



### Shipyards – The Netherlands

Hardinxveld-Giessendam  
Heusden  
Kinderdijk  
Krimpen aan den IJssel  
Sliedrecht

### Shipyards – P.R. of China

Dalian

### Sites – The Netherlands

Apeldoorn  
Delfgauw  
Dordrecht  
Emmeloord  
Goes  
Hardinxveld-Giessendam  
Heusden  
Kinderdijk  
Sliedrecht

### Sites – Europe

Blandford Forum – United Kingdom  
Belgrade – Serbia  
Komarno – Slovakia  
Riding Mill – United Kingdom  
Rijeka – Croatia

### Sites – USA

Houston, TX  
Wayne, NJ

### Representative offices

Beijing – P.R. of China  
New Delhi – India  
St. Petersburg – Russia

### Regional IHC Organizations

#### worldwide

Dubai – United Arab Emirates  
Lagos – Nigeria  
Mumbai – India  
Singapore – Republic of Singapore  
Tianjin/Tanggu & Guangzhou – P.R. of China



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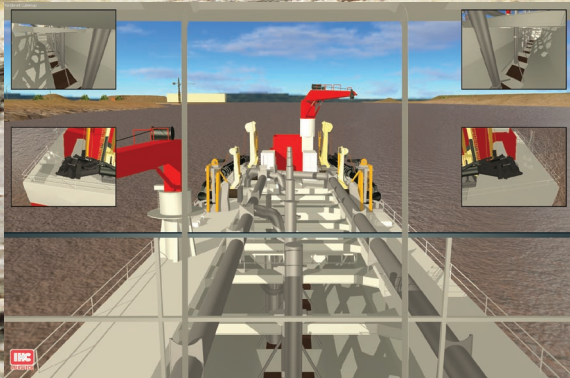
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# IHC Systems

*Dedicated to Efficient Dredging*

*Dredging Training Simulators*



an IHC Merwede company



# *Efficient Dredging...*

'**Efficient Dredging**' helps contractors to make the most of their dredging equipment: to generate high economic and ecological benefits, achieve optimal utilisation rates, reduce dredging time, make the dredging process smoother, simplify fault diagnosis, reduce downtime and wear, prevent under- and over-dredging, and maximise crew satisfaction.

Even after a shipbuilder has built reliable and efficient equipment, and even after contractors have optimised equipment utilisation, the **Efficient Dredging** concept continues to make a significant contribution, providing dredgers with extra 'senses' and 'hands & feet'.

Relatively modest investments in instrumentation, automation, surveying and simulation techniques produce major improvements in efficiency and accuracy. Automation under dredge master supervision can enhance production by up to 30%.

IHC Systems draws on all kinds of conventional and innovative control, automation, communication and presentation technologies. We also make the most of the knowledge and resources of the entire IHC Merwede group.

The concept is honed in close alliances with contractors and worked out in specific products, systems and services for every category of dredger and in every field. The products can cope with all dredging and mining conditions.

Our knowledge, expertise and experience are dedicated to reducing over-dredging, spillage, energy consumption, emissions, turbidity, ecological side-effects and operational costs. They represent our contribution to a sustainable future for all our stakeholders.

*...our contribution to a sustainable future*





## The benefits of training simulators

Modern industries use dedicated simulators widely for crew training. The idea is to provide realistic training while eliminating accidents, production losses, damage to highly expensive assets and even personal injury. Simulators represent substantial investments but cost just a fraction of the real thing. So it's no surprise that the dredging industry is using more and more of these systems.

Simulators are one element in a comprehensive dredging training programme. For example, trainees can partake in a simulator-supported training course at IHC Merwede's training institute TID. Large organisations that train about 100-150 people annually are better off with a simulator of their own.

As well as the cost and safety considerations, there are two other reasons for the increasing use of simulators. Firstly, improvements in the efficiency of dredging technology, advanced designs, dredging components and integrated systems are

proceeding relentlessly. These advances make high-efficiency, high-accuracy dredging operations possible, and make it possible to cope with more difficult soils and tougher site constraints. Advanced automation and control systems make it possible to use the innovative dredging equipment in efficient and sustainable ways in these circumstances, but final performance still depends on the crew and the project management. So highly competent crew and staff – utilising a combination of proper dredging knowledge, skills and experience – are vital. Without extensive training, it is impossible to exploit the opportunities provided by modern dredging technology.

