IHC MERWEDE

IHC Merwede

Insight

Dredging | Mining | Offshore

Spring 2013 | E 2

Tower of strength

The new IHC Beaver® 65 DDSP dredger unveiled

DOCS improves dredging efficiency for contractors

New and upgraded DP/DT systems for an entire fleet

The technology innovator.

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Welcome

Dear reader,

Welcome to the second issue of *IHC Merwede Insight*, formerly known as *Ports and Dredging* magazine. A digital version is also available via the IHC Merwede website. Online or on paper, our aim is to inform you about the latest developments regarding IHC Merwede's innovative vessels, advanced equipment and life-cycle support, which can be found in dredging, mining and offshore operations worldwide.

Following the news section, the first feature reports on the design and manufacture of custom-built, high-specification lay systems for pipelaying vessels. Supplied by IHC Engineering Business, this equipment demonstrates IHC Merwede's capability to deliver integrated turnkey solutions in one of its many specialist fields.

Turning to innovative vessels, the new IHC Beaver® 65 DDSP is the result of 50 years' unrivalled experience in the design, building and commissioning of standardised cutter suction dredgers (CSDs). Read how the latest in a long line of IHC Beaver® vessels was developed, using valuable feedback from customers around the world. The second part of the feature outlines the new vessel's improved health, safety and environmental features, and the positive impact these have on production figures and uptimes.

Two other innovative vessels set sail last summer, destined for work on Iraqi ports and waterways. The DOHUK, a grab hopper dredger especially equipped to dredge close to quay walls, was delivered to the same customer as the KARBALA, a trailing suction hopper dredger (TSHD) with two suction pipes, which can unload her hopper either through bottom valves, or through shore discharging/rainbowing equipment. Find out more about each vessel and the training programme of the crews provided by IHC Merwede on page 22.

Training is an important element of IHC Merwede's life-cycle support to customers. An article on IHC Merwede's Training Institute for Dredging's cooperation with a Chinese customer on page 28 illustrates the benefits of a new certification course for operators and crews of CSDs. Also falling under the life-cycle support banner, a report on IHC Systems (see page 32) highlights the successful fulfilment of an order to replace and upgrade DP/DT systems on the TSHD fleet of the Jan De Nul Group.

The next issue of *IHC Merwede Insight* is due before the Europort maritime exhibition in Rotterdam on 5-8 November 2013. We hope to see you there.

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Cover: Saipem's J-Lay tower

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Two out of three for DCI

IHC Merwede successfully named and launched the 5,500m³ trailing suction hopper dredger, DCI DREDGE XX, in a special ceremony on 2 February 2013 at the company's shipyard in Kinderdijk, The Netherlands. This is the second of a series of three vessels to be supplied to Dredging Corporation of India Ltd (DCI). The first, DCI DREDGE XIX, was delivered three weeks ahead of schedule on 15 November 2012 at Waalhaven in Rotterdam.

The naming and launch ceremony for DCI DREDGE XX was performed by Mrs R Mohanty, the wife of Captain DK Mohanty, the Managing Director of DCI. They were joined by Mrs Geetu Joshi, the Director of the Ministry of Shipping in India, and senior representatives and employees from IHC Merwede.

A highlight of the event was the smashing of a coconut against the side of the ship (see above right), as a Hindu symbol of fortitude, purity, truth and prosperity. It was also a sign that all obstacles attempting to stand in the way of the vessel would be overcome.

DCI DREDGE XX has a dredging depth of 25m, measures 114m in length and has accommodation for 35 people. She will be built under dual class (Lloyd's Register and Indian Register of Shipping) and will be deployed – along with the DCI DREDGE XIX – for the maintenance-dredging project on the Hooghly River, a tributary of the Ganges River in West Bengal. She is scheduled for delivery mid-way through 2013.

DCI's dredging fleet is specially designed for working on the Hooghly River, taking into account its soil properties, strong current and shallow depth. The dredgers feature high levels of productivity, reliability and efficiency as well as low power consumption and operational costs. Their construction is believed to be having a positive effect on the Indian economy.

IHC Merwede was selected as supplier of the DCI DREDGE XIX, XX and XXI vessels due to its efficiency and reliability in delivering ten previous orders to DCI on time.

First sale of IHC Beaver® 65 DDSP

Following the launch of the IHC Beaver® 65 DDSP in February, IHC Merwede has confirmed the sale of the first vessel to Advanced Construction Company, a member of the Al Geithy Group. Testing was completed at the shipyard in Sliedrecht, The Netherlands, in early March, and the ship will be prepared for delivery to Saudi Arabia in the second quarter of this year.

The new vessel succeeds the highly successful IHC Beaver® 6518 and belongs to the renowned IHC Beaver® series of standard cutter suction dredgers. She has been designed with an integrated spud carrier, direct-driven submerged pump and an ergonomic operating console.

Built in accordance with BV Coastal Area classification, the vessel can be used on inland water or out at sea. Like all IHC Beaver® dredgers, she offers easy dismounting and transportation possibilities, and is built from stock for short delivery times.

To find out more about the development of the IHC Beaver® 65 DDSP, read the full-length feature starting on page 16.

Three pipelaying vessels simultaneously under construction

IHC Merwede is building three top-tension 550t pipelaying vessels simultaneously at its Krimpen aan den IJssel yard in The Netherlands. The keel-laying ceremony for the first of two identical 550t pipelaying vessels for TL Offshore, a subsidiary of SapuraKencana, took place on 15 January 2013.

This event was held one week ahead of schedule and was performed by Darryl Peter Nelson, Project Director with TL Offshore. IHC Merwede began the steel-cutting work on the second TL Offshore pipelaying vessel directly after the ceremony.

The full hull of the third vessel, designed and engineered for Subsea 7, was already on the slipway in January. Her keel-laying ceremony was held in August 2012, one month ahead of schedule. All three pipelaying vessels are therefore well under way and on track for delivery in 2014.

The two vessels for SapuraKencana are fully integrated pipelaying vessels completely designed, engineered and built by IHC Merwede. The pipelaying spread is supplied by IHC Merwede's subsidiary, IHC Engineering Business, which began steel cutting for its tower structure in January (see page eight). IHC Drives & Automation is responsible for the delivery of the integrated automation system, the full electrical installation and the complete electrical machinery package.

IHC Packhorse™ offshore support vessels launched in Singapore

IHC Merwede unveiled the new series of IHC Packhorse™ offshore support vessels in January at an official launch event in Singapore.

The new range consists of: the IHC Packhorse, which has been positioned as a platform supply vessel (PSV); and the IHC Packhorse™-Maxi, which is a variation on the basic hull form, providing a 59-person accommodation unit and a range of options designed for subsea support on IRM work, light construction and cablelaying projects. IHC Merwede offers the portable equipment for the IHC Packhorse-Maxi, either as an in-house supply package or as specified by customers, depending on their preference.

The IHC Packhorse range will initially be built through the cooperation agreement established between IHC Merwede and Jaya Holdings. Jaya Holdings CEO, Venkatraman Sheshashayee, says, "We welcome the launch of the IHC Packhorse as another key step forward in our ongoing cooperation with IHC Merwede. This is an exciting development in the market to offer vessels built with European quality at Asian prices."

IHC Merwede's President, Govert Hamers, explained that, while IHC Merwede was best known in the offshore sector for innovative custom-built vessels, it had recently extended its product range with the IHC Supporter® Class. "This is a cost-effective mid-size vessel, which offers a reduced build time and flexibility in the selection and configuration of mission equipment by virtue of its modular construction. The IHC Packhorse range represents the first move to extend our product portfolio into the volume market, while continuing to be a dependable partner for offshore operators."

The launch of the IHC Packhorse range is the latest development to reinforce the company's internationalisation strategy, which aims to provide a choice of designs and build locations to its customers on a global basis.

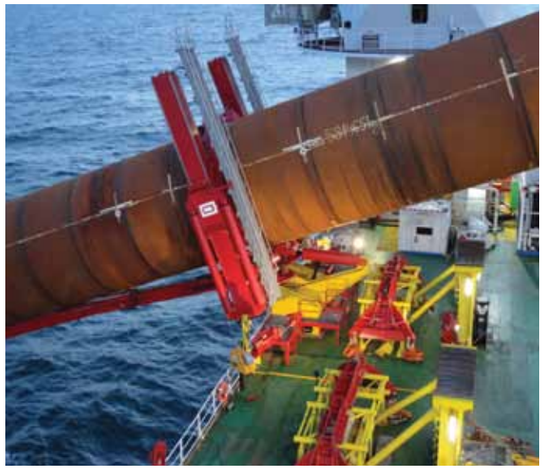
IHC Handling Systems delivers innovative pile guiding tool

IHC Handling Systems has designed, constructed and delivered a pile guiding tool for the installation of 80 wind turbine foundations at sea. The innovative equipment was installed on board the ZARATAN jack-up vessel, owned by Seajacks, in autumn 2012.

The company was awarded the contract on the strength of its vast expertise and experience in the offshore market. It supplied the tool as part of an extensive package of advanced handling and lifting equipment. The order included a 700t upending tool and accompanying hydraulic power packs.

The equipment is being used to lift and position monopiles, which are essential for the foundation of windmills, on the Meerwind offshore wind farm project in the German North Sea. A total of 25 monopiles were successfully installed between September 2012 and January 2013.

The foundation of the wind turbines in the Meerwind offshore wind farm project consists of a monopile and transition piece. The monopiles have an outer diameter of 5,500mm, an overall length of 64m and a maximum weight of 680t. The transition piece connects the monopile to the mast of the wind turbine.



The new pile guiding tool replaces the commonly used 'upending bucket' and 'guiding and positioning tool' by combining two operations – tilting and positioning – into one piece of equipment. It saves valuable time during the installation process. In addition, less deck space is required and the tool is much lighter than the current equipment.

The new IHC Handling Systems' tool was produced in conjunction with: IHC Vremac Cylinders, which supplied the cylinders; IHC Winches, where the assembly and testing took place; and IHC Hydrohammer®, which supplied the S-2000 hydraulic hammer for driving the monopiles.

Demand grows for Delta Multi Craft work boats

The popularity of Delta Multi Craft (DMC) work boats manufactured by IHC Beaver Dredgers, the world's market leader for standard cutter suction dredgers, is continuing to grow. The company has delivered more than 40 vessels from the versatile DMC series in recent months. They are designed and built to assist dredgers in daily operations, including pushing/pulling, buoy handling, and the transportation of personnel and goods such as fuel, oil and water.

Two recent successful deliveries include a DMC 1400 for a customer currently operating an IHC Beaver® 6518C, and a DMC 1050 to support an IHC Beaver® 1200 for its operations in Nigeria.

