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2017. 6

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월간 KORSHIP 발행

2016년 개정판

조선 & 해양 총람

Offshore & Shipbuilding Guide

조선&해양 총람 '2016년 개정판' 발행

월간 KORSHIP은 지난 2013년 조선해양 관련업계의 관심과 협조에 힘입어 국내 처음으로 '조선&해양 기업총람(Offshore & Shipbuilding Guide)'을 제작해 발행했습니다.

이번에 월간 KORSHIP은 국내 조선업계의 요구에 따라 '2016년 개정판'을 새롭게 발행하게 되었습니다. 2016년 개정판은 기존 2013년 총람 (1,008개 업체)에 비해 50% 이상 업체가 추가되어 총 1,600여 곳의 조선&해양 업체 정보가 수록되어 있습니다.

발 행 사: 프로콘 (Procon) / 월간 KORSHIP
발 행 일: 2016년 7월 20일
연 락 처: (02) 2168-8896~8899
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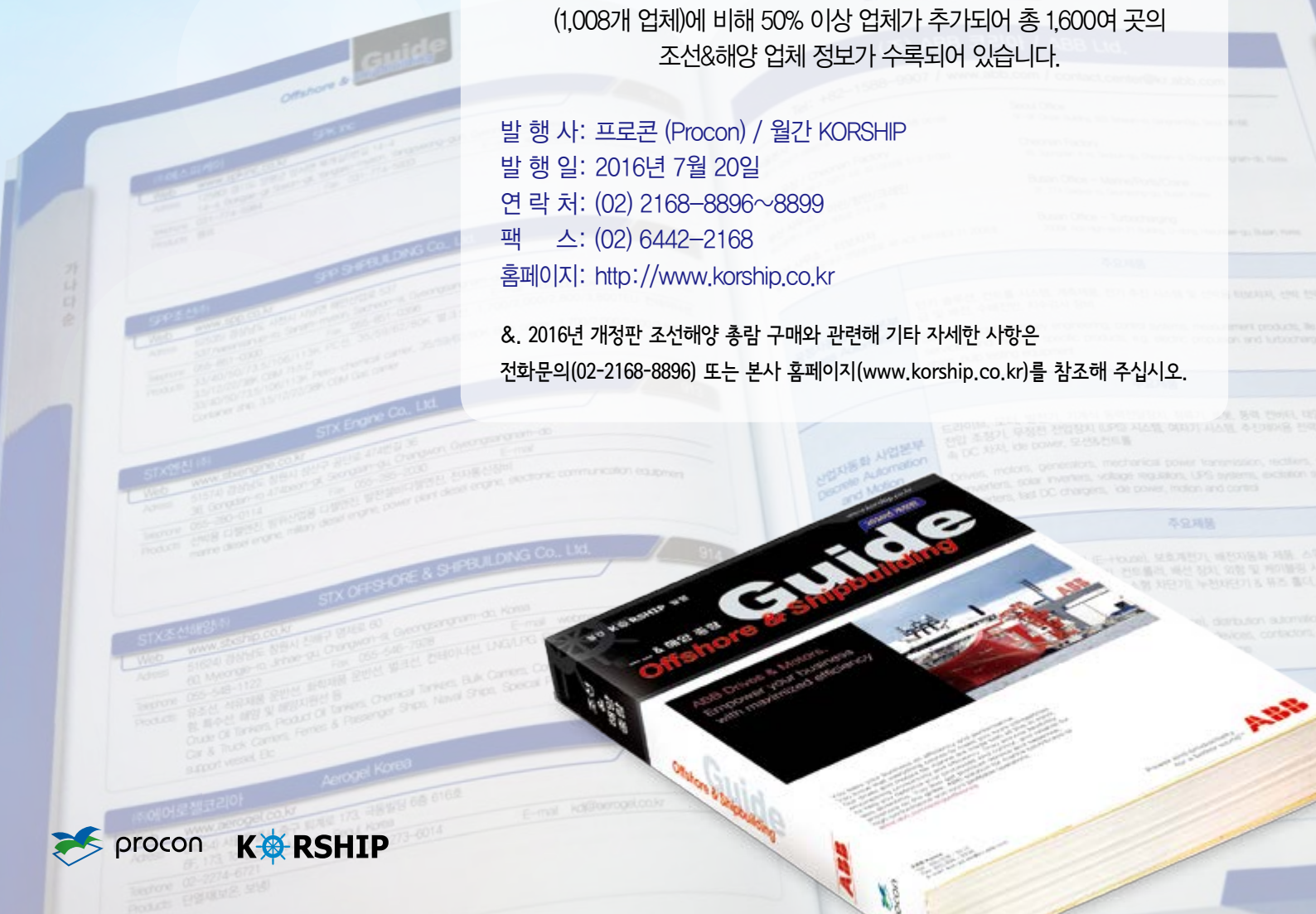
&. 2016년 개정판 조선해양 총람 구매와 관련해 기타 자세한 사항은 전화문의(02-2168-8896) 또는 본사 홈페이지(www.korship.co.kr)를 참조해 주십시오.



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생활에 에너지를 전해주는 넥상스

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석유와 가스를 시추하는 해양구조물도 품질과 성능을 보장하는 케이블에서 시작합니다.

더 멀리, 더 깊은 곳에 설치되는 해양구조물에 필요한 것은 안전과 성능입니다. 극동전선이 공급하는 해양용 전선은 화재에 안전하고 극저온에서도 작동가능 할뿐만 아니라, 프로젝트가 요구하는 특성을 만족하는 맞춤형 전선을 제공하여 고객의 가치창출에 기여합니다.

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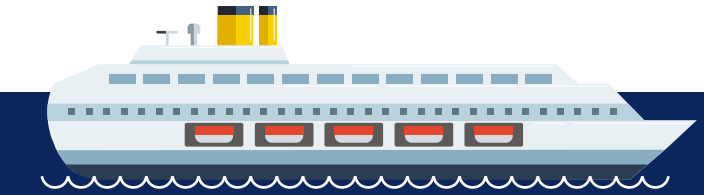
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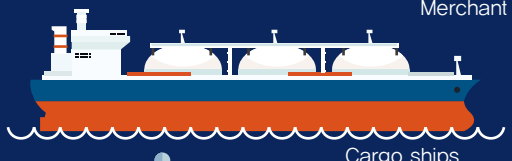
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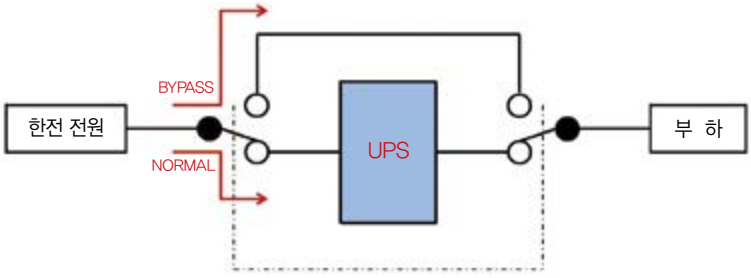
◈UPS 구성 예시



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- 오동작 가능성 높음

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- 긴급 상황시 비인가자도 전환 가능
- 기계적 인터록 구성으로 오동작 가능성 없음

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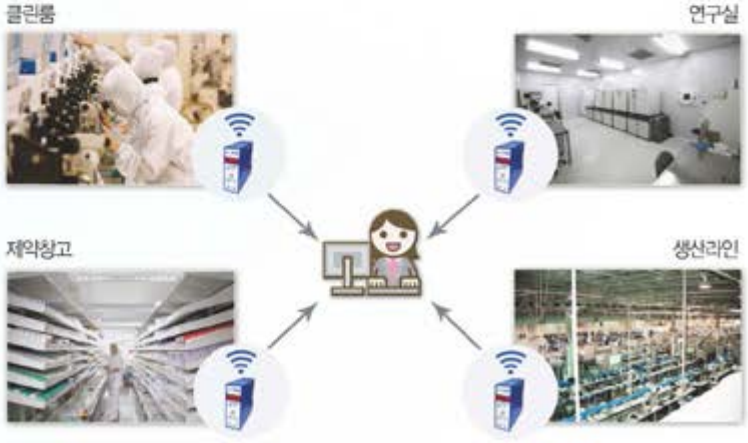

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제품들끼리는 **무선연동**이 가능.

TC 13가지 RTD 11가지 그 외 4가지
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정밀한 세부설정까지 사용자 편의 위주의
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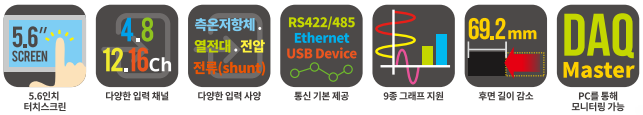

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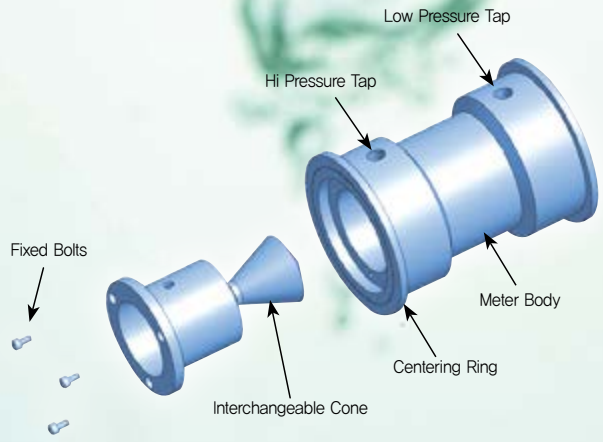
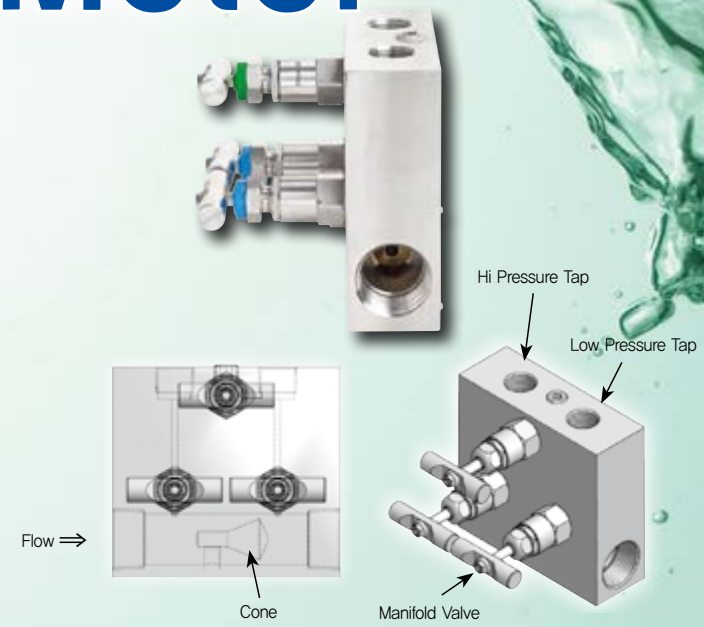
Cone Meter





HFV-WM (Wafer type Cone Meter) **IVCM** (Integral Valve Cone Meter)

DP HiCone Meter

DP HiCone Meter는 일반적인 차압유량계의 일종이며 차압유량계와 같은 물리적 원리에 따라 유량을 측정합니다. 조임부 역할을 하는 Cone은 Meter body 중앙에 위치하여 유체의 흐름에 따라 유속을 증가시키고 차압을 발생시킵니다. 두 개의 검출 Tap은 High 와 Low pressure를 DP 전송기로 보내 유량을 지시합니다.

70 % 전단 3D 후단 1D의 짧은 직관부를 가짐에 따라 플랜트 건설에 최대 70 %까지 원가를 절감하는 효과를 가집니다. (미국 CEESI에서 API 22.2 TESTING)

±8 % Cone Meter는 제조공정상의 사소하게 보이는 차이에도 교정하지 않으면 최대 ±8 % 의 오차가 발생할 수 있습니다. 정확도 ±0.5~1 % 수준의 정밀한 유량측정을 위해서는 반드시 교정을 해야 합니다. (미국 CEESI에서 발표한 내용중)

하이트롤에서 생산되는 Cone Meter는 **ISO 17025 국제공인 교정시스템**에 의해 교정하며 ±0.5 %의 정확도를 가집니다.

HFV-WM

HFV-WM은 Meter body의 교체 없이 Cone을 교체하여 유량 범위를 변경할 수 있으며, 과도한 유속 또는 슬러그 뭉치의 충격으로 인한 Cone의 변형에 쉽게 교체 사용할 수 있는 특징을 가지고 있다. 또한, Wafer형태로 설치가 용이하고 모든 구성품이 정밀 기계가공되어 측정정확도가 우수하며, 용접부가 없어 압력부의 건전성이 확보 되었다.

(특 허 : 제 10-0915088호)

IVCM

IVCM은 차압식 유량계의 필연적 구성품인Manifold Valve를 Meter body와 일체형으로 제작하여 공정시 발생할수 있는 연결부의Leak를 최소화 하고, 설치시 공사 비용 및 시간을 줄이는 장점을 가진다.

(특 허 : 제 10-0915089호)

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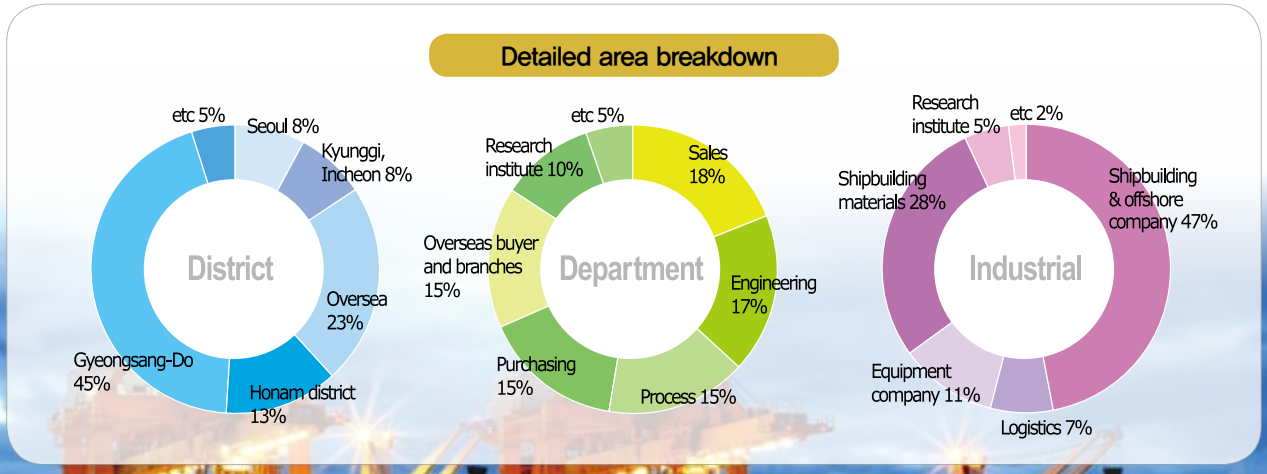

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HHI teams up with Bahri to develop smart ship technology

Hyundai Heavy Industries (HHI) announced on May 7 that it signed a memorandum of understanding (MOU) on establishing a partnership in the smart ship sector with the National Shipping Company of Saudi Arabia (Bahri). The signing ceremony of the MOU was attended by Chung Ki-sun, Executive Vice President of Corporate Planning Office of HHI, An Kwang-hean, CEO of Hyundai Global Service, and Ali Al Harbi, CEO of Bahri.

Under the MOU, the two companies will jointly develop smart ship solutions and apply them to ships operated by Bahri that currently operates 37 VLCC.

Smart ship technology is a system that helps ships' efficient operation by using information and communication technology (ICT) and big data. HHI developed the smart ship technology in 2011 for the first time in the world and has applied the system to about 300 ships it delivered so far.

Hyundai Global Service that was split from HHI in December last year will take the lead in developing the technology that will allow ship owners remotely monitor and control a ship's machinery status including engines and generators, and informs repair status and period in advance.

At the MOU signing ceremony, Chung Ki-sun, Executive Vice President of Corporate Planning Office of HHI is shaking hands with Ali Al Harbi, CEO of Bahri.

Chung Ki-sun said, "The MOU is significant in that HHI and Bahri, leaders in the global shipbuilding and shipping sector, are teamed up with in preparation of Fourth Industrial Revolution era. We will exert our efforts to lead our respective markets by creating synergy of our shipbuilding expertise and Bahri's fleet management know-how."

HHI and Bahri have long been close business partners. Bahri has order a total of 34 ships to HHI Group so far and the two companies are currently closely cooperating in developing King Salman Global Maritime Industries Complex in Saudi Arabia.

현대중공업, 사우디 국영 바흐리와 스마트십 사업 협력

현대중공업이 세계적 해운사인 사우디 바흐리(Bahri)와 손잡고 스마트십 사업 협력을 통한 4차 산업혁명 시대 대응에 나선다. 이를 위해 지난 5월 7일 사우디 현지에서 양사는 스마트십 부문 협력관계 구축을 주 내용으로 하는 MOU를 체결했다. 이날 체결식에는 현대중공업 정기선 전무(그룹선박해양영업본부 부문장)와 현대글로벌서비스 안광헌 대표이사, 바흐리의 알리 알하르비(Ali Alharbi) CEO 등이 참석했다.

양사는 이번 MOU 체결을 통해 스마트십을 공동 개발하는 한편 바흐리 보유 선박에 이 기술을 적용해 나가기로 했다. 바흐리는 사우디 국영 해운사로, 전 세계에서 가장 많은 37척의 VLCC를 보유하고 있다.

스마트십은 정보통신 기술(ICT)과 빅데이터를 활용해 선박의 효율적인 운항을 돕는 시스템으로, 지난 2011년 현대중공업이 세계 최초로 개발했다. 이 시스템은 4차 산업혁명 시대 대표적인 기술의 하나로 꼽히고 있어 업계의 주목을 받고 있다.

스마트십은 연비나 배출가스 등을 고려해 최적의 운항 상태를 유지하며, 각종 기자재에 대한 이상여부를 진단해 유지보수 비용을 감소시킬 수 있다. 지금까지 300여척의 선박에 스마트십 시스템을 탑재했다.

특히 국제해사기구(IMO)가 2019년부터 선박운항 관리체계를 디지털로 전환하는 '이내비게이션(e-Navigation)'을 도입하기로 하면서, 스마트십 수요는 더욱 증가할 것으로 기대되고 있다.

스마트십 공동개발은 지난해 12월 현대중공업에서 분할된 현대글로벌서비스가 주축이 돼 진행된다. 현대글로벌서비스는 선박시스템부터 엔진, 각종 전장품까지 선박 일체에 대한 서비스를 제공하는 회사로, 바흐리와 함께 엔진과 발전기 등 선박의 기관 상태를 원격 모니터링 및 제어할 뿐만 아니라 정비시점까지 선제적으로 알려주는 기술을 개발할 예정이다.

현대중공업 정기선 전무는 "이번 협력관계 구축은 조선과 해운 분야에서 각각 업계를 선도하고 있는 양사가 4차 산업혁명을 함께 준비한다는 의미가 있다"며, "현대중공업이 보유한 기술력과 바흐리의 선대 운영 노하우를 접목, 제조업과 ICT 기술을 융합한 새로운 시장을 이끌어 가겠다"고 말했다.

한편 바흐리는 지난 2015년 현대삼호중공업에 VLCC 10척을 포함해 지금까지 총 34척의 선박을 현대중공업그룹에 발주했으며, 사우디 국영 석유회사인 아람코와 추진 중인 사우디 합작 조선소 프로젝트도 함께 진행하는 등 현대중공업과 긴밀한 관계를 유지하고 있다.

DSME sees its operating profit for Q1 2017 turning into surplus in 5 years

Daewoo Shipbuilding & Marine Engineering (DSME) announced on April 27 that its operating profit for Q1 2017 turned into surplus in 17 quarters after the fourth quarter of 2017 based on prior period adjustment in its report on estimated consolidated business results.

According to the report, DSME registered KRW 2 trillion 784 billion in sales, KRW 291.8 billion in operating profit, and KRW

261.3 billion in current net income in the first quarter of 2017, showing that sales decreased by about 20.1% year-on-year while both operating profit and current net income turned into surplus.

DSME explained that the surplus was accomplished by thoroughly securing the change orders for some offshore projects ready for imminent delivery while uncertainties over offshore plants were mostly reflected in previous year's performance results. In addition, DSME indicated that surplus was the results of strict compliance with budget for high value-added vessels such as LNG carriers, ultra-large containerships, etc., in commercial vessel segment, improvement of productivity, timely deliveries and cost competitiveness built on self-rescue plan which it has vigorously pressed ahead thus far.

An official from DSME said, "We anticipate constant upturn in profitability with full-fledged production of LNG carrier which represents one of the most lucrative sectors from the second quarter. More than 30 LNG carriers will be delivered between this year and next year, which signifies a turn-around in profitability."

대우조선해양, 2017년 1분기 5년만에 영업이익 흑자전환

대우조선해양은 연결기준 잠정실적 공시를 통해 2017년 1분기 영업이익이 2012년 4분기 이후 전 기손익수정 반영기준으로 17분기 만에 흑자전환 했다고 지난 4월 27일 발표했다.

이날 발표한 대우조선해양의 2017년 1분기 매출액은 2조 7,840억원, 영업이익 2,918억원, 당기순이익은 2,613억원이다. 전년동기 대비 매출은 약 20.1% 감소했고, 영업이익과 당기순이익은 흑자전환했다.

대우조선해양 측은 해양플랜트에 대한 불확실성은 지난해 대부분 반영됐고, 일부 인도 임박한 해양프로젝트에 대해서는 체인지오더를 철저하게 확보해 흑자달성에 도움이 됐다고 밝혔다. 또 상선분야에서도 LNG운반선, 초대형컨테이너선 등 고부가가치 선박들의 철저한 예산준수, 생산성향상, 적기인도 등에 따른 이익확보와 그동안 지속적으로 추진해온 자구계획에 바탕한 원가경쟁력에 힘입은 것이라고 밝혔다.

대우조선해양 관계자는 "2분기 이후에도 수익성이 가장 좋은 선박 중 하나인 LNG운반선의 생산이 본격화됨에 따라 수익성이 지속적으로 개선될 것"이라며, "올해 및 내년에 모두 30척 이상의 LNG운반선이 인도될 예정으로 수익성 개선의 좋은 신호다"라고 말했다.

KR authorized as verification body for EU MRV

Korean Register (KR) has announced on May 10 that it is now authorized by Germany's National Accreditation Body (DAkks) to act as a verification body for EU MRV (Monitoring, Reporting, Verification).

EU MRV refers to regulation (EU) 2015/757 and covers the monitoring, reporting and verification of carbon dioxide (CO_2) emissions from ships above 5,000 gross tonnage that are calling at any EU or EEA (Norway/Iceland) port.

The regulation requires shipping companies to submit their monitoring plan including the ships' monitoring and reporting procedures to the accredited verifier - which could be KR - by 31 August 2017. In addition, from 1 January 2018, in accordance with the approved monitoring plan, shipping companies will need to collect their ships' details annually, and submit the verified emission report to European Commission by 30 April of each year from 2019.

After submitting the verified emission report, the ships will need to carry on board a valid document of compliance issued by the accredited verifier by 30 June of the year, following the end of a reporting period. By gaining this accreditation, KR can now provide prompt and effective services covering the assessment of the monitoring plan, the verification of the emission report and the issuance of document of compliance to the shipping companies.

Furthermore, KR's EU MRV services can be delivered to any ship anywhere in the world regardless of its flag or class.

Lee Jeong-kie, Chairman and CEO of KR commented "We are proud to have obtained this accreditation from DAkkS without any non-conformities, even though it was the first accreditation audit we have undertaken. The authorization was successfully gained thanks to our close collaboration with Hyundai Merchant Marine (HMM). Working together, we have successfully met the criteria and look forward to providing this service to our customers."

"This latest accreditation clearly demonstrates KR's technical expertise. This together with our extensive survey experience will ensure that we continue to provide fair and prompt services to our clients, helping them to meet the requirements of the increasingly strict environmental regulations around the world."

KR's successful accreditation is attributed to its experience and significant capability gained through more than 700 GHG (greenhouse gas) verification projects including ISO 14064, and the analysis of environmental performance of ships for the Clean Cargo Working Group (CCWG) and CSI (Clean Shipping Index).

With its global network, KR is ready to provide the full range of statutory EU MRV services to shipping companies anywhere in the world, quickly and cost-effectively.

한국선급, 국내 기관 최초로 EU MRV 검증기관 지정

한국선급(KR)이 독일인정기구(DAkkS)로부터 선박 이산화탄소 배출량 모니터링, 보고 및 인증에 관한 규칙인 EU MRV(Monitoring, Reporting, Verification) 검증기관으로 인정받았다고 지난 5월 10일 밝혔다.

EU는 2015년 4월 EU MRV를 채택하고 2018년 1월부터 EU 항만(노르웨이 및 아이슬란드 포함)에 출도착하는 5,000GT를 초과하는 모든 선박의 이산화탄소 배출량에 대한 모니터링 및 보고, 검증함으로서 해운분야 온실가스 감축에 박차를 가하고 있다.

이로서 EU MRV의 영향을 받는 선박을 보유한 전 세계 해운회사는 오는 8월 31일까지 선박의 모니터링 및 보고 절차 등이 포함된 모니터링 계획서를 작성하고 한국선급과 같은 검증기관에 제출하여 검증을 받아야만 한다.

이후, 해운회사는 2018년 1월 1일부터는 승인받은 모니터링 계획서에 따라 매년 선박의 정보를 수집하여 2019년 4월 30일까지 이산화탄소 배출량 보고서를 작성하고 검증기관의 검증을 받아 유럽연합 집행위원회(European Commission)에 보고해야 한다. 제출된 보고서에 대해 유럽연합 집행위원회의 검증이 끝나면 검증기관이 발행한 적합확인서(Document of Compliance)를 매년 6월 30일부터 선박에 비치해야 한다.

한국선급이 EU 공식 검증 기관으로 지정됨에 따라 국내 해운업계는 EU MRV 관련 각종 필요사항, 기술서비스 및 최신 관련 정보를 국내에서 신속하고 편리하게 제공받게 되어 업계경쟁력 강화에 도움이 될 것으로 보인다. 또한 한국선급이 여러 EU 국가 중 독일인정기구의 인정을 받음으로써 브렉시트로 검증기관 자격 유지 여부가 불투명한 여타 검증기관 보다 안정적인 서비스를 제공할 수 있게 되었다.

한국선급 관계자는 "최초 인정심사에도 불구하고 이례적으로 부적합사항이 단 한건도 발생하지 않고 인증서를 획득한 것은 한국선급의 글로벌 기술 경쟁력을 입증한 것"이라고 밝히며, "특히 금번 검증기관 인정은 현대상선과의 긴밀한 협력을 통해 실제 검증 역량에 대한 우수성을 전 세계 해사업계를 주도하는 EU에 입증한 결과로서 양사의 협업이 국내 해사업계의 산업경쟁력을 강화에 기여하여 그 의미가 더욱 크다"고 말했다.

한국선급은 EU MRV를 비롯하여 ISO 14064에 따른 온실가스와 선박과 관련한 친환경 검증기관으로 약 700여건의 검증 서비스를 국내외 관련업계에 제공하는 등 환경 규제와 관련된 다수의 경험과 세계적 역량을 보유하고 있다.

HHI posts five consecutive quarterly profits of 618.7 billion won

Hyundai Heavy Industries (HHI) issued a public disclosure of its 1Q 2017 consolidated earnings on April 27.

According to a regulatory filing, during the January-March period HHI racked up 10.0756 trillion won in consolidated sales while consolidated operating income stood at 618.7 billion won, 90.3% up from last year's comparable period, posting profits for five straight quarters.

Remarks	1Q 2017	4Q 2016	Change	1Q 2016
Sales	10.0756 trillion won	10.3427 trillion won	–2.5%	10.2728 trillion won
Operating Profits	618.7 billion won	437.7 billion won	41.4%	325.2 billion won
Net Profits	462.3 billion won	–314.5 billion won	Returned to Profit	244.5 billion won

HHI mainly attributes the whooping quarterly operating profit increase to 127.1 billion won operating profits from HHI's Shipbuilding Division which is 251% up from the first three months last year. The strong earnings of shipbuilding business were attributable to an increased building volume of high value-added ships that HHI has competitive edge on, stabilization of manufacturing processes, and cost reduction efforts. Offshore & Engineering Division and Engine & Machinery Division post 94 billion won of profits thanks to an optimized operation of HHI's Offshore Yard and material cost cut efforts for engine parts while Electro & Electric Systems, Construction Equipment and Robotics Division reported 107.6 billion won of profits with continued efforts to reduce material costs.

Hyundai Oilbank and other affiliates also played a role in reporting strong earnings with 350 billion won income even with a drop in refining margins and sales.

An HHI official said, "We have been active in improving profitability and fiscal health with preemptive and comprehensive restructuring measures since 2014. With five consecutive quarterly profits, we will redouble our efforts to continue to report stable profits with technology and quality-oriented management."

Meanwhile, HHI Group netted 39 ships worth $2.3 billion in the first four months this year, which is its largest ship orders for the comparable period in three years.

Despite a dearth of new orders in the global shipbuilding market, HHI Group was capable of winning the huge orders on the back of its competitive edge on eco-friendly shipbuilding capabilities and healthier fiscal soundness over its competitors.

현대중공업, 5분기 연속 흑자 달성

현대중공업은 지난 4월 27일 공시를 통해 2017년 1/4분기 연결기준 매출 10조756억원, 영업이익 6,187억원, 당기순이익 4,623억원을 기록했다고 밝혔다. 전 분기 대비 매출은 다소 감소했으나, 영업이익이 눈에 띄게 개선되어 전 분기 대비 41.4%, 전년 동기 대비 90.3% 증가했다.

조선 · 해양플랜트 · 엔진기계 사업부문이 2,200억여원의 영업이익을 올리며 실적 안정세에 크게 기여했다. 또, 전기전자시스템, 건설장비, 로봇, 정유도 모두 흑자를 기록하며 견고한 성장세를 이어갔다.

부문별로 살펴보면, 조선부문은 건조 물량 감소로

매출이 다소 줄었으나 영업이익은 전 분기 대비 251% 증가한 1,271억원을 달성했다. 이는 기술경쟁력을 갖춘 고부가가치 선박(가스선 등)의 건조 비중 증가, 공정 안정화 및 원가 절감 노력 등이 주된 원인이다. 해양플랜트 및 엔진기계 부문 또한 해양 야드 효율화, 엔진 자재비 절감 등으로 영업이익 940억원을 기록했다.

