : Bolt & Nut (Exhaust valve, Cylinder cover, Connecting-rod, Main bearing & etc.)
TEL : +82 52-254-3290

JHK INC.
head office : Gimhae Gyeongnam
homepage add :
main products : Container Fixed Fitting, Car Lashing Equipment
TEL : +82 55-346-2225

JONGHAP MACHINERY CO., LTD.
head office : Yangsan Gyeongnam
homepage add : www.jonghap.biz
main products : sewage treatment plant, welding positioning equipment sys. parts former
TEL : +82 55-383-2300

JS CABLE LTD.
head office : Cheonan Chungnam
homepage add : www.jscable.co.kr
main products : offshore & marine cable, power cable, speciality cable, nuclear cable
TEL : +82 41-559-4800

KANGRIM HEAVY INDUSTRIES CO., LTD.
head office : Changwon Gyeongnam
homepage add : www.kangrim.com
main products : boilers, marine & industrial, inert gas system(i.g.s.), i.g.g. & n2generator
TEL : +82 55-269-7701

KANGRIM INSULATION CO., LTD.
head office : Saha-Gu, Busan
homepage add : www.kangrim.com
main products : lng & lpg carriers tank & pipe cryogenic insulation, lng receiving terminal tank & pipe cryogenic insulation
TEL : +82 51-220-6001

KUNSUL CHEMICAL IND. CO., LTD.
head office : Jin-Gu Busan
homepage add : www.jebi.co.kr
main products : marine & heavy duty, protective coatings
TEL : +82 51-892-4221/7

KYUNG EUN CERAMICS CO., LTD.
head office : Gimhae Gyeongnam
homepage add : www.ke-ceramics.com
main products : ceramic back-up tape
TEL : +82 55-345-7761

KUKDONG ELECTRIC WIRE CO., LTD.
head office : Jincheon Chungbuk
homepage add : www.cablekukdong.co.kr
main products : shipboard cable, lan utp cable, power cable, rubber cable, pvc cable
TEL : +82 43-530-2000/1, +82 2-2140-3061

KUMKANG PRECISION CO., LTD.
head office : Saha-Gu, Busan
homepage add : www.kkmarine.co.kr
main products : marine valve, valve for engine, air reservoir tank
TEL : +82 51-262-4890

KUMOH MACH. & ELEC. CO., LTD.
head office : Gijang Busan
homepage add : www.komeco.net
main products : eng. & t/c tacho system, vibration measuring system, d/g engine control panel
TEL : +82 51-724-5070

KEYSUNG METAL CO., LTD.
head office :
homepage add : www.keysungmetal.com
main products : valves for marine & offshore plant, cryogenic vlaves, strainer
TEL : +82 51-831-3391

K. C. LTD.
head office :
homepage add : www.iccp-mgps.com
main products : I.C.C.P. System, Anti-fouling System(M.G.P.S.), Shaft Earthing Device
TEL : +82 51-831-7720

KSP CO., LTD.
head office :
homepage add : www.kspvalve.com
main products : Engine Valve, Flange
TEL : +82 51-831-6270/7

KTE CO., LTD.
head office :
homepage add : www.kte.co.kr
main products : Marine Switchboard(high, low), Marine Control Console, Alarm Monitoring System, Thruster
TEL : +82 51-265-0255

KOKACO CO., LTD.
head office :
homepage add :
main products : Exhaust Valve & Valve Seat Grinding Machine, Nozzle Lapping Machine
TEL : +82 51-403-4114/6

KONGSBERG MARITIME KOREA LTD.
head office :
homepage add : www.km.kongsberg.com
main products : IAS, DP, K-Chief 500, Auto Chief c20, K-Gauge, K-Bridge, MIP, MBB
TEL : +82 51-749-8600

KEYSTONE VALVE(KOREA) LTD.
head office : Anseong Gyeonggi
homepage add : www.tycovalves.com
main products : Butterfly Valve, Ball Valve, Safe Valve
TEL : +82 31-670-2500

KEON CHANG IND. CO., LTD.
head office :
homepage add : www.keonchang.co.kr
main products : marine equipment, ladle turret, roll stand assy, side trimmer & chopper, bloom c c, screw conveyor, etc.
TEL : +82 51-203-0161

KWANG SAN CO., LTD.
head office :
homepage add : www.kwangsan.com
main products : heating coil, sus spool, air vent head, expansion joint
TEL : +82 51-974-6301

KEUMYONG MACHINERY CO., LTD.
head office : Buk-gu, Daegu
homepage add : www.keumyong.com
main products : exhaust valve complete with valve spindle, axial vibration damper
TEL : +82 53-608-8110/6

KWANG SUNG CO., LTD.
head office :
homepage add : ikwangsung.com
main products : t-girder, panel, stair, handrail, inclined ladder,
TEL : +82 55-338-9973

KUK DONG ELECOM CO., LTD.
head office : Saha-Gu, Busan
homepage add : www.kukdongelecom.com
main products : marine & offshore light fixtures, explosion-proof lights, flood & search lights, mgf packing system
TEL : +82 51-266-0050

