

# One man-operated bridge

## How dedication succeeded in starting a new era in dredging



### A fascinating history

For long years Mr. Etienne Clymans, Manager Newbuilding Department of DEME, had observed that safety, reliability and efficiency of dredging ships was seriously harmed and put under stress by the (relatively) large number of crew involved in operations, carrying inherently the risks of misunderstood commands, wrongly executed actions, colliding operations and a lot of things more. Suddenly there it was, this new insight: trailing suction hopper dredgers should be operated by only one person, who co-ordinates all ship's movements and operations without confusion in a natural way! Naturally, all of this is directed by one single human mind. He realized that this idea could only succeed when a lot of communication was brought up.

In his own words: 'This is a case of one percent of technology and ninety-nine percent of communication.'

So, serious communication started at DEME's. The Safety Department was to assure that only one person could simultaneously navigate and dredge in busy ports. Classification Societies were approached on certifying. Management and crews were to be brought over natural human fears on a seemingly abundance of tasks and responsibilities. People must be reconciled with the prospect that diminishing crews in the short term would generate more jobs in the long term. Fortunately, there was a broad consensus for the one man-operated bridge. At that time, nobody knew exactly how this concept could be implemented.

It is there where IHC enters the story. The remnant one percent of technology became their 'one percent of inspiration and ninety-nine percent of transpiration'. It was the intention to introduce the innovation on two dredgers to be built as identical daughters of eminent PALLIETER, commissioned 2004, MARIEKE and REYNAERT – names inspired by renown Belgian author Felix Timmermans' roman Pallieter of 1916.

First of all trust was at stake. DEME had to order 'copy' ships with a large technological blank spot, to fill in during building. IHC had to have enough self-confidence that they really could colour this spot. And all that within normal budget and construction time of 'copy' ships, and without any flaw, as

even the slightest bug should ruin the 'public' opinion on the case and set back the idea for decades – a well known phenomenon around innovations. Well, IHC Dredgers and DEME ventured to enter the risky thing and signed the building contract, based on these fine human values: trust and dedication. And they won – as the trace of this story will prove.

### Filling in the blank

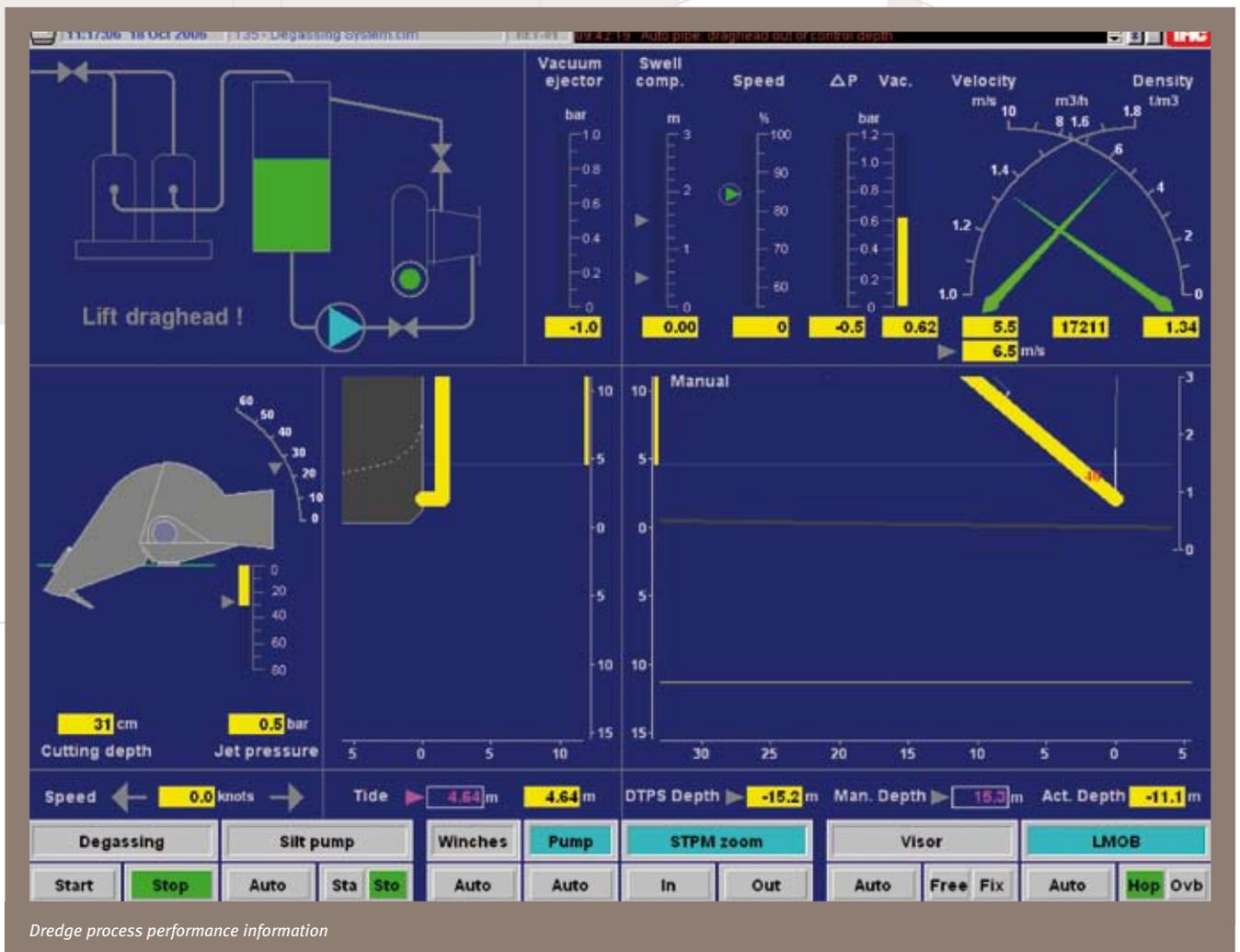
Naturally, there were some broad outlines of the one man-operated bridge from the beginning. First of all: the operator should concentrate on navigation, as vessel- and environment-safety could never be subject of any discussion. Then the crucial element was introduced: Normally the navigating officer onboard of trailing dredgers is responsible for geographic position and load of the vessel. He (or possibly she) then determines start and