전기전자시스템, 건설장비, 로봇 등도 원가 경쟁력 강화와 인력효율화 작업 등을 통해 1,076억원의 흑자를 기록했다. 이 3개의 사업부문은 지난 4월 1일 각각 현대일렉트릭앤에너지시스템, 현대건설기계, 현대로보틱스로 분사해 제 2의 도약을 위한 첫 발을 내디뎠다. 분할법인은 각 사업 분야에서 글로벌 톱5 진입을 목표로 경쟁력 극대화에 박차를 가할 계획이다. 이외 현대오일뱅크 등 기타 계열사는 판매량 감소 및 정제마진 축소에도 불구하고 약 3,500억원의 영업이익을 실현했다.

현대중공업 관계자는 "2014년부터 자산 매각, 경영합리화 및 사업분할 등 선제적인 경영개선 계획 실시로 안정적인 수익성과 재무건전성을 확보하는데 노력을 기울여 왔다"며 "앞선 노력들이 5분기 연속 흑자로 이어진 만큼, 지속적인 경영합리화와 기술 · 품질 중심의 경영으로 수익을 안정적으로 확보하는데 최선을 다하겠다"고 밝혔다.

현대중공업은 최근 수주실적에서도 회복세를 보이며 미래 실적 전망을 밝게 하고 있다. 1월부터 4월까지 4개월 누적 실적으로는 3년만의 최대치인 총 39척, 23억 달러를 수주했다. 4월 한 달 실적은 18척, 9억 달러로 추가 5척의 수주도 기대되는 상황이다. 특히 안정적인 재무건전성과 기술력을 바탕으로 시장가 대비 높은 수준의 선가로 계약을 체결함으로써, 향후 수익이 더욱 안정화될 것이라는 기대를 모으고 있다.

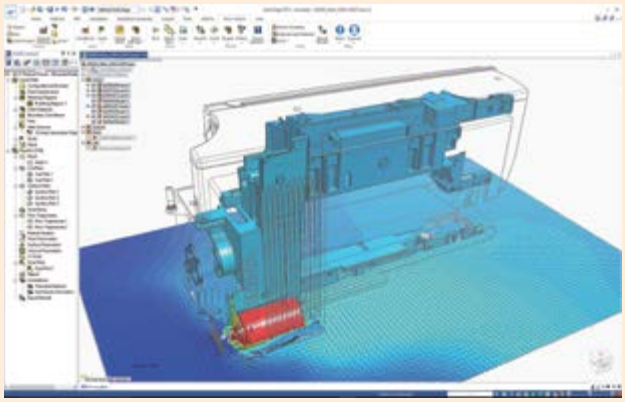
Solid Edge ST10 offers robust enhancements for design, simulation and collaboration

The latest release of Siemens' Solid Edge® software (Solid Edge ST10) brings every aspect of product development to the next level with new design technology, enhanced fluid flow and heat transfer analysis and cloud-based collaboration tools. Improved publishing tools enable the creation of interactive technical documents and the ability to share designs in the cloud.

Solid Edge ST10 now makes it much easier to optimize parts for additive manufacturing (AM) and obtain quotes, material selection and delivery schedules from AM service providers. Newly integrated topology optimization technology, combined with Siemens' exclusive Convergent Modeling™ technology, enables designers to dramatically improve product design efficiency and streamlines the ability to work with imported geometry.

"We import many 3D models for components like lamps and cushions in a faceted format," said Ricardo Espinosa, R&D Engineering Manager at Kimball International. "The new Convergent Modeling technology that underlies Solid Edge ST10 will enable us to work faster and more flexibly with this data."

Expanding beyond traditional CAD capabilities, Solid Edge ST10 now offers a complete portfolio of tools to improve product development and design. New topology optimization technology, a subset of automated generative design, quickly optimizes the strength to weight ratio of individual part designs. Convergent Modeling greatly simplifies the ability to work with geometry consisting of a combination of facets, surfaces, and solids – such as those created by importing third-party CAD files or through topology optimization. New simulation capabilities such as fully-integrated fluid flow analysis eliminate the need to transfer data between different applications, giving designers the ability to achieve accurate and fast fluid flow and heat transfer analysis directly in Solid Edge.



Enhancements to integrated computer-aided manufacturing (CAM) enables efficient programming of CNC machine tools, and the ability to define complex sheet metal components, optimized for manufacturing. New additive manufacturing tools enable users to 3D print parts in house or access a network of additive manufacturing services, optimizing material selection and delivery.

Solid Edge ST10 also includes enriched publication features to quickly create detailed illustrations of designs. Publishing interactive digital documents can help communicate the correct manufacturing process and maintenance procedures for products. These documents are associative to the original design information, enabling rapid updates to the documentation when the design changes.

New enhancements to built-in Solid Edge data management and improved integration with Siemens' Teamcenter® software delivers scalable product data management to help companies of all sizes become digital enterprises. Component classification and off-line working are now supported for Solid Edge using the embedded Teamcenter integration.

지멘스 PLM 소프트웨어, 설계와 시뮬레이션 및 협업 기능을 강화한 솔리드 엣지 ST10 출시

지멘스 PLM 소프트웨어는 3D CAD 솔루션인 솔리드 엣지(Solid Edge) ST10을 출시한다고 밝혔다. 솔리드 엣지 소프트웨어의 최신 버전인 솔리드 엣지 ST10은 새로운 설계 기술과 향상된 유체 흐름(fluid flow), 열 전달 해석(heat transfer analysis) 및 클라우드 기반 협업 툴을 통해 제품 개발의 모든 측면을 한 차원 높여준다. 향상된 퍼블리싱 툴을 이용해 대화형으로 문서 생성이 가능하고 클라우드에서 설계를 공유할 수 있다.

솔리드 엣지 ST10은 적층 제조(additive manufacturing)용 부품들을 보다 쉽게 최적화하고, 적층 제조 서비스 제공 업체로부터 편리하게 견적, 재료 선정 및 납품 일정을 얻을 수 있다. 설계자는 지멘스 고유의 컨버전트 모델링(Convergent Modeling™) 기술과 새롭게 통합된 토폴로지 최적화(topology optimization) 기술을 통해, 제품 설계 효율성을 획기적으로 향상시킬 수 있다. 외부에서 가져오기한 지오메트리 작업도 단순화할 수 있게 되었다.

킴볼 인터내셔널(Kimball International)의 R&D 엔지니어링 매니저 리카르도 에스피노사(Ricardo Espinosa)는 "우리는 램프 및 쿠션과 같은 부품들의 많은 3D 모델들을 다양한 포멧으로 불러온다. 솔리드 엣지 ST10의 근간을 이루는 새로운 컨버전트 모델링 기술을 통해 이 데이터들을 더욱 빠르고 유연하게 처리할 수 있을 것으로 기대한다"고 말했다.

솔리드 엣지 ST10은 전통적인 CAD 기능의 한계를 뛰어 넘어, 제품 개발 및 설계 기능을 향상시켜 주는 완벽한 툴을 제공한다. 자동화된 제너레이티브 설계(generative design)에 포함된 토폴로지 최적화 기술은 개별 부품 설계의 강도 대 중량 비율을 신속하게 최적화한다. 컨버전트 모델링은 패싯(facets), 곡면(surfaces), 솔리드(solids) 조합으로 구성된 지오메트리 또는 타사 CAD 파일에서 가져오기하거나, 토폴로지 최적화를 통해 생성된 지오메트리에 대한 작업을 간소화해 준다. 또한 솔리드 엣지 ST10은 유체 흐름 해석(fluid flow analysis)과 같은 새로운 시뮬레이션 기능을 완전히 통합했다. 이를 통해 설계자는 서로 다른 애플리케이션 간에 데이터를 전송할 필요 없이, 솔리드 엣지에서 정확하고 신속한 유체 흐름 및 열 전달 해석을 직접 수행할 수 있다.

또한 CAM(Computer-Aided Manufacturing) 통합 기능을 강화해 CNC 공작 기계를 효율적으로 프로그래밍 할 수 있으며, 제조 공정에 최적화된 복잡한 판금 부품을 정의할 수 있다. 사용자는 새로운 적층 제조 툴을 통해 자체적으로 부품을 3D 프린팅 하거나, 적층 제조 서비스 네트워크에 액세스해서 재료 선택 및 공급을 최적화할 수 있다.

솔리드 엣지 ST10는 풍부한 퍼블리싱 기능으로 섬세한 설계 일러스트레이션을 신속하게 생성할 수 있도록 했다. 대화형 디지털 문서 퍼블리싱 기능은 제품의 올바른 제조 및 유지 보수 절차에 대한 커뮤니케이션에 유용하다. 이 문서는 설계 정보의 원본과 연결되어 있어 설계가 변경될 시 해당 문서를 신속하게 업데이트할 수 있다. 탑재된 솔리드 엣지 데이터 관리 기능 및 지멘스의 팀센터(Teamcenter) 소프트웨어와의 통합 기능을 더욱 강화해, 유연한 데이터 관리가 가능하다. 이로써 기업 규모에 상관없이 모든 기업들의 디지털화를 돕는다. 내장된 팀센터와의 통합 기능을 기반으로 솔리드 엣지에서 부품 분류 및 오프라인 작업이 지원된다.

Marine Finance Center strengthens profitability assessment of vessel and offshore plant contracts

Marine Finance Center announced that it would lower the threshold of contract price subject to feasibility assessment from current USD 500 million to USD 300 million in connection with issuance of refund guarantee (RG) in offshore plant segment.

This measure is expected to help preclude low price contract-induced insolvency of shipyards and improve fiscal health of public financial institutions. Marine Finance Center will adopt the contract price suitability assessment system for ordinary commercial vessels such as containership, LNG carrier, etc., and issue the refund guarantee (RG) for contracts with potential profitability.

Ordinary commercial vessels which usually did not exceed USD 300 million apiece were not subject to feasibility assessment. As the decline in new orders remains persistent, even commercial vessel segment has seen controversies swirling over low price contract and excessive competition.

An official from Marine Finance Center said, "We mapped out this measure to strengthen profitability review for offshore plant and ordinary commercial vessel segments as part of efforts to prevent low price contracts and improve the soundness of loans in public financial institutions. I anticipate that this measure will help underpin fair competition of domestic companies and strengthen export competitiveness over the long-term."

해양금융종합센터, 선박 및 해양플랜트 수주 지원시 수익성 검토 강화

해양금융종합센터는 해양플랜트사업에 대한 이행성보증 발급시 사업성평가 의무화 대상을 기존 척당 5억 달러 이상에서 3억 달러 이상으로 확대한다고 밝혔다. 이에 따라 저가수주에 따른 조선사 부실 발생을 선제적으로 차단하고, 정책금융기관의 여신 건전성도 제고될 전망이다.

해양금융종합센터는 컨테이너선, LNG선 등 일반상선에 대한 '수주가격 적정성 평가제도'를 도입해 수익성이 있다고 판단될 경우에 한해 선수금환급보증(RG)을 발급할 방침이다. 일반상선은 통상 계약금액이 척당 3억달러를 넘지 않아 기존 사업성평가의 대상이 아니었으나, 조선업계의 수주 부진이 장기화되면서 일반상선 부문에서도 저가수주 및 과당경쟁 논란이 발생되고 있는 상황이다.

해양금융종합센터 관계자는 "이번 해양플랜트 부문과 일반상선에 대한 수익성 검토 강화 방안을 마련한 것은 저가수주 방지와 정책금융기관의 여신건전성 제고를 위한 것"이라며, "이번 방안이 향후 국내 기업들의 공정경쟁으로 이어져 장기적으로 수출경쟁력 확보에 큰 도움이 되길 기대한다"고 말했다.

Wilhelmsen acquires Drew Marine Technical Solutions

"This acquisition offers a unique opportunity to enhance the scale and geographic reach of our marine products division," said Thomas Wilhelmsen, group CEO about Wilhelmsen's acquisition of the technical solutions business from Drew Marine. The acquired business will be brought into Wilhelmsen Ships Service.

As part of the transaction, the business, people and competence in Drew Marine Technical Solutions will be transferred to Wilhelmsen. Approximately 400 Drew Marine employees will join Wilhelmsen Ships Service upon completion of the transaction.

"This acquisition is among the largest investments in our history," said Wilhelmsen about the deal with a purchase price of around USD 400 million.

In addition to realising operational benefits, the acquisition is expected to result in a USD 150 million increase in annual total income for Wilhelmsen Ships Service. The transaction will be financed by using existing credit facilities, available cash and new facilities.

"Our aim is to enhance the business and simplify the operations for our customers and partners with the leading people, services, and solutions of the maritime industry," said Wilhelmsen. "The acquisition strengthens our position as a comprehensive supplier serving the global merchant fleet. Stronger technical competence in combination with higher volumes and efficiency, offers our collective customers and

partners attractive benefits in the time to come."

The final closing of the transaction is subject to regulatory approvals. If approval from relevant bodies is not received, the parties have agreed on a termination fee of USD 20 million.

DNV GL starts Joint Industry Project to improve assessment of site condition data for offshore wind farms

On 16 May 2017, DNV GL invites industry partners to start a Joint Industry Project (JIP) for improving the collection and assessment of site conditions data for offshore wind farms. Aiming to increase the efficiency of collecting site conditions, the new JIP will work with stakeholders from across the wind industry. The knowledge generated from the JIP is planned to be ultimately incorporated in a DNV GL recommended practice.

The design of an offshore wind farm is dependent on the quality of the calculated site conditions used to derive the design parameters. To achieve an optimal quality in data collection and assessment, extensive and costly investigations are needed at a very early stage of the development, long before final investment decision is made. A recommended practice will allow stakeholders to improve their planning, investigation and design.

"The development of this recommended practice will create an industrial consensus on an agreed set of practices to follow for the analysis of the system and its validation. This will allow stakeholders to increase transparency and reduce the risk in the early phases of the development," said Kim Moerk, Executive Vice President for Renewables Certification at DNV GL.

Incorporating the experience and objectives of stakeholders along the wind energy value chain will add significant value for all parties involved. They will be able to contribute and influence the development of the assessment criteria to ensure their concerns are covered, practices are acknowledged and the objectives of all stakeholders are met. The involvement provides early access and insight into the results, ensuring participants are best prepared for its implementation.

The launch of new Simrad ECDIS One subscription service

The launch of the new Simrad ECDIS ONE Subscription Service helps ship and fleet owners meet updated ECDIS carriage mandates with a flexible, cost-controlled solution.

The new one-stop-shop solution includes requirements scoping, planning consultancy, ECDIS hardware, system commissioning, a full digital services package, access to Navico's global support and service network, and type-specific ECDIS training, all based on a single monthly fee over a chosen duration with the flexibility to stop the service before the term ends. This subscription model simplifies financial planning by offering companies regular and predictable costs throughout a customisable contract.

"We are providing a simple economic solution to help ship and fleet owners achieve full SOLAS compliance using our ECDIS solutions and also giving them access to a wide range of electronic charts and support services we have within the company." said Nicolas Queru, EVP, MD of Navico's commercial division.

"The new ECDIS 'ONE' subscription-based service will help owners control operational costs, and meet the compliance requirements for ECDIS mandated ships including implementation deadlines fast approaching for those who need retrofit by July 2017, 2018 or 2019."

The ECDIS 'ONE' Subscription Service is made up of six core - ECDIS, Digital Charts, Digital Publications, On-Board Chart Management Software, Fleet Management, Global Service - components.

ABB shaft generators and turbochargers to raise the energy efficiency on environmentally friendly cargo vessels

ABB shaft generators will raise the energy efficiency on two DFDS vessels which have been designed to meet the latest environmental regulations. Two shaft generators will be installed in each of the cargo Ro-Ro ships allowing the main engines to operate at a wider, more optimal speed range. The shaft generator system takes its power from main engines, thereby increasing safety if there is a failure on the auxiliary engine. The ships' main engines will also be turbocharged by ABB's latest generation technology.

Juha Koskela, Managing Director of ABB's Marine and Ports business said, "Efficiency and safety are cornerstones of the maritime industry and our shaft generators will introduce both to these DFDS vessels. Not only is this an environmentally friendly technology but it is also very cost effective."

By using an alternative power source the shaft generators allow the main engines and the propeller pitch to be optimized no matter what the vessel speed, adding the load on the main engine and improving overall fuel efficiency. The system will be tailored for the vessels which will operate in DFDS' North Sea network.

The shaft generator system also enables the vessel to be sensitive to the local community and environment when it reaches port as it is compatible with shore-to-ship power. This allows the ship to shut down its auxiliary engines when it berths, therefore reducing emissions and vibrations.

Two high performance A270-L turbochargers, for two-stroke engines were selected for each vessel, reducing fuel and consequently lowering emissions further. For the typical demands of low-speed marine engines, the turbochargers offer greater engine operating flexibility: high pressure

tuning for part or low loads, and designed for best efficiency in slow-, and ultra-slow steaming.

The two 6,700 lane meter Ro-Ro's, the largest ever freight vessels to be built for DFDS, will be built by Jinling Shipyard in China for delivery at the beginning of 2019, with an option of a further four vessels.

Gibdock takes invasive action for Normand Reach

A surge in offshore vessel repair and maintenance work at Gibdock has included a special project for returning customer Solstad, to ensure that Normand Reach meets the exacting hull cleanliness standards set by Australia's National Biofouling Management Guidelines for commercial vessels.

The 120.85m length Solstad CSV entered the yard for a special wash and brush up on its way to Western Australia, where it has been reported as due to enter charter in the coming weeks to work in the Ichthys gas field development project.

Solstad is a regular Gibdock customer, but this is the first time that the 2014-built Normand Reach has been in the yard, with an 11-day period spent in Gibdock Drydock No.2 for hull-washing, blasting and antifouling coating, routine drydocking works, and final tasks carried out afloat.

"Our decision to use Gibdock on the Normand Reach project was based on our previous good experience with the yard," said Conrad Melhus, Solstad Shipping Technical Manager Norway. "The fact that Gibraltar is on the route from the North Sea to Singapore/Australia via Suez Canal was also a factor. A lot of cleaning and paintwork performed on the hull, and the climate in Gibraltar is most favourable in April compared to Norway. Gibdock demonstrated once again that it was a good choice for Solstad Shipping AS."

Australian guidelines covering invasive species are among the most demanding in the world. Over and above regular hull-cleaning work and propeller polishing, Australian inspections focus on niche areas where biofouling can accumulate, including the rudder hinge, sea chest, bilge keel and bow thruster, and any associated grates.

"The internal surfaces of sea chests, for example need to be painted with antifouling coatings that are suitable for the flow conditions of seawater through the chest," said Gibdock Ship Manager Filip Tsankov. "These standards demand deep cleaning and close attention to detail." Gibdock has performed hull cleaning work in line with Australian expectations on several occasions, he added.

Gibdock also undertook some special fabrication work as part of the job, with new plating installed to reinforce the vessel's bridge and main deck protection against the threat of piracy.

"The yard acquitted itself once more on offshore work demanding high quality solutions while meeting the owner's schedule. Of eight ships in the yard, three are offshore vessels from returning customers. It is not yet clear whether the upturn in offshore work demonstrates the green-shoots of recovery in the market, or is further evidence of Gibdock's favourable location on the main Europe-Asia trade-lane," said Richard Beards, Managing Director, Gibdock. "What is certain is that more complex offshore projects have been coming through from the major oil and gas majors in recent months, and our purpose-built 'Pad 1' area for heavier work and fabrication has been playing a significant role in ongoing projects." said Beards.

Emerson Completes Pentair Valves & Controls Acquisition

Emerson announced on April 28 that it has completed the purchase of the Valves & Controls business from Pentair plc for $3.15 billion.

"This acquisition enables us to continue to grow our global footprint in automation and expand our leadership position in key served markets such as chemical, power, refining, mining and oil and gas," said Chairman and Chief Executive Officer David N. Farr. "By adding these highly respected products and aftermarket ser-

vices to our portfolio, Emerson is better positioned to serve the needs of our global customers."

Headquartered in Schaffhausen, Switzerland, the Valves & Controls business is a leading provider of valve solutions and services with nearly 7,500 employees around the world. The business will be integrated into Emerson's Automation Solutions platform.

Mike Train, Automation Solutions executive president, said, "Pentair's Valves & Controls business fits extremely well with Emerson's existing portfolio of Fisher control valves and regulators and Bettis actuators. The addition of market leading product brands such as Anderson Greenwood, Vanessa and Keystone creates the most comprehensive global valve business. Emerson's final control portfolio now includes control valves, pressure relief, butterfly, gate, globe, ball and check valves, and an extensive global network of more than 200 service centers. The combination of these two leading businesses will allow us to better support and help customers select the right product and maintain it for the life of the asset."

DONG Energy-led US offshore wind farm developments to use Lloyd's Register's expertise

DONG Energy, a global leader in offshore wind has developed a significant portfolio of wind farms, with a total installed capacity of 3,000 MW offshore Germany, Denmark and the UK, has recently secured two leases in the United States - Bay State and Ocean Wind, off the coasts of Massachusetts and New Jersey respectively. If approved, Bay State OWF and Ocean Wind OWF are each expected to have an installed capacity of more than 1,000 MW.

Lloyd's Register, a leading global provider of engineering and technology-centric professional services, has used its specialist expertise in its Maine-based subsidiary, SGC Engineering, to support DONG Energy on its evaluation phase of the Bay State project with its offshore site and export cable route geophysical and hydrographic surveys.

The route surveys are a critical part of the early phases of work in developing an offshore wind farm. They are used to investigate the narrow seabed corridor which contains the export cable that brings power onshore from the wind farm.

Malgorzata Zorawinska at DONG Energy said "The offshore wind energy industry is less mature in the US than in Europe, and our focus is very much on being 'smarter from the start'. As the global leader in its field, DONG Energy can apply significant experience, knowledge and lessons learned through its own in-house expertise and with trusted partners such as Lloyd's Register."

DONG Energy has also awarded Lloyd's Register a second contract, which will support further offshore survey work of the Bay State Wind project in addition to the initial survey work needed in the Ocean Wind site, both planned for May 2017.

"We are delighted to continue our long-standing relationship with DONG Energy and to support its significant new wind farm projects off the eastern seaboard of America," said Michael Cousins, Geoscience Manager at Lloyd's Register. "Being strategically located in the region with related electrical engineering, marine geoscience and survey capability allows us to readily apply our knowledge and to mobilise resources in an efficient and cost effective manner, which are undoubtedly important factors as the industry in the US starts to develop."

MacGregor participates in developing unmanned/autonomous traffic in the Baltic Sea

MacGregor, part of Cargotec, is one of several leading global companies that have teamed up for the advanced co-creation ecosystem, One Sea. Founded in 2016, the goal for the ecosystem's partners is to jointly-develop the world's first system of autonomous ships. The partner's shared vision is to enable fully remote-controlled vessels in the Baltic Sea in three years and to achieve autonomous commercial maritime traffic by 2025.

Leading the One Sea ecosystem is DIMECC (Digital, Internet, Materials & Engineering

Co-Creation). The association of Finnish Marine Industries also supports its work and the Finnish funding agency TEKES has invested in the project.

MacGregor believes that in today's world, co-creation and collaboration are efficient and sustainable ways to innovate and develop systems and solutions for more technologically-advanced and safer operations, ultimately enabling autonomous traffic at sea.

"The benefits of co-creation are obvious, software experts, together with systems and equipment experts, can improve efficiency and safety throughout the whole value chain," said Alexander Nürnberg, Senior Vice President, R&D and Technology, MacGregor.

"We in MacGregor started the transformation journey several years ago and are proceeding step-by-step towards autonomous equipment operations and eventually autonomous vessels," continued Mr Nürnberg. "The steps we have already taken on this journey include the ability to have greater connectivity to equipment. This means that we can undertake performance monitoring and further enable condition-based monitoring and predictive maintenance. About ten years ago, MacGregor introduced its OnWatch service for offshore crane customers, which included round-the-clock remote access and trouble-shooting. This service is now being further enhanced by a 'Scout' function that performs predictive maintenance and condition-monitoring."

The One Sea ecosystem is the latest in a series of collaborative initiatives by MacGregor and is one of many projects designed to create products and develop software and solutions to enable autonomous vessel traffic. MacGregor is collaborating with Rolls-Royce on research and development in autonomy for cargo ship navigation and cargo systems on board container ships.

MacGregor has, for many years, also cooperated with the University of Turku and Åbo Akademi within the framework of the FIMECC Rebus programme, which is oriented towards adopting boundary-spanning business models that focus on a high-level cooperation between partners in a project and the development of new, innovative solutions.

Additionally, in recent years, MacGregor has implemented a new, value-oriented approach and has been at the forefront of developing pioneering thinking in the shipping industry. The MacGregor PlusPartner concept for container ships is a good example of such an innovative solution. PlusPartner is a holistic way to maximise a ship's return on investment through a combination of optimised cargo systems and utilisation support.

Thordon Bearings and Drydocks World team up to convert ships to seawater lubricated shaft lines

Thordon Bearings and Drydocks World-Dubai (DDW-D) signed a milestone agreement under which the UAE-based shipyard will work together with Thordon Bearings Inc. to promote the conversion of ships' oil lubricated propeller shafts to Thordon's COMPAC open seawater lubricated bearing system.

The agreement will create an action plan in which a specialist team, comprised of Drydocks World-Dubai and Thordon Bearings' personnel, offer support to ship managers and owners looking to ensure their vessels are fully compliant with environmental legislation prohibiting the discharge of oil from the oil-to-sea interface of ships' propeller shafts. Shipowners could face substantial financial penalties if their vessels are found to be non-compliant.

Mohammad Rizal, COO of Drydocks

World-Dubai, said "Thordon Bearings is a pioneer in water lubricated propeller shaft bearings, with over 35 years' of experience in this technology. By entering into this partnership, we will not only have an opportunity to expand our service offering, but will also have the opportunity to provide our customers with a real, long-term solution to the environmental problems they face with oil lubricated stern tube bearings and seals. With concerns increasingly being raised about the impact oil discharges have on the marine environment, converting an oil lubricated system to seawater is the only guaranteed solution for today and tomorrow."

Terry McGowan, President and CEO of Thordon Bearings said "Drydocks World-Dubai is an internationally renowned shipyard with the capabilities and state-of-the-art facilities required to carry out some of the world's most specialised ship and rig repair, maintenance and conversion projects. Having the advantage of offering comprehensive, engineered solutions in partnership with an experienced bearing manufacturer will help further strengthen Drydock World's position as one of the world's leading shiprepair yards."

Leaking shaft seals are known to be a significant contributor to on-going pollution at sea. The use of biodegradable lubricants, which are an improvement over mineral oils, are still a very expensive option for shipowners and some are having seal compatibility issues. Even biodegradable lubricants still need to be reported to authorities when discharges occur. Thordon provides a solution that uses seawater as the lubricant that meets all regulations, eliminating any risk of oil pollution.

Under the terms of the agreement, Thordon Bearings will also provide equipment, training and guidance to Drydocks World-Dubai personnel and support the yard in carrying out propeller shaft conversion projects to the "highest standards and in the most efficient and cost effective manner".

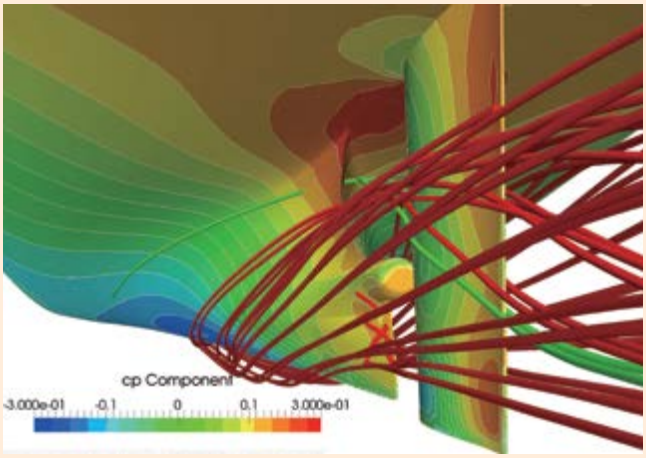
DNV GL adds asymmetric stern to ECO Lines hull optimization service

A vessel with an asymmetric stern has a twisted aft shape that is designed to account for the differing flow conditions on each side of the propeller. The idea emerged in the 1960s, but due to the difficulty of manually developing the optimal shape, this design failed to make a large impact at the time.

DNV GL has revisited the idea and, using high-fidelity computer fluid dynamics (CFD) in combination with parametric formal optimization, the classification society can now offer ship owners the option of incorporating an asymmetric stern into their new vessels.

"Basically, what we are now able to do is model an aft shape that acts as a propulsion improving device, without the vibration and fatigue strength concerns that come with fins and nozzles," said Karsten Hochkirch, Head of Department, Fluid Engineering at DNV GL-Maritime. "Using our in-house formal parametric optimization procedure, we can assess hundreds of options until we find a design that strikes an optimal balance between pre-swirl and resistance, while meeting the design requirements of the customer."

In a recent project, a 3,000 TEU container ship was tuned to achieve minimum power consumption. Starting from a well-optimized symmetric baseline design, the asymmetric design achieved a propulsion power reduction of more than 3%, a result that was confirmed in tank testing. In another project, the ECO Lines team was asked to find propulsion efficiencies in a 38,000 DWT tanker. The CFD optimization generated a design promising a 3.5% percent decrease in propulsion power compared to the symmetrical design.



Computational fluid dynamics (CFD) allow the details of the flow to be assessed. The colors denote the pressure distribution on the hull.

"This is another instance where advances in computing power and software sophistication are enabling us to unlock efficiencies in ship design. By accurately simulating the performance of these complex hull forms, we are achieving propulsion power improvements of up to 5%, with greater structural robustness," said Karsten Hochkirch. "And because yards are now able to utilise advanced CAD/CAM techniques and modern, CNC-controlled fabrication methods, they can bring these designs into production much more easily and economically."

Wärtsilä 34DF engines awarded EPA Tier III emissions compliance certification

Wärtsilä has been awarded model year 2017 certification of emissions compliance from the United States Environmental Protection Agency (EPA) for its Wärtsilä 34DF dual-fuel engine family. The EPA Tier III certification and the corresponding EIAPP certificate were both issued in March 2017. The Tier III certification of conformity covers the Wärtsilä 34DF engines manufactured from the date of issue until the end of 2017.

These are the first Category 3 Tier III certificates issued by the EPA to any manufacturer. Category 3 relates to engines with a displacement per cylinder of greater than 30 litres.