Both work boats were supplied from stock to ensure a minimum lead time, and have already formed perfect working partnerships with their respective dredgers. Each work boat is of standard design and built within the specification of the DMC series. This guarantees a proven concept with a combination of good performance and operational reliability.

Merchandise now available online

A wide range of IHC Merwede-branded merchandise can now be purchased online at webshop.ihcmerwede.com. The new webshop is open to customers and employees of IHC Merwede, including its various business units. Clothing, sport and leisure products, gifts, and items for the office and corporate events, can all be found on the site, displaying the distinctive IHC Merwede logo.

The clothing range includes red and white baseball caps for adults and children, polo shirts, T-shirts and jackets. A silk tie and red pashmina complete the corporate look.

Office items such as mousemats, table flags, USB sticks, ballpoint pens and key rings are available, in addition to a wide range of leather items such as A4 document holders, wallets and cardholders. For corporate gifts, visitors to the site can choose from watches and clocks, flasks and lunchboxes, and mugs and coasters.

Away from the office, a selection of sports bags and backpacks, golf umbrellas and balls, travel wash bags and beach towels completes the range. Most products can be personalised with logos and if visitors can't find exactly what they're looking for, they can simply complete the contact form online and the customer care team will help them to find something suitable.

New faces at IHC Merwede

IHC Merwede has made two significant new appointments in recent months, with both having valuable experience of the maritime sector and extensive knowledge of the markets in which the company operates.

René Raaijmakers (above left) is the new Offshore Sales Director and succeeded Twan Voogt on 1 December 2012. And in February 2013, subsidiary IHC Asia Pacific welcomed Francis Tang (above right) as Product Director for the Product Market Combination team responsible for global sales and marketing of service and support vessels.

Mr Raaijmakers joined IHC Merwede in April 2012 as Product Director of the Renewables department and Manager of IHC Offshore Systems. In his new role, he will be responsible for all commercial activities within the Offshore division.

He began his career with Bluewater, a leading offshore FPSO contractor and worked there for 14 years. After six years in business development, he became part of Bluewater's executive management team, ultimately responsible for the Engineering and Tendering departments. In this role, Mr Raaijmakers' tasks included preparing the company with products to meet the future demands of the offshore market.

In 2010, he founded OceanMill, where he developed commercial-scale projects and explored opportunities for starting up a new company around the Wave Rotor technology. This company is now part of IHC Merwede, operating under the name of IHC Tidal Energy.

Prior to his new role at IHC Asia Pacific, Mr Tang was Managing Director of the Singapore office of a major international ship design company. As Product Director, he will lead the development of two new offshore support vessels, the IHC Packhorse™ and IHC Packhorse™-Maxi (see page five for more details). This will involve working with local third-party designers and liaising with IHC Merwede's in-house design and engineering resources.

Pipelaying: IHC Merwede's tower of strength

1. Saipem's J-Lay system is an excellent example of IHC EB's capabilities

Custom-built, high-quality pipelay systems

IHC Merwede confirmed its status as a leading supplier of custom-built ships and equipment for the offshore construction market with the announcement that it had secured a new €450 million order for three pipelaying vessels in March 2012. The contracts were signed by IHC Offshore & Marine for two identical new 550-tonne ships with TL Offshore, a subsidiary of SapuraKencana, and a 300-tonne vessel with OSX Construção Naval SA Brazil.

In the case of the two 550-tonne pipelaying vessels – currently being designed, engineered and constructed at the company's Krimpen aan den IJssel shipyard in The Netherlands – it is the first time that the IHC Merwede Offshore division is fully integrating equipment developed in-house into this type of vessel and to this extent. Several of the company's business units are playing a key role: IHC Engineering Business (IHC EB) is supplying the pipelay spreads; IHC Drives & Automation is delivering the integrated automation system, full electrical installation and complete electrical machinery package; and others, such as IHC Piping, are also delivering equipment.

The pipelay spread for the third vessel is also being supplied by IHC EB. This ship is being designed and engineered by IHC Merwede, but built at the OSX yard in Acu, Rio de Janeiro, in accordance with the requirements of Petrobras. After completion in 2014, all three vessels will be utilised to install flexible pipelines in Brazilian waters, pursuant to Petrobras' contracts for the provision of pipelaying services.

The installation of pipelines for the transportation of oil and gas is a vital part of the construction of offshore subsea infrastructure. These interconnect oil and gas wells to production centres, such as platforms or FPSOs. The increasing demand for oil and gas has driven the industry to deeper waters, which makes the installation of the pipelines and infrastructure even more challenging.

The totally integrated solutions offered by IHC Merwede ensure the delivery of reliable equipment for this purpose. The company has already demonstrated its expertise by establishing a reputation for supplying multiple innovative pipelaying vessels on time and within budget.

In addition, IHC EB designs and engineers advanced pipelaying equipment that provides a commercial and technical advantage for its customers. IHC EB works in partnership with them on projects ranging from fully integrated vessel systems to the rapid supply of subsystems.

These include a variety of tailor-made, advanced lay systems – namely J-Lay (*figure 1*), S-Lay (*figures 8-9*), Reel-Lay (*figure 10*) and Flex-Lay (*figure 7*) – as well as carousels (*figure 2*) and reel skidding systems. It can also provide trenching equipment (*figure 3*), handling systems, winches, and electrical power and automation systems.

2. A 3,000-tonne carousel that was delivered to Subsea 7

3. Saipem's PL3 plough and BPL3 backfill plough

4. One of the world's largest, most versatile and complex J-Lay systems


5. The J-Lay system was a challenging project due to its sheer scale

IHC EB's approach to engineering, and in-house mechanical, structural, electrical hydraulic and control systems design expertise enable it to deliver: lay systems that offer maximum operability and functionality; and tower structures optimised for low system weight, while ensuring safe and reliable operations in the harshest of conditions.

J-Lay: designed for durability

An excellent example of IHC EB's custom-built capabilities is one of the world's largest, most versatile and complex J-Lay systems [1], which was delivered to Saipem in 2010 (*figures 4-5*). This category of lay system takes its name from the 'J' shape that the rigid, large-diameter product makes between the vessel and the seabed when it is being laid.

This was a challenging project due to its sheer scale – by far the biggest taken on by the company at that time – and the size of the team required (a total of 45-50 personnel throughout). For a massive industrial engineering project such as this, accurate documentation and effective communication are crucial. Everyone must work towards the same goal and this is how IHC Merwede's integrated approach pays dividends.

Each quad joint pipe is hoisted to a vertical orientation into the J-Lay tower from the deck, where it is aligned for welding. It is then moved down to create space for the next quad joint and the process is repeated to form the pipeline. The system is capable of deploying at line tensions of up to 1,500 tonnes and is able to hold the pipe string in the hang-off clamp at catenary tensions of up to 2,000 tonnes.

Furthermore it is able to accommodate 4-36" pipes and can work in shallow and ultra-deep water (up to 3,000m) depending on the type of product, with the tower angle adjustable from 45 to 96 degrees. Multiple travelling tower clamps, an adjustable stinger and a dedicated bulky item handler also contribute to the high functionality and low cycle time of the system.

IHC EB worked hard on preventing any fatigue issues – for example, by using the best available welding techniques – and the possible impact that it might have on the overall structure. Safety was also of paramount importance and the team adhered to IEC 61508, which is a standard that produces a high level of integrity.

Principal Engineer at IHC EB, Ralph Manchester – who has worked in the industry since 1996 and for the company since 2007 – highlights how this works in practice, "The stakes can be very high in an offshore environment and safety is of course a big issue in today's market. So, this is something that we must prioritise at all costs.

"We go through the mechanical, electrical, hydraulic and control system design processes, and if we assess that it isn't secure enough, then we go back through each stage to check if we can add additional redundancy into these systems. We are one of only a few companies that can supply a finished product to this standard."

After the J-Lay system had been delivered to Korea, it was 'plugged in' and worked perfectly 'out of the box'. Once it had been installed and commissioned on the vessel, it was laying product within two months and the first project was completed ahead of schedule.

The life-cycle support package offered by IHC Merwede has ensured that the relationship with Saipem has gone from strength to strength. From the team that was deployed in Korea with the vessel for six months after delivery, to the 24-hour helpline that caters for all time zones and shift patterns around the globe, IHC EB has been proactive in assisting the customer and rectifying any operational issues.

"IHC EB secured this contract because it gave the customer exactly what was required," explains Ralph. "They knew what they wanted this J-Lay system to do as a result of their operational expertise.

"Some people within the industry didn't think that we'd be able to deliver the goods, but we've definitely been taken seriously since the completion of this award-winning project. It's a real technological achievement for all concerned and has led the way for other orders and enquiries. The durability, availability and productivity of the Saipem J-Lay system has helped to build our reputation and there has been a lot of positive feedback from the market."

Flex-Lay: high-quality engineering

IHC EB has also taken a leading role in designing and engineering high-quality integrated Flex-Lay systems. A good example is the integration of a new 300-tonne capacity vertical Flex-Lay system – as an upgrade to the existing horizontal lay system – on to one of McDermott International's vessels during the early part of 2013 (*figures 6-7*).

This ship is a modern, high-payload, dynamically positioned, fast-transit and flexible-laying product, which utilised the existing 7,000-tonne capacity of the IHC EB carousel system.

"Once again, we focused our attention on the customer's specific requirements with a flexible approach during and after the proposal phase," explains Ralph. "There were quite strict weight restrictions in place, but by employing

6. IHC EB has taken a leading role in integrated Flex-Lay systems

7. McDermott International's new 300-tonne capacity vertical Flex-Lay system


8. IHC EB supplied the pipe-handling and working stations for Allseas' S-Lay system


9. The S-Lay system on board Allseas' vessel


10. IHC Merwede's supply of integrated pipelay spreads is providing it with a competitive advantage

best practice with regard to structural design, we were able to commit to the required specification.

"The attention to detail paid off and we have already developed a strong working relationship with this new customer. They have confidence in our ability, as we have been able to pass on our expertise to develop the system. If we felt they needed something better to improve its performance, then we went back to them with an open and honest approach."

S-Lay: built for reliability

IHC EB's capacity for S-Lay systems (*figure 8*) – that lay rigid pipelines in deep water up to 2,000m – may be evidenced by the equipment that was designed, manufactured and commissioned for Allseas in 2006. This delivery involved the turnkey supply of the various pipelaying system components together with an integrated control system.

S-Lay systems provide precise control of the product through the use of variable speed drives and synchronisation of line-up buggies and tensioners during the laying process. The finished product emerges from within the vessel and moves over a stinger, which controls the bend and makes the 'S' shape as the pipe is lowered on to the seabed. Safe and efficient operations are achieved through the use of an integrated control and monitoring system with automatic interlocks.

IHC EB supplied the pipe-handling systems and working stations for the Allseas vessel. It has the capacity to weld 12m-long, 48"-diameter pipes in pairs, which are then welded again to form 48m lengths. This continuous process enables the crew to check the integrity of the welding before it goes on to the main pipeline.