Secondly, current project sizes and huge equipment investment programmes are leading to an increasing shortage of experienced crew. So the need for recruitment and training is clear. Simulators have a role to play in both these areas.

Of course, training simulators

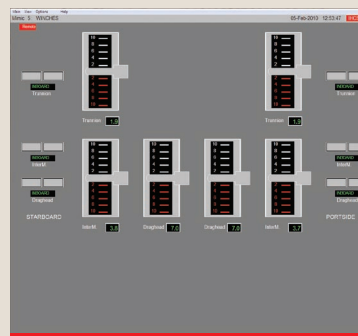
from IHC Systems are, in the first place, used to familiarise operators with the manual control of the dredging installation on board dredgers, to teach them to get the best out of monitoring and automatic control systems and to train appropriate responses to difficult situations, failing equipment and calamities. But they open up other opportunities:

They can be used to familiarise technical staffers, electricians and field managers with the operational ins and outs of jobs and the possibilities of the vessels deployed on that job, to draw in new talent and to motivate new staff and assess their potential.

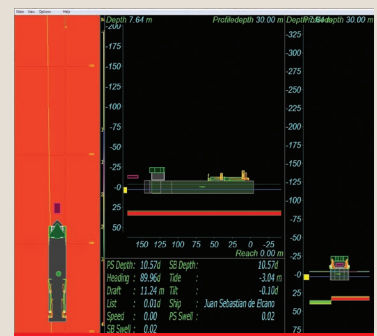
Finally, projects can be prepared on the simulator for showing to clients. Survey data is loaded into the simulator and clients can see themselves in their own backyards, observing the dredger, strolling around the scene and shaping the landscape according to their plans. This is an attractive marketing application.



Training on the CSD simulator



Winch page in a TSHD simulator



TSHD physical overview page

## Typical training simulator

A typical IHC Systems simulator draws on proven hardware and software, including:

- A powerful PC containing the 'dredger', i.e. the models. This PC communicates with the HMI and also with the PLC system, controlling and reading the latter's 'soft' I/O. It also generate realistic sounds taken from the real vessel and manipulated by the models.
- Outside and artificial camera views (picture-in-picture suitable for wide-screen presentation).
- A complete copy of the dredger's control equipment and instrumentation panels.
- A programmable logic controller (PLC), supervised by a human-man-interface system (HMI) consisting of a fast PC network, video screens/touch screens and operator keyboard-trackballs.
- A desk for the trainer with a 'soft' control console, which is in fact an extension of the HMI system, providing a mixture of physical presentations and the familiar interactive dialogue windows.

A simulator must imitate the behaviour of the real-life dredger, so the system is crammed with physical models that are integrated in an overall model. The models use a range of sources: literature and standard modules from the public domain, knowledge from external knowledge centres, expertise and models from IHC Merwede's R&D institute, MTI Holland, and its training institute

for dredging, TID. Standardised modules serve the modularity of the system and allow for the configuration of the simulator for more than one dredger of the same type.

The simulator is highly versatile. It can house all a dredger's features, such as:

- the number of pumps (submerged and in-board), their power provision and multi-stage gearboxes;
- the length and configuration of suction tubes, ladders, booms, sticks, spuds, spud carriers, anchor booms, backhoe upper carriers and other mechanical parts;
- the type of dragheads (active or passive), cutter heads, buckets, backhoes and, for example, hammers;
- the number and arrangement of bottom doors, self emptying doors, visors, swell compensators, winches, jet water and dredging-circuit sluice valves, and so on.

Several options are available:

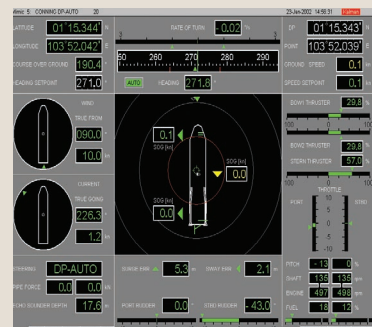
- DP/DT and one-man operated bridge functionality on TSHD simulators;
- interfaces with survey equipment, DP/DT, DTPS and ECDIS functions;
- incorporation of vibrations in the operator's chair for a major enhancement of the impression of reality in CSD and excavator simulators;
- TID simulator-supported dredging courses and training manuals to any desired extent.