The certification verifies that the Wärtsilä 34DF engine is fully compliant with the EPA Tier III emission standards in gas mode operation. As required by the EPA Tier III standard, the engine is equipped with a continuous nitrogen oxide (NOx) measuring and monitoring system for verifying emissions compliancy inside NOx Emission Control Areas (NECA). When sailing outside NECAs, the fuel-flexible 34DF engine can be operated with conventional marine diesel fuels if required.

"Once again Wärtsilä technology is leading the way to greater environmental sustainability and a cleaner shipping industry. It is an honour for the company to be the first to be awarded this important EPA certification," said Patrik Wägar, Product Director, Medium Bore Engines, Wärtsilä Marine Solutions.

The 34DF engine features advanced dual-fuel technology and high efficiency, and its success is evidenced with more than 300 engines delivered globally. For marine applications, it is manufactured in configurations from 6 to 16 cylinders covering a power range of 2880-8000kW. Based on the well proven and reliable Wärtsilä 32 diesel engine introduced in the mid-1990s, the Wärtsilä 34DF's fuel flexibility means that the engine can be optimised for constant speed generating sets, as well as variable speed mechanical drives for main engine applications.

Advent of offshore wind power era

- Renewable energy with proven economic viability
- Burgeoning investment and interest in wind power

The installed capacity of offshore wind power has more than tripled globally over the past five years amid the decline in energy production costs and greater generation capacity, bolstered by rapid technological advancement. Global interest and investment in offshore wind power have soared over the last 5-6 years. In particular, technological advancement has enabled construction of wind farms even in deeper waters and production of more electricity even when conditions such as air flow and wind speed are same. As a result, initial cost recovery period has been shortened, improving business feasibility. Investment is expected to increase constantly in offshore wind which has high growth potential. Currently, about 10 offshore wind power projects are underway in Korea.

In fact, offshore wind power farm construction processes are very similar to those of offshore plant construction and installation. For that reason, domestic major shipyards and heavy industry companies participated actively in the development of large-scale offshore wind power generation systems a few years ago. By contrast, they are currently avoiding investment in wind power projects due to technical barriers with overseas competitors and recession taking its toll on global shipbuilding industry. However, offshore wind power sector is likely to emerge as new future growth engine, depending on market situations, given that domestic shipyards have excellent technologies for production and installation of offshore structures.

Offshore wind power has been thrust into limelight again in the field of renewable energies. According to the International Energy Agency (IEA), the cost of wind power production has been diminished over the last 5 consecutive years and wind power is expected to comprise over 20% of global electricity mix by 2030. To keep pace with this trend, Europe, the United States, and China are making aggressive investments in wind power. In Korea, wind farm projects have been in full swing mainly in the West Sea, Jeju Island, etc., which have optimal conditions for offshore wind power generation.

The biggest advantage of offshore wind power is that huge profits can be reaped with construction of large-scale wind farms based on capital and technology alone. Europe, a leader in global offshore wind market, has already invested heavily in offshore wind development for several years, proving the environmental and economic viability of offshore wind power. The United States, China, the latecomers in the market, are also building large-scale offshore wind farms vigorously.

Return on investment in energy production facilities is the key to success in offshore wind power market. For that, offshore wind power industry has focused on developing large-scale wind power generation system with an output from 1.5-2 MW to 3-7 MW. The cost-savings on production has underpinned by active government support for commercialization and cutting-edge IT (Information Technology) advancement. The

global installed capacity of offshore wind power totaled approximately 15,000 MW, as of late last year, which is considered a relatively steep increase from 4,117 MW recorded in 2011.

Robust growth

According to the World Wind Energy Association (WWEA), 4 out of 5 countries with world's largest cumulative offshore wind power capacity were European countries at the end of last year. U.K. topped the global list, followed by Germany and Denmark. It is no exaggeration to say that Europe is leading the offshore wind power sector, considering that the top 5 countries carve out 90% share of global offshore wind power market.

Europe has emerged as the leader of offshore wind power, leveraging its geographic advantage for renewable energy. Those countries, the powerhouse of global offshore wind power sector, have also dominated onshore wind power sector. Moreover, they have a geographical advantage that offshore wind turbines can be installed at a distance of 10 km or more from the land due to gentle submarine topography in surrounding area. Particularly, Europe's grip on global offshore wind power market has strengthened as European shipbuilding industry is turning to offshore wind power amid decline of European shipbuilding cities such as Bremerhaven and Emden in Germany, Odense and Aarhus in Denmark, and Belfast in Northern Ireland.

As of late last year, the installed capacity of offshore wind power in 10 countries of European Union totals 12,631 MW. The European Wind Energy Association (EWEA) predicts that the installed capacity of offshore wind power in Europe will increase to 24,600 MW by 2020 and 66,500 MW by 2030.

The Dutch government recently announced a plan to raise the share of renewable energies in total electricity mix to 14% by 2020 based on drastic revision of existing energy policies that had relied on fossil fuels for more than 95% of electricity. For that, the Dutch government will build ultra-large offshore power plants with a total output of 600 MW along the 85km-long section of the North Sea coast.

High growth potential

Developed countries are focusing on offshore wind power that generates a considerable amount of electricity per unit of area. If over 10,000m^2 of solar photovoltaic power is needed to produce 1 MW, offshore wind power generation will require only about 490m^2. The output of each offshore wind turbine is usually twice larger than that of onshore wind turbine. Wind turbine with an output of 6 to 8 MW is common while wind turbine with an output of 13 MW is almost ready for commercialization.

The offshore wind market is expected to witness even more robust growth in the period ahead. Offshore wind farms with a combined capacity of 65,000 MW are planned to be built by 2030 in Europe alone. Furthermore, United States and China have announced plans to dramatically expand offshore wind power facilities.

China, which has the world's largest installed capacity of onshore wind power, has accumulated extensive know-how in wind power generation for a long time. Meanwhile, China's cumulative installed capacity of offshore wind power stands at 1,626 MW, the world's largest, except for European countries. China built offshore wind farms with a combined capacity of about 600 MW last year and recently acquired a European offshore wind power, which suggests that China will make aggressive investments in offshore wind power generation in the period ahead.

The United States, the second largest producer of onshore wind power after China, is a latecomer in global offshore wind power generation sector. Until 2015, the United States produced little offshore wind power. However, it produced 30 MW of wind power last year. The offshore wind farms located near Block Island in the State of Rhode Island began to operate 5 wind turbines. The United States announced a plan to expand the installed capacity of offshore wind power to 54,000 MW by 2030.

Japan has also turned to renewable energy after the meltdown of Fukushima nuclear power plant and mapped out a

plan to expand investment in offshore wind power. Japan has the installed capacity of offshore wind power totaling only 60 MW, but plans to install an offshore wind farm with a capacity of 10,000 MW along Fukushima-Chiba coastline and another offshore wind farm with a capacity of 5,600 MW in Kabashima, Nagasaki by 2030.

Offshore wind power production in incipient stage

According to the Korea Wind Energy Industry Association (KWEIA), Korea has an installed capacity of wind power exceeding 1 GW (1031.4 MW) with 551 wind turbines spread over 83 wind power plants. The government plans to expand the capacity of wind power facilities to 23 GW by 2030 which corresponds to 21.5% of total domestic power generation mix (107 GW) as of last year.

Korea's first offshore wind power was generated by the offshore wind turbine installed by Korea Institute of Energy Research (KIER) in the sea of Jeju Island in 2012. The cumulative installed capacity of offshore wind power in Korea totals only 5 MW and it was only last year that Tamra offshore wind farm with a capacity of 30 MW in Jeju started operation in part. Currently, offshore wind power is produced mainly in Jeju Province and southwestern coast. In particular, offshore wind farms with a combined capacity of approximately 600 MW will be installed in 5 regions of Jeju which has optimal conditions for offshore wind power production.

The offshore wind power test bed construction in the south-

Higher economic efficiency with diminishing cost of offshore wind power production

The cost of offshore wind power production decreased by more than 60% in U.K., compared to four years ago. According to foreign media, the cost of offshore wind power production amounts to an average of 97 pounds per megawatt hour (MWh) between 2015 and 2016, costing one-third less than it did four years ago. The cost of 97 pounds per MWh is based on service life of 20-25 years, meeting the target set by the U.K. government in 2012. At that time, the U.K. government had set a goal of slashing offshore wind power costs by 100 pounds per MWh by 2020.

As the cost of offshore wind power has been lowered, controversy has been swirling over the scale of subsidies which remain relatively higher than those for other types of power generations such as onshore wind power generation, etc., due to high installation costs and varying weather conditions. Currently, offshore wind farm operators, such as Dong Energy and U.K.-based SSE, are guaranteed the fee of 114 pounds per MWh and 119 pounds per MWh, respectively, thanks to subsidies, which is about double the price of wholesale electricity.

Last year, global investment in offshore wind power generation rose to an all-time high of USD 30 billon, jumping about 40% from the previous year. U.K. is expected to invest more than 20 billion pounds in wind energy for the next 5 years.

western coast has been in full swing after it was planned in 2011, adding vitality to offshore wind power market. The offshore wind power project in the southwestern coast aims to build wind power farms in 3 phases which have a combined capacity of 2 GW in Busan County, Jeollabuk-do located about 10km from the coast and in the sea southeast from Uido Island with an investment of KRW 10 trillion. The construction of offshore wind power test bed with a capacity of 60 MW corresponds to the first-phase project.

Including the first-phase project in the southeast coast, 18 offshore wind farms with a combined capacity of 3,337 MW have been either planned or under construction across the country. Among them, the largest is the offshore wind farm under construction off the coast of Gijang County in Busan which will have a capacity of 540 MW. The installation cost alone amounts to KRW 2.2 trillion.

Mid and long-term investment

Although it is impracticable to immediately replace nuclear and fossil energies with wind power alone, there is an indisputable need for constant investment in wind power over mid and long-term. Significantly, offshore power producible in large scale represents the first step towards the shift away from nuclear power. Furthermore, offshore power is expected to create synergic effects with domestic shipbuilding and related industries currently under grip of recession, considering that shipyards can tap into their excellent shipbuilding and offshore technologies similar to those required for production, installation, etc., of offshore structures.

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Rockwell Automation CEO Discusses Future of Industrial Internet of Things

Blake Moret shares insights on IoT and Industrial Productivity at Cisco's 2017 Internet of Things World Forum

Blake Moret, president and CEO of Rockwell Automation, spoke on Internet of Things (IoT) adoption and its impact on industrial productivity, sharing insights with more than 1,200 business leaders at Cisco's IoT World Forum in London. As the industry's only company solely dedicated to industrial automation and information, Rockwell Automation is uniquely positioned to understand the challenges and opportunities associated with harnessing the future of smart manufacturing.

As Moret described, the positive outcomes associated with IoT will continue to accelerate as organizations progress from pilot or proof-of-concept IoT projects to scalable IoT deployments. According to the Global IoT Decision Maker Survey published by International Data Corporation (IDC), nearly one-third (31 percent) of those surveyed have already launched IoT solutions, and another 43 percent are looking to deploy solutions in the next 12 months. Rockwell Automation is seeing a similar trend in its deployment of IoT solutions, and continues to increase its number of pilots across industries, applications and geographies.

"Manufacturers and industrial operators are discovering practical ways to apply IoT across their operations, and they're deriving measurable business value as a result," said Moret. "Combining IoT

technology and expertise in specific industrial applications enables better collaboration, faster problem-solving and increased productivity."

Moret referenced several factors driving the adoption of industrial IoT and connected operations, including lower cost of computing and connectivity, and the convergence of information technology and operations technology.

Moret explained how a connected enterprise that adopts IoT technologies can generate better insight into industrial operations and deliver greater value by providing the right information at every level of their business through scalable analytics. He cited Great Lakes Brewing Co. as a Rockwell Automation customer that is adopting scalable analytics to improve visibility and productivity for different parts of their operations.

The 2017 IoT World Forum explores the impact of IoT on business, technology and society. As strategic partners, Rockwell Automation and Cisco have long collaborated on industrial networking and security solutions required for industrial digital transformation. Together, they help manufacturers improve business performance by bridging the technical and cultural gaps between plant-floor and higher-level information systems.

"We have great technology, good people and a strong culture, but another component that sets us apart from our competitors is our ability to partner with companies such as Cisco. Together, we deliver expertise and solutions for highly secure, smooth connectivity from the plant floor to the enterprise network," said Moret.

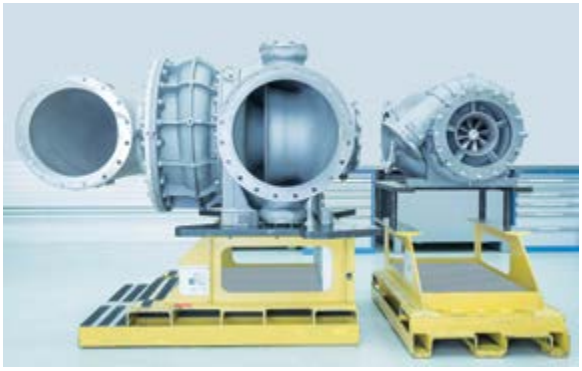
ABB Turbocharging opens two-stage turbocharging to a wider market

A new frame size for the Power2® 800-M two-stage turbocharging solution will allow more vessels to benefit from the high efficiency and fuel savings.

ABB Turbocharging will launch a new frame size for its two-stage turbocharging solution, Power2 800-M. With this addition to the portfolio, to be launched mid-2017, the benefits of high pressure ratios, increased turbocharging efficiency and fuel savings will be extended to a wider scope of advanced medium-speed engine configurations.

The new frame size marks a milestone in the continued development of the Power2 platform, following unveiling of the second generation at Nor-Shipping 2015 and selection for the world's most efficient four-stroke diesel engine. The new frame size, Power2 845-M, applicable to an increased range of ship propulsion solutions, will open up the market-leading efficiency and operational benefits to a greater spectrum of vessel types. These may include OSVs, drill and semi-submersible vessels, RoPax, ferries, as well as medium-sized tankers, container ships and bulk carriers, for main engines, DE and auxiliary engines.

Marco Burgwal, Product Line Manager, Medium-Speed, ABB Turbocharging said "Two-stage turbocharging responds to the most important technology value drivers in the development of modern four-stroke medium-speed engines, reaching beyond the parameters of single-stage turbocharging. In extending our Power2 portfolio, we are achieving our product development goal of bringing these values of high efficiency for fuel savings, system compactness and flexible operation to a greater number of engine builders' customers."



Power2 800-M was designed to set new standards in turbocharging performance. The innovative design achieves an overall turbocharging efficiency of more than 75 percent, some 10 percent higher than conventional single-stage models. For vessel owners, this can translate into yearly six-figure savings in fuel as well as significant cuts in emissions - up to 60 percent lower NOx emissions. With engine room space at a premium on modern tonnage, careful attention was given to optimizing the layout with dedicated components for two-stage turbocharging application, resulting in a 20 percent smaller footprint than a solution based on conventional single-stage components.

Ensuring straightforward service and maintenance while minimizing downtime was another design criteria. Power2 800-M comes with an extractable cartridge for ease of service, reducing overhaul time by 30 percent.

"Based on our experience, lower service costs and maximizing availability are crucial for operators in optimizing total cost of ownership," explained Marco Burgwal.

Power2 800-M will first be commercially applied on a state-of-the-art icebreaker to serve the Yamal LNG project in the Russian Arctic. Fuel efficiency and reliability were the two major deciding factors in the design specification. Other key considerations were operational flexibility as well as performance in extreme environmental conditions as the vessel will operate in temperatures down to -50°C.

Other forthcoming marine applications of Power2 800-M include a Danish-built purse seiner/trawler to operate in the North Atlantic, North Sea, and Norwegian waters, and a car and passenger ferry to be built in Finland for a Danish operator. Further Power2 800-M units are also on order for marine and stationary power applications.

The innovation maintenance coating system for offshore

Jotun develops world's first NORSOK approved offshore maintenance coating system for brush and roller application on power tooled and water jetted surfaces.

Jotun has developed a unique maintenance coating system offering offshore operators the optimum in protection, durability and ease of application, while reducing costs. The new range - which consists of the Barrier Smart Pack, Jotamastic Smart Pack HB and Hardtop One - will be the world's first NORSOK approved solution for brush and roller application on power tooled and water jetted surfaces.

"Until now, offshore maintenance solutions were typically designed and tested in accordance with standards for new constructions," commented Lasse Isaksen, Global Concept Director - Offshore, Jotun. "This simply does not reflect the challenges that our customers experience when maintaining existing assets."

For example, preparing a surface for coating application offshore is far more demanding than doing so in a yard. Poor preparation can lead to premature coating breakdown and shorter lifetimes than for standard products, resulting in an increased frequency of maintenance. With offshore maintenance being up to 10-15 times more expensive per square meter than it is in a yard, this is an added cost our customers can do without.

That's why this system, designed specifically for brush or roller application and passing the industry's most stringent

standards (NORSOK and ISO 20340), is so important. It delivers better coating integrity, longer maintenance intervals, enhanced efficiency, and, of course, real cost savings. It's the solution the industry has been waiting for.

The three individual products have a range of key benefits: Barrier Smart Pack, a ceramically reinforced zinc rich epoxy primer, extends system lifetime while reducing surface preparation and application cost; Jotamastic Smart Pack HB delivers high build, even thickness finish, is easy to apply and gives long-lasting protection in the harshest environments; and Hardtop One offers all the benefits of a two-component high quality polysiloxane coating, in a single component polysiloxane coating.

"We work closely with our customers across the world to gain an intimate understanding of their operations, challenges and needs for new solutions," explained Isaksen. "This is an industry like no other, and it requires systems that are customised to meet the most demanding conditions, both environmentally and commercially."

Jotun's new maintenance range showcases both our understanding of that, and an on-going commitment to practical innovations, harnessing technology to deliver powerful benefits. This is an important step forward for us, our customers, and the efficiency, quality and success of essential oil and gas maintenance routines," concluded Isaksen.

Shell provides smarter solutions to simplify ship owners' operations & reduce costs

Shell Marine is introducing its Marine Integrated Lubrication and Expert Solutions (MILES) programme, its new and unique approach in lubricants management.

This new initiative includes combining purchasing options, services and an extensive range of lubricant products in a multi-faceted strategy addressing its customers' most pressing operational concerns.

Shell Marine is also considering continuous product and service developments as part of an integrated strategy that includes innovative delivery options and a coherent response to digital disruption in the maritime sector.

"It is vital that Shell Marine is responsive to the challenges in the maritime industry where complexity and cost pressure is the new normal," said Jan Toschka, Shell Marine Executive Director. "The flood of new regulations, changing engine technology, new fuels, efficiency pressures and increasing digitalisation means ship owners must adapt to thrive. It is only natural that they look to suppliers not only to help optimise their operating costs, but also to take away operational complexities where possible, allowing them to focus on their core business."

To maximise scale and benefits of MILES, Shell Marine is working with external experts to develop digital solutions utilising greater connectivity, artificial intelligence, machine learning and data science. This will allow Shell Marine to offer a wide range of new services, from building recommendations about optimal volume/port lifting as well as creating ways to reduce purchasing costs to the extent of managing the entire lubrication management for the vessel. Such method of combining stock levels, demand planning and supply costs, will certainly lead to greater synergies between customers and Shell Marine.

In addition to the new lubricant solutions, Shell Marine will be offering different payment solutions which help ship owners optimise their working capital and budgeting.

Continuous product development is critical in meeting the industry's technical challenges. Shell Alexia 140, a BN 140 cylinder oil that addresses issues related to corrosive wear in some highly-tuned two-stroke engines. It also supports blend on board mixing and blending such as MAN Diesel & Turbo's automated cylinder oil mixing (ACOM), to find the optimal feed rate for customers' engines. Shell Alexia 140 will be available in Q3 2017 at selected ports. Deliveries of Shell Alexia 140 will be combined with Shell LubeMonitor service. Results obtained from our own testing and from services delivered to our customers show the reductions in feed rate and savings that can be achieved by using our cylinder monitoring service.

Four-stroke engines are also continuously evolving and require oil in lower amounts that can perform well at higher temperature and pressures. Shell Marine's portfolio of four-stroke engine oils Shell Argina and Shell Gadinia have been developed to give superior engine cleanliness and lacquer control.

Summing up, Toschka adds, "Shell Marine acknowledges that the Marine industry needs smarter and more intelligent ways to work together and create synergies on both sides, for ship owners and suppliers. Our customers have responded positively to our new services and we are committed to introduce these new ways of working to a wider customer base."

Dual-Fuel ME-GIE Successfully Runs on Ethane

Positive operational performance expands MAN B&W alternative fuel possibilities

The world's first ME-GIE (Gas Injection Ethane) two-stroke engine has successfully passed gas trials on board the 'Gaschem Beluga', an LEG (liquefied ethylene gas) carrier, while sailing between Houston and the Bahamas.

The Mitsui-MAN B&W 7G50ME-C9.5-GIE unit is the first in a series of two engines acting as main propulsion for two such LEG carriers of 36,000 m^3 ordered by Hartmann Reederei of Germany and Ocean Yield of Norway, and constructed at Sinopacific Offshore Engineering (SOE) in China.

MAN Diesel & Turbo personnel monitored proceedings aboard the vessel and reported successful operation on ethane with the ME-GIE responding as expected to different loads. No gas leaks were observed while ethane levels in the double-walled piping were constant and comfortably under the gas's LEL (Lower Explosive Limit).

The Gaschem Beluga subsequently crossed the Atlantic on its way to Europe, powered solely by ethane, and has already achieved a total of 550 operational hours.

Capt. Ulrich Adami, Fleet Manager of Hartmann Reederei, said "Developing and finalizing this type of vessel was hard work for the whole team and the process took several years. Therefore, we already knew that GasChem Beluga is a very good ship with a pioneering technology. But there is always a difference between a plan and its successful implementation. We are proud that we achieved the expected results entirely."

The 7G50ME-C9.5-GIE engine aboard the Gaschem Beluga

René Sejer Laursen - Sales & Promotion Manager, MAN Diesel & Turbo, said "The reports from the ME-GIE trials and first operational experiences are very encouraging and confirm our faith in this groundbreaking technology. While the engine is primarily designed for the combustion of ethane gas, our research shows that it is also possible to operate the engine on other gas types. This development is particularly exciting as it opens the prospect for multi-fuel combustion, including the combustion of methane, waste gas, and volatile organic compounds (VOCs)."

Indeed, MAN Diesel & Turbo's research recently confirmed that ME-GIE operation on VOCs is feasible, making it an eminently suitable main driver within the shuttle tanker and VLCC segments.

The Gaschem Beluga is equipped with a propulsion package supplied by MAN Diesel & Turbo, Frederikshavn (Denmark). It includes a remote control system AT3000, a VBS 1350 – ODS Mk5 CP Propeller, and a shaft generator with frequency converter that enables it to run on variable speed between 80 to 100rpm.

MAN Diesel & Turbo currently has eight ME-GIE engines on order. The benefits of the ME-GIE's Diesel-type combustion can now be fully exploited by its ability to operate on almost any gas quality - without any reduction in efficiency - and through a complete combustion maintained by a relatively high gas-injection pressure.
The engine will be able to run on a mixture of LPG and methane, or ethane, with an unchanged gas-mode efficiency. Such a mixture may comprise as much as 50% LPG, while MAN Diesel & Turbo's findings thus far indicate that an even greater LPG percentage can be used.

Significant potential

MAN Diesel & Turbo sees significant opportunities in the development of the ME-GIE as the engine can also run on almost any form of waste gas. Such gases could be the light hydrocarbons or VOCs emitted from crude oil during storage and during the loading/unloading of crude oil. This opens the door for new applications for the engine in, for example, shuttle tankers, for power generation in remote power plants, or in off-shore applications - such as floating production storage and offloading vessels (FPSOs) - where VOC is abundant and poses a potential environmental hazard.

Ethane

While MAN B&W ME-GI engines have been designed for use by methane, operation on ethane is a new development. After methane, ethane is the second-largest component of natural gas with a content that varies from < 1% to > 6% by volume. However, before natural gas can be used as a commercial fuel, it must be processed to remove impurities, including ethane. Like many hydrocarbons, ethane is isolated on an industrial scale from natural gas, usually by liquefaction at cryogenic temperatures. Its chief use is within ethylene production.

MAN Diesel & Turbo reports that ethane was chosen as fuel for the LEG carriers, in preference to HFO, due to its more competitive pricing. As a fuel, its emissions profile is similar to methane and contains negligible sulphur and comparatively lower CO_2.

ME-GIE Technology

The ME-GIE engine features MAN Diesel & Turbo's newly developed pump vaporizer unit (PVU) that matches the requirements for the supply of high-pressure LNG to the ME-GIE engine. The PVU supercedes previous fuel-gas supply systems with its low installation costs, smaller space requirement and full pump redundancy. Tier III operation can also be met in combination with selective catalytic reduction (SCR) systems, either low- or high-pressure SCR. The engine can be delivered in the 5-90 MW power range.

Roxtec flat cable seals protect industrial cranes

Roxtec sealing solutions are used to prevent water and steel process dust from entering outdoor cabinets and indoor control room containers of the Konecranes lifting equipment at SSAB's steel works in Raahe, Finland. The overhead traveling cranes must be operational at all times in a steel production process resulting in 2.5 million tons per year.
"We need good cable seals to avoid dust in the electrical cabinets, and Roxtec is a good way to seal around flat cables. The worst thing that can happen to us is a stop in the steel production," said Jarmo Manninen, responsible for crane maintenance and work planning at SSAB. "Our customers want seals that are easy to install and that provide very good protection. When it comes to high IP ratings, Roxtec is the only seal we use."
Roxtec has helped SSAB and Konecranes handle a tough and frequent sealing challenge by providing sealing modules also for flat cables of many different sizes. Konecranes started using Roxtec's seals instead of cable glands in the mid 90's. Arto Vaaraniemi, leading electrical engineer of Konecranes, explains why the crane provider continues to specify Roxtec seals for all cranes.

Designers should not treat water treatment as afterthought

ACO Marine is nearing the commercial launch of a new, enhanced biological system for yachts in the LY3 category.

"Wastewater management presents a challenging dilemma that if not addressed in the design stages can impact a vessel's operational flexibility," ACO Marine's managing director Mark Beavis told delegates yesterday at a Royal Institution of Naval Architects conference.

Providing an overview of the technical challenges faced when designing and building systems for prestigious projects, such as mega yachts, offshore and naval vessels, Beavis said that while water treatment is a 'mission critical' component to operations, it is, in reality, "an afterthought" for naval architects involved in the design and construction of arguably the world's most prestigious and innovative vessels.

"Many systems onboard can technically malfunction without passengers and staff ever noticing… but if the wastewater system associated with the bathrooms and toilets fail, it will not go unnoticed by the owner and guests. Similarly, if the treatment process is incorrectly specified. a process overload or even breakdown could result in pollution and environmental breaches often attracting hefty fines and, in extreme cases, criminal proceedings against the crew and owner of the vessel," said Mark.

Speaking at RINA's Design & Construction of Super & Mega Yachts conference, in Genoa, Italy, Beavis emphasised the importance of not just the treatment aspect of the problem, but to consider wastewater treatment from a "whole ship" perspective.

"To understand what wastewater is being produced where, in what quantities, at what frequency and how it will be stored and transferred around the vessel prior to, and after, treatment, is crucial to not only meeting stringent wastewater requirements, but also to optimising the operational performance of the vessel."

Going on to explore the impact of IMO MEPC 227 (64), the revised wastewater discharge rules that entered into force in January 2016, Mark said, "Given the increasing trend for expedition-type yachting in ecologically sensitive areas such as the Baltic, the new regulation will make some existing plant incompatible as MEPC 227 (64) changes both discharge requirements and test protocols. It has the specific aim of reducing nitrogen and phosphorous from passenger vessel treated water discharges, preventing the acceleration of nitrification of the seas."

"For PYC vessels (with more than 12 passengers) the Section 4.2 of the revision specifically prohibits black (sewage) water discharge into the Baltic Sea special area, with the exception of vessels equipped with a type-approved wastewater treatment system that meets effluent discharge requirements of less that 10mg/l of Nitrogen and less than 1.0mg/l of Phosphorous."

Mark revealed that a survey carried out in 2012 concluded that "a significant number of treatment systems did not meet the existing standards, due to improper use of detergent, a lack of maintenance, or simply because operators failed to follow the plant manufacturer's operating instructions".

"Many technologies in use on larger yachts have, until now, used technologies that depend on dilution and chemical sterilisation to achieve permitted effluent standard," said Mark, adding that this is largely due to the smaller footprint and capital expenditure of these systems. "But dilution is not a solution to pollution; it is not treating the waste, only reshaping it."

New high performance SAILOR Ku-band antenna brings VSAT broadband to ships sailing on tight budgets

Cobham is introducing a super-light Ku-band antenna system that brings the advantages of unlimited high-throughput broadband to all vessel types regardless of operating budget.

The SAILOR 600 VSAT Ku-band system comes with a super-light 60 cm antenna that delivers a level of radio performance better than any antenna of similar size on the market today. In combination with regional satellites or global HTS services it is opening the way for intra-regional carriers in Asia and operators of smaller vessels as well as globally trading vessels of any size to capitalise on the benefits of unlimited throughput that VSAT enables.

Constructed from lightweight materials, the new antenna is compatible with all Ku-band satellites. It also features advanced diagnostics and configuration options for close integration into network operation centres.

"From the outset, the SAILOR 600 VSAT Ku was engineered to maximize performance on the smallest form factor. All vessels, including smaller tonnage, such as short sea shipping and fishing vessels, can now exploit the benefits of a new breed of high-throughput satellites," said Christian Kock, Senior Sales Director, Global Maritime at Cobham SATCOM.

Taking advantage of lightweight materials such as carbon fibre composites and aluminium, Cobham's engineers have shaved the weight off the antenna so that it can be hand-carried and fitted on the compass deck without the use of a crane or forklift. This results in swifter and more cost-effective installation.

The SAILOR 600 VSAT Ku comes with an array of technical features designed to sustain the market leading performance of SAILOR antennas, including the automatic roaming capability that allows vessels to stay online even when sailing between different coverage areas. The feature enables connectivity both under traditional wide-beam satellites or the new smaller spot beams that distinguish a new generation of high throughput satellite constellations, such as Intelsat's EpicNG.

Uniquely, the new antenna can also be natively configured for dual antenna installations, eliminating a requirement for a separate dedicated switchover box and the additional complexity and cost this entails. "This is particularly important for ships which have structures that could block the direct line-of-sight of one antenna to a satellite, which will result in link degradation and intermittent connection," explained Jens Ewerling, Director, Maritime Broadband.