"This was our first move into pipelaying with a new customer at that time and so it was a significant landmark in the company's historical development," highlights Ralph. "The scope of the project increased by almost a third from the initial brief and we even got involved with the installation of the equipment on the vessel."

Reel-Lay: large capacity and capability

IHC EB also specialises in the supply of tailor-made Reel-Lay systems, such as the turnkey equipment being supplied in early 2013 for Technip's DEEP ENERGY. This will be one of the most capable pipelaying vessels ever built, with the capacity to handle up to 18" rigid pipe and incorporating an integrated, efficient PLET handling system.

Up to 3,000 tonnes of rigid product has to be preloaded on to a huge reel. During the lay process, it moves over the top of the IHC EB-supplied tower and down through straightening tracks with enormous force to eliminate the bow. Then, it passes through two tensioners to squeeze the product, with tracks pushing upwards to support the load going down as far as 3,000m to the seabed.

A wide range of systems has been supplied to Reel-Lay vessels. These include pipe roller box assemblies, moon pool handling systems, piggybacking and straightener systems. Once again, IHC EB works on individual solutions to meet specific requirements, and provide each customer with commercial and technical advantages.

"Technip's large-capacity vessel is capable of bending and straightening up to 18"-diameter pipe," says Ralph. "We believe this is the first ship in the world that has been designed to do this. A high safety integrity level has also been built into the control system and it has been designed to work seamlessly from day one."

Pipe-Lay systems: flexible approach

With the demand for pipelaying vessels being propelled by the Petrobras contracts in Brazil, IHC Merwede's supply of integrated pipelay spreads and other advanced equipment on its ships is providing it with a competitive advantage. The common denominator is the flexible, customer-focused approach that the company adopts for its custom-built, high-quality pipelay systems.

IHC Merwede's President Govert Hamers summarises the company's position in the market, "We are delighted with the orders that we are executing for TL Offshore/SapuraKencana and OSX. Together with the pipelaying vessel we are building for Subsea 7 – which is also a 550-tonne vertical pipelay system for the Brazilian market – IHC Merwede is playing a major role as the technology provider on four of the six pipelaying vessels ordered by Petrobras.

"We are extremely proud of our record on reliability and cost effectiveness for the delivery, management and execution of such projects. These contracts reinforce our position as a supplier of reliable, efficient and flexible vessels, and advanced equipment that can meet the shortest possible lead times for the demands of oil and gas projects."

11. A-frames provide safe working conditions

12. The I-trencher is a highly manoeuvrable self-propelled tracked machine

Award-winning enterprise

IHC EB designs specialist equipment for the offshore oil and gas, submarine telecoms and renewables industries. Typical projects include the design, manufacture and supply of bespoke systems, including pipelay equipment, ploughs (*figures 3 and 13*), trenching machines (*figures 11 and 12*) and handling systems (*figure 11*). The company's scope of supply ranges from engineering design, modifications or upgrades, to complete turnkey integrated ship systems.

It has invested heavily in expanding its production and support facilities. The majority of the company's 200 employees operates from its UK headquarters in Stocksfield Hall, Northumberland. These rural facilities provide a relaxing atmosphere and stimulating environment for innovative design with easy access to key transport links for the company's impressive international customer base.

In addition to its design and management offices, IHC EB has a manufacturing and customer support base at Riverside Quay, Port of Tyne. This facility accommodates the assembly, testing, commissioning and installation of several major projects simultaneously. It also represents a further commitment by IHC EB to offer its customers a wider range of manufacturing, mobilisation and support services from one deep-water base.

IHC EB's ability to deliver world-class offshore equipment is entirely due to the dedication, expertise and creativity of its staff. Across all disciplines – from engineering to QA and production – a passion for technology, innovation and delivering systems of the highest quality is at the heart of every project and service provided by the company.

At the end of 2011, the company received two awards for its work on the Saipem J-Lay system: British Engineering Excellence Awards (BEEA) Design Team of the Year; and the NOF Energy Innovation and Technology Award.

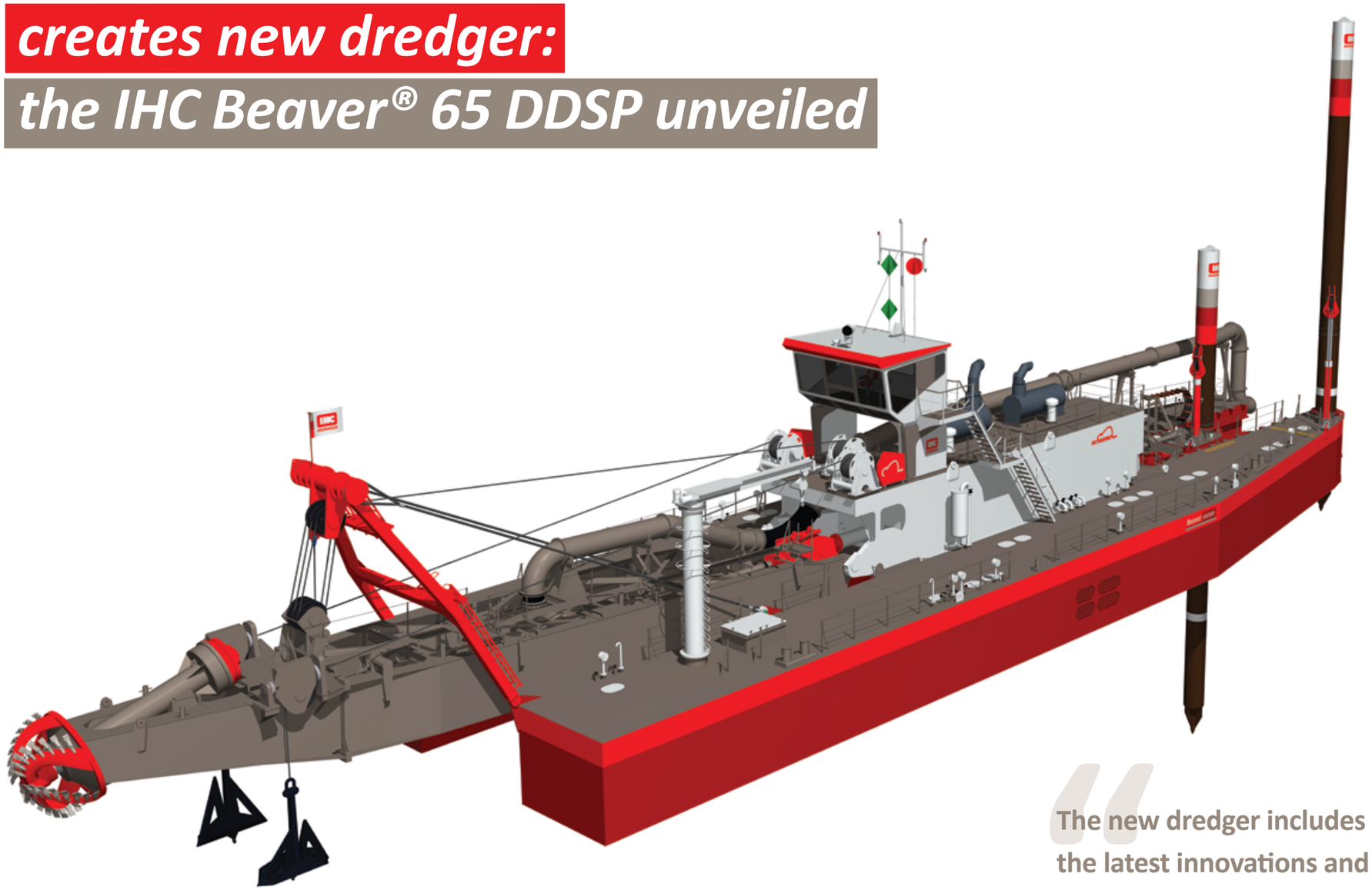
References

[1] 1] "The first IHC Merwede J-Lay tower". Ports and Dredging 177. IHC Merwede, Sliedrecht, The Netherlands, 2011. 32-35

"IHC EB's ability to deliver world-class offshore equipment is entirely due to the dedication, expertise and creativity of its staff"

13. IHC EB staff have a passion for technology, innovation and delivering systems of the highest quality

Unrivalled experience creates new dredger: the IHC Beaver® 65 DDSP unveiled



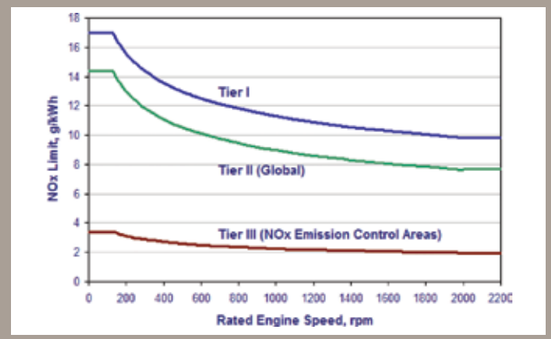
1. An artist's impression of the IHC Beaver® 65 DDSP

> "The new dredger includes the latest innovations and technologies, making it reliable, efficient, easy to maintain and productive"

Introduction

In 2013, IHC Beaver Dredgers in Sliedrecht, The Netherlands, celebrates the 50th anniversary of the IHC Beaver® product range. Throughout this half-century, the company has focused on the design and delivery of standard cutter and wheel suction dredgers in the IHC Beaver® series. Now a registered trademark, the range has become regarded in the dredging industry as the epitome of highly qualified, extremely reliable and cost-effective standardised cutter suction dredgers (CSDs) – mainly in the power range up to approximately 4,000kW.

Taking advantage of 50 years of uninterrupted enhancement of knowledge, design and production methods, services and feedback from service personnel, customers and the market in general, the company has become a regular innovator in this area and an excellent performer in the field. All these years, it has been at the forefront of developments. Yes, there are more CSDs in the world in general, but IHC Beaver® dredgers set the standards by which others follow.