KYUNGSUNG INDUSTRY CO., LTD.
head office : Gangseo Busan
homepage add : www.e-clamp.com
main products : clamp, sus corner, anchor strip
TEL : +82 51-831-4960

LS CABLE LTD.
head office :
homepage add : www.lscable.co.kr
main products : marine shipboard & offshore cable, bare conductor wire, (pvc/pe/xlpe/rubber) power & control cable
TEL : +82 2-2189-9114

LEE YOUNG INDUSTRIAL MACHINERY CO., LTD.
head office : Ulju Ulsan
homepage add : www.leeyoung.co.kr
main products : engine casing, corr. bhd, upper deck, built-up longitudinal, chain locker, lashing bridge
TEL : +82 52-231-5800

MIN SUNG CO., LTD.
head office : Sasang Busan
homepage add : www.minth.co.kr
main products : cable tray, hatch, electric cable box
TEL : +82 51-305-8862

Mt.H CONTROL VALVES CO., LTD.
head office :
homepage add : www.mth.co.kr
main products : crankcase relief valve, main starting valve, pneumatic control valve, safety relief valve
TEL : +82 51-974-8800

MSL COMPRESSOR CO., LTD.
head office : Pocheon Giyeonggi
homepage add : www.mslcomp.com
main products : breathing air compressor, h.p air compressor, n2 gas booster
TEL : +82 31-853-7000

MYCOM KOREA CO., LTD.
head office :
homepage add : www.mycomkorea.com
main products : screw compressor unt, reciprocating compressor unit condensing unit, brine chiling unit
TEL : +82 55-294-8678

MYCOM KOREA CO., LTD.
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homepage add : www.mycomkorea.com
main products : screw compressor unt, reciprocating compressor unit, condensing unit, brine chiling unit
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Myung Sung Engineering Co., Ltd.
head office : Mokpo Jeonnam
homepage add :
main products :rudder & rudder stock, rudder horn, stern roller
TEL : +82 61-276-7650

Marine Radio Co., Ltd.
head office :
homepage add : www.mrckorea.com
main products : public address system, auto tel. exchanger sys. communal aerial sys. marine clock system
TEL : +82 51-414-7891

NK CO., LTD.
head office :
homepage add : www.nkcf.com
main products : ballast water system, co2system, deck foam system, dry power system
TEL : +82 51-204-2211/3

ORIENTAL PRECISION & ENGINEERING CO., LTD.
head office :
homepage add : www.opco.co.kr
main products : deck house, funnel & engine room casing, life boat davit, engine room crane
TEL : +82 51-202-0101

OSCG CO., LTD.
head office : Sasang Busan
homepage add : www.oscg.net
main products : cable gland(eexd & e), adapter / reducer, flexible connectors
TEL : +82 51-305-3910

PANASIA CO., LTD.
head office : Gangseo Busan
homepage add : www.pan-asia.co.kr
main products : cargo monitoring sys. tank level gauge sys. high & overfill alarm sys.
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SARACOM CO., LTD.
head office : Yeongdo Busan
homepage add : www.saracom.net
main products : gmdss, ship sound signal appliances, navigation equipment, fire detection system
TEL : +82 51-600-9000

SAMGONG Co., Ltd
head office :
homepage add : www.sam-gong.co.kr
main products : oil purifiers, ships accommodation ladders, ships windows
TEL : +82 51-200-3040/1

SAMYOUNG MACHINERY CO., LTD.
head office : Daedeok Daegeon
homepage add : www.sym.co.kr
main products : cylinder head, cylinder liner, piston
TEL : +82 42-625-4064

SAMYUNG ENC CO., LTD.
head office :
homepage add : www.samyungenc.com
main products : ais(si-30)-auto. identification sys. dsc vhf radio telephone(str 6000a)-gmdss equipment
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SUH HAN INDUSTRY CO., LTD.
head office :
homepage add : www.suhhani.co.kr
main products : cable tray others-steel, galvanized steel, stainless steel, aluminium
TEL : +82 51-204-1920

SMS CO., LTD.
head office : Saha Gu Busan
homepage add : www.sms-marinesystem.com
main products : hatch-pontoon type, folding type, side rolling type, etc. lashing equipment-2/3tier
TEL : +82 51-290-1000

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head office :
homepage add : www.sunboind.co.kr
main products : tank top unit, engine room unit, package unit
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main products : pipe fittings-butt. welding / socket welding / thread type/ flange
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head office :
homepage add : www.sung-mi.co.kr
main products : fire retarding doors, fire retarding wall, ceiling panel
TEL : +82 55-329-1117

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head office :
homepage add : sungsin.koreasme.com
main products : hatch coaming, t-bhk block, fore mast & port, water separator
TEL : +82 54-776-6441

SUNG IL CO., LTD. (SIM)
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main products : satellite tv sets-satellite communication equipments, draft buoy(1m, 1.6m, 2.4m discus buoy)-ocean information technology division
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homepage add : www.samgong.com
main products : inflatable rubber products
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homepage add : www.sy-ind.com
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main products : Wall Panel, Ceiling Panel, Unit Toilet, Cabin Door, Furniture,
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main products : piston, piston liner, piston skirt
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TK CORPORATION
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main products : Elbow, Reducer, Tee, Cap
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