To maximise reliability, the development team also packed the SAILOR 600 VSAT Ku with a host of diagnostic tools. Automatic event reporting provides service providers with details of any unusual operating anomalies. The antenna is also fitted with shock and vibration sensors, whose data can also be retrieved for remote diagnostics and analysis. "Together this information allows service providers to monitor and pro-actively maintain the antenna to ensure uninterrupted connectivity on board as well as ensure that service level agreements (SLAs) are met," added Jens Ewerling.

Cobham SATCOM's decision to design a new 60cm Ku-band antenna was driven by growing demand for high-speed broadband on a wider range of vessel types and size, Christian Kock noted. "For example, in the commercial fishing sector, a small VSAT system can provide both Internet broadband for keeping the crew happy, whilst simultaneously ensuring compliance with regulatory requirements."

WinGD 2-stroke opens new virtual reality engine room facilities

Winterthur Gas & Diesel (WinGD) has inaugurated a new installation of its sophisticated W-Xpert Full Mission Simulator (FMS) for training complete engine room crews at the Marine Power Academy Training Centre of Hudong Heavy Machinery Co. Ltd. (HHM), in Shanghai, China.

The W-Xpert Full Mission Simulator developed by WinGD and UNITEST Marine Simulators allows complete engine room teams to work in a multi-interface virtual environment where routine and emergency situations can be rehearsed.

The simulator joins a network of some 20 further installations at strategic locations around the world. As well as being the first installation of WinGD's dedicated, multi-touchscreen simulation hardware in China, the Shanghai FMS system is also first to be pre-programmed with specially adapted versions of the engine-specific W-Xpert simulation software WinGD develops with its partner UNITEST Marine Simulators Ltd, based in Gdynia, Poland.

The FMS training facility at the Marine Power Academy, where some 500 crew are trained each year, is shared by HHM and WinGD, and both report that the system is proving very popular with course participants. Like the specially adapted W-Xpert software it runs, the FMS system is the result of a long-standing partnership with UNITEST. To cover large training courses in which a whole engine room crew can work simultaneously, the FMS hardware system utilises 18 touch screens located in up to four separate classrooms. In combination with the W-Xpert engine simulation software, it creates a multi-interface, virtual environment which includes not only the main engine but also all the auxiliary systems of a typical engine room.

W-Xpert software

Initially designed for use on personal computers and laptops or notebooks to provide a versatile, portable tuition tool, the W-Xpert software employs sophisticated thermodynamic models of diesel and gas engine processes to give high levels of virtual reality. To date, the range of engines which can be simulated by the W-Xpert software comprises the X35, X62, and X72 models the WinGD X-generation of diesel engines, as well as the RT-flex50DF dual-fuel engine models. During 2017, the X82 and X92 will be added, followed in quick succession by more dual-fuel engine software versions, WinGD confirms.

"The advanced features of the W-Xpert software, like our proprietary thermodynamic simulation algorithms which are capable of calculating accurately engine performance parameters including fuel consumption and emissions levels, mean that the FMS system enables high fidelity simulations of functional and thermodynamic factors," stated Gregory Sudwoj, General Manager Technical Experts at WinGD.

"The extensive, multi-interface virtual environment we can create also includes

all the auxiliary systems of a typical engine room and enables a team to experience a wide range of simulations. To encourage decision making and to promote sharing of responsibility, these include both routine and distress situations. Overall, the scope of the FMS gives WinGD unique opportunities to familiarise engine crews with all the systems involved in operating an engine in a ship."

The W-Xpert Full Mission Simulator has been approved by Classification Societies for Marine Crew Training and Competence Assessment in accordance with IMO STCW (Standards of Training, Certification and Watchkeeping for Seafarers) regulations.

Engine simulation policy

Whenever new two-stroke engines are delivered, WinGD always can provide the ship's crew and technical staff with the operational training needed for the engines and ancillary equipment found in the engine room. "During 2016 WinGD trained more than 350 personnel and the most popular tool for WinGD trainees is the W-Xpert virtual engine room simulator because it mimics very realistically situations happening on the bridge, in the control room and in the engine room at the same time", Sudwoj added.

"Previously, WinGD relied on a standard twin screen training but now, with the support of UNITEST, we can use the FMS for navigating around the engine and control room. This enables numerous trainees to replicate and rehearse very real operating sequences, conditions and emergency situations."

Global training network

To ensure WinGD engine training is available worldwide, WinGD plans to offer high definition digital simulation training in strategic shipping industry locations around the world. With W-Xpert software, it is possible to provide basic operator training anywhere in the world using just a standard PC or laptop. However, the ideal crew training is provided using the high levels of simulation enabled by the FMS system, WinGD confirms.

WinGD trainers have been permanently located in the HHM Marine Power Academy in Shanghai since Summer 2015 and the W-Xpert FMS has been fully utilised ever since its inauguration.

In June 2017 W-Xpert Full Mission Simulators will also be commissioned in Athens Greece and Pusan Korea to provide crews with expanded virtual training possibilities in these two important shipping locations.

Inmarsat confirms successful launch of the fourth Global Xpress satellite

Inmarsat has confirmed the successful launch of the fourth, high-speed broadband communications satellite in its transformational Global Xpress (GX) constellation. Inmarsat GX is the world's first globally available, broadband connectivity service and was created to enable communities across the world to benefit from the emerging digital society.

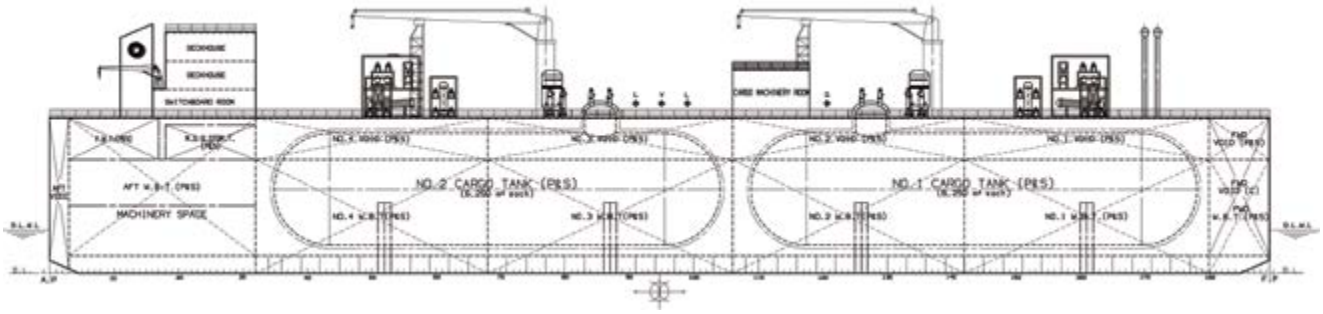
Inmarsat-5 F4 (I-5 F4) was launched by SpaceX on a Falcon 9 rocket at 00:21 (BST) / 19:21 (ET) from the historic launch pad 39A at NASA's Kennedy Space Center in Florida. Following satellite separation at 00:53 (BST) / 19:53 ET, we acquired telemetry from our Perth ground station at 01:04 BST / 20:04 ET.

The launch team from Inmarsat and Boeing Network & Space Systems, the manufacturer of I-5 F4, are now raising the spacecraft to a geostationary orbit, at which point the satellite will deploy its solar arrays and reflectors, and undergo payload testing.

I-5 F4 joins the three GX satellites already in orbit, which have, since December 2015, been delivering unprecedented service speeds, global coverage, reliability and security to users on land, at sea and in the air. The fourth satellite adds further capacity to the GX network, as well as in-orbit redundancy that further upgrades the reliability and resilience of Inmarsat's service offerings.

ABS, HHIC Project Leads to Innovative FSRU Concept

ABS partners with Hanjin Heavy Industries and Construction (HHIC) to advance safety and set standards in new FSRU design concept.



New Floating Storage and Regasification Unit (FSRU) design concept

ABS, a leading provider of classification and technical services to the marine and offshore industries, continues to support innovation in industry. Working with Hanjin Heavy Industries and Construction Co., Ltd. (HHIC) as it completed a new Floating Storage and Regasification Unit (FSRU) design concept, ABS provided safety guidance and advice on regulatory compliance throughout concept development.

"Industry is exploring options for getting gas to new and expanding markets," said ABS Vice President for Global Gas Solutions Patrick Janssens. "As a technology leader, ABS is working with innovators who are looking more closely at FSRUs as a flexible and efficient gas delivery solution."

The smaller 25,000 m^3 design concept incorporates four type C cargo tanks to simplify the transfer of gas to the storage terminal. In reviewing this new design, ABS applied its latest safety standards and confirmed that the conceptual design meets applicable class requirements.

"Partnering with ABS and leveraging its knowledge and experience in LNG regasification helped us prove the feasibility of the concept and better understand the safety implications throughout development of the design," said HHIC Executive Managing Director Moon-Tae Yoon. "This project is an important milestone for HHIC, and this type of asset will serve a critical need in markets that are looking for efficient ways to get gas."

Recognizing the changing landscape and increased industry focus on gas, ABS launched its Global Gas Solutions team in 2013 to support industry in developing gas-related projects. A pioneer in classification for the safe transport and handling of gas, ABS classed the world's first LPG carrier conversion, the first LNG carrier conversion, the Methane Pioneer, in 1959, as well as the first newbuild LNG carrier, Methane Princess, in 1964, and has extensive experience with the full scope of gas-related assets, including many of the most advanced gas carriers in service. ABS is the industry leader in classification of liquefied gas carriers.

로크웰 오토메이션 CEO, 산업용 사물인터넷의 미래 제시

블레이크 모렛(Blake Moret), 시스코의 2017 사물인터넷 월드포럼(Internet of Things World Forum)에서 사물인터넷과 산업생산성에 대한 통찰 공유

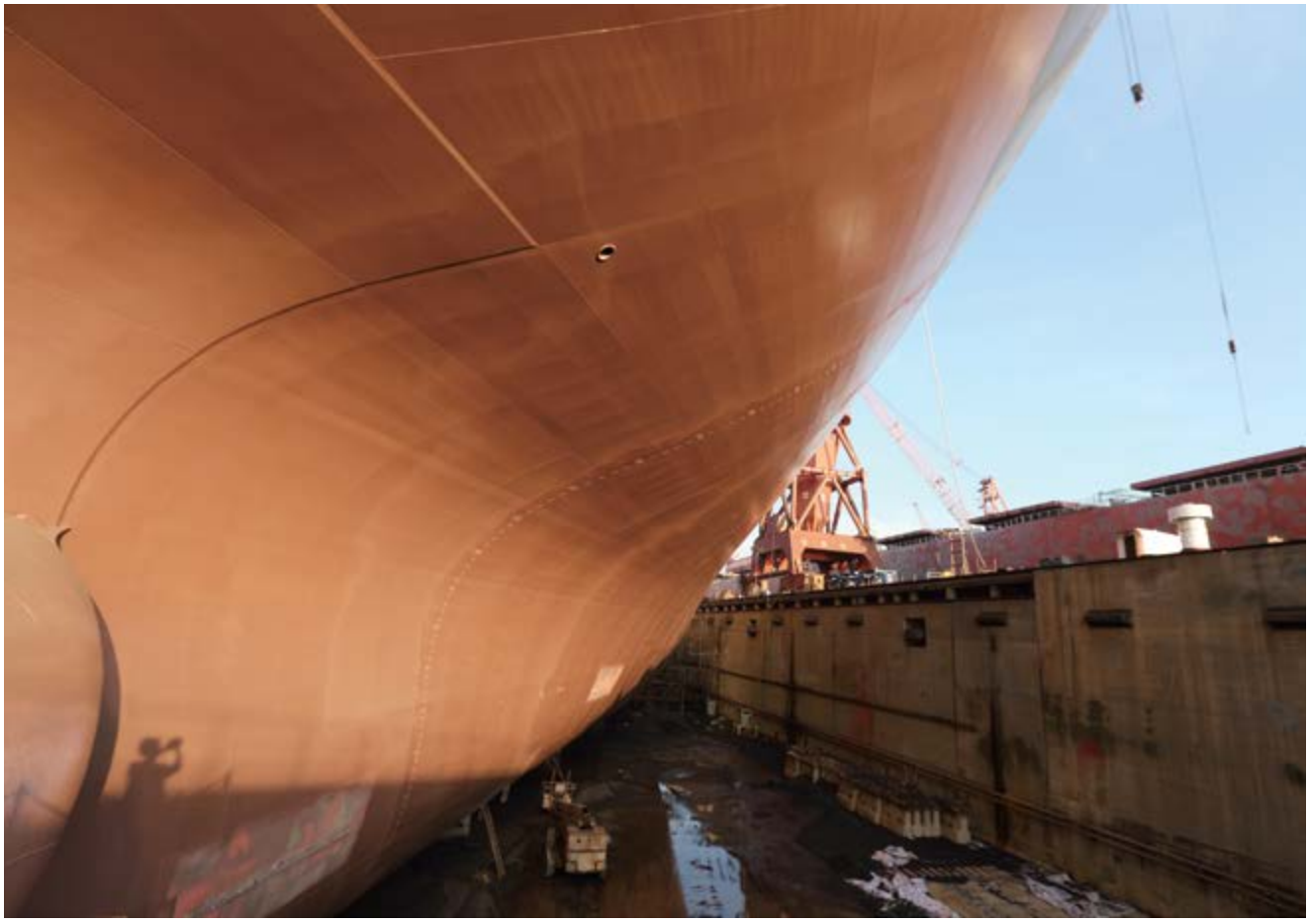
로크웰 오토메이션(Rockwell Automation)의 사장 겸 CEO인 블레이크 모렛이 지난 24일 런던에서 열린 시스코(Cisco)의 IoT 월드포럼(IoT World Forum)에서 사물인터넷(IoT) 도입과 그것이 산업 생산성에 미치는 영향에 대해 발표하고 포럼에 참여한 1200여 명의 비즈니스 리더들과 통찰을 공유했다. 산업 자동화 및 산업정보에만 주력하고 있는 로크웰 오토메이션은 스마트 생산의 미래 설계와 관련한 도전과 기회를 이해하는 독보적인 위치를 선점하고 있다.

모렛이 설명했듯이 조직들이 파일럿이나 개념 증명(proof-of-concept) IoT 프로젝트 단계에서 확장 가능한 IoT 배치로 발전하는 과정에서 IoT와 관련한 긍정적인 결과들은 지속적으로 가속화될 것이다. 인터내셔널 데이터 코퍼레이션(International Data Corporation, IDC)이 공개한 글로벌 IoT 디시전 메이커 설문조사(Global IoT Decision Maker Survey)에 따르면, 응답자의 약 1/3(31%)이 이미 IoT 솔루션을 개시했고 43%는 향후 12개월 이내에 솔루션 배치를 계획하고 있다. 로크웰 오토메이션은 IoT 솔루션 배치에서 유사한 추세를 보이고 있으며 모든 산업, 응용프로그램 및 지역에 걸쳐 파일럿의 수를 지속적으로 늘리고 있다.

모렛은 "제조업체 및 산업 운영자들은 그들의 업무 전반에서 IoT를 적용할 실용적인 방안을 모색 중이며 결과로서 측정 가능한 비즈니스 가치를 이끌어내고 있다"며 "IoT 기술과 특정 산업용 응용프로그램과의 융합을 통해 더 나은 협업과 더 빠른 문제해결 및 생산성 증대가 가능해진다"고 말했다. 모렛은 컴퓨팅 및 연결 비용 절감을 포함해 산업용 IoT 도입과 커넥티드 운영으로 도출되는 몇 가지 요소들과 정보기술과 운영 기술의 융합의 장점을 언급했다. 모렛은 IoT 기술을 도입한 커넥티드 기업이 확장 가능한 분석을 통해 사업의 모든 단계에 걸쳐 올바른 정보를 제공함으로써 어떻게 산업 운영에 대한 더 나은 통찰을 만들어내고 더 큰 가치를 창출할 수 있는지 설명했다. 그는 로크웰 오토메이션을 채택한 고객사 중 확장 가능한 분석을 도입해 운영 전반에서 가시성과 생산성을 개선한 그레이트 레이크 브루잉(Great Lakes Brewing Co.)의 사례를 언급했다.

2017 IoT 월드포럼은 IoT가 사업, 기술 및 사회에 미치는 영향을 탐구한다. 로크웰 오토메이션과 시스코는 전략적 파트너로 산업의 디지털 변환에 필요한 산업용 네크워킹 및 보안 솔루션 분야에서 오랜 기간 협업해 왔다. 또한 이들은 공장 단계와 높은 수준의 정보 시스템 간의 기술 및 문화적 격차에 가교 역할을 함으로써 제조업체들이 사업 성과를 개선할 수 있도록 지원한다.

모렛은 "우리에게는 우수한 기술, 유능한 인재와 강력한 문화가 있지만 시스코와 같이 훌륭한 회사와 제휴하고 있다는 것이 경쟁사와 차별되는 또 하나의 요소"라며, "우리는 공장에서 기업 네트워크까지 높은 보안성과 원활한 연결을 보장하는 기술과 솔루션 제공을 위해 함께 노력하고 있다"고 밝혔다.



Back to the future: steam turbine to DFDE conversion for LNG carriers

As per maritime common practice, the fuel bill is not included in the charter daily rate and the gas consumption directly affects the charterer's business. For this reason, steam turbines became obsolete on LNG carriers in early 2000s, when the adoption of DFDE (dual-fuel diesel electric) brought a drastic boost in ship efficiency. Existing steam turbine vessels are still accounting for about 60% of the active fleet and are losing competitiveness against more modern technologies. If a charter contract is close to expiring, charterers will simply move to a more efficient propulsion system, while those bound to a several-year residual agreement face a strong challenge. To enable this transition with a limited investment of funds and time, Wärtsilä has developed an integrated, total solution package to convert old, steam turbine LNG carriers into modern DFDEs.

Wärtsilä Corporation

By Matteo Natali, Applications Developments, Engines Sales, Wär tsilä Marine Solutions
Stefano Mori, General Manager Sales, Gas Carriers, Wär tsilä Marine Solutions

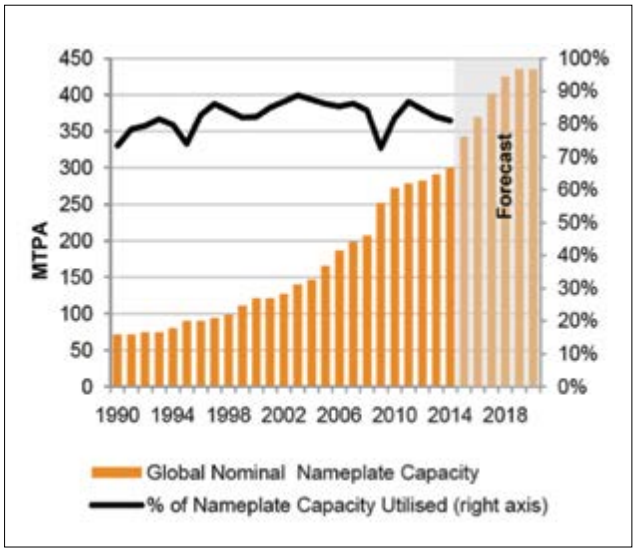


Figure 1. Global liquefaction capacity build-out, 1990–2020. (Source: IHS)

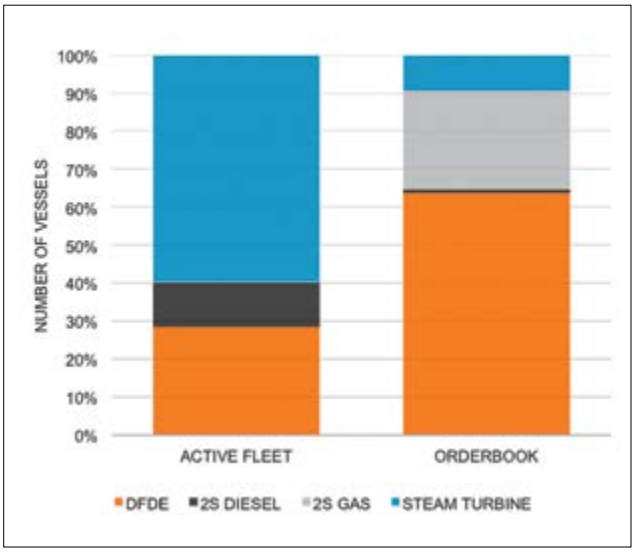


Figure 2. Existing and on order LNG fleet (>100,000 cbm) by propulsion type. (Source: Clarksons)

LNG market

World LNG trade volumes have more than tripled over the last 20 years, growing from 70 MTPA (million tons per annum) in 1995 to 250 MTPA in 2015 (Figure 1). Despite slowing down in the last few years, due to the longer-than-expected European economic crisis, it will resume its expansion over the long term. Recently discovered technology will extend the accessible reserves, and new terminals will boost the liquefaction capacity. On the demand side, the growth will be driven by a steadily raising hunger for energy as well as an increasingly stronger focus on reducing emissions.

The LNG carrier building market has evolved accordingly. The newbuilds orderbook amounts to around 170 units (compared to an active fleet of about 450), regardless of the momentary tonnage oversupply. The fact that as much as 20% of the newbuilds consists of vessels commissioned on speculation further highlights a strong and widespread confidence in a steep market ramp-up.

Propulsion systems

The major driver for LNG carrier machinery selection is the need to burn natural boil off-gas, which shaped a totally diverging trend from the traditional merchant vessel design. Until the early 2000s, as boilers were the only means for consuming natural boil-off-gas, steam turbines were the broadly preferred propulsion system. In 2001, GDF Suez ordered the first two LNG carriers powered by Wärtsilä dualfuel, medium-speed engines in a diesel electric configuration. The new propulsion system brought major enhancements in terms of operating flexibility and, above all, efficiency, enabling up to 40% fuel savings over the traditional steam turbines.

Wärtsilä DFDE quickly became the new standard for LNG carriers, equipping 90% of newbuilds in 2014 and boasting almost 200 references. A variety of other new technologies, such as the low pressure slowspeed dual-fuel or the high pressure slowspeed gas-diesel, have recently entered this market claiming a further trimming of operating expenditures. (Figures 2 and 3)

Conversion business potential

Wärtsilä realized the opportunity to offer an integrated solution to convert an obsolete steam turbine system into a modern and business-competitive DFDE. When assessing the relevant market, over 150 vessels were identified as potential targets.

Different business scenarios arose (Figure 4), depending on the contract situation between owner and charterer.

The conversion proved to be particularly attractive when the residual chartering time is long enough to generate buy-in by the charterers and make it convenient for them to contribute to the initial investment. Thanks to the improvement in ship efficiency, some charterers calculated an impressively low

payback time, even if they would have to take on the whole conversion cost.

A high level study was presented at GasTech in Singapore in October 2015 and triggered extraordinary interest - to the extent that a conversion specification was commissioned for Wärtsilä.

Conversion in practice

The specification basically consists of a detailed picture of what the conversion entails, with respect to equipment components, structural impact and system modifications.

Three propulsion system conversion alternatives have been considered: DFDE (2 x Wärtsilä 12V50DF + 2 x Wärtsilä 6L50DF

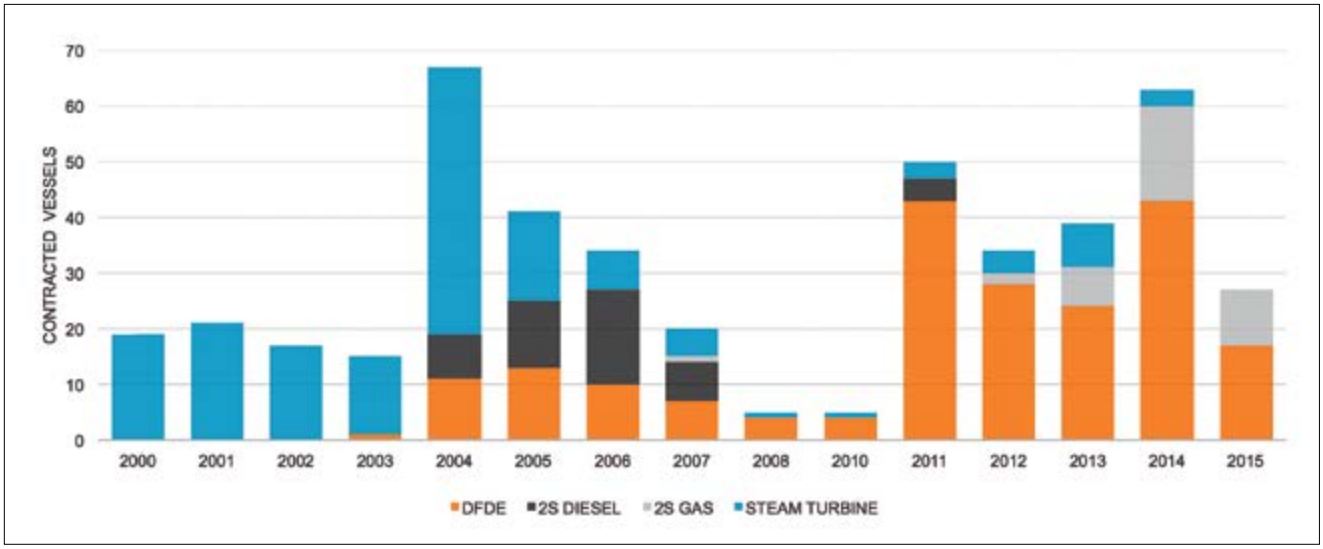


Figure 3. LNG Fleet (> 100,000 cbm) by propulsion type. (Source: Clarksons)

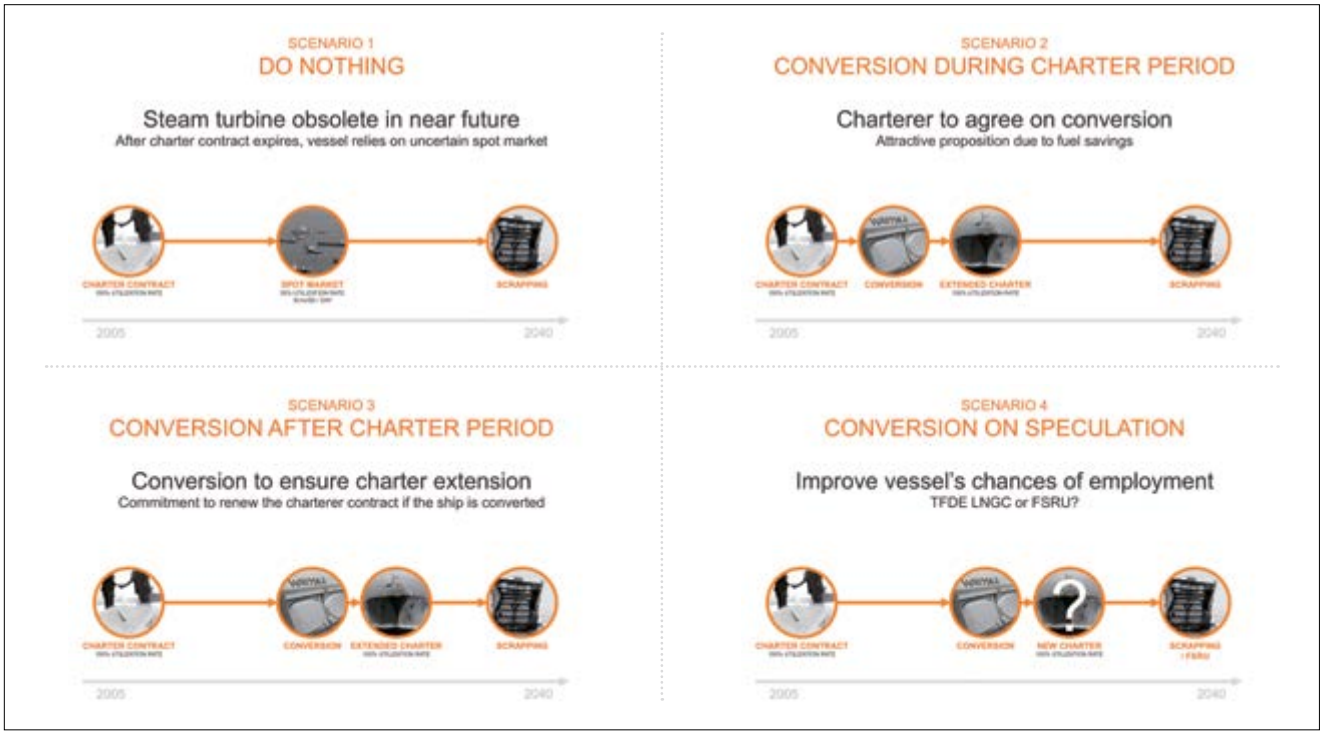


Figure 4. Conversion business scenarios.