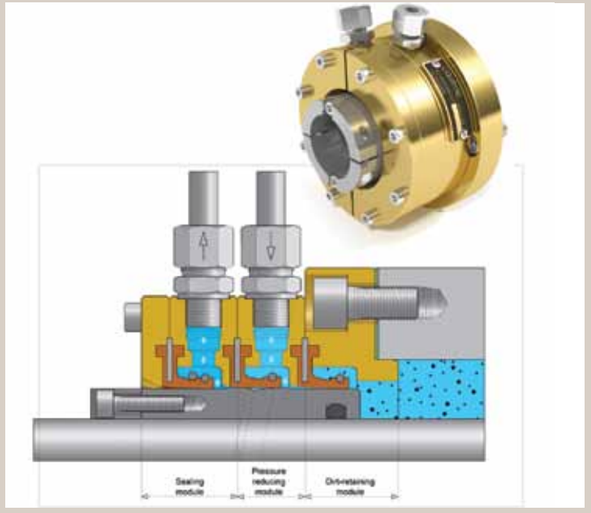
2. IMO regulations can be a good reason to upgrade the design of an entire product range

3. The patented pivoting gearbox in the ladder trunnion for optimum drive train efficiency

4. The stylish operating cabin is mounted on top of the engine room unit


5. The intuitive operator's chair and auxiliary panels help to prevent fatigue


6. The submersible pump is good for high densities and large discharge distances



7. The IHC Liquidyne® shaft sealing for good wear characteristics and a wide pressure range

8. The IHC Curve® impeller boasts improved suction and wear-resistance properties

Staying ahead of the competition implies that designs must be overhauled regularly. Components and concepts are improved or updated using state-of-the art technology. However, the utmost care is taken to preserve proven technology, too. This helps to maintain the dredgers' reputation as the most reliable in the industry. Besides technology innovation and optimisation requirements, legislation can be another good reason to start a cycle of redesigning an entire series.

There are enough examples of both: dredger efficiency considerations brought about the introduction of the pivoting gearbox, the submersible dredge pump and the IHC Spud Guard®. Recently, the actualisation of Tier II of the IMO rules and regulations on NOx emissions (*figure 2*) required the installation of adapted diesel engine types.

This was a good reason to review and modernise a 650mm CSD design that has been successfully deployed over the world and that originates from the company's early years. It concerns the IHC Beaver® 6518 design, which has her illustrious predecessors in the IHC Beaver® 3800NG, IHC Beaver® 3800, IHC Beaver® 3300 and IHC Beaver® Giant 3300, respectively. The outcome is a specimen of the company's unrivalled experience, and has been named the IHC Beaver® 65 DDSP, the acronym indicating the discharge pipe diameter of 65cm and the vessel's Direct Driven Submersible Pump *(figure 1*).

More powerful and efficient, safer and environmentally friendly

Like all IHC Beavers, the IHC Beaver® 65 DDSP is built in stock for short delivery times. For extended operations, she has been designed and built under the BV Coastal Area classification. With a continuous focus on customer value, the concept of the IHC Beaver® 65 DDSP is based on the experience of 50 years in developing and building standard CSDs in the 650mm class.

The new dredger includes the latest innovations and technologies, making it reliable, efficient, easy to maintain and productive. The IHC Beaver® 65 DDSP is equipped with *greater* cutting and pumping power than her predecessors and other dredgers in her class. She can be set to work on inland as well as coastal waters.

A complete list of improvements has been collected from IHC Merwede dredge masters and engineers, as well as from customers in recent years. This resulted in enhancements to the dredger in view of operational ease and efficiency, health and safety, and the environment. This may be evidenced by, for example:

- styling and ergonomics, in particular the operating cabin and operator's chair/console
- protective hoods for the winches
- vibration and sound damping of important components
- greater fuel efficiency and reduced emissions
- greasing and maintenance-free bearings, preventing oil leakage into the environment
- as few parts and components as possible.

Of course, traditional properties of IHC Beaver dredgers have been maintained, such as easy dismounting and transportation possibilities. At delivery, an IHC Beaver® is complete and ready for service: no essential options (such as cutterheads) must be purchased as additional extras before commissioning. In addition, the dredging installation's performance is always tested before delivery.

Construction overview

The IHC Beaver® 65 DDSP is a dismountable non-propelled CSD. The catamaran-shaped hull is composed from two long pontoons, interconnected by coupling pontoons. Special attention has been paid to simple and quick assembly and dismantling of the pontoons.

The engine room unit is mounted on the coupling pontoons. The trunnions for the cutterladder are integrated in its construction, as are the hydraulically operated swing winches and ladder winch. The single-walled wear-resistant and high-efficiency (HR) submersible dredge pump, mounted on the cutterladder, is directly driven by the main diesel engine via IHC Merwede's patented pivoting gearbox in the ladder turning point (*figure 3*). This greatly reduces efficiency losses between the engine and pump, such as is the case in other submersible dredge pump drives. At the lower end of the ladder, the cutter is driven by a low-speed, high-torque hydraulic motor.

Dredging is performed from the operating cabin, which is mounted on top of the engine room unit (*figure 4*). It features an adjustable operating chair, fitted with two speed control levers integrated within the arm rests. Following a programme, these integrated controllers can be used to intuitively operate the dredge winches and spuds in every operation. The chair is supported by a dredging instrument panel and control console for auxiliary instrumentation and controls (*figure 5*).

The composition of the engine room unit, cutterladder and operating cabin integrates all vital dredging-related subsystems into one single, yet easily dismountable unit. Consequently, as few parts as possible must be dismantled for preparing the dredger for transportation. This feature is supported by the configuration of the hydraulic installation and its control electronics, which allow it to keep fully intact when dismounting the dredger. This philosophy on dismounting and commissioning makes life easier for the dredging contractor throughout the lifetime of the vessel.

As standard, the dredger is provided with an *integrated* hydraulically operated spud carriage installation and two spuds, operated by hydraulic cylinders. The carrier is integrated in the ship's hull firmly between the two side pontoons. An electric deck crane completes the standard version, offering assistance to daily operations, maintenance and repair.

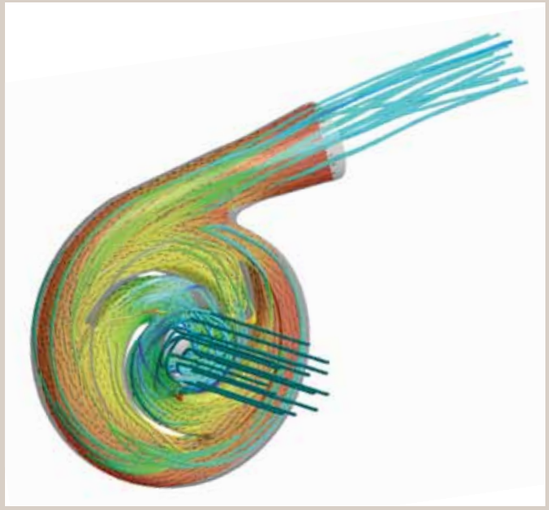
CFD and IHC Curve® impeller

The application of a submersible dredge pump, driven by the pivoting gearbox, provides a compact and easy maintainable construction. It allows the dredger to operate at all imaginable dredging depths with high mixture densities, and provides highly efficient mixture transport and high dredger production figures against a modest amount of installed power (*figure 6*).

The submersible IHC Merwede high-efficiency (HR) medium pressure pump is made from wear-resistant steel and equipped with a 3-bladed impeller. The pump shaft seal is the renowned IHC Liquidyne® (*figure 7*) from IHC Sealing Solutions, which prevents leakage and shaft wear with several flushed pressure stages [1].

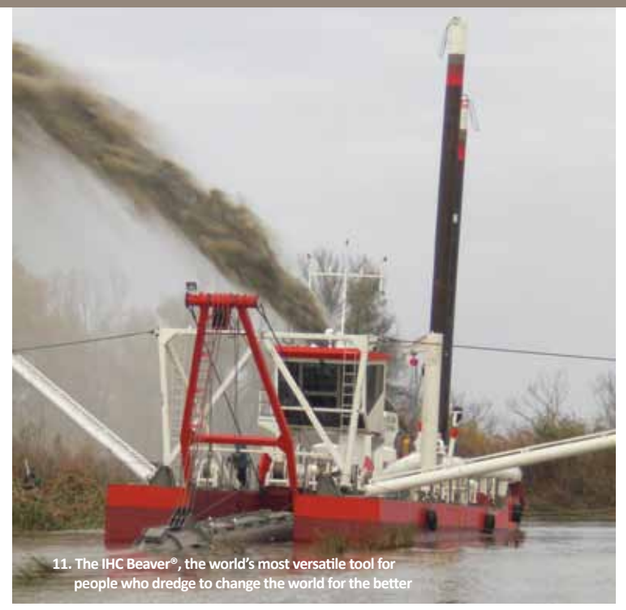
Speaking of the impeller, a true innovation has been installed on the IHC Beaver® 65 DDSP. It is named the IHC Curve®, referring to its curvature in multiple directions. This is common with impellers used within high-efficiency *water* pumps, but the true art for *dredge* pumps is to find out *how* it should be curved in order to achieve the desired performance improvement.

Specialists at MTI Holland, IHC Merwede's research institute, have a vast knowledge of fluid mechanics, pump design and manufacturing at their disposal, as well as various design tools and people with good ideas. Over the years, suggestions have been made to improve the *suction* and *wear-resistance properties* of impellers (*figure 8*), but these could not be conventionally achieved at reasonable costs, as they require the repeated production of moulds and steel castings, followed by costly testing in real pumping circuits.



9. An example of a CFD application demonstrates velocity patterns in a dredge pump geometry

10. The award-winning IHC Spud Guard® enables dredging under severe wave conditions



11. The IHC Beaver®, the world's most versatile tool for people who dredge to change the world for the better

12. IHC Merwede continues to show leadership in evolving technology

To meet this challenge, the group of specialists added another tool, Computational Fluid Dynamics (CFD). This tool allows for realistic simulation of the interaction of fluids with physical shapes without the need for costly production and testing of hardware. Consequently, the use of CFD dramatically reduces cost and time for collecting viable data such as the pump characteristics.

Thanks to the great advancement in computer performance, the numerical simulation of fluid flow has become widely adopted in the industry. Inherent to being the world's leading dredging equipment supplier, IHC Merwede's products heavily rely on the fundamentals of fluid flow. The advantage of CFD is that it is based on physics rather than empiricism.

In addition, the output of a CFD simulation gives a detailed visualisation of the physical phenomena that play an important role in, for example, the flow through a dredge pump (*figure 9*), which is often impossible to achieve by experiments. In this way, CFD serves as a solid basis, which provides the guidelines for product optimisation.

The Curve impeller project started with verification of existing IHC Merwede pump characteristics from a design of the Nineties. Known deviations between practice and theory could be explained with the use of CFD simulations, providing confidence in its use for new pump designs. Next, CFD simulations were applied to verify the effectiveness of the ideas adopted in the new impeller designs, ultimately resulting in the IHC Curve®, having superb suction properties and high wear resistance. With the IHC Curve® impeller as its pumping heart, the IHC Beaver® 65 DDSP maintains her position ahead of the competition.

Options package

Like all IHC Beaver® dredgers, the new IHC Beaver® 65 DDSP is available with an arrangement of options, such as an anchor boom installation, swivel bend, or the Lancelot cutter, for example. Even highly efficient dredgers, such as the IHC Beavers, can be pushed to perform even better by adding IHC Systems' instrumentation and automation equipment. This provides the operator with additional operations-related information and resources for optimising the dredging process. They play a key role in achieving the specified dredge profile and preventing under- and over-dredging, generating major savings on operational and fuel costs, and emissions. They may include production measurement, automatic pump control (APC), the Operator Assist System (OAS), Dredge Track Presentation System (DTPS) and/or the Dredge Profile Monitor (DPM).