Real copy of control hardware



CSD process and underwater view



Dynamic Positioning page

## Typical training session

Training simulators from IHC Systems are used to familiarise operators with the manual control of the dredging installation aboard dredgers, to teach them to get the best out of automatic control systems and to train appropriate responses to difficult situations, failing equipment and calamities.



The trainer guides every session

A training session may draw on any selection from the full training programme. The trainee operates the control levers and is expected to deliver a correctly dredged site. Normally, the trainer provides the operator with a fully operational vessel. If the trainee's response falls short, the system generates calamities such as jammed tools, clogged pipes and overloaded diesel engines. As trainees start to feel at home with the virtual dredger, the trainer can throw other events at them, such as equipment failures: failing hydraulic pumps, leakages, worn impellers and so on. Trainers can alter settings and introduce calamities and equipment failures by altering values on their 'soft' control console.

Fellow trainees can follow training, either alongside their colleague at the control levers, or on a screen in

the trainer's room. After a session, the system generates a trip report.

For realistic training, trainees should not see more than they would on board the dredger. So, during training, that is the view presented to them. On the other hand, for evaluation purposes and for trainees looking over the shoulder of the trainer, it is considered useful to observe the physical effects of their actions. So the main presentation can be extended to include picture-in-picture (PIP) features: relevant subsystem 'puffin' views are inserted in the main display, allowing for a comparison between the 'real' thing and the process pages in the simulator. This feature considerably enhances the rapid acquisition of an understanding of the dredger's possibilities and limitations in practice.



Excavator dredger training session



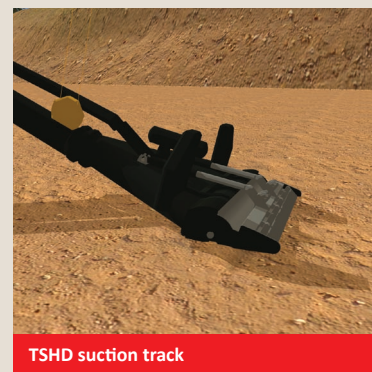
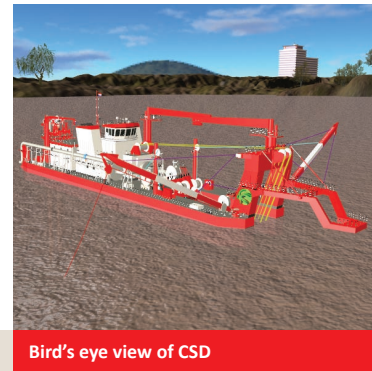
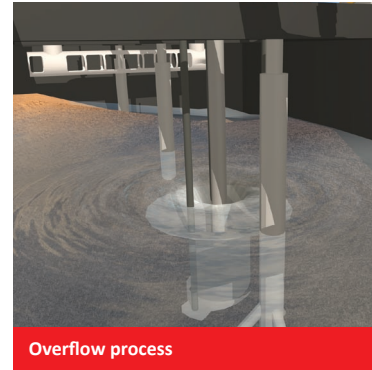
## Outside view

The outside view, which is projected on a wide screen, presents a high-quality 3D picture of the dredger from any angle, whether above or below the water. This is known as the 'puffin' view, referring to the way this bird is equally at home above and below the water. IHC Systems' unique outside view realistically presents the amounts, structures and estimated colour and texture of material taken from one place, loaded, and then deposited at other places: sand, silt, rock, clay, peat, gravel, boulders, or whatever.