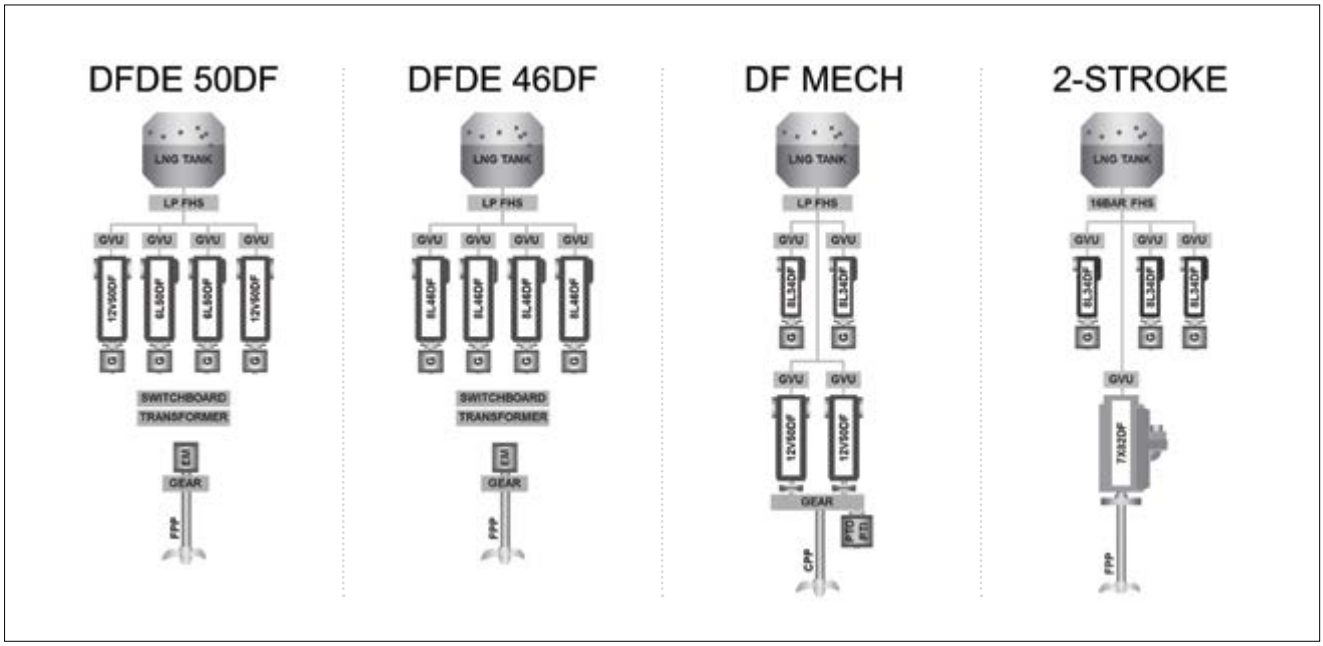


Figure 5. Conversion options.

or 4 x Wärtsilä 8L46DF), dual-fuel four-stroke mechanic (2 x Wärtsilä 12V50DF + 2 x PTO + 2 x Wärtsilä 8L34DF) and dual-fuel two-stroke (1 x Wärtsilä 7X82DF + 3 x Wärtsilä 8L34DF). (Figure 5)

In all cases, the existing steam turbine plant has to be removed through openings in the decks. The dual-fuel four-stroke mechanic and the dual-fuel two-stroke alternatives require drastic structural modifications, including hull cropping to fit the main engines. Moreover, for the two-stroke alternative, it is not always viable to keep the existing shaftline, resulting in a possible re-design of the whole vessel aft. In comparison, the impact of a DFDE installation is more limited; the equipment can be fit through the openings created to remove the steam turbine system, and the existing propeller and shaftline potentially can be maintained. (Figure 6)

Available natural boil-off-gas is sufficient for a DFDE system to sail at any vessel speed. So benefits from further paring down gas consumption materialise only in ballast conditions. Therefore, those benefits are too limited to justify a bigger impact conversion than what a mechanical solution entails.

In cooperation with one of the major ship owners in the LNG market, strategically located yards were identified worldwide, based on their relevant experience, and asked to provide both a quotation and a time schedule. Some of them proved to have the right skills and expertise to perform the conversion, and their offers matched the budget and time-span upper limits defined in the owner business cases.

Charterer business case: number crunching

Wärtsilä estimated the potential fuel savings that a DFDE system would enable on a 145,000 cbm steam-turbine-powered LNG carrier built in early 2000s.

Given a standard operating profile, a DFDE vessel can sail exclusively on natural boil-off-gas in laden conditions. On the other hand, with a steam turbine, it is necessary to force a remarkable quantity of boil-off (e.g. at 17.5 knots the usual forced boil-off-gas demand is in the range of 50 tons per day).

The calculated savings for reducing the fuel by more than 15,000 tons per year is USD 5.5 million, assuming an average LNG price of USD 350 per ton over the forthcoming period. Financial evaluations based on today's gas prices are quite limiting, as the conversion benefits materialise over the longer term. (Figure 7)

In the current market situation, charterers have to pay a USD 2.5 million premium on their yearly rate, if they choose a DFDE over a steam turbine vessel. However, the extra fee does not fully apply if the charterer invests in the conversion: the premium is limited to the maintenance costs coverage, about USD 500,000 per year.

For the DFDE alternative, the conversion implies an initial

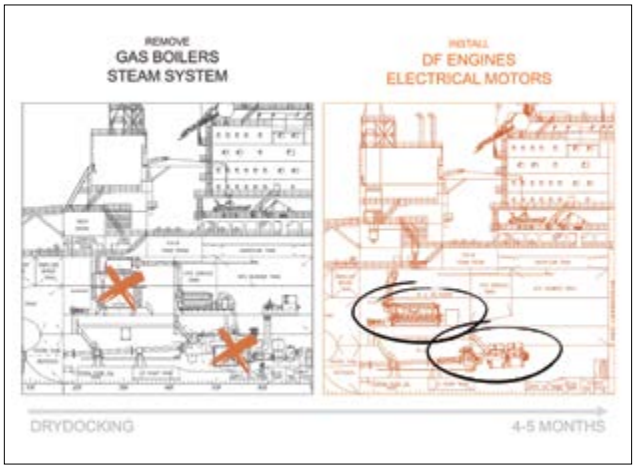


Figure 6. Conversion in brief.

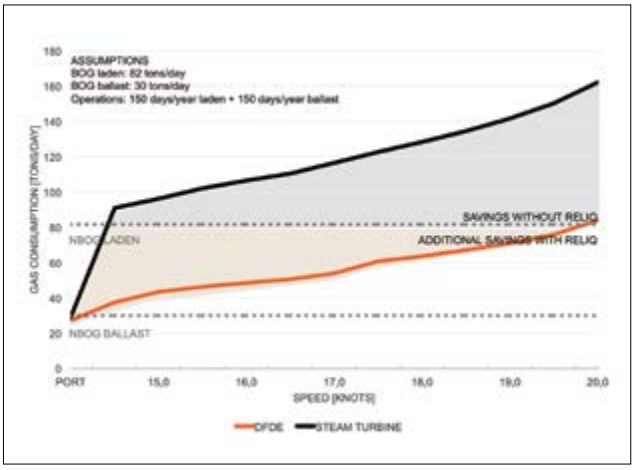


Figure 7. No forced boil-off required with DFDE in laden.

investment that ranges between USD 30-40 million and requires about 3 months' conversion time, depending on the shipyard capabilities and vessel specification.

Time, in particular, turned out to be a key factor, not only due to the direct costs at the yard, but also because of the need to hire a replacement vessel. Even taking advantage of pre-assembled modules and combined with the extended dry-docking, the vessel off-hire translates into USD 2.5 million additional expenditure.

All in all, considering direct and indirect initial costs, as well as net operational savings, the payback time does not exceed 7 years. Although very conservative, as based on the assumption that the owner does not contribute to the conversion, the financial outcome suggests an exciting business opportunity for the charterer.

Indeed, the market response has been extremely enthusiastic: Wärtsilä is receiving queries from owners and charterers on a daily basis, and the on-going discussions are becoming more and more concrete.

DFDE technology

Besides high efficiency, DFDE offers several advantages in terms of ease of installation, reliability, redundancy, performance, flexibility and emissions.

- Ease of installation: the conversion to a DFDE has no major impacts on the vessel structure, unlike mechanical configurations.
- Reliability: DFDE configuration has by far the most extensive references in the LNG marine business, with more than 1400 engines sold and over 13 million running hours.
- Redundancy: DFDE is able to sail 24/7/365, even during a sea-going maintenance.
- Performance: Electrical motors can provide maximum torque at zero speed with any propeller design.
- Flexibility: The fuel-sharing mode can maximize the use of boil-off gas and reach the highest output with lower gas quality.
- Emissions: Dual-fuel engines work according to the Otto cycle, which means IMO Tier III compliance in gas mode without any after-treatment, while diesel cycle engines require either EGR (exhaust gas recirculation) or SCR (selective catalytic reduction).

Wärtsilä turnkey total solution

Thanks to its broad product portfolio, the most comprehensive in the marine market, Wärtsilä aims to promote the conversion as a turnkey total solution. All of the needed equipment and engineering can be included in the project scope, ranging from fuel gas system, engines, electrical package, gearbox, IAS (integrated automation system) upgrade, boilers, economizers, and GCU (gas combustion unit) to the class-approved drawings. Opting for a total integrated solution rather than a product bundle can be highly beneficial for the customer from many different perspectives. (Figure 8)

Communication is a good example. The interfaces are drastically simplified and reduced to three main stakeholders: owner, shipyard and Wärtsilä, the one single equipment supplier.

Project risk mitigation is another important added value. This is guaranteed, for instance, by state-of-the-art integration

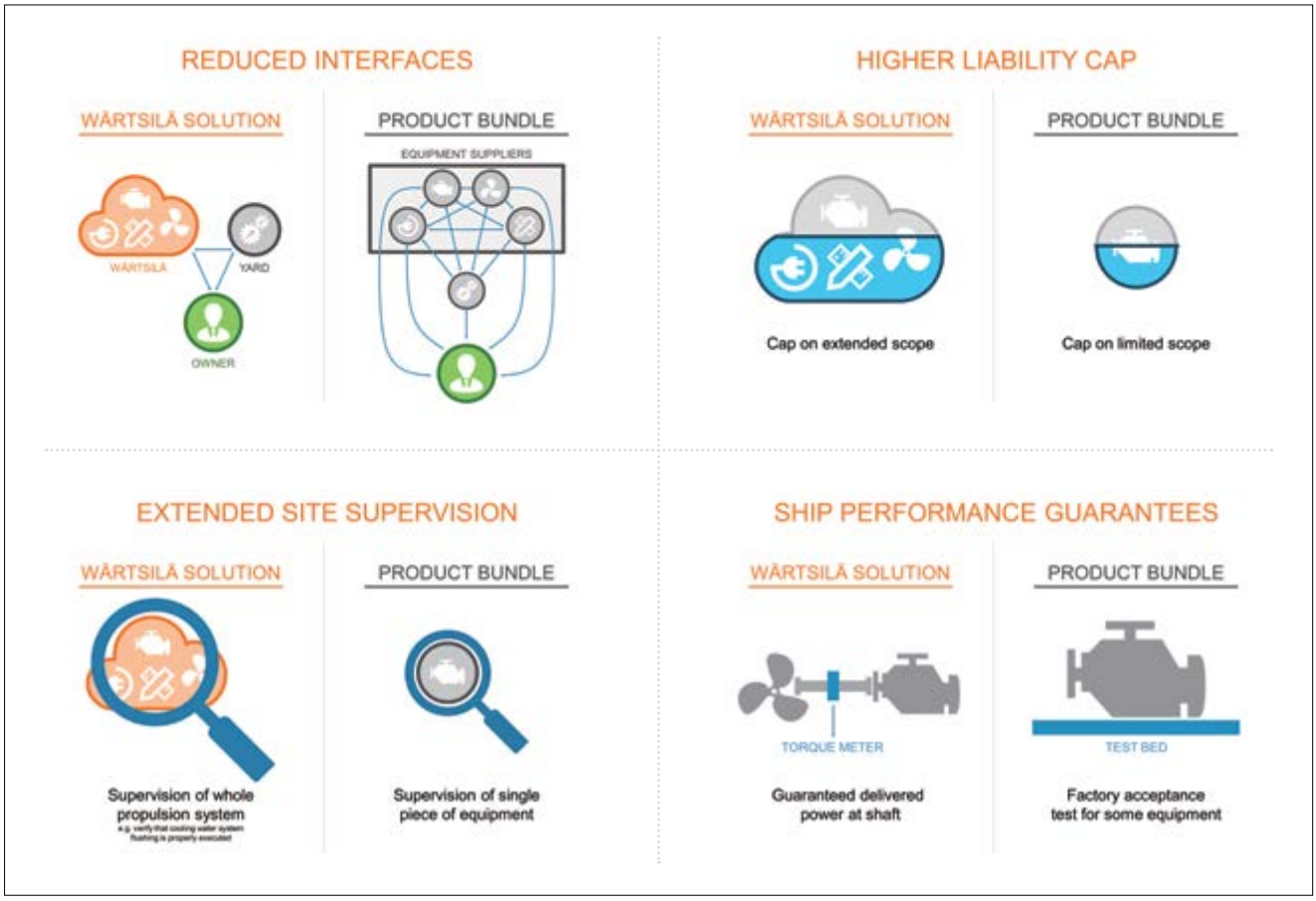


Figure 8. Comparison between a total integrated solution and a product bundle.

engineering and is reached thanks to information availability, geared internal synergies and deep knowledge about Wärtsilä's own product portfolio.

On top of that, Wärtsilä is able to provide support prior, during and post installation, i.e. by estimating the expected overall efficiency of the system, supervising the building phase (including installation and integration of equipment and auxiliary systems), and training the crew regarding the management of the entire engine room.

Furthermore, a liability cap covering an extended scope, rather than a single product, further limits the customer's exposure to risks.

A glimpse ahead

In an increasingly tough market, owners are facing the need to boost their fleet competitiveness. Improving efficiency by 40% makes vessels remarkably more attractive and ensures fleet employment, also in case of tonnage oversupply, whereas steam turbines are doomed to remain the very last choice. Moreover, the asset lifetime gets longer and can be even further extended through via an FSRU (Floating Storage and Regasification Unit) through the installation of a regasification plant.

Nevertheless, charterers are those who can benefit the most from the conversion, thanks to a terrific abatement of operational expenditures.

An investment cost-sharing between owner and charterer is therefore a fair compromise, where both parties can significantly enhance their respective business with a limited investment.

Getting the first project to materialize successfully could pave the way for a new course of action in the LNG shipping industry. Thanks to its unmatched track record as technology pioneer and its unique capacity to provide turnkey solutions for the whole engine room, Wärtsilä is the ideal partner for a successful conversion.

The power of the future

What will power the ships of the future? Will the industry manage on its own to transition out of its dependency on heavy fuel oil, or will regulations be needed to force a change? Is LNG the fuel of the future, or more of a placeholder while greener alternatives ramp up? Will the first movers into new technologies inspire others to follow in their wake?

ABB

Experts and journalists from the maritime industry gathered in London.

To gather some solid perspectives on these and other challenges and opportunities facing shipping as we enter into the 4th Industrial Revolution, ABB Marine & Ports invited four prominent maritime journalists, a progressive shipowner, and a marine emissions and regulations authority to a roundtable discussion with their own experts in London on 28 February 2016. The following is a subjective account of the discussion. In these days of paradigm shifts and overnight revolutions, where predictability seems to have left the building, perhaps a philosophical approach is a useful supplement to business acumen. The discussion in London was kicked off by University College of London Reader Tristan Smith:

Dr. Tristan Smith - University College of London Consultants Ltd.

"When navigating the regulatory picture, it is important to start in the present and try to see the inevitable future," he proposed. "Extrapolating on the current state of shipping, we can assume that volumes will grow, while emissions will decrease."

Emissions are expected to decrease by 60-90% per tonne mile by 2050, he related, adding "Many things could contribute to this, including slower steaming, new fuels, and other technologies, but fuel will be the main driver."

Smith and his colleagues employ this same methodology in much of their work, running scenarios that explore potential future outcomes, and trying to gain an understanding of what they mean. He advises companies to take a lesson from the game of hockey, and "skate to where the puck will be", or position themselves where they see things moving, based on macro trends and major developments.

One of those doing just that is tourist ship owner The Fjords, operating out of idyllic Flåm on the Norwegian west coast, and trafficking the UNESCO-protected Nærøyfjord. CEO Rolf A. Sandvik told of how they came to equip their latest vessel, the Vision of the Fjords, with hybrid diesel-battery propulsion:

"When we built the hybrid Vision, the spreadsheet told us we should have chosen pure diesel. But we felt an obligation to respect our presence on this pristine fjord. We wanted to make a difference, but also to stand out from the competition."

While there could be no contesting their idealistic motives, there was never any guarantee that their investment would pay off. But Sandvik and The Fjords decided to "skate to where the puck will be," and that has proved to be a decision as prudent as it was bold: "We had faith that travellers would appreciate our decision, and a study to be published in the spring of 2017 has confirmed this assumption, that they are willing to pay for the green advantage."

The Vision of the Fjords in fact has many advantages, not least its striking design inspired by a winding mountain path, and unmatched viewing experiences, both inside the main cabin and on deck. But gliding silently along Nærøyfjord under battery power is definitely a key selling point in the overall experience, underpinned by the environmental bonus of zero emission cruising. "We have not yet marketed the green aspect with full strength, but we will do so in the future," he related.

As for positioning themselves where they believe things are headed, Sandvik and The Fjords are way ahead of the puck: "What we have done so far is with zero support from the government. We are doing it because we believe that people want a carbon-free future, and that technological advances will eventually bring costs down."

What makes change happen?

A comment from the journalists emphasised the impact of market forces and critical mass. The turning point, they observed, comes when technology converges at an affordable point, for example when an automobile manufacturer can turn out mass-produced models with new technologies at affordable prices.

Janne Kuivalainen - Head of Technology, ABB Marine and Ports

ABB's John Olav Lindtjørn conferred: "The transfer of technologies from other industries is speeding up conversion processes in shipping. Perhaps we will see major changes in just 10 years?" His postulation received support from Tristan Smith: "The 'Hydrogen Hypothesis' predicts 2030 as a turning point, but this involves several trade-offs, including the de-carbonisation of electricity production."

Here the veteran journalists weighed in with a healthy dose of scepticism: Could it be realistic to hope for such a major reduction in emissions by 2030, or even 2050? And if so, which fuels will enable such a dramatic reduction in just one new generation of ships?

Tristan Smith replied that fleet renewal would drive much of the change, primarily newbuilds, but with some retrofitting to add to momentum. Still, he cautioned against painting too rosy a picture of an industry not built for rapid change: "Regulations will drive the move to new fuels, but shipping will still be heavily fossil for some time to come."

Underscoring the slow nature of change in the shipping industry, ABB's Janne Kuivalainen pointed out one of the major differences between shipping and other transport industries: "Ship construction is more conglomerate than automobiles or planes. This makes it difficult to scale up quickly, because there are so many contributors that have to be on the same page."

John Olav Lindtjørn - Global Product Manager, Onboard DC Grid, ABB Marine and Ports

Jorulf Nergard - Head of Short Sea Shipping, ABB Marine and Ports

In with the new

Moving on to new power sources, John Olav Lindtjørn elaborated on the expanding role of batteries onboard: "Batteries can contribute to more than pure propulsion. They can compensate for sub-optimal engine operations, or serve as a backup, reducing the need for auxiliary power, and thus reducing emissions." He was supported by ABB colleague Jorulf Nergaard, who pointed out that batteries have the potential serve these and many other purposes that can improve a ship's overall efficiency and economy.

But batteries need charging, and charging is a challenge, Janne Kuivalainen stated: "We need more cases to achieve standardisation. Each route has its own needs, and the same thing basically applies to each vessel."

Here Rolf Sandvik turned his attention to regulations as the driver for change: "Regulations are needed to drive standardisation in charging infrastructure. With these in place the industry will adjust, and as we have seen, the customers are willing to pay."

But regulations can be tricky, especially at the local level, as The Fjords have experienced: "Local politicians are unwilling to implement regulations that could influence competition. If they reward hybrid or zero-emission solutions where we operate, they fear it would give us an unfair advantage. Of course we believe that regulations would push others to move toward greener solutions. Instead, the responsibility is pushed upward, from local to national, then to the international level, and eventually they land with the IMO, where things move slowly."

"We would like to be able to operate anywhere in the world with our concept, but that requires standardisation, and the road to international standards is a very long one. The industry should take initiatives for standardisation of charging facili-

The Vision of the Fjords uses a hybrid power system

ties, perhaps working within the ISO regime."

Sandvik is also looking to other fuel sources in his quest for greener operations: "We are planning to retrofit an older vessel with hydrogen power in a government-funded conversion project, and we have started talks with a west coast yard."

Janne Kuivalainen pointed out that fuel cells will require further technical development before they take a larger role, emphasising the need for the industry to take control of markets, research, and development. "But for now," he maintained, "the future is electric."

Seeing the opportunities

Addressing the transition from the old to the new, John Olav Lindtjørn reflected on the potential life span of diesel, and the factors that will determine how long it takes to achieve a shift from fossil fuel: "Power will definitely increase in fuel cells, but combustion engines will be around for a long time, if perhaps in smaller dimensions. Batteries last between 5 and10 years, so costs will drop by the time replacement is required. Battery recycling will also improve, and the second life of batteries in non-critical situations in being considered."

True to form, the press corps posed another sticky question: Will shipowners be able to convince customers to pay more for transportation without a reward for using green solutions?

Tristan Smith offered a reply: "Cargo owners are demanding green transport, with less carbon. I believe containers will pave the way, as their customers are more concerned with maintaining green and clean profiles. With everything from iPhones to automobiles, manufacturers want to be seen as green along the whole supply chain. Eventually, tankers and bulkers will follow, but I am cynical about market forces alone driving change. Regulations are needed to catalyse the shift."

Rounding off with perspectives on the 4th industrial revolution and its impact on the power of the future, Janne Kuivalainen assumed a holistic perspective: "Digitalisation will impact R&D, and thus influence power systems development not just directly, but by giving industry the chance to try out systems in realistic simulated test situations and model systems more accurately. Performance, lifetime, many factors can be made more predictable. In this way digitalization can help us gain deeper domain knowledge before we move technologies into the field."

Tristan Smith agreed, summing up the discussion with an appropriately hybrid approach, merging virtual and physical realities: "Increasing access to knowledge is important to driving change. But each ship is essentially a prototype, and this is both an advantage and a disadvantage, a blessing and a curse. Ships can be designed to purpose, but not easily standardised."

That would seem a fitting description of the reality of powering ships. When it comes to determining the power of the future, there are as many challenges as there are ships – and as many opportunities.

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FEIN magnetic core drills for universal use

FEIN KBM 50 and KBM 65: powerful and long-life machines

C. & E. Fein GmbH

FEIN KBM 50 and 65: low weight, yet powerful

Core-drilling specialist FEIN has fully revamped three of its KBM magnetic core drills with 50 and 65 mm diameters. In the process, it has undertaken a number of product improvements, including a centrally positioned drill motor cable guide with swivel-mounted cable hose, a 30 mm longer and reinforced drill motor guide for greater precision, an intuitive control panel in the user's direct line of sight and an extra-large stroke range.

The tools have an impressively low weight for their performance class. The magnetic core drills KBM 50 Q, KBM 50 U and KBM 65 U were designed to high technical standards, which helps them deliver a long service life in tough conditions.

High versatility

The FEIN magnetic core drills KBM 50 and KBM 65 meet all the requirements of core drilling in metal: core drilling, twist drilling, countersinking, tapping and reaming. Clockwise/anti-clockwise rotation and electronic speed setting allow the speed to be adapted to any application. A double drill-motor guide gives the tools the largest stroke range on the market. They can therefore also be used with longer accessories.

One unique feature is that the stroke range can be adjusted without the help of tools; utilising two clamping levers on the drill motor side. The core drill bit can also be changed at speed, again without any tools: one click and the drill bit is fitted and running at high concentricity.

Simple operation

The FEIN KBM 50 and KBM 65 offer intuitive operation. Six large controls are easily accessible and in the users' direct line of sight on the top of the drill motor. A convenient magnetic holding force display assists the user in carefully making contact with the workpiece surface. If the magnetic switch lights up continuously, the full holding force is applied. If the button flashes, the material surface is thin, uneven, dirty or scaled and the holding force thereby reduced. Compared with previous models, the drills have up to 25% more magnetic holding force.

The edges at the front of the magnets are bevelled by 45 degrees, providing a good width across corners for use in a steel girder bar. Extended magnetic feet improve leverage and provide a good hold so the tool cannot be pushed off or break away. The magnetic core drills also have a drill depth display in the form of a scale ring with a 0 point. This allows the cutting depth to be calculated for blind or twisted holes. A scale in mm or inches can be selected.

Long-life design

FEIN developed the KBM series for tough industrial and manual trade applications. The durable "made in Germany" design is the result of quality materials and workmanship. Both the gearbox housing and the supportive drill jig are made from high-strength die-cast aluminium. The barrel design drill motor is torsion-resistant and ensures a secure bearing seat for the rotating motor parts.

The speed-stable FEIN high-power motor is also designed for a long service life and high power and guarantees economical drilling. Higher long-term power than other models of the same performance class is achieved through the extra high copper content in the FEIN motors. The low-wear, double drill motor guide of the magnetic core drills is made from hard nickel-plated aluminium and has been extended by 30 mm and is reinforced for extra strength.

The drill motor cable is positioned centrally and swivel-mounted to protect against snagging or getting caught on the workpiece. FEIN has also incorporated a gravity-driven cooling lubrication system in the drill jig which can be removed without the need for tools. The permanent cooling extends the tool life and results in a better cutting performance.

Low weight

Despite their high power and long-life design, the three FEIN KBM tools are amongst the lightest in their segments. They display a low power-to-weight ratio while retaining their compact design thanks to a weight-optimised construction, with high-strength aluminium die-cast elements with reinforcement ribs for all components and a magnetic foot optimised in terms of performance and weight. The low weight of the FEIN KBM tools allows for mobile everyday use in the workshop or on the construction site – even when working vertically or overhead.

Three models

The FEIN KBM range with 50 and 65 mm diameters includes three two-speed magnetic core drills. One model with a core

KBM: long-life tools for challenging tasks

KBM 50 Q: one of the lightest 2-speed tools in its segment

Powerful FEIN KBM 50 U and 65 U for universal use

bit holder and two with MT3 holders. The light magnetic core drill KBM 50 Q weighs in at 13.2 kg, making it one of the lightest two-speed tools in its segment. With its MT3 holder, the KBM 50 U allows for universal applications and the use of long drilling tools. Both KBM 50 models enable flexible use in the workshop and on the construction site.

The powerful KBM 65 U with MT3 holder combines a compact design with performance. Its speed remains stable even during high-power applications such as core drilling holes up to 65 mm in diameter or tapping up to M20. Through fine adjustment, the drill spindle can be quickly and conveniently aligned with precision without the magnets having to be removed and refitted. The KBM 65 U is designed for use in the workshop.

FEIN core drills for trades and industry

Incorporating the KBB, KBM and KBH product ranges, the FEIN core drilling range includes the right tool for any metal core drilling job. The four models of the FEIN KBB series with optimum speed for HSS core drill bits are designed for core drilling in the workshop and installation work and deliver impressively economical, precise results: the compact FEIN KBB 30 for core drilling in tight and difficult-to-reach spots, the FEIN KBB 38 for precision drilling of holes up to 38 mm in diameter, the FEIN KBB 40 with fixed drill motor for core drilling up to 40 mm in diameter in tight spaces and the powerful two-speed KBB 60 with extra long drill shaft.

Alongside the KBM 50 Q, KBM 50 U and KBM 65 U models, the FEIN core drilling range of the KBM series also includes the FEIN KBM 32 Q – a compact core drill for installation work – and the three-speed tools FEIN KBM 80 U for the workshop and the fully automatic FEIN KBM 80 auto with digitally controlled drill feed. FEIN rounds off its core drilling range with the world's first hand-guided core drill KBH 25.

About company

The world's first power tool was invented by C. & E. Fein GmbH. Wilhelm Emil Fein founded the Company in 1867. In 1895, FEIN invented the electric hand drill, the first-ever power tool. Today this long-standing Company is a world-renowned power tool manufacturer. The German manufacturer of premium products develops and produces application solutions for the metal working, interior outfitting and automotive sectors and is the specialist for professional and extremely reliable power tools for industry and manual trades. FEIN holds more than 800 active industrial property rights, including around 500 patents and patent applications. FEIN markets its products through 19 international subsidiaries and more than 50 representations around the globe. For over 140 years, FEIN has been synonymous with application solutions and premium quality.

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HSHI secured an order for 2 units of VLCCs

Hyundai Samho Heavy Industries (HSHI) announced on April 26 that it received an order from a Singapore-based shipping company Sentek Marine for 2 units of VLCCs (Very Large Crude Carriers). These vessels measure 330m in length, 60m in width, 29.6m in depth and can carry 300,000 tons of crude oil.

They will be constructed to high environmental standards, incorporating cutting-edge technologies such as high pressure selective catalytic reduction system and SOx scrubber, etc. All of these VLCCs are scheduled for delivery by the first half of 2019. This contract includes an option for 2 optional vessels of same kind, raising expectation for additional orders.

The signing ceremony held on the same day in Singapore was attended by executives of HSHI and labor union branch representative Yoo Yeong-chang who drummed up support for the contract. Labor union branch representative Yoo Yeong-chang said, "HSHI has secured unrivalled competitiveness in terms of quality and delivery, bolstered by stable labor-management relations. All labor union members will make concerted efforts to ensure delivery of best quality vessels."

An official from HSHI said, "It is very meaningful that labor union and management have joined forces to overcome crisis. With labor union standing behind the contract, we will see stronger trust of ship owners in our company and greater stability at production site."

The latest contract will bring total value of orders placed at HSHI so far this year to USD 660 million with 9 vessels.

현대삼호중공업, 초대형 원유운반선(VLCC) 2척 수주

삼성중공업은 대한해운으로부터 소형 LNG선 2척을 약 1억 달러에 수주했다고 지난 5월 22일 밝혔다. 이 선박은 7,500㎥급 LNG선으로 국내 기술로 개발한 한국형 화물창(KC-1)을 장착하며, 2척 중 1척은 LNG 급유 기능을 갖춘 LNG벙커링 겸용선으로 건조될 예정이다. 납기는 각각 2019년 5월과 12월까지이다.

이번에 수주한 LNG선은 한국가스공사가 경남 통영에서 제주도로 LNG를 운송하는데 사용될 예정이며, 지난 4월 한국가스공사가 실시한 LNG 수송입찰에서 20년간의 운송계약을 따 낸 대한해운이 이에 필요한 선박을 삼성중공업에 발주한 것이다.

삼성중공업은 2015년에 17만4천㎥급 KC-1 타입 LNG선 2척을 국내 최초로 수주한 데 이어, 이번에 다시 소형 LNG선 2척을 KC-1 타입으로 수주함으로써 이 분야에서 독보적인 건조경험과 기술을 축적할 수 있게 되었다. 또한, 삼성중공업은 이번 수주를 통해 향후 시장 확대가 예상되는 소형 LNG선과 LNG 벙커링선 분야 진출의 교두보를 마련했다.

중국과 동남아 지역의 LNG 수요 증가에 따라 연안 운송에 필요한 소형 LNG선 수요가 증가할 전망이다. 클락슨의 선박 발주 전망에 따르면, 4만㎥급 이하 소형 LNG선은 2006~2016년에는 발주량이 연평균 2척에 그쳤지만 2017년부터 발주가 계속 증가해 향후 10년간 70척 이상이 발주될 것으로 예상했다.

또한 2020년부터 선박 연료의 황 함유량을 0.1%로 제한하는 SOx 규제가 시행됨에 따라 LNG를 연료로 사용하는 LNG추진선 발주도 늘어날 전망이다. 이에 따라 LNG추진선에 연료를 공급하는 LNG벙커링선의 신규 수요도 지속적으로 증가할 것으로 예상되고 있다.