Working in rough waters

Some of these features have been well proven in the industry for years. This cannot yet be said of the IHC Spud Guard® with which IHC Merwede designers won the Holland Marine Equipment Maritime Innovation Award in 2011. This system – a spin-off of sophisticated systems on large IHC Merwede CSDs – enables dredgers to work in waves [2] and includes dedicated hardware, a hydraulic buffering system and integrated software.

Available as an option, it protects the main spud against damage caused by severe weather. In normal conditions, it operates as a conventional, rigid spud carriage. In more severe wave conditions, it is able to slightly rotate the spud carriage in the longitudinal direction of the dredger, reducing excessive forces. If forces threaten to exceed a specific value, the system intervenes automatically.

The IHC Spud Guard® limits downtime, maximising productivity and revenues. It is fully interchangeable with a conventional spud carriage (*figure 10*). With an integrated spud carrier, BV coastal area classification and the IHC Spud Guard® technology, the IHC Beaver® 65 DDSP is fully prepared to work in rough waters.

Life-cycle support packages

IHC Merwede supports owners of IHC Beaver® dredgers with several life-cycle support packages, which can be selected according to customer requirements, the experience of operators and the need for managing more or less complicated dredgers.

- As standard, an IHC Merwede dredge master will guide the crew during the first three operational weeks.
- Additional support can be provided by a web access point, which links manuals and spare parts to simplify maintenance.
- Furthermore, remote support can be given by telephone and email and, if installed, the Operator Assist System (OAS) is a powerful means to support the crew remotely under all circumstances. It allows specialists to follow operator actions and give advice on optimisation.
- If high-level operator training is desirable, IHC Merwede's Training Institute for Dredging (TID) can provide classroom, simulator and on-site training sessions. It also runs a web-based operator training portal.

Conclusion

With the IHC Beaver® 65 DDSP, IHC Merwede has again demonstrated its leadership in the field of standardised CSDs in the 650mm, 3,000kW segment of the worldwide dredging market. The current dredger has been developed from a contractor's perspective and with a clear understanding of their needs. Innovative features and a wide availability of options make it the most versatile tool in its class, ready to serve a new generation of people who dredge to change the world for the better (*figures 11-12*).

Principal characteristics	
Type	IHC Beaver® 65 DDSP
Classification	Bureau Veritas Class I, ✠ Hull dredger coastal area Engine installation after construction ✠ MACH
Length overall, ladder raised	58m
Length over pontoons, moulded	43.5m
Breadth, moulded	12.44m
Average draught, bunkers filled	1.95m
Dredging depth	18m (standard execution)
Suction and discharge pipe diameter	650mm
Total installed power	2,819kW
Cutter power	700kW
Total dry mass approx.	492mt
Emission standards	Compliant with IMO Tier II

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[1] "Excellence in sealing solutions". *Ports and Dredging 176*. IHC Merwede, Sliedrecht, The Netherlands, 2011. 26-29

[2] "Dynamic simulation of Cutter Dredger at sea". *Ports and Dredging 169*. IHC Merwede, Sliedrecht, The Netherlands, 2008. 6-13

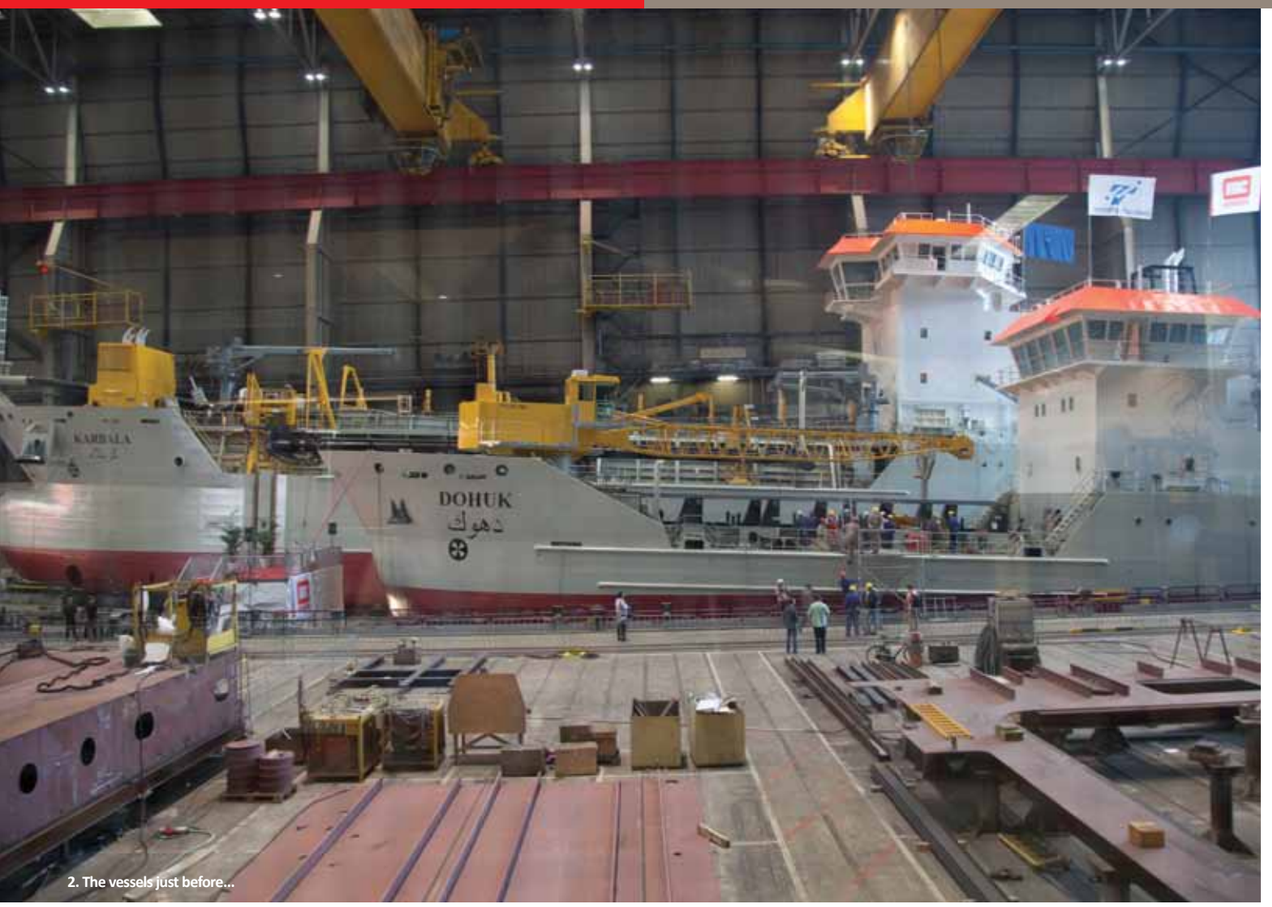
DOHUK and KARBALA:
two dedicated hopper dredgers

In the final quarter of 2012, IHC Merwede delivered two hopper dredgers to the Japanese Toyota Tsusho Corporation. The contract for the vessels included the design, construction and delivery of a 500m³ grab hopper dredger (DOHUK) and a 3,500m³ trailing suction hopper dredger (KARBALA) (*figure 1*).

Although ordered by the Toyota Tsusho Corporation, after delivery the vessels would be owned and operated by the General Company for Ports of Iraq (GCPI). The dredgers are part of a larger Japanese/Iraqi venture for the development of Iraqi ports and waterways, including capital dredging projects, wreck-salvage operations, crane and diving support vessels.

> **“GCPI has acquired modern, state-of-the-art instruments for building the future of Iraqi ports and estuaries”**

1. The 500m³ grab hopper dredger and the 3,500m³ trailing suction hopper dredger at IHC Merwede’s Krimpen aan den IJssel shipyard, The Netherlands



2. The vessels just before...

3. .. during...

4. .. and after the launch

IHC Merwede launched the two vessels for the same owner, from the same covered slipway, on the same day (*figure 2*). Early in the morning of 25 July 2012, the grab hopper dredger, named DOHUK, first saw daylight and was soon followed by the trailing suction hopper dredger (TSHD), which received the name KARBALA. It involved two ceremonies at the shipyard in Krimpen aan den IJssel, The Netherlands (*figures 3-4*). The vessels were named by breaking a jar of yoghurt over the bow. Both ceremonies were performed by Mr Hussain Mohammed Abdullah, GCPI's Project Director.

Both state-of-the-art vessels have extensive navigation and communication equipment for worldwide navigation, which is identical for reasons of crew exchangeability. Not withstanding configuration from proven technology, both vessels fully comply with modern rules and regulations, and will provide the crews with a platform upon which to live and work comfortably.

Technically, the vessels are ideal for the operations of GCPI. Initially they will perform maintenance dredging in rivers and ports such as Umm Qasr in the south of Iraq. In a combined operation, the grab hopper is able to remove upper layers of stiff soil and debris, particularly in corners and around quay walls. The TSHD may then follow, for the removal of sand and silt up to the required working depth.

Attention has been paid to accessible and robust technology to enable the crew to do much of the maintenance themselves. Vital systems have a certain degree of redundancy, and a large supply of spares was an important part of the order, as well as a period of equipment training for future crews.

Training programme

Crew members of both dredgers participated in an elaborate training programme at Krimpen Shipyard, organised by IHC Merwede's Training Institute for Dredging (TID). During the seven-week programme, the trainees were introduced to the operational capabilities of the new dredgers, the equipment installed on board and new technologies. In addition, a schedule for planned and preventive maintenance of the vessels and their components was drawn up together with the participants. Beside technical topics, ample attention was paid to safe working procedures.

In the first stage, the training covered generic topics like safety, design and layout, and general maintenance theory. Following that, the crew were split up into groups according to their roles, such as electrical engineers, engine room officers and dredge/maritime officers, for function-specific equipment training sessions. They were offered a training programme for the tasks that they typically encounter during daily operations.

In the smaller groups, information on operational practices and maintenance of the new equipment was efficiently exchanged and task-specific topics were covered. For example, the maritime officers practiced with navigation and communication equipment on a real-life ship simulator. Furthermore, crews of both vessels did a 'Survival at Sea' training session in cold water (*figure 5*).

The programme ended with the crews participating in the dredge trials of both vessels. In December 2012, after the training had been completed, IHC Dredgers organised the delivery voyage to Umm Qasr Port. Redwise was chosen to manage the voyages, with the captain and chief engineer of each vessel as guests on board. The whole programme is a win-win situation for both the builder and the owner. IHC Merwede is assured that the crew is competent to handle the new vessels with care; GCPI directly profits from the efficient utilisation of costly equipment by skilful people.