end of dredging operations as well as related manoeuvring. During manoeuvring the navigating officer utters some verbal commands to the dredging operator, for example: 'pipe overboard', 'pipe before inlet', or 'pipe on ground'. The dredge operator is then assumed to follow these commands appropriately ... in the way they were understood and interpreted. The very innovation was now to shelter these 'commands' in very sophisticated so-called 'macro keys'. And instead of giving a verbal command, the navigating officer should only touch these macro keys. The ship and her installation should then adapt presentation and perform these 'commands' automatically as if she herself was an infallible dredge operator. This was the starting point of technical design.

Now a new 'officer' enters the 'bridge'. Mr. Marc Franssen, experienced merchant captain, navigating officer and dredge operator was to define precisely how 'the ship' should react so perfectly on macro-key commands. Meticulous discussions with DEME's crew exposed the proverbial difference between theory and practice: Dredgers of DEME have been equipped with modern IHC-made presentation and automation systems. However, it proved out that in some cases the crew did not use them, sometimes for personal reasons, sometimes due to confusing behaviour of automation or malfunctioning sensors. On a more hidden level, some vigilant myths even circulated, for example: 'do never block the swell compensator; at release it will rocket to the moon'. These facts – only suspected, not known, by the technical staff of builder and contractor – were lifted to the surface.