한편, 삼성중공업은 올해 들어 이번 수주를 포함해 유조선 8척, LNG선 2척, LNG-FSRU 1척, 부유식 원유생산설비(FPU) 1척 등 12척 23억 달러를 수주했다.

STXOS won orders for 4 tankers

STX Offshore & Shipbuilding (STXOS) announced that it sealed contracts with 2 domestic shipping companies for 4 tankers (including 1 optional vessel) on April 27. These contracts came about a year and five months after November 2015, bringing much-awaited respite to the shipbuilder struggling with sharp decline in new order intake. These vessels are product oil & chemical tankers, each with a capacity of 11,200 DWT, and measure 120m in length and 20.4m in width.

They will be built at Jinhae shipyard of STXOS and delivered by the end of 2018.
Ship prices have remained undisclosed at the request of ship owners. However, the contract is said to have been recently inked based on market prices.
All of these vessels will be built into eco-friendly and high efficiency ship models that can reduce fuel consumption, increase fuel efficiency, and minimize exhaust gas emissions to meet the mandatory requirements of EEDI (Energy Efficiency Design Index) which have become ever more rigorous since 2015.
An official from STXOS said, "The signing of this contract has been bolstered significantly by the financial support with Refund Guarantee (RG) issuance. We will make desperate efforts to put the business back on track by fully leveraging our extensive shipbuilding track records and technologies that we have accumulated over many years of works despite sharp drop in global new order placement."

STX조선해양, 탱커 4척 수주

STX조선해양은 지난 4월 27일 국내선사 2곳으로부터 탱커 4척(옵션 1척 포함)에 대한 계약을 체결했다고 밝혔다. 이로써 STX조선해양은 지난 2015년 11월 이후 약 1년 5개월 만에 수주에 성공하며, 그 동안 목메어 기다리던 수주의 물꼬를 트게 됐다.
이번에 수주한 선박들은 1,1200 DWT급 석유화학제품운반선(Product Oil & Chemical Tanker)으로 길이 120m, 폭 20.4m의 재원을 갖추고 있다. STX조선해양 진해조선소에서 건조되어 오는 2018년 말에 인도될 예정이다. 선주사 요청에 따라 선가는 공개되지 않았으나 최근 시장가격 수준에서 계약이 이뤄진 것으로 전해졌다.
이들 선박은 지난 2015년부터 한층 더 강화된 이산화탄소 배출(EEDI) 규제로 인해 선박 연료소모량을 줄여 연비를 높이고, 배기가스 배출량을 최소화할 수 있는 친환경 고효율 선형으로 건조된다.
STX조선해양 관계자는 "이번 수주에는 RG(선수금 환급보증) 발급에 따른 금융지원이 큰 역할을 했다"면서 "글로벌 선박 수주시장의 어려움이 크지만 그 동안 쌓아온 풍부한 건조경험과 기술력을 바탕으로 경영 정상화를 위한 필사의 노력을 다하겠다"고 말했다.

SHI clinched an order for 4 units of VLCCs

Samsung Heavy Industries (SHI) announced that it signed a contract worth KRW 379.8 billion with a Oceania ship owner for 4 units of VLCCs (Very Large Crude Carriers) on May 12. These vessels will be delivered to the ship owner by the first half of 2019.
Although specific details of this contract remain undisclosed, the price per unit of vessel under this contract amounts to approximately USD 84 million which is higher than current market price of USD 80 million.
This year, major Korean shipyards, such as Hyundai Heavy Industries (HHI) and Daewoo Shipbuilding & Marine Engineering (DSME), etc., have won a series of new orders for VLCCs, bringing much-awaited respite to shipbuilding industry under the grip of order drought.
Meanwhile, SHI has won orders worth about USD 1.83 billion for 6 vessels so far this year. Particularly, SHI is expected to win additional orders worth USD 100 million from Korea Gas Corporation (KOGAS)

for 2 units of small-sized LNG carriers, along with FLNG project worth USD 2.5 billion from Italy-based ENI.

삼성중공업, VLCC 4척 수주

삼성중공업은 지난 5월 12일 오세아니아지역 선주로부터 초대형 원유운반선(VLCC) 4척 총 3,798억원의 수주 계약을 체결했다고 밝혔다. 이들 선박은 2019년 상반기에 선주사에 인도될 예정이다.

이번 계약과 관련해 구체적인 내용은 공개되지 않았으나 척당 계약금은 약 8400만 달러 수준으로, 현재 시장가격인 8000만 달러 보다 높은 가격이다. 올해 들어 현대중공업, 대우조선해양 등 한국 조선업계의 VLCC 수주 소식이 잇달러 전해지면서 수주 가뭄 해소에 단비가 되고 있다. 한편 삼성중공업은 올해 들어 현재까지 총 6척 약 18억 3000만 달러 규모의 수주고를 기록 중이다. 특히 이탈리아 ENI가 발주하는 25억 달러 규모의 FLNG 프로젝트와 한국가스공사가 발주하는 1억 달러 규모의 소형 LNG선 2척 등 추가 수주도 예상되고 있다.

Rolls-Royce to supply MT30 gas turbines to next three Korean Daegu-class frigates

Rolls-Royce has won a contract to supply MT30 marine gas turbines to power the next three ships in the Republic of Korea Navy's Daegu-class frigate programme.

Eight Daegu-class frigates (also known as FFX Batch 2) are scheduled to be built. The first ship being built by Daewoo Shipbuilding and Marine Engineering (DSME) was launched at DSME's Okpo shipyard in June 2016. Ship 2 will also be built by DSME and Ships 3 and 4 by Hyundai Heavy Industries (HHI) SNSD. The MT30 gas turbines for Ships 2 and 3 are due to be delivered in the second half of 2018 and for Ship 4 very early in 2019.

The frigates are intended for a variety of missions including anti-submarine warfare, anti-air warfare, patrol, surveillance, search and rescue, protection of EEZ, and transport.

Don Roussinos, Rolls-Royce, President - Naval, said "Our continued supply to this programme validates our on-going relationship with DSME and HHI. The Daegu class is an exciting programme. It is the world's first frigate to use a single MT30 in the compact package and our first application for MT30 outside the UK and US markets. The MT30 gas turbine has been successfully installed in Ship 1 and is currently successfully supporting the commissioning of ROK Daegu's propulsion system. We understand that MT30 has powered the ship to meet its full speed requirement."

The MT30 is derived from Rolls-Royce Trent aero engine technology and builds on over 45 million hours of operating experience and ultra-high reliability. It is initially built as separate modules on the same build line as the Rolls-Royce Trent aerospace engines in Derby. It is then assembled and tested at the company's Bristol facility.

With testing complete, the MT30 engine is shipped to Korea, where Hyundai Heavy Industries (HHI) Engine & Machinery Division integrate it into the steel enclosure which also houses the air inlets, exhausts and ancillary equipment, prior to installation in the ship.

The MT30 gas turbine is the world's most powerful in-service marine gas turbine with the highest power density and will deliver a high power output in a compact space.

Rolls-Royce MT30s are in service with the US

Navy's Freedom class Littoral Combat Ship and already successfully powering the Zumwalt class. MT30 has been selected for the Royal Navy's Type 26 Global Combat Ship and is powering the Royal Navy's new Aircraft Carriers. On HMS Queen Elizabeth the two MT30 gas turbine alternators have now been released to full power. MT30 has been recently selected for the Italian Navy's new Landing Helicopter Dock.

롤스-로이스, 한국 해군 대구급 호위함 3척에 MT30 가스 터빈 공급

롤스-로이스(Rolls-Royce)가 대한민국 해군의 대구급 호위함 세 척에 대한 MT30 선박용 가스 터빈 공급 계약을 수주했다.

대구급 호위함(FFX Batch 2) 8대가 건조될 예정이며, 대우조선해양(DSME)이 건조한 제1호 선박은 2016년 6월 대우조선해양 옥포 조선소에서 진수됐다. 제2호 선박 또한 대우조선해양이, 제3호와 제4호 선박은 현대중공업 특수선사업본부(HHI SNSD)가 건조할 예정이다. 제2호 및 제3호 선박에 사용될 MT30 가스 터빈은 2018년 하반기에, 제4호는 2019년 초에 공급될 계획이다.

이 호위함은 대잠수함전, 대공전, 정찰, 감시, 수색 및 구조, 배타적 경제수역(EEZ) 보호, 수송 등의 다양한 임무를 수행하기 위한 함선이다.

롤스-로이스 해군 사업부 사장인 돈 러시노스(Don Roussinos)는 "이번 프로그램에 자사 제품을 계속해서 공급함으로써 대우조선해양 및 현대중공업과의 지속적인 협력관계를 보여줄 것이다. 특히 대구급은 초소형 패키지에 단일 MT30을 사용하는 세계 최초의 호위함으로, 영국 및 미국 시장을 제외하고, 롤스-로이스의 MT30이 최초로 적용된 사례라 매우 흥미롭다. 현재 MT30 가스 터빈은 제1호 선박에 성공적으로 장착되어 한국 해군 대구함의 추진 장치 시범 운영을 원활하게 지원하고 있으며, MT30의 동력이 선박의 최대 속력 기준에 충족한 것으로 보인다"라고 말했다.

MT30 엔진은 롤스-로이스의 트렌트(Trent) 항공 엔진 기술을 바탕으로 개발되었으며 4,500만 시간이 넘는 운영 경험과 높은 신뢰성을 기반으로 제작되었다. 영국 더비(Derby)에 위치한 롤스-로이스 트렌트 항공 우주 엔진과 동일한 빌드 라인에서 모듈 별로 우선 제작된 다음, 브리스톨(Bristol)에 위치한 시설에서 조립 및 시험 과정을 거친다.

시험이 완료되면 MT30 엔진을 한국으로 운송하고, 현대중공업 엔진기계사업본부는 선박에 설치하기 전에 공기 흡입구, 배기 가스 및 보조 장비가 있는 철제 밀폐 공간에 엔진을 설치한다. MT30 가스 터빈은 현재 전력 밀도가 세계에서 가장 높은 강력한 선박용 가스 터빈으로, 좁은 공간에서도 높은 출력을 제공할 것으로 기대를 모으고 있다.

롤스-로이스 MT30은 미 해군의 프리덤급 LCS(Littoral Combat Ship, 연안 전투함)에 사용되고 있으며, 이미 줌왈트급(Zumwalt-classs) 함선에 동력을 공급하고 있다. MT30은 영국 해군의 첨단 26형(Type-26) 글로벌 군함에 선정되었으며, 영국 해군의 새로운 항공 모함에 동력을 공급하고 있다. 또한, HMS 퀸 엘리자베스(Queen Elizabeth) 항공 모함의 경우, MT30 가스 터빈 발전기 2대가 장착되어 있으며, 최근 이탈리아 해군에서 신형 다목적 강습상륙함(Landing Helicopter Dock)에 롤스-로이스 MT30을 채택한 바 있다.

Hyundai Global Service was awarded a contract by AMPTC for BWTS retrofitting project

Hyundai Global Service, a subsidiary of Hyundai Heavy Industries(HHI), announced that it signed a contract with AMPTC to retrofit the ballast water treatment system (BWTS) in Cairo, Egypt on May 11. This contract aims to install the HiBallas, a BWTS developed by HHI, in 8 vessels currently operational to convert them into eco-friendly vessels. Hyundai Global Service was awarded the contract on a turnkey basis covering whole processes ranging from design, through installation, to commissioning.

현대글로벌서비스, AMPTC으로부터 BWTS 수주

현대중공업 자회사인 현대글로벌서비스는 지난 5월 11일 이집트 카이로에서 AMPTC과 선박평형수처리시스템(BWTS) 개조공사 계약을 체결했다고 밝혔다.

이번 공사는 운항 중인 8척의 선박에 현대중공업이 개발한 선박평형수처리시스템인 하이 밸러스트(HiBallast)를 탑재해 친환경 선박으로 개조하는 것으로, 현대글로벌서비스는 2022년까지 설계부터 설치, 시운전까지 일괄도급방식(Turnkey)으로 공사를 수주했다.

SHI wins USD 100 million small-LNGC order

Samsung Heavy Industries (SHI) revealed on 22th May that they signed on the day a contract to build two small-scale LNGCs at a total of about 100 million USD.

The LNG carriers are built for KOGAS to transport LNG from Tongyeong, Gyeongsangnam-do, to Jeju Island. The 7,500m³ LNG vessels would be equipped with KC-1 cargo containment system designed in Korea. One of the two carriers would be built with LNG bunkering capability. The delivery dates are May and December of 2019.

The contract is a significant milestone for SHI, developing a leading track record in KC-1 LNG carriers, as well as expanding into small-scale LNGCs and LNG-bunkering vessels. Korean Cargo containment system is solely developed by Korean technologies by KOGAS with cooperation between the Korean Big 3s.

SHI had won an order to build the first-ever pair of KC-1 174,000m³ LNGCs in 2015. The newly signed contract further solidifies SHI's leading track record in the LNGC market. The contract also signifies SHI's entering into promising small-scale LNGCs and LNG-bunkering markets.

Increase in LNG demand in China and Southeast Asia is expected to call for demand for near-sea transport utilizing small-scale LNGCs. According to the Clarksons Research, small-scales LNGCs under 40,000m³ had a annual contracting of only two between 2006 and 2016, but the orders are expected to boost to 70 vessels for the next 10 years. Also, 0.1% SOx regulation starting in 2020 would also increase demand for LNG-fueled vessels, which naturally leads to newbuild demand for LNG bunkering vessels.

SHI has won a total of 2.3 billion USD dollar worth orders for 2017, including 8 tankers, 2 LNGCs, 1 LNG-FSRU, and 1 Floatin Production Unit (FPU).

삼성중공업, LNG선 2척 1억 달러 수주

삼성중공업은 대한해운으로부터 소형 LNG선 2척을 약 1억 달러에 수주했다고 지난 5월 22일 밝혔다. 이 선박은 7,500㎥급 LNG선으로 국내 기술로 개발한 한국형화물창(KC-1)을 장착하며, 2척 중 1척은 LNG 급유 기능을 갖춘 LNG벙커링 겸용선으로 건조될 예정이다. 납기는 각각 2019년 5월과 12월까지이다.

이번에 수주한 LNG선은 한국가스공사가 경남 통영에서 제주도로 LNG를 운송하는데 사용될 예정이며, 지난 4월 한국가스공사가 실시한 LNG 수송입찰에서 20년간의 운송계약을 따 낸 대한해운이 이에 필요한 선박을 삼성중공업에 발주한 것이다.

삼성중공업은 2015년에 174,000㎥급 KC-1 타입 LNG선 2척을 국내 최초로 수주한 데 이어, 이번에 다시 소형 LNG선 2척을 KC-1 타입으로 수주함으로써 이 분야에서 독보적인 건조경험과 기술을 축적할 수 있게 되었다. 또한, 삼성중공업은 이번 수주를 통해 향후 시장 확대가 예상되는 소형 LNG선과 LNG 벙커링선 분야 진출의 교두보를 마련했다.

중국과 동남아 지역의 LNG 수요 증가에 따라 연안 운송에 필요한 소형 LNG선 수요가 증가할 전망이다. 클락슨의 선박 발주 전망에 따르면, 40,000㎥급 이하 소형 LNG선은 2006~2016년에는 발주량이 연평균 2척에 그쳤지만 2017년부터 발주가 계속 증가해 향후 10년간 70척 이상이 발주될 것으로 예상했다.

또한 2020년부터 선박 연료의 황 함유량을 0.1%로 제한하는 SOx 규제가 시행됨에 따라 LNG를 연료로 사용하는 LNG추진선 발주도 늘어날 전망이다. 이에 따라 LNG추진선에 연료를 공급하는 LNG벙커링선의 신규 수요도 지속적으로 증가할 것으로 예상되고 있다.

한편, 삼성중공업은 올해 들어 이번 수주를 포함해 유조선 8척, LNG선 2척, LNG-FSRU 1척, 부유식 원유생산설비(FPU) 1척 등 12척 23억 달러를 수주했다.

Evergas and Clipper Group to Equip Vessels with MFT SEA-Mate® Lubricant BOB System

Maersk Fluid Technology (MFT) has signed contracts with both Evergas and the Clipper Group for the supply of the SEA-Mate® Blending-on-Board (BOB) system. This recent order takes the total number of SEA-Mate® BOB systems invested in by ship owners to over two hundred units, representing millions of logged cylinder operation hours.

Evergas will install the SEA-Mate® B1000 unit on their vessels, a system which is suitable for medium range engines with a bore size of 50–72 cm. The Clipper Group have taken delivery of the smaller B500 unit, which is the system specifically designed for engines with a bore size of 26–48 cm, to be fitted on a vessel equipped with a MAN Diesel S42MC engine.

Initially a tool for reduction of lubrication issues on very large 2-stroke engines, the concept is today available in three different sizes and suitable for all modern 2-stroke engines. MFT's BOB technology facilitates blending of the in-use system oil, as a base oil, with a high-BN cylinder oil product to produce a fit-for-purpose cylinder lubricant matching the actual fuel composition. With BOB units on board, ship operators can blend cylinder lubricant compositions that match actual engine operating conditions and fuel sulphur levels.

The use of this technology can reduce cylinder oil consumption and alleviate issues such as cold corrosion, excessive cylinder wear. The system also mitigates issues associated with worn system oil, causing problems for the hydraulic control system in modern electronic 2-stroke engines. Once oil is refreshed, significant energy savings in connection with purification and frictional losses can be realised.

The SEA-Mate® BOB concept is designed with a shipowners needs in mind and is actively developed together with the major engine designers and has received "no objection" letters for MAN Diesel & Turbo and Winterthur Gas & Diesel (WinGD) engines. The system is suitable for use on all types of vessel, both retrofit and newbuild, and does not require installation of additional cylinder oil tanks nor does installation result in offhire – it is fitted and commissioned during regular port stays.

BOB system to be installed on EverGas Gas Carrier, JS Greensail

"Maersk Fluid Technology welcomes the recent orders from Evergas and Clipper Group. The 200+ unit orders received to date represent systems installed across a wide range of vessels types, for retrofit and newbuild application. This is a technology that is supporting ship operators with both changing engine operating conditions and fuel sulphur levels, it is needed in the industry and we are pleased that our order book reflects that requirement." said Sune Lilbaek, Head of Sales at Maersk Fluid Technology.

Sembcorp Marine and Coldharbour sign ballast water treatment system agreement

Coldharbour Marine, developer of a unique in-tank, in-voyage and inert gas-based ballast water treatment system for large tankers, bulkers and LNG vessels, has signed an agreement with Sembcorp Marine that will see the latter offer the Coldharbour GLD™ BWT as part of the Sembcorp Marine Green Technology Retrofit (GTR) solutions for ship owners.

The GTR solutions provide carefully evaluated ballast water treatment systems from a select group of equipment manufacturers with whom Sembcorp Marine is working closely. Coupled with expert technical assistance from Sembcorp Marine, the

GTR solutions ensure that ship owners are able to select and install the most appropriate technology for their vessels.

Coldharbour CEO Andrew Marshall, said "We are delighted to sign this agreement with Sembcorp Marine. We have always maintained that no single technology is suitable for all vessel types and for all operating requirements. Our ballast water treatment systems target the largest vessels with the highest pumping rates, largest ballast volumes and longest ballast legs. For many ballast water treatment technologies, these three elements combined would have translated into a perfect storm of terminal delays and unrecoverable costs for owners, which by comparison, would make the initial cost of installing a ballast water treatment system pale into insignificance."

The Coldharbour GLD™ system carries full International Maritime Organization type-approval issued by the UK Maritime and Coastguard Agency; Lloyd's Register type-approval; and US Coast Guard Alternate Management Systems acceptance. It is currently undergoing full US Coast Guard type-approval.

As the global marine industry prepares for the implementation of the Ballast Water Convention on September 8th this year, there is still a considerable level of confusion and uncertainty surrounding the questions of

suitable equipment choice for different types of vessel and securing a successful retrofit installation strategy.

Addressing these concerns, Sembcorp Marine Executive Vice President and Head of Repairs and Upgrades Lee-Lin Wong said the company had examined various ballast water technologies and established collaborations with the best manufacturers around the world over the past 24 months.

Wärtsilä scrubber system to clean new Korean ferry's exhaust

Wärtsilä has been contracted to supply its exhaust gas cleaning system for a new Korean ferry. The vessel is being built for Weidong Ferry at the Hyundai Mipo Dockyard (HMD). This is the first Wärtsilä scrubber system to be installed where the shipyard, the owners, and the vessel's operational area are all in Korea. The contract with Wärtsilä was booked in January 2017.

Wärtsilä will supply a system consisting of two 13 MW Open Loop V-SOx Scrubbers specifically optimised for the new vessel. Delivery of the Wärtsilä equipment is scheduled for July of this year.

"This is an important order since it strengthens our visibility in the Asian market. Exhaust gas cleaning is something that ship owners and operators around the world are having to take very seriously, since the IMO's global cap on the sulphur content in marine fuel comes into effect in 2020, which is really rather soon. Wärtsilä has tremendous experience and a broad range of systems to help our customers comply with these regulations," said Sigurd Jenssen, Director, Exhaust Gas Cleaning, Wärtsilä Marine Solutions.

"We value Wärtsilä's experience and expertise in this field. We also

The new Korean ferry being built at the HMD will be equipped with a Wärtsilä exhaust gas cleaning system.

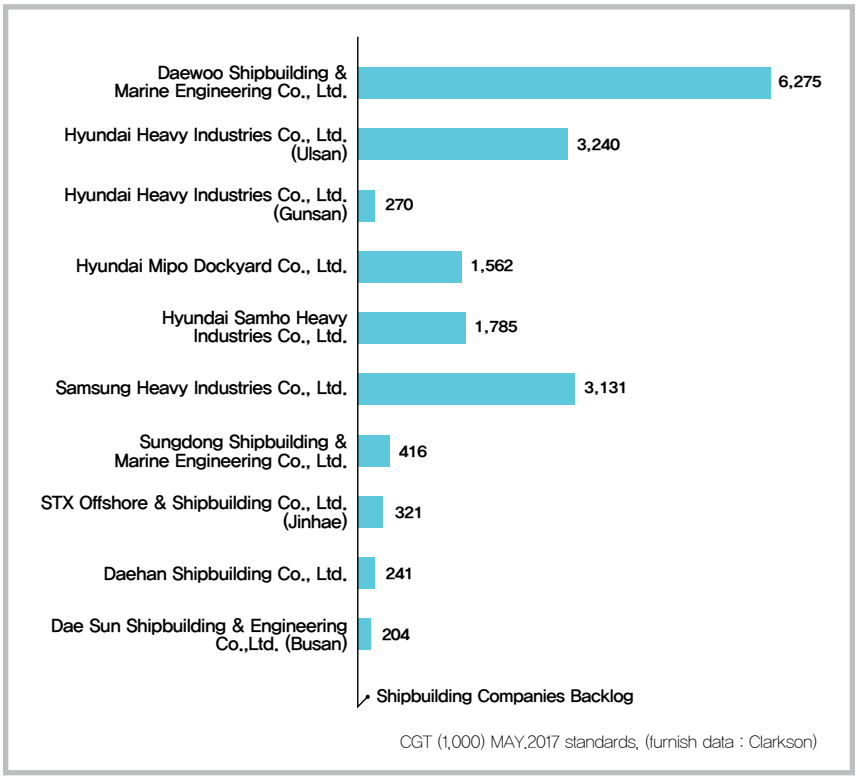
appreciate their ability to deliver the systems on a fast-track basis," said Mr Ki-Hyeon Hong, Vice President, Weidong Ferry.

The 31,000 gross tonnage RoPax ferry will be operated by Weidong Ferry and will sail between Korea and China.

According to Clarkson, global new orders slid from the previous year to 750,000 CGT with 28 vessels in April. New orders at Korean shipyards stood at 340,000 CGT (12 vessels), topping the global list, followed by China (260,000 CGT with 13 vessels). Japan received no order.

Global cumulative new orders up to April this year stood at 4.71 million CGT with 179 vessels, which is similar to the previous year's level of 4.51 million CGT with 179 vessels. By country, new orders totaled 1.43 million CGT (78 vessels) at Chinese shipyards, 1.23 million CGT (34 vessels) at Korean shipyards, 740,00 CGT (8 vessels) at Italian shipyards, 330,000 CGT (2 vessels) at Finnish shipyards, and 250,000 CGT (11 vessels) at Japanese shipyards.

Meanwhile, Korean shipyards took the third spot in terms of order backlog despite strong growth in order intake during April. Global order backlog stood at 78.24 million CGT, as of late April. By country, order backlog totaled 26.82 million CGT at Chinese shipyards, 17.73 million CGT at Japanese shipyards, and 17.62 million CGT at Korean shipyards.



Newbuilding price index hit 122 points in early May and pre-owned vessel price index hit 86 points in the same period. Newbuilding price index, which rose to an all-time high of 190 points in October 2008, has been on a downward spiral.

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

Photo: Samsung Heavy Industries Co., Ltd.

Korea Shipbuiling Orders awarded to domestic shipyards in 2015~2017

Data		Type	Number of vessel	Amount	Ship owner	Delivery	Shipyard
2015	Jan	174,000m³ LNG carriers	2 vessels	USD 400 million	Korea Line Corporation, Korea	The end of 2017	Daewoo Shipbuilding & Marine Engineering
		174,000m³ LNG carriers	2 vessels	USD 400 million	Hyundai LNG Shipping, Korea	The end of 2017	Daewoo Shipbuilding & Marine Engineering
		19,200 TEU container ships	3 vessels	USD 450 million	Scorpio Group, Monaco	-	Samsung Heavy Industries
		LNG carriers	2 vessels	USD 416 million	SK shipping, Korea	The end of 2017	Samsung Heavy Industries
		319,000 DWT VLCCs	2 vessels	USD 198 million	Maran Tankers Management, Greece	-	Daewoo Shipbuilding & Marine Engineering
	Feb	158,000 tons oil tankers	5 units (2 optional vessels)	USD 330 million	-	2017s	Sungdong Shipbuilding & Marine Engineering
		174,000m³ LNG carriers	1 vessel	USD 200 million	-	-	Daewoo Shipbuilding & Marine Engineering
		74,000 DWT oil products carriers	2 units (1 optional vessels)	USD 46 million	Valles Steamship, Hong Kong	-	STX Offshore & Shipbuilding
		300,000 DWT VLCCs	2 vessels	USD 192 million	Metrostar Management, Greece	The end of 2016	Hyundai Heavy Industries
		1,800 TEU container ships	4 units (2 optional vessels)	-	Cosmoship Management S.A, Greece	-	Dae Sun Shipbuilding & Engineering
		180,000m³ LNG carriers	1 vessel	-	Mitsui O.S.K Lines, Japan	2018s	Daewoo Shipbuilding & Marine Engineering
	Mar	38,000m³ liquefied petroleum gas and ammonia carriers	2 vessels	-	Asian ship owner	-	Hanjin Heavy Industries & Construction
		20,100TEU container ships	4 vessels	USD 619.57 million	Mitsui O.S.K Lines, Japan	2017. August	Samsung Heavy Industries
		LR1 tankers	2 vessels	KRW 320 billion	BW, Singapore	2016 ~ 2017	STX Offshore & Shipbuilding
	Apr	319,000 DWT VLCCs	2 vessels	USD 198 million	Maran Tankers Management, Greece	The end of 2016	Daewoo Shipbuilding & Marine Engineering
		20,600 TEU container ships	3 vessels	-	CMA CGM, France	The end of 2017	Hanjin Heavy Industries & Construction (HHIC)-Phil's Subic Shipyard
		21,100 TEU container ships	6 vessels	USD 950 million	OOCL, Hong Kong	The end of 2017	Samsung Heavy Industries
		10,500 TEU container ships	5 vessels	-	Hapag-Lloyd, Germany	-	Hyundai Samho Heavy Industries
		Pure Car/Truck Carriers	2 vessels	USD 130 million	Norwegian Car Carriers, Norway	The end of 2016	Hyundai Samho Heavy Industries
		11,000 TEU container ships	6 vessels	-	Asian and European ship owners	2016 ~ 2017	HHIC-Phil's Subic Shipyard
	May	156,000 tons oil tankers	2 vessels	-	Maran Tankers Management, Greece	-	Daewoo Shipbuilding & Marine Engineering
		5,200 ton training vessel	1 vessel	-	-	-	Hanjin Heavy Industries & Construction
		74,000 tons LR1 tankers	8 units (4 optional vessels)	USD 375 million	Marshall Islands-based ship owners	The end of 2016	STX Offshore & Shipbuilding
	Jun	300,000 DWT VLCCs	10 units (5 optional vessels)	USD 1 billion	The National Shipping Company of Saudi Arabia	2017s	Hyundai Samho Heavy Industries
		19,630 TEU container ships	11 vessels	USD 1.1 billion	Maersk Line A/S, Denmark	2018s	Daewoo Shipbuilding & Marine Engineering
		Tankers	2 vessels	-	Arcadia Shipmanagement, Greece	-	Hyundai Heavy Industries
		300,000 DWT VLCCs	6 units (4 optional vessels)	USD 540 million	John Fredriksen	-	STX Offshore & Shipbuilding
		174,000 CBM LNG carriers	3 units (1 optional vessels)	-	Teekay LNG Partners, Canada	First quarter of 2019	Hyundai Samho Heavy Industries
		155,000 DWT tankers	3 vessels	USD 330 million	-	2018. February	Samsung Heavy Industries
		84,000m³ VLGCs	4 vessels	USD 320 million	China Peace, China	-	Daewoo Shipbuilding & Marine Engineering
	Jul	173,400m³ LNG Carriers	1 vessel	USD 195 million	Chandris, Greece	The end of 2018	Daewoo Shipbuilding & Marine Engineering
		14,000 TEU container ships	9 vessels	USD 1.1 billion	Maersk Line A/S, Denmark	2017	Hyundai Heavy Industries
	Aug	Product Carriers	4 vessels	USD 144 million	Scorpio Tankers, U.S.A	The first of 2017	Hyundai Mipo Dockyard
	Sep	84,000m³ LPG Carriers	2 vessels	-	Asia ship owner	2017s	Daewoo Shipbuilding & Marine Engineering
		74,000 tons LR1 tankers	4 units (2 optional vessels)	-	Greece ship owner	The second half of 2017	STX Offshore & Shipbuilding
	Oct	173,400m³ LNG Carriers	2 vessels	USD 400 million	BW Group, Singapore	The first half of 2019	Daewoo Shipbuilding & Marine Engineering
		84,000m³ LPG carriers	2 vessels	-	Asia ship owner	2017s	Daewoo Shipbuilding & Marine Engineering