Grab hopper dredger DOHUK

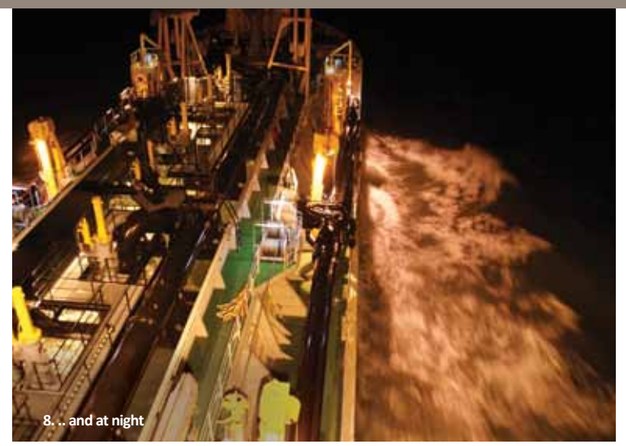
The vessel (*figure 6*) is propelled by a single fixed pitch propeller, running in a fixed nozzle and driven by a 554kW diesel engine through a reversible reduction gearbox. For powering of the grab crane, bow thruster and auxiliaries, three diesel-driven generator sets are available, supplying a usual electric system consisting of switchboards, transformers and distribution systems.

To fill the hopper, the electrically operated inboard grab crane has been installed on a fixed ring gear, and is suitable for dredging clay, sand and silt from the sea floor, using a 4m^3 grab. The electric winches, driven by variable frequency drives, perfectly serve a four-ply application of holding, closing and luffing wire ropes that prevent the grab from spinning, without the need for a taut wire. In view of the Iraqi climate, much attention has been paid to the cooling of the frequency drives and the winch brakes.

Two spuds maintain the vessel's position during dredging up to a depth of 16m. A grid above the hopper retains oversized pieces of dredged matter. Four fixed overflows drain the superfluous water content. The soil can be unloaded through two rows of five box-shaped bottom doors.

The control bridge has been provided with a navigation control console and an instruments rack, including a draught recorder and tank sounding installation.


5. Training included a 'Survival at Sea' session in cold water


8. .. and at night


9. Fit for purpose: filled with sand


6. The DOHUK during sea trials


7. The KARBALA performs her sea trials in broad daylight...


10. IHC Parts & Services delivered floating discharge lines


11. Easy-to-operate control consoles on the bridge

Trailing suction hopper dredger KARBALA

For propulsion, the KARBALA (*figures 7-8*) relies on twin fixed-pitch propellers, running in fixed nozzles and driven by diesel engines through reversible reduction gearboxes. Like the DOHUK, the vessel is suitable for unmanned, remotely controlled engine room operation. A diesel-driven bow thruster unit with reversible gearbox enhances manoeuvrability. Two main and one emergency/harbour generator sets supply power to switchboards, transformers, UPS units and distribution systems.

The hopper is loaded via two 600mm-diameter trailing suction pipes, one at port and the other at starboard side. The dragheads of the excavating type are equipped with self-adjusting visors and high-pressure water jets for loosening compact soil. The dredge pumps – situated in a pump room in the fore ship – are driven by diesel engines via gearboxes. To manage gases, entrapped in silt-like soils, a degassing system has been installed.

The soil is loaded into a V-shaped hopper (*figure 9*), provided with one cylindrical and adjustable overflow. It can be unloaded through one row of eight conical bottom valves, equipped with renewable sealings. The hopper can also be unloaded by pumping the soil to shore by means of a self-emptying system, a shore pipeline, an hydraulically operated ball-joint type bow coupling, and the two dredge pumps working in series.

IHC Parts & Services delivered floating discharge lines [1] for shore discharging and reclamation dredging operations (*figure 10*). The hopper diluting system is fed by the diesel-driven jet pumps.

The bridge is home to navigation and dredging control consoles (*figure 11*) and an instrument rack. The dredging control system is built around programmable logical controllers (PLC) and a PC-based supervisory control and data acquisition system (SCADA), which enables the operators to monitor and operate the dredging equipment by simply using keyboards.

The instrumentation comprises a draught and loading measuring system (IHC DLM®), including a hopper volume and dry solid mass measuring system, and ALMO controller. The suction pipe position is measured by the IHC STPM®, including a suction pipe automatic winch controller, which matches the suction pipe position to a number of essential boundaries. The usual pressure, production, position and tank sounding measurements have been installed.

The IHC dredge track presentation system (DTPS) collates signals from geographical and environmental sensors. It presents the dredger in a digital terrain model (DTM) achievable from surveys, and upgrades this model on the basis of the dredger's work. It is an excellent and operator-friendly way to generate progress reports, and prevent under- and over-dredging.

Finally...

By obtaining these IHC Merwede-built hopper dredgers, perfectly suitable for working together as a team and accompanied by well trained crew, GCPI has acquired modern, state-of-the-art instruments for building the future of Iraqi ports and estuaries. The editorial board of *IHC Merwede Insight* wishes GCPI every success in achieving this goal.

Principal characteristics	DOHUK	KARBALA
Type	Grab hopper dredger	Trailing suction hopper dredger
Classification	Bureau Veritas class I, ✠ Hull ✠ Mach, Hopper dredger, Unrestricted Navigation ✠ AUT-MS	
Length overall	57m	91m
Breadth	12.5m	17m
Depth	4.9m	7.9m
Draught	3.9m	6.3m
Hopper capacity	500m^3	3,500m^3
Dredging depth	25m	25m
Suction pipe diameter	Not applicable	600mm
Installed power	1,650kW	7,260kW
Speed, loaded	8 knots	12 knots
Accommodation	12 people	37 people

References

[1] "IHC Merwede dredge hoses and floating discharge lines". *IHC Merwede Insight E1.* IHC Merwede, Sliedrecht, The Netherlands, 2012. 26-31

The new standard in dredging: Dredger Operator Certification System

The quality of dredging equipment continues to improve year after year, the efficiency of dredging technology is increasing and the designs of such things as advanced dredging components and integrated systems are growing more complex. These developments are allowing modern operators to achieve higher production levels at lower costs and also to work under more difficult circumstances (due to weather or soil conditions, for example). Or at least that's how it should be.

"The conclusion is that advanced and complex equipment is not enough – it requires highly skilled crews, skippers, onboard engineers and dredge masters to really benefit from its potential"

1. DOCS would be ideal for training operators of the IHC 8527MP®, which was developed especially for the Chinese market

Evaluations have continuously demonstrated that experienced operators achieve 95% of the potential of the specific equipment with which they work, whereas less experienced operators stagnate at approximately 60-70%. This can often be the difference between winning and losing a project, being competitive or not – and, in fact, a question of the company's ability to survive. Research has shown that the difference in efficiency is based on three factors: the state of the equipment; the planning and methods of operation; and the human factor, i.e. the competence of employees involved at all levels.

The conclusion is that advanced and complex equipment is not enough – it requires highly skilled crews, skippers, onboard engineers and dredge masters to really benefit from its potential. And whereas contractors are happy to invest in good quality high-end equipment, investing in the training of personnel is somehow not that obvious. The extra costs for training, which are only a small percentage of the amount invested in equipment, seem to be perceived as too high and sometimes contractors are reluctant to spend on something as intangible as this.

For those working at IHC Merwede's Training Institute for Dredging (TID), this is difficult to understand. They see the results of the training they provide to IHC Merwede customers, and other contractors and parties involved in the dredging world, on a daily basis. These results clearly reveal that the money spent on training is recouped in very little time and soon leads to healthy profits.

Luckily, one of TID's customers, Chinese contractor CCCC Guangzhou Dredging Company (GDC), could see the advantages. The company, a subsidiary of China Communications Constructions Company (CCCC), the state-owned public overseer and administrator of the Chinese inland dredging market, also recognised the important links between project, people and equipment.

GDC specialises in the construction of ports and waterways. Its activities include: maintenance and capital dredging; reclamation; marine engineering; irrigation and environment works; cofferdam and harbour construction; soft soil treatment; aggregate reclaiming; underwater rock blasting; and dredging for power plants. The company operates a fleet of over 80 cutter suction dredgers (CSD) (*figure 1*), trailing suction hopper dredgers (TSHD) (*figure 2*), bucket type dredgers, hopper barges and service vessels.

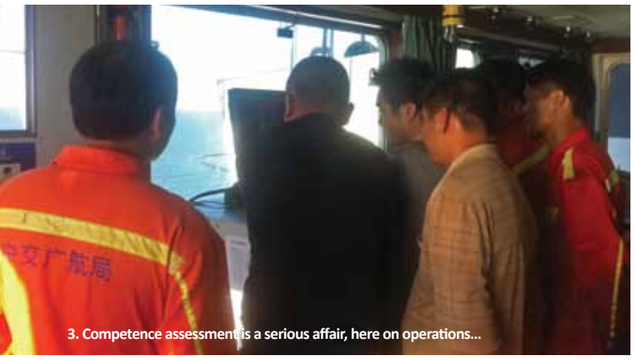
In cooperation with GDC, TID developed the Dredger Operator Certification System (DOCS), which has several important benefits.

- It enables the user to measure the effects of training and changes in working methods. It shows the return of investments

2. The WAN QING SHA is one of the trailing suction hopper dredgers in GDC's fleet


5. .. and on practical skills


6. The evaluators are assessed to prove their competence level


3. Competence assessment is a serious affair, here on operations...


4. .. on knowledge...


7. Keeping ahead of competitors in dredging: moving the optimum amount of soil at the lowest possible cost

in training, linked to improvement in Key Performance Indicators (KPIs) in terms of production, wear, fuel consumption and matching of schedules – in summary: costs and yields per cubic metre of removed soil.

- It has a built-in reporter function, which allows it to be used as a fact-based human resource management instrument for assessment, evaluation and selection of employees. It is intended to "promote pertinence, and the adaptability of crew and their positions, as well as the interaction between crew's personal career development and company's strategic development", as expressed by Mrs Ye Bing of GDC's training centre. Within this framework the company wanted to define and certify the results of personnel training, both in terms of effects for the person himself as well as for the organisation in terms of the above-mentioned KPIs.

GDC is entitled to exclusivity on using DOCS within the Chinese market. However, throughout the rest of the world, TID can implement DOCS with any other customer. The first version, dedicated to CSD operators, is currently in the process of extension and is available in every country worldwide, except China.

The secret of DOCS: a competence-based approach

Responding to GDC's requirements, TID came up with an innovative solution, based on a modern didactically inspired approach. According to this, employees are not regarded as cost factors, but valuable assets for whom training should not be learning new tricks, but the acquisition of a higher professional level. In practice, it has been proven that only people who are competent for a specific assignment can sufficiently fulfil its challenges under all circumstances. Others will certainly fail once in a complex and competitive environment.