The main characteristics are:

- A realistic 3D presentation of a dredger of the specific type and its subsystems. This includes the presentation of layers of wire on winches, running wire sheaves, moving gantries, swell compensators and overflow ducts, dangling suction tubes, a connected shore discharge pipeline and rainbowing – or a running cutter and side winches, etc. in the case of a CSD simulator. An excavator simulator shows a moving boom, stick and one of the tools as well as the mixture loaded in a barge.
- True process phenomena such as jet water flow, the mixture flowing into the hopper, the overflow water, water jets and the turbidity around the ship. In addition, a state-of-the-art approximation is provided of the mixture breach patterns in the hopper during shore discharging or rainbowing, divided according to the bottom door compartments. This true-to-life presentation is only possible because IHC Systems, as part of the IHC Merwede group, can draw on MTI Holland's extensive scientific knowledge and vast experience with sophisticated soil models.
- The possibility of immediate seawater run-off resulting in a complete, 'dry' underwater view. This opens the way to a host of additional features, such as the realistic presentation of operations with dragheads, visors and water flaps, cutter heads, spuds and buckets. The true dredged track is presented using the calculation of the process values and the parameters of the soil model.
- A defined dredging area set in a natural landscape that can be adapted to any client requirements and that can incorporate any landscape elements from the public domain. The landscapes include varied climate conditions – day and night, clouds and light intensity. The weather type can be adjusted from bright sun to heavy showers. Of course, the sea state affects the dredger's behaviour in the simulator, but it also determines the appearance of the water in the outside view.

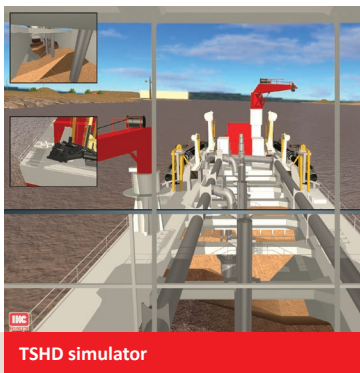
It is barely possible to express all the outside views' features in writing. Please visit our website and run the simulator videos at the hopper dredger and the excavator main pages for a better impression.



TSHD outside view with 'puffin' inserts

## Examples of IHC Systems' training simulators

IHC System's training simulators can be configured specifically for nearly all types of equipment, including dipper dredgers, grab crane dredgers, submerged crawlers, ROVs and the like. In practice, the ten operational units delivered in recent years are restricted to three common family members: TSHDs, CSDs and Excavator Dredgers.



### Trailing suction hopper dredger (TSHD) simulators

Operators training to handle a TSHD learn about the complete loading and unloading processes, including suction pipe handling, the aspiration process at the draghead, jet water handling, the pumping process, hopper settlement, unloading through bottom doors, pumping ashore, rainbowing within the constraints of tide, current, waves and weather. They learn to operate and debug the vessel's auxiliary systems and about the specifics of those systems. Any process situation can be saved, and be re-used at a later stage at the start of a new training module. Optionally, operators can learn how to operate and make the most of automation, the one-man operated bridge, DP/DT, DTPS and ECDIS.

### Cutter suction dredger (CSD) simulators

Operators training to handle a CSD become acquainted with the complete dredging and discharging process, including barge, ladder, cutter head, main spud and spud carrier movements, as well as auxiliary spud, anchor booms and anchor handling, including the accompanying motors and hydraulic drive systems. They learn about the excavation process and the interaction between cutter head and soil, caving in and breaching of the soil, the

mixture transport chain and the influence of tide, current, waves and weather. They discover how to operate and debug the vessel's power and auxiliary systems and about the specifics of those systems. Any process situation can be saved, and recovered again at the start of a new training session. Optionally, operators can learn how to operate and make the most of automatic cutter control (ACC) functionality, DTPS and ECDIS.

### Excavator dredger simulators

Would-be operators of an excavator dredger/backhoe dredger learn about the complete dredging and dumping process, including barge loading, boom, stick, tool and cabin movements, loading and shifting barges, rock placement and whatever is involved. They get a feeling for the cutting forces and the interaction between soil and bucket, caving in and breaching of the soil and the influence of tide, current, waves and weather. They find out how to operate and debug the dredger's power and auxiliary systems and about the specifics of those systems. Any process situation can be saved for a restart at the beginning of a new session. Optionally operators can learn how to adjust and optimally operate excavation position monitoring and automation (XPM, XPC and AXC) functionality, and also DGPS and DTPS.