	Nov	319,000 tons VLCCs	2 vessels	-	Maran Tankers Management, Greece	2017s	Daewoo Shipbuilding & Marine Engineering
	Dec	114,000 tons products carriers	2 vessels	-	Sea Tankers Group	2017. September	Daehan Shipbuilding
2016	Feb	158,000 DWT oil products carriers	2 vessels	-	Ditas Shipping, Turkey	2018s	Hyundai Heavy Industries
	May	40,000 DWT products carriers	2 vessels	-	Greece ship owner	-	Hyundai Mipo Dockyard
		159,000 DWT oil tankers	2 vessels	-	AMPTC, Kuwait	2018s	Hyundai Heavy Industries
	Jun	75,000 tons product carriers	4 vessels	USD 170 million	Tsakos, Greece	The first of 2018	Sungdong Shipbuilding & Marine Engineering
		180,000m³ LNG carriers	2 vessels	USD 400 million	SK E&S, Korea	The first of 2019	Hyundai Heavy Industries
		50,000 tons bulk carrier	1 vessels	-	Ilshin Marine Transport, Korea	The end of 2017	Hyundai Mipo Dockyard
	Jul	31,000 tons Car ferry	1 vessels	-	Weidong Ferry	The end of 2018	Hyundai Mipo Dockyard
	Sep	180,000m³ LNG carriers	2 vessels	USD 367 million	Europe ship owner	-	Samsung Heavy Industries
	Oct	2,800 ton convoy	1 vessel	USD 297 million	Korean Navy	The end of 2020	Daewoo Shipbuilding & Marine Engineering
		2,600 ton frigates	2 vessels	USD 324 million	Department of National Defense, Philippines	2020s	Hyundai Heavy Industries
		Patrol killer medium	3 vessels	USD 173 million	Korean DAPA	2019s	Hanjin Heavy Industries & Construction
		157,000 DWT oil tankers	2 vessels	USD 220 million	Viken, Norway	-	Samsung Heavy Industries
		113,000 DWT oil tankers	2 vessels				
		157,000 DWT oil tankers	3 vessels	USD 170 million	Nordic American Tankers Limited, Norway	-	Samsung Heavy Industries
	Dec	14,500 TEU container ships	4 vessels	USD 700 million	IRISL, Iran	2th quarter 2018	Hyundai Heavy Industries
		49,000 tons products carriers	6 vessels				Hyundai Mipo Dockyard
		LNG Bunkering Vessel	1 vessel	-	Bernhard Schulte, Germany	The end of 2018	Hyundai Mipo Dockyard
2017	Jan	114,000 tons product carriers	2 vessels	-	SFL, France	3th quarter of 2019	Daehan Shipbuilding
		50,000 tons oil tankers	1 vessel	-	Fukujin Kisen, Japan	-	Hyundai Mipo Dockyard
	Feb	RO-RO Ship	2 vessels	USD 117.8 million	CLdN, Luxembourg	The first of 2017	Hyundai Mipo Dockyard
		50,000 DWT product carriers	1 vessel	-	Greece ship owner	-	Hyundai Mipo Dockyard
		300,000 DWT VLCCs	2 vessels	-	Enesel, Greece	The end of 2018	Hyundai Heavy Industries
	Mar	173,400m³ LNG carriers	2 vessels	-	Europe ship owner	The end of 2019	Daewoo Shipbuilding & Marine Engineering
		114,000 tons oil tankers	4 vessels	USD 240 million	Sovcomflot, Russia	3th quarter of 2018	Hyundai Samho Heavy Industries
		21,000m³ LPG carriers	2 vessels	-	Solvang ASA, Norway	2019s	Hyundai Samho Heavy Industries
	Apr	VLCCs	1 vessel	-	Neda Maritime, Greece	2019s	Hyundai Samho Heavy Industries
		318,000 tons VLCCs	3 vessels	USD 250 million	Maran Tankers Management, Greece	2018s	Daewoo Shipbuilding & Marine Engineering
	May	300,000 DWT VLCCs	2 vessels	-	Sentek Marine, Singapore	The first of 2019	Hyundai Samho Heavy Industries
		VLCCs	4 vessels	-	Oceania ship owner	The first of 2019	Samsung Heavy Industries
		11,200 DWT product oil & chemical tanker	3 vessels	-	Korea ship owner	The end of 2018	STX Offshore & Shipbuilding
		7,500m³ LNG carriers	2 vessels	USD 100 million	Korea Line, Korea	The end of 2019	Samsung Heavy Industries

*Note : Based on the press release and public announcements of each shipyards, internal estimation of Monthly KORSHIP (estimation until May 15, 2017)

Offshore plant orders awarded to domestic shipyards in 2011-2017

Data		Type	Number of vessel	Amount	Ship owner	Delivery	Shipyard
2011	Jul	Drillship	2 vessels	USD 1.1225 billion	Maersk, Denmark	July 2014	Samsung Heavy Industries
	Aug	LNG-FSRU	1 vessel	USD 280 million	Excelerate Energy, U.S.A	First quarter of 2014	Daewoo Shipbuilding & Marine Engineering
	Sep	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 vessel	KRW 600 billion	Noble Drilling, U.S.A	Second half of 2014	Hyundai Heavy Industries
	Oct	Fixed Offshore Platform	-	USD 1.4 billion	Chevron, U.S.A	Second half of 2014	Daewoo Shipbuilding & Marine Engineering
		Drillship	1 unit	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	-	-	From 2013 to 2014	STX OSV
		Platform Supply Vessel	4 units	KRW 2 trillion	Island Offshore, Norway	Consecutively from the 3rd quarter	of 2013 to the 1st quarter of 2014
	Nov	Pipe Laying Support Vessel	2 units	USD 500 million	Odebrecht, Brazil	August of 2014	Daewoo Shipbuilding & Marine Engineering
	Dec	Offshore facilities (Gas platform and various facilities)	-	USD 900 million	Major multinational oil companies	2nd half of 2014	Hyundai Heavy Industries
2012	Jan	CPF (Central Processing Facility)	-	KRW 2.6 trillion	INPEX, Australia	4th quarter of 2015	Samsung Heavy Industries
		Semi-submersible rig	1 unit	USD 620 million	Odfjell, Norway	by mid 2014	Daewoo Shipbuilding & Marine Engineering
	Feb	LNG-FSRU	-	-	Hoegh, Norway	-	Hyundai Heavy Industries
	Mar	Offshore Platform	1 unit	USD 560 million	DONG E&P A/S, Danish	April 2015	Daewoo Shipbuilding & Marine Engineering
		FPSO	1 unit	USD 2.0 billion	INPEX, Australia	April 2016	Daewoo Shipbuilding & Marine Engineering
	Apr	Drillship	1 vessel	USD 645 million	Ensco plc	Third quarter 2014	Samsung Heavy Industries
	May	Semi-submersible Drilling Rig	2 units	USD 1.1 billion	Songa Offshore, Norway	Mid 2015	Daewoo Shipbuilding & Marine Engineering
		Drillship	1 vessel	USD 600 million	Seadrill, Norway	Second half of 2014	Samsung Heavy Industries
		Drillship	1 vessel	USD 655 million	Diamond Offshore Drilling Limited., U.S.A	4th quarter of 2014	Hyundai Heavy Industries
	Jun	Semi-submersible drilling rig	1 unit	USD 700 million	Fred Olsen Energy, Norway	March 2015	Hyundai Heavy Industries
		LNG-FPSO	1 unit	-	Petroliam Nasional Berhad, Malaysia	June 2015	Daewoo Shipbuilding & Marine Engineering
	Jul	Drillship	1 vessel	USD 645 million	Ensco plc	-	Samsung Heavy Industries
		Gas Compression Platform	1 unit	USD 420 million	(Letter of Award)	Second half of 2015	Hyundai Heavy Industries
	Aug	LNG-FSRU	8 vessels	-	Excelerate, U.S.A	Between early 2015~2017	Daewoo Shipbuilding & Marine Engineering
	Sep	Drillship	1 vessel	USD 620 million	Rowan, U.S.A	First half of 2015	Hyundai Heavy Industries
		Drillship	1 vessel	USD 623 million	-	-	Samsung Heavy Industries
	Oct	Drillship	4 vessels	USD 2.06 billion	Transocean, U.S.A	One-by-one from mid 2015	Daewoo Shipbuilding & Marine Engineering
		Drillship	1 vessel	USD 560 million	Atwood Oceanics, U.S.A	-	Daewoo Shipbuilding & Marine Engineering
		LNG-FSRU	1 vessel	USD 270 million	Hoegh LNG, Norway	First half of 2015	Hyundai Heavy Industries
	Nov	Drillship	1 vessel	USD 700 million	-	2nd half of 2015	STX Offshore & Shipbuilding
	Dec	offshore platform (Top side)	1 unit	USD 1.77 billion	Statoil, Norway	The end of 2016	Daewoo Shipbuilding & Marine Engineering
2013	Jan	Gas Production Platform (topside)	1 unit	USD 1.1 billion	Statoil, Norway	Mar 2016	Hyundai Heavy Industries
		LNG-FSRU	1 vessel	-	BW Maritime, Singapore	2015	Samsung Heavy Industries
	Mar	Floating Production Unit (FPU)	1 unit	USD 1.3 billion	Total, France	First half of 2016	Hyundai Heavy Industries
		Tension Leg Platform (TLP)	1 unit	USD 700 million	Total, France	First half of 2015	Hyundai Heavy Industries
	Apr	FPSO	1 unit	USD 1.9 billion	Chevron, U.S.A	-	Hyundai Heavy Industries

	May	Semi-Submersible Drilling Rig	1 unit	USD 750 million	Diamond Offshore, U.S.A	Nov of 2015	Hyundai Heavy Industries
	Jun	Ultra-deepwater Drillship	1 unit	USD 515 million	Ensco, United Kingdom	Third quarter of 2015	Samsung Heavy Industries
		FPSO	1 unit	USD 3.0 billion	Nigeria	Second half of 2017	Samsung Heavy Industries
		Jack-up Rig	2 units	USD 1.3 billion	Statoil, Norway	-	Samsung Heavy Industries
	Jul	Ultra-deepwater Drillship	2 units	USD 600 million	Seadrill, Norway	Second half of 2015	Samsung Heavy Industries
		Semi-Submersible Rig	1 vessel	USD 718 million	Stena, Sweden	First half of 2016	Samsung Heavy Industries
		Ultra-deepwater Drillship	1 unit	USD 570 million	Atwood Oceanics, U.S.A	The end of 2015	Daewoo Shipbuilding & Marine Engineering
	Sep	Drillship	1 unit	USD 550 million	-	Dec of 2015	Samsung Heavy Industries
		Ultra-deepwater Drillship	1 unit	USD 600 million	Ocean Rig, Greece	Dec of 2015	Samsung Heavy Industries
		Jack-up Rig	1 unit	USD 530 million	Maersk Drilling, Denmark	The middle of 2016	Daewoo Shipbuilding & Marine Engineering
	Oct	Drillship	2 vessels	USD 1.24 billion	-	Second half of 2015	Daewoo Shipbuilding & Marine Engineering
		Drillship	1 vessel	USD 520 million	Transocean, U.S.A	The middle of 2016	Daewoo Shipbuilding & Marine Engineering
		LNG-FSRU	1 unit	-	Gas Sayago (Joint venture)	Sep of 2016	Daewoo Shipbuilding & Marine Engineering
	Dec	LNG-FSRU	1 unit	-	BW Maritime, Singapore	Early 2016	Samsung Heavy Industries
		LNG-FSRU	1 unit	-	Mitsui OSK Line, Japan	The middle of 2016	Daewoo Shipbuilding & Marine Engineering
2014	Feb	LNG-FPSO	1 unit	USD 1.45 billion	Petroliam Nasional Berhad, Malaysia	2018	Samsung Heavy Industries
	Apr	Drillship	2 vessels	USD 1.29 billion	Oceania	First half of 2017	Samsung Heavy Industries
	Jul	Central Processing Platform	2 units	USD 700 million	Hess E&P Malaysia, Malaysia	The end of 2016	Hyundai Heavy Industries
		Fixed offshore platform	4 units	USD 1.94 billion	ADMA-OPCO, UAE	The end of 2019	Hyundai Heavy Industries
	Nov	Fixed Offshore Platform & Submarine Cable	4 units	USD 1.9 billion	ADMA-OPCO	Second half of 2019	Hyundai Heavy Industries
		Offshore Platform	1 unit	USD 700 Million	Royal Dutch Shell	-	Samsung Heavy Industries
		FPU	1 unit		-	-	
2015	Jun	Offshore Platform	2 unit	USD 1.06 billion	Statoil, Norway	The end of 2018	Samsung Heavy Industries
	Jul	FLNG	3 unit	USD 4.7 billion	Royal Dutch-Shell	-	Samsung Heavy Industries
2016	Dec	LNG-FSRU	1 unit	USD 587 million	Maran Gas Maritime, Greece	First half of 2020	Daewoo Shipbuilding & Marine Engineering
2017	Jan	FPU	1 unit	USD 1.27 billion	British Petroreum, United Kingdom	Augst of 2020	Samsung Heavy Industries
		FSRU	1 unit	USD 230 million	Höegh LNG, Norway	May of 2019	Samsung Heavy Industries
		FSRU	1 unit	USD 230 million	Höegh LNG, Norway	4th quarter of 2018	Hyundai Heavy Industries
	Feb	FSRU	1 unit	-	Turkey	-	Hyundai Heavy Industries

*Note : Based on the press release and public announcements of each shipyards, internal estimation of Monthly KORSHIP (estimation until May 15, 2017)

Tanker, a thriving segment of Korean shipyards

European shipping companies who dominate global tanker market tend to take high-efficiency as top priority. Among commercial vessels, tanker has the heaviest hull. The cargoes to be carried are in liquid state which leads to increased resistance. In addition, the resistance against the hull is increased due to slow-steaming for reduction in fuel consumption. Therefore, 'fuel economy' is the priority for tankers.

This year, Korean shipyards have outperformed Chinese and Japanese shipyards in terms of shipbuilding orders while there is a preponderance of new orders for tankers. Hyundai Heavy Industries (HHI) has secured new orders for 39 vessels so far this year, out of which 31 units are tankers. Korean shipyards captured an average of over 50% share of global tanker market since 2012 and carved out over 70% share last year.

Tanker undoubtedly represents a thriving segment of Korean shipyards reeling from the recession. However, it is pointed out that efforts need to be made for entry into the market for high value-added vessels such as cruise ship, etc., over the long-term.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T E N

New Product

The SIMRAD® NAIS 500 CLASS-B AIS

Navico Inc.

Announcing a fully integrated, Class-B Automatic Identification System (AIS) transponder - the Simrad NAIS 500. Essential for navigating busy shipping lanes and congested ports, the NAIS 500 - which includes a dedicated GPS-500 receiver - is compact in size, lightweight and fully waterproof. It offers low power draw and features multiple connections for networking with any NSS, NSO or GO series chartplotter/multifunction display and Simrad RS VHF systems.

Meeting the strict regulations set for Class-B AIS transponders, the NAIS 500 ensures that a vessel is seen on a display - reducing the risk of collisions. The transponder sends a signal to other vessels in the area, allowing boaters to plan any necessary avoidance maneuvers well in advance. Compatible with NMEA 2000®, NMEA 0183®, NMEA 0183 multiplexing and USB, the NAIS 500 is simple to install in any configuration. Capable of withstanding the harshest of offshore conditions, the transponder meets IPX7 standards. Weighing less than 250 grams and featuring a low average power consumption of 180 mA at 12 VDC, the NAIS 500 is ideal for sailboats or powerboats.

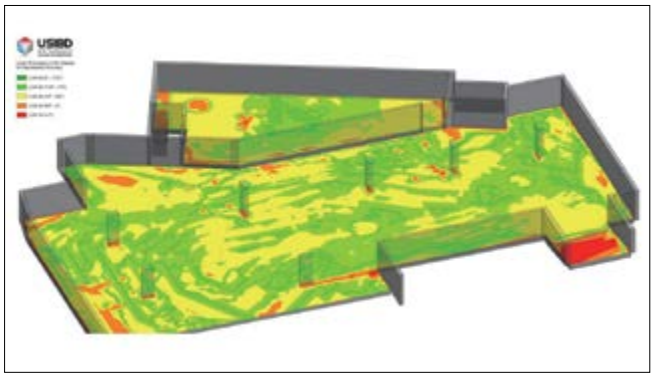
“Identifying ships that are heading towards you is almost as important as knowing where you are and is vital to safe passage,” said Leif Ottosson, CEO, Navico. “With current regulations, most commercial ships are required to have AIS onboard. The NAIS 500 works with Simrad chartplotters and multifunction displays to provide boaters with the peace of mind that, regardless of the sea conditions, they will be visible to any traffic in the area.”

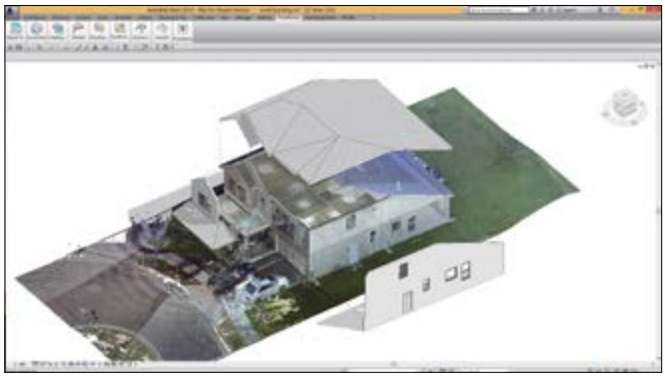
Pairing the NSPL-500 VHF Splitter Box with the NAIS-500 enables the capability to use a single VHF antenna for the NAIS-500 and a VHF fixed-mount radio.

-TEL: +64-9-925-4500 (Navico Asia Pacific)
-http://www.navico-commercial.com

PointSense 18.0 Suite for Construction and Architecture

FARO Technologies Inc.





FARO® announced the availability of the FARO® PointSense 18.0 software suite. This robust software platform evolution delivers seamless integration into the latest 2018 AutoCAD® and Revit® design tools, a better user experience, improved software handling, and enhanced efficiency in processing software data.

The suite includes:

- PointSense basic/Pro for AutoCAD®
- PointSense Building for AutoCAD®
- PointSense Heritage for AutoCAD®
- PointSense Plant for AutoCAD®
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The one stop bundle and compatibility across the broad range of Autodesk architecture, engineering, construction and surveying products makes this the most cost effective solution of its kind currently available.

PointSense 18.0 resets the bar for “ready to go”. It includes the same high value, beneficial use features and functionality with which savvy AutoCAD® and Revit® users are already familiar. The addition of a new, step by step guidance screen assures that even less familiar users can get up to speed quickly and optimize their workflow.

PointSense 18.0 for Revit® is the first software platform to incorporate Levels of Accuracy as defined USBID (U.S. Institute of Building Documentation) standards. This enhanced analysis tool enables users to more confidently validate the accuracy of the as-built model compared to the relevant point cloud, i.e. the set of data points acquired by a 3D laser scanner.

The improvement in scan navigation functionality was driven by direct user feedback, supports greater efficiency and assures that the user is able to get to a result faster than ever before. With just a double click, users can move from one scan perspective to another inside a given point cloud.

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New Product

New Cylinder Oil NAVIGO MCL Extra approved by MAN and WinGD

LUKOIL Marine Lubricants

NAVIGO MCL Extra shows excellent piston cleanliness on E.R. TALINN at end of trial inspection.

There is a big change in fuels ahead of us and the fuel suppliers are busy looking into several options. However, regardless of whether de-sulphurisation, MGO or distillate blends or any pre-dominantly hydrocarbon blend with a maximum of 0.5% sulphur content or a 0.1% limit in ECA. In order to offer the best possible lubricant solutions in the years leading up to 2020 and beyond, LUKOIL Marine Lubricants launched NAVIGO MCL Extra, a 40 BN marine cylinder oil for distillate, ultra-low Sulphur fuel oil (<0.1%S) and low Sulphur heavy fuel oil applications.

NAVIGO MCL Extra has been granted approval for MAN and Wärtsilä (WinGD) engines and complements LUKOIL Marine's product portfolio for low and ultra-low Sulphur applications, which also comprises NAVIGO MCL Ultra with a BN of 20 suitable for distillate and ultra-low Sulphur fuel oil (<0.1%S).

Since NAVIGO MCL Extra also covers low Sulphur HFO applications, it will replace NAVIGO 40 MCL and will from now on be delivered globally instead of NAVIGO 40 MCL.

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Main Products : Marine Transmission, Power Take off, Steering System
TEL : +82 55 760 5500

DooSan Engine Co., Ltd.
Location : CHANGWON, GYUNGNAM
Website : www.doosanengine.com
Main Products : Marine diesel engine, Diesel engines for power generation
TEL : +82 55 260 6000

DRB Holding Co., Ltd.
Location : YEUNGDEUNGPO-GU, SEOUL
Website : www.drbworld.com
Main Products : Marine rubber fender, Industrial rubber sealing & gasket, Industrial rubber track, Rubber damper
TEL : +82 2 2168 9133

ELSCOM Inc.
Location : SASANG-GU, BUSAN
Website : www.elscom.co.kr
Main Products : Explosion-Proof Products, Distribution Board Components, Solar Cable/PV JB
TEL : +82 51 329 8990

Emerson Process Management Korea Ltd.
Location : SEONGNAM-SI, GYEONGGI
Website : www.emersonprocess.co.kr
Main Products : Pressure, Temperature, Level, Analytical & Flow Measurenet, Valves, Tank radar level guaging, etc.
TEL : +82 2 3438 4600

ENTECH (Engineering & Technology Co., Ltd.)
Location : CHANGWON-SI, GYEONGNAM
Website : www.tkhic.com
Main Products : Engine Bed/Frame box, Crane Pedestal, Tubular (SAW Pipe), Air Reservoir, Jacket, Pile, Wind Tower
TEL : +82 70 4628 8844

ESAB SeAH Corp.
Location : CHANGWON, GYUNGNAM
Website : www.esab.co.kr
Main Products : Flux cored wire
TEL : +82 55 289 8111

Flutek, Ltd.
Location : SEONGSAN-GU, GYEONGNAM
Website : www.flutek.co.kr
Main Products : Axial piston pumps, Axial piston motors & reduction gear, Electro-hydraulic steering gear, Deck machinery, Staffa motor, ECO servo
TEL : +82 55 570 5800

FRIEND Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.thefriend.co.kr
Main Products : Engine valve spindle, Cable tray
TEL : +82 51 974 7911

GASTRON Co., Ltd.
Location : GUNPO-SI, GYEONGGI
Website : www.gastron.com
Main Products : Installation-Type Detector, Portable Gas Detector, Acid Leak Detecting Paint, Alarm Signalling
TEL : +82 31 490 0800

G.S HIGH-TECHER Co., Ltd.
Location : MIRYANG-SI, GYENGNAM
Website : http://gshightecher.koreasme.com
Main Products : Air vent head, Convex coupling
TEL : +82 51 832 0456

GENERAL MARINE BUSINESS
Location : NAM-GU, INCHEON
Website : www.gmbmarine.com
Main Products : Marine system (ship shore comm. system, emergency shutdown system, etc.), Defense Eng. (Control & monitoring system integration, etc.),Manufacturing & services (new shipbuilding, module production)
TEL : +82 52 270 3500

GESKO Co., Ltd.
Location : GANGSEO-GU, BUSAN
Main Products : CNG Transportation&Refilling, Fire Fighting system, Engineering for Fire fighting system & Ballast treatment system, Annual inspection
TEL : +82 51 973 9913

GS-Hydro Korea Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.gshydro.com
Main Products:Flare flange system, Retaining ring system
TEL : +82 51 266 8221

TECH FLOWER Co., Ltd.
Location : SASANG-GU, BUSAN
Website : www.haean21.com
Main Products : Marine crane, Deck machinery
TEL : +82 51 320 8222

Haewon Ind. Co., Ltd.
Location : SAHA-GU, BUSAN
Website : www.haewon.net
Main Products : Water seal, Inflatable/mating ring
TEL : +82 51 831 4600

Halla Industrial Co., Ltd.
Location : SAHA-GU, BUSAN
Website : www.hallaiq.co.kr
Main Products : Non seal canned motor pump, Gear pump
TEL : +82 51 264 2201

Han Jo Co., Ltd.
Location : YOUNGDO-GU, BUSAN
Website : www.hanjoms.co.kr
Main Products : Lubication oil filter, Fuel oil filter, Filter elements
TEL : +82 51 414 7201

Hankook Flexible Co.
Location : SASANG-GU, BUSAN
Website : www.hkflex.com
Main Products : Metalic flexible hose, Metallic expansion joint, Manufacturing of Metalic flexible hose assemblies
TEL : +82 51 508 6291

HanKuk Miboo Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.hankukmiboo.co.kr
Main Products : Spiral duct, Cold chamber, Deck covering, Level
TEL : +82 51 263 3621

HANLAIMS Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.hanlaims.com
Main Products : Instruments (Level gauge/Level switch) Tank remote sounding system/Cargo monitoring system, valve
TEL : +82 51 601 7016

HANSHIN ELECTRONICS Co., Ltd.
Location : YOUNGDO-GU, BUSAN
Website : www.ehanshin.com
Main Products : Public address sys., Telephone sys.
TEL : +82 51 412 5551

HANSUN ENGINEERING Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.slok.co.kr
Main Products : Instrument Tube Fittings, Instrument Valves, Filters, Condensate Pot
TEL : +82 51 899 6700

HEARTMAN Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.heartman.co.kr
Main Products : Fuel injection nozzle for marine diesel engine, Fuel injection plunger ass'y for marine diesel engine
TEL : +82 51 264 8826

HI AIR KOREA Co., Ltd.
Location : GIMHAE-SI, GYUNGNAM
Website : www.hiairkorea.co.kr
Main Products : Air handling unit, Spot cooler, Refrigeration condensing unit, Fire damper, Provision refrigeration plant, MGO cooling system, Packaged air conditioner, Ventilation fan, Spiral duct
TEL : +82 55 340 5000

Hi Tech Co., Ltd.
Location : GYUNGJU-SI, GYUNGBUK
Main Products : T-Bar, Gas Protect Plate
TEL : +82 54 776 5310

HOSEUNG ENTERPRISE Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.hosent.co.kr
Main Products : Sewage Treatment System, Plasma Bilge Separator, E/R Package Unit, Tank Package Unit, Ventilator
TEL : +82 51 831 2233

HODU INDUSTRIAL Co.
Location : GANGSEO-GU, BUSAN
Website : www.hoducompany.com
Main Products : Catering furniture, Galley hood W/fire fighting, Galley E/Q (Deep fat fryer/Cooking range, etc.)
TEL : +82 51 271 3342

Hy-Lok Corporation
Location : GANGSEO-GU, BUSAN
Website : www.hy-lok.com
Main Products : Tube fitting & valve, Double lock & bleed valve, Cryogenic valve
TEL : +82 51 970 0800

HYUNDAI HEAVY INDUSTRIES Co., Ltd.
Location : DONG-GU, ULSAN
Website : www.hhi.co.kr
Main Products : Marine diesel engine & machinery w
TEL : +82 52 202 7291

Hyundai Elevator Co., Ltd.
Location : ICHEON-SI, GYEONGGI
Website : www.hyundaielevator.co.kr
Main Products : Lifts (elevator, escalator, moving walk), Logistics automation system, Parking system (automobiles, bicycles), SOC infrastructure systems (platform screen door, automatic folding canopy, gap zero, etc.)
TEL : +82 31 644 5114

Hyundai Fitting Co., Ltd.
Location : GIJANG-GUN, BUSAN
Website : www.hdfco.co.kr
Main Products : Flange
TEL : +82 51 831 0891

HLB Co., Ltd.
Location : ULJU-GUN, ULSAN
Website : www.hdboat.com
Main Products:Lifeboat , GRP rigid-type rescue boat
TEL : +82 52 240 3500

Hyundai Marine Machinery Co., Ltd.
Location : SEO-GU, INCHEON-SI
Website : www.hmmco.co.kr
Main Products : W.O. incinerator, Aux/blower, F.D fan
TEL : +82 32 583 0671

HYUNDAI WELDING Co., Ltd.
Location : GANGNAM-GU, SEOUL
Website : www.hyundaiwelding.com
Main Products : Covered electrode arc welding consumables, Sub-merged arc welding flux & wire, Soild wire arc welding consumables, Flux cored wire, MIG TIG arc welding consumables, Welding machines
TEL : +82 2 6230 6883

I.M.E. CORPORATION
Location : GIMHAE-SI, GYUNGNAM
Website : www.promarine21.com
Main Products : Engine valve spindle & seat
TEL : +82 55 346 1127

ILJIN AND Co., Ltd.
Location : GIJANG-GUN, BUSAN
Website : www.iljinamst.co.kr
Main Products : Fire detection system, Gas detection system, Emission monitoring system, Water spray & cargo spray system, etc.
TEL : +82 51 755 6191

ILSHIN ENGINEERING Co., Ltd.
Location : SIHEONG-SI, DYEONGGI
Website : www.ilshineng.com
Main Products : Chemical equipment and Tanks
TEL : +82 31 499 4502

ILSUEUNG Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.ilseung.co.kr
Main Products : Sewage Treatment plant, Fresh water generator, Oil purifier
TEL : +82 51 831 4110

IL-SUNG IND. Co.
Location : SASANG-GU, BUSAN
Website : www.ilsunghs.co.kr
Main Products : Hot water calorifier, Silencer (For M/E, G/E, fan), Mist eliminator, Washable
TEL : +82 51 312 4056

International Machine Tool Co.
Location : SASANG-GU, BUSAN
Website : www.clampimt.com
Main Products : Vertical clamp, Horizontal clamp, etc.
TEL : +82 51 314 2038

INTRA PRECISION MANUFACTURE Co., Ltd.
Location : DONG-GU, BUSAN
Website : www.intraspare.co.kr
Main Products : PISTON CROWN, CYLINDER LINER, CYLINDER COVER, PISTON SKIRT, WATER JACKET
TEL : +82 51 466 4635

JHK Inc.
Location : YANGSAN-SI, GYUNGNAM
Main Products : Container fittings, Lashing fittings
TEL : +82 55 346 2225

JINSEONG LINER & PISTON
Location : DAEDEOK-GU, DAEJEON
Website : www.jinseong.com
Main Products : Cylinder liner, Piston
TEL : +82 42 931 8558