Competences integrate three areas: knowledge, skills and attitude – which must be applied to carry out a task or function in accordance with the requirements of the job and the goals of the organisation. The competent person is able to apply what he has learned, to manage the required technical manipulations, and has enough self-confidence and responsibility to perform the required actions. Every type of assignment needs its own set of competences.

The operator of a CSD, for example, must have sufficient knowledge of the pumping, cutting and anchoring process, and spud handling in relation to the job requirements and the dredge profile. He also has to know how to control the pump drive train and the drive automation systems. In addition, he must have the confidence to: take responsibility for correctly dealing with heavy components, highly powered equipment and thick steel cables; communicate with other people on the job; and keep afloat a vessel that can sink if mishandled.

Put into practice

DOCS is equipment-related: it is pointless to teach TSHD competences to a CSD operator and vice versa. Neither is it useful to advise on fixed spuds procedures if the dredger is equipped with a spud carrier, etc. Therefore, the practical training focuses on enhanced professionalism to improve the competences of operators and project engineers on the optimum utilisation of their own CSDs in relation to specific projects.

It was discovered that 60 competences in ten categories had to be achieved by means of classroom and/or simulator and/or extensive on-the-job training. For all training, evaluation is conducted on an organisational level in terms of KPIs, such as production, wear rate, fuel consumption and accuracy.

On a practical level, DOCS consists of the following five stages.

1. Identifying competence gaps: operators are classified into job/functional groups and assessed by an expert TID dredge master (*figures 3-5*). The assessment provides an insight – per individual and job group – into the extent to which their dredging competences are developed and how they perform, compared to the general standard for the operational functionality of the equipment, e.g. a 13,000kW CSD.
2. On the basis of the above baseline assessment, training needs are analysed for every individual and arranged per job group and competence category, for example the competences 'process awareness' and 'instrument interpretation' for the job group of 'second dredge mates'.
3. Then the real training starts. Knowledge is taught in the classroom, while skill improvements are learnt mostly on the simulator and extensive on-the-job training. Attitude training can only be given on the job, where a candidate is coached by an experienced and qualified person.
4. Every trainee keeps a logbook on exercises and improved competence, which is observed by expert examiners on the relevant KPIs concerning the trainee and the organisation.
5. Finally, the trainee is enrolled within an existing crew on a real dredger, where he is extensively and practically trained on the job in response to any blanks in the logbook. Accordingly, he is scheduled for specific activities within normal operations, for example, starting up the pump process in a long pipeline. Within GDC, the captain of the dredger is responsible for the trainee's development, and acts as his mentor and supervisor.

GDC's integration of DOCS

To ensure continuity in achievements and a complete integration of DOCS within its organisation, GDC has appointed two experienced and trusted captains from its fleet as 'evaluators' (*figure 6*). This role requires them to carry out regular visits to all GDC dredgers and evaluate the results of the training courses, new working methods and mentor effectiveness. They verify statements at KPI level on the basis of interviews, and engine room, shift and daily reports. Therefore the installation of reporting systems has been initiated on GDC's fleet.

The evaluators implement the overall results as part of an ongoing process to position GDC as leaders in their field (*figure 7*). The ultimate goal is to establish a standard on dredging competence for different assignments, testified by standardised certification (the C in DOCS). This certification can be used in human resource management practice for recruitment, assessment, evaluation and career development in relation to the company's ambitions. Once implemented within the company, GDC intends to support other Chinese dredging contractors with certification.

TID is proud of the development of DOCS and believes it will be a useful instrument to achieve its goal.

Keeping course for the future: IHC Systems renews 13 DP/DT systems for Jan De Nul Group's fleet

DP/DT in dredging and offshore operations

Dredging and offshore activities focus on: creating and maintaining proper waterways and ports; reclaiming land; extracting and transporting raw materials; installing renewable energy installations; and laying and protecting vital energy and communication lines. Ports, hinterland and shore landings make up an intricate infrastructure that is closely interwoven with structures on the sea floor. Specialist working vessels play an essential role in such cases.

1. GERARDUS MERCATOR was built by IHC Merwede in 1997 and now receives a brand-new DP1 system *(courtesy Jan De Nul Group)*

These vessels facilitate: removing and reclaiming soil and rock; digging and filling trenches; laying cables and pipes; supporting diving activities; and positioning heavy equipment on the sea floor. In most cases, a high level of precision is required against a backdrop of tight operational schedules. Dynamic Position & Dynamic Tracking (DP/DT) systems are essential for such operations. Generally speaking, they allow working vessels to maintain position, course and track accurately for longer periods – and more reliably than manually operated vessels. Indeed, some operations just wouldn't be possible without these systems. In addition, they often considerably enhance safety, and indirectly reduce fuel consumption and emissions.

DP/DT systems compensate for wind, current and vessel characteristics. They maintain course, position and/or track through the model-based control of propulsion thrusters, azimuth thrusters, bow and stern thrusters, and rudders. Maritime authorities and legislators specify the required number and configuration of sensors and actuators for each DP notation. Configuration, power capacity, and the performance of thrusters and rudders determine a vessel's DP and DT capability.

In the areas of dredging and specialist working vessels, an additional and complicating factor is the triple dynamic relationship between the vessel, the vessel/sea floor 'connection', and external forces. This is particularly true with the extreme forces generated by the draghead and suction pipe of trailing suction hopper dredgers (TSHD), which easily confuse the vessels' power-sharing gear.

IHC Systems has developed and designed its DP/DT system for, and in cooperation with, dredging contractors for application on TSHDs in particular. It distinguishes itself by superior user-friendliness through an intuitively operable human-machine interface (HMI). Its unique feature, however, is a patented algorithm, which feeds the system models with the considerable

2. JAMES COOK, the first Jan De Nul Group TSHD to be equipped with a DP/DT system *(courtesy Jan De Nul Group)*

3. The largest vessels from a distance: CRISTÓBAL COLÓN, LEIV EIRIKSSON and VASCO DA GAMA at work in Vietnam *(courtesy Jan De Nul Group)*

forces, generated by the suction pipe and draghead. By processing these forces, the system is able to accurately keep a TSHD on course and track during trailing operations better than any other system available.

Jan De Nul Group and DP/DT

In 1992, Luxembourg contractor Jan De Nul Group (JDN) commissioned the IHC Merwede-built 11,250m³ J.F.J. DE NUL (renamed JAMES COOK in 2004, *figure 2*). At that time, JDN foresaw a trend that is now widely established, namely that dredging contractors have become increasingly involved in works for offshore operators and are broadening their portfolio to include maritime technology. In that field, dredging depths increase and safety considerations aim to prevent the collision of vessels and offshore structures, such as production platforms.

In line with these insights, the JAMES COOK was equipped with a dredging installation for 75m of depth and a DP/DT system. Her first job was on a prestigious offshore dredging project in the Irish Sea, where the DP/DT system proved its usefulness. Since then, JDN has consistently applied DP/DT systems to the larger units of its fleet, led by the two 46,000m³ giants CRISTÓBAL COLÓN and LEIV EIRIKSSON, and the 33,000m³ VASCO DA GAMA (*figure 3*).

The first series of DP/DT systems were all of the DP0 class, which means that although they provide the required functionality, they are not testified or certified by a notified body in the maritime world. Over the years, it became clear that having such a certification would be preferable, primarily for gaining recognition within the industry and acquiring orders for offshore projects.

Since the CRISTÓBAL COLÓN (built in 2009), all modern TSHDs, such as the CHARLES DARWIN (*figure 4*) and AL-IDRISI for example, were equipped with IHC Systems DP1 class systems, which are certified for Bureau Veritas notation Dynapos AM/AT and are annually inspected for this notation. This fact is added to the vessels' Certificate of Registry, which is an important document for clearance of a ship, entering a new job and/or country.

DP1 certification demands that DP1 systems should officially be operated by a certified person, a so-named DP Operator (DPO for short). Becoming a DPO requires a long trajectory of courses and simulator training at an acknowledged maritime training institution, accompanied by DP watch-keeping experience on board DP1 vessels for no less than 180 days, and endorsed by the vessel's captain.

In reality, this would take the officers of JDN's TSHD fleet more than a year to complete. Nevertheless, JDN is committed to achieving the grade of junior DPO for all bridge officers of its DP1 vessels and has made progress in this respect. As well as DP1, the company also owns DP2 vessels. One is the multi-purpose WILLEM DE VLAMINGH (*figure 5*), which is capable of subsea rock installation by means of a fall pipe, and other offshore operations. She carries an IHC Systems DP class 2 system, allowing her to work safely alongside offshore platforms and structures. Officers on DP2 vessels have to be fully certified DPOs.

An IHC Systems DP/DT system includes three main functional modules: position keeping (DP); track keeping (DT); and a simulator module. TSHD operators on the JDN fleet use the DP module to keep the vessel stationary during shore discharging and rainbowing. In the latter case, the built-in Track Offset facility enables them to laterally move the whole ship with the simple turn of a knob.

A type-approved Autopilot is an integrated part of this module and is used during sailing. The DT module is mainly used during trench dredging and can simplify the process significantly. An operator may decide to add the speed pilot, which maintains a certain minimum ground speed to prevent the suction pipe from stalling – and its hazardous consequences. Due to the intensive utilisation of the fleet, the built-in simulator cannot be used often, according to JDN captains.

Time for renewal

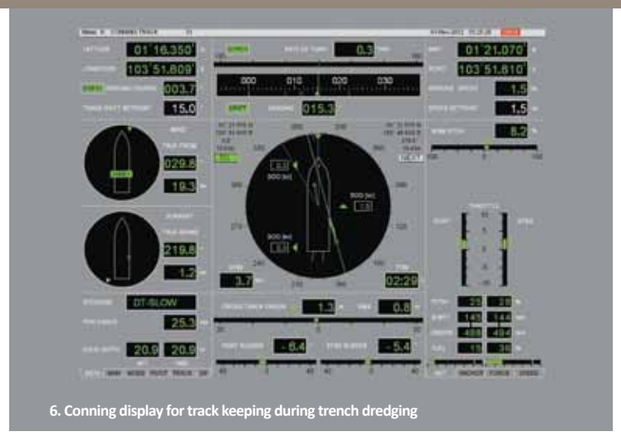
It is an established fact that vital computer systems on board dredgers, such as DP/DT systems, must be replaced regularly [1, 2]. So, recently JDN had to replace the two oldest systems installed on veterans VASCO DA GAMA and on long-time IHC Merwede acquaintance GERARDUS MERCATOR (*figure 1*). The process eventually highlighted that the systems on the whole TSHD fleet had been fitted at various times and subsequently had different functionality and software releases. Most importantly, four of them were still DP0 systems.

In a commercial trajectory this led to the award of an order to IHC Systems for the renewal and/or upgrade of 13 DP/DT systems. As JDN's Manager Vessel Automation Ruben De Lille and PR spokesperson Liesbeth Van der Biest told *IHC Merwede Insight*, "IHC Systems won the order on the basis of its price/quality ratio in relation to successfully matching JDN's specifications."

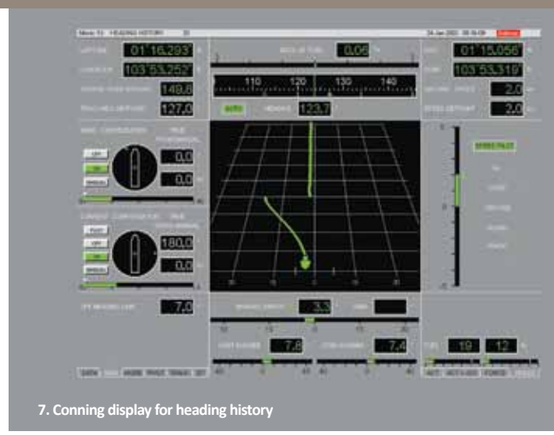
Of the 13 systems, two have been entirely replaced, including extension to class DP1 for AM/AT notation. For the remaining 11 vessels, the existing systems have been upgraded with additional functionality and the latest software releases, among them AM/AT notation for four vessels too.

4. The splendid CHARLES DARWIN also boasts DP/DT functionality *(courtesy Jan De Nul Group)*

5. Multi-purpose vessel WILLEM DE VLAMINGH has an IHC Systems DP2 system *(courtesy Jan De Nul Group)*



6. Conning display for track keeping during trench dredging



7. Conning display for heading history

8. The keyboard gives a high degree of intuitive control to operators

Existing and new technology

The renewal will not change the distinguishing features of IHC Systems' DP/DT system:

- an outstanding HMI, including high-resolution video pages (*figures 6-7*) and a dedicated keyboard-joystick combination that facilitates a high degree of intuitive control, which is highly appreciated by operators. "The three turning knobs for instantly changing speed, course and track offset are particularly beneficial," confirmed Mr De Lille (*figure 8*)
- a patented algorithm to estimate the extremely varying forces exerted by the draghead and suction pipe during dredging, and the inertia compensation. It is able to accurately keep a dredging TSHD on course and track
- an embedded, type-approved track control system to be used up to cruise speed and replacing standard autopilots (*figure 9*)
- fast tuning of the system, achieved by a pre-programmed model, based on a hydrodynamic study of the vessel, which saves considerable model-validation time during harbour and sea trials. "JDN was pleasantly surprised by this feature when the first IHC Systems DP/DT was installed," revealed Mr De Lille.

However, there are new features and facilities. The transition to DP1 requires the interfacing and processing of a minimum of two motion reference units, DGPS, wind sensors and gyrocompasses – instead of one each. This is taken care of by JDN's vessel automation department, which doesn't expect an interface problem, knowing the track record with IHC Systems.

In addition to the previously mentioned auto-heading/autopilot function, AM/AT notation implies the installation of an independent joystick system for the combination and allocation of power, and direction to thrusters and rudders, as a translation of calculated power vectors. More attention is given to safety aspects, demonstrated by more extensive hard-wired interfacing and BV-attended and testified factory acceptance tests (FAT), harbour acceptance tests (HAT) and site acceptance tests (SAT), the latter sufficiently demonstrating full DP functionality.

Finally, all 13 systems are provided with additional functionality, such as:

- the possibility to input 999 waypoints for track control of extensive projects
- active force control of the stern anchor winch as if it were a thruster. This feature either saves fuel consumption during DP operations, or increases DP capability in severe weather conditions
- remote diagnostics facility, enabling JDN's and IHC Systems' specialists to safely login to the systems at the operator's request in order to solve faults remotely.

Conclusion

By the end of the process, and after the systems have been commissioned worldwide, both JDN and its operators, as well as IHC Systems, have gained a great deal from the experience. JDN's fleet is fully up-to-date once again, running identical DP/DT software releases on every vessel, and the operators will surely benefit from the enhanced functionality and identical operating methods. From IHC Systems' perspective, it has once again confirmed and consolidated its leadership in the TSHD segment of DP/DT systems, and can continue developing yet more functionality and improvements. Keeping course for the future is the image that remains.

References

[1] "Shipboard Automation: when computers become vital". *Shipbuilding Industry. Volume 6 issue 2*. Yellow and Finch Publishers, Vlissingen, The Netherlands, 2012. 12-19

[2] "In close collaboration: over 20 years' experience with SCADA". *Ports and Dredging 175*. IHC Merwede, Sliedrecht, The Netherlands, 2010. 34-37

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Certificate number: 13281/B0 EC
File number: NAV 3/13528/06
Annex A1 Item number: A.14.33

This certificate is not valid when presented without the full attached schedule composed of 7 sections.

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Notified Body 0062 - MARINE EQUIPMENT DIRECTIVE 96/98/EC

EC TYPE EXAMINATION CERTIFICATE

as per Module B of European Union Council Directive 96/98/EC on marine equipment as amended by Commission Directive 2009/26/EC

This certificate is issued to

IHC SYSTEMS B.V.
Sliedrecht - NETHERLANDS

for the type of product

TRACK CONTROL SYSTEM
Category B Track Control System, including heading control mode (TCS + HCS), DpDt system configured as trackpilot type: Track Pilot MK3

Requirements:
SOLAS 74 Convention as amended, Regulations V/18, V/19, IMO Resolution A.694(17), IMO Resolution MSC.74(69), IEC 60945 (2002), IEC 61162 series, IEC 62065 (2002), IEC 62288 Ed.1.0(2008).

This certificate is issued under the French Maritime Authority to attest that BUREAU VERITAS did undertake the relevant type-examination procedures for the product identified above which was found to comply with the relevant requirements of the Council Directive 96/98/EC of 20 December 1996 as amended.

This certificate will expire on: 16 Apr 2015

For BUREAU VERITAS Notified Body 0062,
At BV ROTTERDAM, on 16 Apr 2010,
Erwin Poortvliet

PARIS 1828

This certificate does not allow to issue the Declaration of Conformity and to affix the mark of conformity (wheelmark, ⓦ) to the products corresponding to this type. To this end, the production-control phase module (D, E or F) of Annex B of the Directive is to be complied with and controlled by a written inspection agreement with a notified body.
This certificate remains valid until the date stated above, unless cancelled or revoked, provided the conditions indicated in the subsequent page(s) are complied with and the product remains satisfactory in service. This certificate will not be valid if the applicant makes any changes or modifications to the approved product, which have not been notified to, and agreed in writing with BUREAU VERITAS. Should the specified regulations or standards be amended during the validity of this certificate, the product(s) liable to be re-approved prior to it/they being placed on board vessels to which the amended regulations or standards apply, BUREAU VERITAS is designated by the French Maritime Authority as a "notified body" under the terms of the French Regulations Decrees 1/81 Chapter 145-2. This certificate is issued within the scope of the General Conditions of BUREAU VERITAS Marine Division available on the Internet site www.veristar.com. Any Person not a party to the contract pursuant to which this document is delivered may not assert a claim against BUREAU VERITAS for any liability arising out of errors or omissions which may be contained in said document, or for errors of judgement, fault or negligence committed by personnel of the Society or of its Agents in establishment or issuance of this document, and in connection with any activities for which it may provide.

BV Mod. Ad.E 536 May 2009 — This certificate consists of 4 page(s)

9. Type approval certificate of the track control system

On order

Yard number	Name	Specifications	Country
TRAILING SUCTION HOPPER DREDGERS			
CO 1260	CHANG JIANG KOU 02	12,000m³	China
CO 1265	DCI DREDGE XX	5,500m³	India [1]
CO 1266	DCI DREDGE XXI	5,500m³	India
CO 1272	ALBATROS	1,500m³	The Netherlands
STANDARD CUTTER SUCTION DREDGERS			
02490	IHC Beaver® 1200		Congo
02704	IHC Beaver® 5014		Vietnam
02741	IHC Beaver® 300		Russia
02768	IHC Beaver® 65 DDSP		Saudi Arabia
02789	IHC Beaver® 50		Brazil
02790	IHC Beaver® 50		Africa
CUSTOM-BUILT CUTTER SUCTION DREDGERS AND WHEEL DREDGERS			
15043	DRAGA 18	1,600kVA WSD	Colombia
15044	DRAGA 19	1,600kVA WSD	Colombia
SELF-PROPELLED CUTTER SUCTION DREDGERS			
02800		23,545kW	Saudi Arabia
CO1262	ARTEMIS	24,000kW	The Netherlands
BACKHOE DREDGER			
11.0002	ALBERTO ALEMÁN ZUBIETA	2,000kW	Panama [3]
PIPELAYING VESSELS			
727	SEVEN WAVES	550t	UK
728	Pipelayer	550t	Malaysia [2]
729	Pipelayer	550t	Malaysia
WORK BOATS			
11026	DMC 1400		Africa
11032	DMC 1200		Portugal


1


2


3

Recently delivered

Yard number	Name	Specifications	Country
TRAILING SUCTION HOPPER DREDGERS			
CO 1264	DCI DREDGE XIX	5,500m³	India
CO 1269	KARBALA	3,500m³	Iraq
STANDARD CUTTER SUCTION DREDGERS			
02767	IHC Beaver® 6518C		UAE
02781	IHC Beaver® 1200		Nigeria
02785	IHC Beaver® 1200		Portugal
CUSTOM-BUILT CUTTER SUCTION DREDGER			
02798	MIONDO	4,836kW	UK
WORK BOATS			
11035	DMC 1400		Ecuador
11048	DMC 1050		Nigeria
GRAB HOPPER DREDGER			
CO 1270	DOHUK	500m³	Iraq [4]


4

Main features

- ✓ Pipelaying: IHC Merwede's tower of strength
- ✓ Unrivalled experience creates new dredger: the IHC Beaver® 65 DDSP
- ✓ DOHUK and KARBALA: two dedicated hopper dredgers
- ✓ The new standard in dredging: DOCS
- ✓ Keeping course for the future: IHC Systems renews 13 DP/DT systems

IHC Merwede is focussed on the continuous development of design and construction activities for the specialist maritime sector. It is the global market leader for efficient dredging and mining vessels and equipment – with vast experience accumulated over decades – and a reliable supplier of custom-built ships and supplies for offshore construction.

IHC Merwede has in-house expertise for engineering and manufacturing innovative vessels and advanced equipment, as well as providing life-cycle support. Its integrated systematic approach has helped to develop optimum product performance and long-term business partnerships. The company's broad customer base includes dredging operators, oil and gas corporations, offshore contractors and government authorities.

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