JONGHAP MACHINERY Co.
Location : YANGSAN-SI, GYUNGNAM
Website : http://jonghap.biz
Main Products : Sewage treatment plant, T-bar auto welding machine
TEL : +82 55 370 2600

JUNG GONG IND. Co., Ltd.
Location : SAHA-GU, BUSAN
Website : www.jung-gong.com
Main Products : Marine window, Fire-resistant window, Marine wiper, Clear view screen,
TEL : +82 51 261 2911

JUNG-A MARINE
Location : GANGSEO-GU, BUSAN
Website : www.jung-a.co.kr
Main Products : Accommodation ladder, Pilot slant ladder, Wiper, CVS, Sunscreen davit,
TEL : +82 51 970 6420

JUNGSAN ENTERPRISE Co., Ltd.
Location : ULJU-GUN, ULSAN
Website : www.jungsan.com
Main Products : Marine engine parts
TEL : +82 52 254 3290

K.C. Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.iccp-mgps.com
Main Products : Impressed current cathodic protection (I.C.C.P) system, Anti-fouling system (M.G.P.S), Shaft earthing device
TEL : +82 51 831 7720

Kangrim Heavy Industries Co., Ltd.
Location : CHANGWON, GYUNGNAM
Website : www.kangrim.com
Main Products : Marine boiler, Plant, LPG tank
TEL : +82 55 269 7700

Kangrim Insulation Co., Ltd.
Location : GIJANG-GUN, BUSAN
Website : www.kangrim.com
Main Products : Tank, Pipe insulation, Cold provision store
TEL : +82 51 200 6000

Keonchang Industry Co., Ltd.
Location : SAHA-GU, BUSAN
Website : www.keonchang.co.kr
Main Products : TOP CHARGING EQUIPMENT, HOPPER & CONVEYER, SIDE GUIDE ASS'Y
TEL : +82 51 203 0161

Keum Yong Machinery Co., Ltd.
Location : BUK-GU, DAEGU
Website : www.beumyong.com
Main Products : Exh. valve complete with spindle
TEL : +82 53 382 9044

Key Sung Metal Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.deysungmetal.com
Main Products : Marine valve
TEL : +82 51 831 3391

Keystone Valve (Korea)
Location : ANSEONG-SI, GYEONGGI
Website : www.keystonekorea.com
Main Products : All kinds of valves for offshore and shipbuilding
TEL : +82 51 604 4000

KHAN Co., Ltd.
Location : GEOJE-SI, GYEONGNAM
Website : www.khan-offshore.com
Main Products : Engineering services, Sea-trial & commissioning service, Facility for fabricaton, Modification
TEL : +82 55 639 7600

Kion Printing & Packaging Inc.
Location : GIMHAE-SI, GYUNGNAM
Website : www.kiwon.com
Main Products : Marine equipment & vacuum system
TEL : +82 55 313 9913

KOC ELECTRIC Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.kocelec.com
Main Products : H/V transformer (ATEX, WATER COOLED TYPE), UPS (Uninterruptible Power Supply), Bus way/Bus duct
TEL : +82 51 970 6302

Kokaco Co., Ltd.
Location : YOUNGDO-GU, BUSAN
Website : www.kokaco.com
Main Products : Exhaust Valve Spindle&Bottom Piece Grinding Machine
TEL : +82 51 403 4114

Komeco Co., Ltd.
Location : GIJANG-GUN, BUSAN
Website : www.komeco.net
Main Products : Tacho sys., Electronic equip.
TEL : +82 51 724 5070

Kongsberg Maritime Korea Ltd.
Location : GIJANG-GUN, BUSAN
Website : www.km.kongsberg.com
Main Products : Alarm monitoring system, Cargo monitoring system, Offshore technology
TEL : +82 51 749 8600

KOREA FILTER Co., Ltd.
Location : GIJANG-GUN, BUSAN
Website : www.korea-filter.co.kr
Main Products : STRAINER, OIL FILTER, AIR FILTER, AUTO STRAINER
TEL : +82 51 727 8360

KOTO Technical Co.
Location : SAHA-GU, BUSAN
Website : http://kotofft.com
Main Products : Maintain & repair items (all hydraulic systems, Adjust alignment, centering)
TEL : +82 51 417 8501

KORVAL Co., Ltd.
Location : SAHA-GU, BUSAN
Website : www.korval.co.kr
Main Products : Control Valves, Regulating Valves, Heat Sensor, Shut-Off Valves
TEL : +82 51 790 9700

KSP Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.kspvalve.com
Main Products : Exhaust valve complete, Exhaust valve spindle
TEL : +82 51 831 6274

KSV (Korea Special Valve) Co., Ltd.
Location : YOUNGDO-GU, BUSAN
Website : www.ksv-valve.co.kr
Main Products : Valve spindle and Valve seat for marine diesel engine
TEL : +82 51 415 4466

KTE Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.kte.co.kr
Main Products : High voltage swichboard, Side thruster, Low voltage swichboard, Side thruster control system, Group starter panel, Alarm monitoring system, Electric equipment, etc.
TEL : +82 51 265 0255

Kuk Dong Elecom Co., Ltd.
Location : SAHA-GU, BUSAN
Website : www.kukdongelecom.com
Main Products : Lighting fixture
TEL : +82 51 266 0050

KTMI Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.saejinintech.com
Main Products : Emergency towing system
TEL : +82 51 971 9911

KUKDONG ELECTRIC Co., Ltd.
Location : JINCHEON-GUN, CHUNGBUK
Website : www.nexans.co.kr
Main Products : WIRE All kinds of cables for offshore and shipbuilding including JIS, BS, IEC, DIN, IEEE, etc.
TEL : +82 2 2140 3064

KUMGOKSTEEL INDUSTRY. Co., Ltd.
Location : SEO-GU, INCHEON
Website : www.kgsi.co.kr
Main Products : Steel Gratings, Manhole Covers and Steel Products
TEL : +82 32 564 6759

Kum Kang Precision Co., Ltd.
Location : SAHA-GU, BUSAN
Website : www.kkmarine.co.kr
Main Products : Marine valve, valve for engine, air reservoir tank
TEL : +82 51 262 4894

KANGNAM JEVISCO Co., Ltd.
Location : BUSANJIN-GU, BUSAN
Website : www.jevisco.com
Main Products : Shop primer, Anti-corrosive coatings, Anti-fouling coatings, etc.
TEL : +82 51 892 4221

Kwanglim Marine Tech. Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.klmt.co.kr
Main Products : Steel Door, Hull Apteher Blank, Radar Mast, Hi-Pressure Water Mist Fire Fighting System
TEL : +82 51 313 0055

KWANG SAN Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.kwangsan.com
Main Products : AIR VENT HEAD, EXP. JOINT, HEATING COIL, AIR VENT HEAD, EXP. JOINT, HEATING COIL, PIPE SPOOL, ETC.
TEL : +82 51 974 6316

Kwang Seong Co., Ltd.
Location : GIMHAE-SI, GYUNGNAM
Website : www.ikwangsung.com
Main Products : PIPE CABLE HANGER, SPARE PART SEAT, ETC.
TEL : +82 55 338 2271

Kyung Eun Ceramics Co., Ltd.
Location : GIMHAE-SI, GYUNGNAM
Website : www.ke-ceramics.com
Main Products : Ceramic packing
TEL : +82 55 345 7761

Kyungjin Shipping Co., Ltd.
Location : CHANGWON-SI, GYEONGNAM
Website : www.kyungjinshipping.com
Main Products : Exports & Imports of Marine Equipment, Shipping Agent Service, Shipbroking Service, Trading
TEL : +82 55 224 4383

Kyungsung Industry Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.e-clamp.com
Main Products : LNG carrier sus corner & anchor strips & Pipe clamp, etc.
TEL : +82 51 831 4960

LDC-KOREA Co., Ltd.
Location : HAEUNDAE-GU, BUSAN
Main Products : Traders (Marine Equipment), Ship Repair
TEL : +82 51 266 4037

Leeyoung Industrial Machinery Co., Ltd.
Location : ULJU-GUN, ULSAN
Website : www.leeyoung.co.kr
Main Products : Lashing bridge, T-bulkhead block, Covered-block, Engine casing & funnel, Upper deck & module unit, etc.
TEL : +82 52 231 5800

LHE Co., Ltd.
Location : GIMHAE-SI, GYUNGNAM
Website : www.lhe.co.kr
Main Products : Plate heat exchanger, Fresh water generator
TEL : +82 55 340 0625

LS Cable & System
Location : ANYANG-SI, GYEONGGI
Website : www.lscns.com
Main Products : Power cable, Marine & offshore cable, Telecom cable, SUBMARINE CABLE, WINDSOL, SUPERCONDUCTIVITY
TEL : +82 51 310 6781

LUXCO Co., Ltd.
Location : SAHA-GU, BUSAN
Website : www.luxco.co.kr
Main Products : Electrical equipment for internal combustion engines, Magnetic products, etc.
TEL : +82 51 260 1300

MIN SUNG Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.minsung.co.kr
Main Products : Steel outfitting, Access hatch, Swing away hatch, Cable tray, Electric cable box, etc.
TEL : +82 51 305 8862

Mirae Industries Co., Ltd.
Location : HAMAN-GUN, GYEONGNAM
Website : www.miraewinch.com
Main Products : Winch, Chain Stopper, Capstan
TEL : +82 55 587 8520

MODERN INTECH Co., Ltd.
Location : SASANG-GU, BUSAN
Website : www.mo-dern.com
Main Products : Fire retardant curtain, Mattress, Upholstery furniture, Fire retardant fabric, Carpet, Rubber flooring
TEL : +82 51 325 0260

MRC (Marine Radio Co., Ltd.)
Location : YOUNGDO-GU, BUSAN
Website : www.mrckorea.com
Main Products : Public address system, Auto telephone sys.
TEL : +82 51 414 7891

MSL Compressor Co., Ltd.
Location : POCHEON-SI, GYEONGGI
Website : www.mslcomp.com
Main Products : Breathing air compressor
TEL : +82 31 541 7000

Mt.H Control Valves Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.mth.co.kr
Main Products : Main starting valve, Crankcase relief valve, Cyogenic safety valves & control valve
TEL : +82 51 974 8800

NK Co., Ltd.
Location:SAHA-GU, BUSAN
Website:www.nkcf.com
Main Products:Ballast water treatment sys., CO_2 sys.
TEL:+82 51 200 0152

NOW Co., Ltd.
Location : YANGSAN-SI, GYEONGNAM
Website : http://nowcan.co.kr
Main Products : Duct, Damper, Fitting, Piston, Ring, Cylinder
TEL : +82 55 387 4811

ONNURIPLAN Co., Ltd.
Location : BUCHEON-SI, GYEONGGI
Website : www.onnuriplan.com
Main Products : Dust & Gas Masks, Sanitary Mask Covers, etc.
TEL : +82 32 681 7780

Oriental Precision & Engineering Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.opco.co.kr
Main Products : Crane, Windlass & Mooring Winch, Life Boat Davit
TEL : +82 51 202 0101

OSCG Co., Ltd.
Location : SASANG-GU, BUSAN
Website : www.oscg.net
Main Products : Cable gland and accessories, GRP junction box
TEL : +82 51 305 3910

OTS Co., Ltd.
Location : SUNCHEON-SI, JEONNAM
Website : www.otshi.co.kr
Main Products : Crane, Winch, A-Frame
TEL : +82 61 724 4100

PANASIA Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.worldpanasia.com
Main Products : Ballast water treatment system/level instrument, Seawater coarse filtration/ Emission gas control system, Engineering services
TEL : +82 51 831 1010

Pie Plus Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.piplus.co.kr
Main Products : Crankshaft, Rudder stock, Motor shaft
TEL : +82 51 831 9338

PROSAVE Co., Ltd.
Location : GIMHAE-SI, GYEONGNAM
Website : www.prosave.co.kr
Main Products : Crankcase Explosion Relief Valve, Smart High Velocity Pressure/ Vacuum Relief Valve, Air Release & Vacuum Breaker Valve
TEL : +82 55 313 3511

S&W Co., Ltd.
Location : SAHA-GU, BUSAN
Website : www.snwcorp.com
Main Products : Cam/cam shaft, Valve/seat ring, Engine bolts/ nuts, Bolts
TEL : +82 51 205 7411

S. A. M-Tech
Location : NAMDONG-GU, INCHEO
Website : www.samartkr.com
Main Products : Engine control lever, Engine control cable, Hydraulic steering system, Stern drive, Helm pump, Cylinder, etc.
TEL : +82 32 815 3614

SG Safety Corp.
Location : PYEONGTAEK-SI, GYEONGGI
Website : www.sgsafety.net
Main Products : Inflatable rubber products, Ship ballast water treatment system, Life rafts, Speed boats, River boats, Fishing boats, Water tanks, High-speed boats
TEL : +82 31 651 3012

SAMGONG Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.sam-gong.co.kr
Main Products : Oil purifier, Ship window, Ship accommodation ladder, Cathodic protection system, Elevator type tower gangway, Ship ballast water treatment system, Quick release mooring hook & road monitoring system
TEL : +82 51 200 3040

Samin Information System Co., Ltd.
Location : HAEUNDAE-GU, BUSAN
Website : www.saminis.com
Main Products : EcoInspection, Ecoserver Package
TEL : +82 70 7771 2104

SAMKUN CENTURY Co., Ltd.
Location : MIRYANG-SI, GYEONGNAM
Website : www.samkunok.com
Main Products : F.W. supply unit, BWTS, PE coating, Paint
TEL : +82 70 4034 0226

SAMYANG METAL IND. Co., Ltd.
Location : SAHA-GU, BUSAN
Website : www.cuniship.com
Main Products : flanges, fittings
TEL : 82 51 266 6655

Samyoung Machinery Co., Ltd.
Location : GONGJU-SI, CHUNGNAM
Website : www.sym.co.kr
Main Products : Cylinder head, Cylinder liner, Piston & carrier, etc.
TEL : +82 41 840 3000

Samyoung M-TEK Co., Ltd.
Location : HAMAN-GUN, GYEONGNAM
Website : www.symtek.co.kr
Main Products : MBS, Chain wheel, Cylinder cover, etc.
TEL : +82 55 589 7000

SAMYUNG ENC Co., Ltd.
Location : YOUNGDO-GU, BUSAN
Website : www.samyungenc.com
Main Products : AIS/GMDSS radio equip, etc.
TEL : +82 51 601 5555

Sandong Metal Industry Co., Ltd.
Location : GUMI-SI, GYEONGBUK
Website : www.smi-sdhitec.com
Main Products : Manifold, Plug valve, Choke valve, Integral Fittings
TEL : +82 54 472 8311

Saracom Co., Ltd.
Location : YEONGDO-GU, BUSAN
Website : www.saracom.net
Main Products : GMDSS equipment
TEL : +82 51 600 9000

Scana Korea Hydraulic Ltd.
Location : GIMHAE-SI, GYUNGNAM
Website : www.scana.co.kr
Main Products : Actuators, HPU and local control panel, Offloading systems/winches and mooring system/turret/swivel, etc.
TEL : +82 55 343 9007

SEJIN IND Co., Ltd.
Location : CHANGWON, GYUNGNAM
Website : www.sejin89.co.kr
Main Products : Tank top unit, Module unit, Purifier unit, Supply unit, etc.
TEL : +82 55 239 4700

Seobu Electric Ind. Co., Ltd.
Location : SAHA-GU, BUSAN
Main Products : Ground Monitor
TEL : +82 51 264 0670

SEOUL ELECTRIC CABLE Co., Ltd.
Location : UMSUONG-GUN, CHUNGBUK
Website : www.seoulcable.com
Main Products : Offshore & shipboard cables
TEL : +82 43 879 7200

Seun Electric Co., Ltd.
Location : SAHA-GU, BUSAN
Website : www.seunelectric.co.kr
Main Products : Battery charger, Alarm sys.
TEL : +82 51 208 4641

SEWON INDUSTRIES Ltd.
Location : HAMAN-GUN, GYEONGNAM
Website : www.sewon-ind.com
Main Products : High velocity P/V valve, Air vent head, Expansion joint, Flame arrester / Breather valve
TEL : +82 55 580 7200

SHINHAN HEAVY INDUSTRIES Co., Ltd.
Location : ULJU-GUN, ULSAN
Website : www.shinhanheavy.co.kr
Main Products : Deckhouse, Rudder
TEL : +82 52 240 5000

Shin Heung ENG Co.
Location : GANGSEO-GU, BUSAN
Website : www.shinheungeng.co.kr
Main Products : Curtain, Upholstery, Sofa & Chair, Mattress, Carpet, Roller blind
TEL : +82 51 817 6455

Shin Myung Tech Co., Ltd.
Location : YANGSAN-SI, GYUNGNAM
Website : www.smdavit.com
Main Products : Air motor, Winch, Davit, Crane, Reel, Capstan, Pump, etc.
TEL : +82 55 363 7091

Shin Sung eng Co., Ltd.
Location : GANGSEO-GU, SEOUL
Website : www.ishinsung.com
Main Products : Air Con. Plant, Ref. Plant
TEL : +82 2 2600 9602

Shin Yeong Co., Ltd.
Location : GIMHAE-SI, GYUNGNAM
Website : www.sy-ind.com
Main Products : Manhole, Access hatch
TEL : +82 55 346 0034

Shin-A Co., Ltd.
Location : SAHA-GU, BUSAN
Website : www.shina-ent.com
Main Products : Navigational/communication equip.
TEL : +82 51 204 6221

Shin-A Metal Tech Co., Ltd.
Location : BUK-GU, ULSAN
Website : www.shinametal.com
Main Products : Engine metal bearing, Bearings for medium & small engines, Main bearing shells, Segment & segment holder, Guide shoe, Top & bottom end bearing, Mesta bearing
TEL : +82 52 298 2100

Shindong Digitech Co., Ltd.
Location : YEOUNGDO-GU, BUSAN
Website : www.shindong.com
Main Products : Navigation & communication, Internal communication equipment
TEL : +82 51 461 5141

Shinshin Machinery Co., Ltd.
Location : GIJANG-GUN, BUSAN
Website : www.sspump.com
Main Products : VID (Cooling F.W & S.W pump), EHC (Volute casting centrifugal pump), NLG (External gear pump)
TEL : +82 51 713 0000

Silla Metal Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.sillametal.com
Main Products : Fixed pitch propeller (FPP), Controllable pitch propeller (CPP, Shafting, Stern equipment)
TEL : +82 51 831 5991

Simulation Tech Inc.
Location : GEUMCHEON-GO, SEOUL
Website : www.simulationtech.co.kr
Main Products : Voyage data recorder
TEL : +82 2 3281 0960

SKMARINTEC Co., Ltd.
Location : GIMHAE-SI, GYUNGNAM
Website : www.skmarintec.co.kr
Main Products : Electrolytic Sewage Processing Eqiupment
TEL : +82 55 314 4620

SMECO Co., Ltd.
Location : YEONGI-GUN, CHUNGNAM
Website : www.smecopiston.com
Main Products : Piston, Piston liner
TEL : +82 44 864 3030

SMS Co., Ltd.
Location : SAHA-GU, BUSAN
Website : www.sms-marinesystem.com
Main Products : Hatch cover, Lashing bridge, Ro-Ro equipment, Hydro door
TEL : +82 51 290 1000

CAPE INDUSTRY Ltd.
Location : YANGSAN-SI, GYUNGNAM
Website : www.capeind.com
Main Products : Cylinder Liner
TEL : +82 55 370 1234

SPECS Corporation
Location : BUNDANG-GU, SEONGNAM
Website : www.specs.co.kr
Main Products : Oil Mist Detection System for Engine Room (AOMD), Oil Mist Detection System for Diesel Engine (COMD), Shaft Torque Power RPM Meter (TPM), etc.
TEL : +82 31 706 5211

STACO Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.staco.co.kr
Main Products : Wall & ceiling panel, Unit toilet
TEL : +82 51 831 7000

STACO CHALMERS Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.staco.co.kr
Main Products : Unit Cabin, Unit Toilet, Marine Door
TEL : +82 51 831 7000

STX Engine Co., Ltd.
Location : CHANGWON, GYUNGNAM
Website : www.stxengine.co.kr
Main Products : Marine diesel engine, Military diesel engine, power plant diesel engine, electronic communication equipment
TEL : +82 55 280 0114

STX Heavy Industries Co., Ltd.
Location : CHANGWON, GYUNGNAM
Website : www.stxhi.co.kr
Main Products : Turbocharger, Diesel engine parts, Industrial components, Shipuilding machinery, Cargo pump system, Casting parts
TEL : +82 55 280 0700

Suh Han Ind. Co., Ltd.
Location : SAHA-GU, BUSAN
Website : wwww.suhhani.co.kr
Main Products : Cable tray and duct, Hot dip galvanizing, Ship window
TEL : +82 51 204 1920

SUNBO INDUSTRIES Co., Ltd.
Location : SAHA-GU, BUSAN
Website : www.sunboind.co.kr
Main Products : Package module unit, Tank top unit, E/R block, etc.
TEL:+82 51 260 5551

Sung Jin Geotec Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.sgtkor.com
Main Products : Ship block, Fin tube, Header pipe
TEL : +82 52 228 5801

Sung Kwang Bend Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.skbend.com
Main Products : Butt welding pipe fittings
TEL : +82 51 330 0200

Sung Mi Co., Ltd.
Location : GIMHAE-SI, GYUNGNAM
Website : www.sung-mi.co.kr
Main Products : Door frame, Wall panel, Ceiling panel, Door hardware, Unit toilet
TEL : +82 55 329 1117

SUNG SIN INDUSTRIES Co., Ltd.
Location : GYEONGJU-SI, GYEONGBUK
Website : http://sungsin.koreasme.com
Main Products : Hatch coaming, T-Block, Water mist catcher, Water separator, Louver
TEL : +82 54 776 6441

Sungil SIM Co., Ltd.
Locatio : GANGSEO-GU, BUSAN
Website : www.sungilsim.com
Main Products : Pipe bending, Pipe spool, Marine Engine, Gas turbine
TEL : +82 51 831 8800

Suro Propeller & Machinery Co.
Location : YOUNGDO-GU, BUSAN
Website : www.suropump.co.kr
Main Products : Propeller, Propeller shaft
TEL : +82 51 415 0445

T.K. Corporation Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.tkbend.co.kr
Main Products : Butt-welding fittings, Forged fittings, Flanges
TEL : +82 51 831 6600

TAE KWANG Co., Ltd.
Location : GANGSEO-GU, BUSAN
Website : www.tkbend.co.kr
Main Products : Pipe Fittings, Fitting & Valve
TEL : +82 51 831 6550

TAE YOUNG TRADING Ltd.
Location : NOWON-GU, SEOUL
Website : www.marine-matarial.com
Main Products : Receptacles & wire accessories, Flood light, Deck light, Reflector lamps, HRF mercury lamps, Sodium lamps, Marine electrical equipment
TEL : +82 2 2272 1960

Taekyung Heavy Industries Co., Ltd.
Location : CHANGWON-SI, GYUNGNAM
Website : www.tkhic.com
Main Products : Engine Bed/Frame Box, Air Receiver/Gas ReceiverSteel Outfittings, Tubular(SAW Pipe), etc.
TEL : +82 70 4628 8844

TANKTECH Co., Ltd.
Location : SAHA-GU, BUSAN
Website : www.tanktech.co.kr
Main Products : Water-mist fire fighting system for engine room and accommodation, LNG fuel tank system, Offshore steel structure
TEL : +82 51 979 1600

TechMarine S/W Co., Ltd.
Location : DONG-GU, BUSAN
Website : www.techmarine.net
Main Products : Loading computer program, CAOS, Stowage program, LOFOS, LMS
TEL : +82 51 467 7003

Techcross Inc.
Location : GANGSEO-GU, BUSAN
Website : www.techcross.com
Main Products : Ballast water management system
TEL : +82 51 603 3500

TETRADYNE
Location : GURO-GU, SEOUL
Website : www.tetradyne.co.kr
Main Products : Marine Monitor, Marine Panel PC
TEL : +82 2 323 4972

TMC Co., Ltd.
Location : CHEONAN-SI, CHUNGNAM
Website : www.tmc-cable.com
Main Products : Marine cables, Oil & rig cables, Onshore cables, Special cables, Optical fiber cables
TEL : +82 41 589 6500

TOPSAFE Co., Ltd.
Location : GIMHAE-SI, GYUNGNAM
Website : www.topsafe.co.kr
Main Products : High-velocity pressure vacuum valve, Breather valve, Flame arrestor, Emergency vent cover, Detonation flame arrestor
TEL : +82 55 338 9986

TTS INTERNATIONAL Corp.
Location : GANGSEO-GU, BUSAN
Website : www.ttsi.co.kr
Main Products : Cuni Pipe, Cuni Flange, Cuni Fitting
TEL : +82 51 832 9977

VISER Co., Ltd.
Location : GIMHAE-SI, GYUNGNAM
Website : www.viser.co.kr
Main Products : PHE GASKET, Valve seat, Dust packing, etc.
TEL : +82 55 346 5575

WARTSILA ACCOMMODATION SYSTEMS KOREA, Inc.
Location : GOSEONG-GUN, GYEONGNAM
Website : www.waskorea.co.kr
Main Products : Unit toilet, Unit cabin, Wall panel, Ceiling panel
TEL : +82 55 673 7315

WhaYoung Co., Ltd.
Location : MIRYANG-SI, GYUNGNAM
Website : www.whayoung.co.kr
Main Products : Fuel pump ass'y for ship engine
TEL : +82 55 359 1100

WONIL Co., Ltd.
Location : MASAN-SI, GYEONGNAM
Website : www.ms-wonil.com
Main Products : Cylinder cover, Common rail unit, Silencer, Spraying plate, Rotor shaft
TEL : +82 55 253 1500

Woo Chang Ind. Co., Ltd.
Location : GIMHAE-SI, GYUNGNAM
Main Products : Weather-tight steel door, Louver vent, Steel window box, Mooring fitting
TEL : +82 55 337 1651

WOOJOO M & E Co., Ltd.
Location : SAHA-GU, BUSAN
Website : www.wjme.com
Main Products : Exp. junction box, Warning alarm, etc.
TEL : +82 51 264 9130

Yoo Won Industry Ltd.
Location : SAHA-GU, BUSAN
Website : www.yoowonind.com
Main Products : Steering gear, Filter, Deck M/C
TEL : +82 51 205 8541

You Jeon Industry Co., Ltd.
Location : CHANGWON, GYUNGNAM
Main Products : Marine engine parts, Engine bed
TEL : +82 55 297 2121

YoungkWang Machine Co., Ltd.
Location : GYEONGJU-SI, GYEONGBUK
Website : www.ykmc.com
Main Products : Skid unit, Pressure vessel, Heat exchanger
TEL : +82 54 776 6456

Younglim Timber Co., Ltd.
Location : NAMDONG-GU, INCHEON
Website : www.younglim.com
Main Products : Wood Fire Retardant, Flooring Board, Furniture, Wood for Interiors
TEL : +82 32 811 9051

YOUNGIL PRECISION Co., Ltd.
Location : HAMAN-GUN, GYEONGNAM
Website : http://youngilco.kr
Main Products : Valvetrain components for all kinds of 4-Stroke Diesel Engine's
TEL : +82 55 585 2915

DAEWOO SHIPBUILDING & MARINE ENGINEERING CO., LTD.

• Address : 85, Da-dong, Jung-gu, Seoul, Korea • Tel : +82-2-2129-0114 • Fax : +82-2-2129-0077~8 • http://www.dsme.co.kr

• Products : *LNG Carriers, LNG-RVs, LNG-FPSOs/FSRUs, LPG Carriers, LPG-FPSOs, ULCCs, VLCCs, Suezmax/Aframax/Panamax Tankers, Shuttle/Chemical Tankers, Product Carriers, Containerships, Capesize/ Kamsarmax/ Supramax Bulk Carriers, Ore Carriers, VLOCs, Ro-Ro Ships, PCTCs, Passenger Car Ferries, FPSOs, FSOs, FPUs, Drill Ships, Semi-Submersible Drilling Rigs, Fixed Platforms, Submarines, Submarine Rescue Vessels AUVs, Destroyers, Battle Ships*

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• Products : *Arctic Shuttle Tankers, VCLLs, Crude Oil Tankers, Container Vessels, LNG/LPG Carriers, FPSO, FSO, Drillships, etc., LNG FPSO, Offshore Platforms, TLP, SEMI, Cruise Ships & Ferries, Steel Structures, Bridges & Building, Cargo & Material Handing Equipment*

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• http://www.hshi.co.kr

• Products : *Tankers, VLCCs, Product Carriers, Chemical Tankers, Containerships, LNG Carriers, LPG Carriers, Pure Car Carriers, Bulk Carriers, Other Vessels*

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• Products : *Product/Chemical Tankers, Containerships, Self-Unloading Bulk Carriers, Multipurpose Cargo Carriers, Drillships, Cable Layers, Pipe Layers, FPSOs, Car Ferry & Passenger Ships, LPG Carriers, Pure Car / Truck Carriers, General Cargo Carriers, Ro-Ro Vessels*

SUNGDONG Shipbuilding & Marine Engineering CO., LTD.

• Address : 940, Gongdan-ro, Gwangdo-myeon, Tongyeong-si, Gyeongsangnam-do, 53006, South Korea

• Tel : +82-55-647-7435/7415 • Fax : +82-55-647-5065 • http://www.isungdong.com

• Products : *Crude Oil Tankers, Product Carriers, Chemical Tankers, Shuttle Tankers, Container Carriers, Bulk Carriers, FSO*

HANJIN HEAVY INDUSTRIES & CONSTRUCTION CO., LTD.

• Address : 29, 5-ga, Bongnae-dong, Yeongdo-gu, Busan, Korea • Tel : +82-51-410-3240 • Fax : +82-51-410-8477 • http://www.hanjinsc.com

• Products : *Container Carriers, Product/Chemical/Crude Oil Tankers, LNG/LPG Carriers, Cable Ships, Supply Boats, Semi-Submersible Drilling Rigs, Dredgers, Navel Ships, Special Purpose Ships, Bulk Carriers*

DAESUN SHIPBUILDING & ENGINEERING CO., LTD.

• Address : 12, 4-ga, Bongrae-dong, Yeongdo-gu, Busan, Korea • Tel : +82-51-419-5090~1 • Fax : +82-51-416-7965 • http://www.daesunship.co.kr

• Products : *Container Ships, Bulk Carriers, Tankers, MPC & General Cargo Ships, Gas Carriers, Ro/Ro ships, Tug Boats, Fishing Boats/Vessels, Special Purpose Vessels*

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