20" Video presentation screens

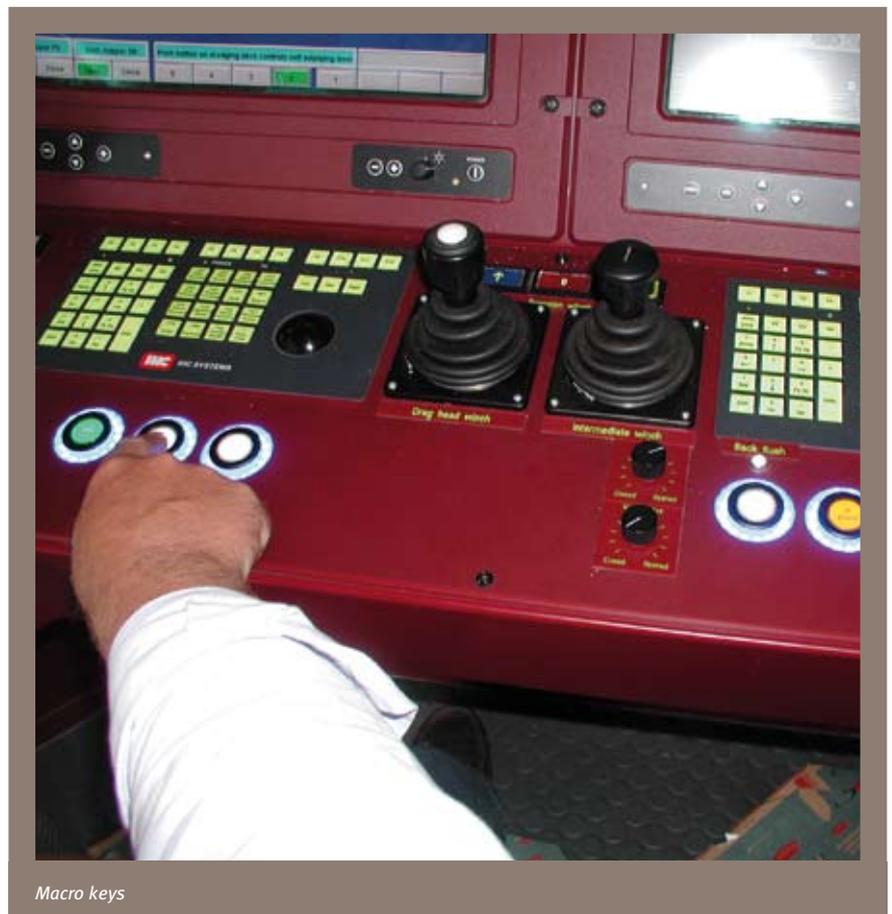


Dredge process performance information

As it was a *conditio sine qua non* that the one man-operated bridge should work flawlessly at the first sea trials, the input of the crew was validated into improvements on automation systems, establishing links between automation systems, enhancing crucial sensors and diagnostic analysis of errors. An important innovation was installed on the swell compensator installation.

### Automation people @ work

At the end of this stage, there was a clear impression of how the ship should react on macro keys, and what it would require from automation and presentation. Generally spoken: the operator only should concentrate on navigation, and dredging was to be an issue of reflexive and intuitive actions. Nevertheless it should be performed perfectly. Now IHC Systems comes in. Naturally they had assisted and backed in colouring the white spot, but from now they are the main players for a certain time. They firstly developed a brand new integrated dredging and navigation console. Seated in front of it, the operator has all apparatus for both



Macro keys

functions within natural range of view and easy reach, ergonomically situated and ready for reflexive and intuitive action.

Main features of the console are:

- Application of large, 20" video presentation screens for Radar, ECDIS, Dredge Track Presentation System, Yield Indicator, Suction Tube Position Monitor, Draught and Loading Monitor and so on. An interesting new feature is, that some of these systems can be combined or can produce overlays of each other on the screen of another one, so condensing information into formats with which the human mind can cope more easily.
- Inclusion of a technology for allocation of any presentation page at any desired location of the console. Naturally, the functional keyboard and tracker ball adjacent to that presentation are switched also. The operator can find them

intuitively under their 'own' monitor.

- As working with functional keys and tracker balls is not always the thing to act quickly in operational situations, dedicated pushbuttons were added, with which presentation can be re-allocated with only one touch, within split seconds.
- Very helpful: one of the video screens can function as a CCTV for a large back view of the vessel, starting from the bridge location - call it a sophisticated rear view mirror.
- The macro-keys were given a prominent place in front of the operator. You will read more about them.
- Last but not least: As the whole vessel can be operated by using keyboards, tracker balls and presentation screens, a first try was done to strip the control console of any component that could indeed be missed without danger.

Employees of more than one IHC business unit developed the idea of the macro keys into a workable 'thing'. Standard pushbuttons were altered until they had to do nearly nothing with a common pushbutton yet! And they may no longer be named 'pushbuttons' according to DEME. An illuminated ring appears around the button itself, obtained by integration of a redundant dimmable sophisticated LED ring in the top cover of the console. This outer ring then lights up when it has sense to touch the adjacent key. The decision whether such operation has any sense is made by a diagnostic program which continuously scans all related signals and operational conditions, and processes them by dense logics. When a macro key-initiated action is underway, an inner light blinks, shifting into continuous illumination when the action is ready. And there is more yet! The macro-keys very helpfully produce approving or disapproving sounds, so

The screenshot displays the 'Pipe control system conditions' interface. At the top, it shows the time '11:30:57 18 Oct 2006' and the system name '242 - Pipe Ctrl Start Cond.cim'. The interface is divided into two main sections: 'Pipe state change conditions' and 'Pipe control system conditions'. The 'Pipe control system conditions' section is a grid with columns for 'FROM' (A1 in sad., A2 Overb., A3 At inlet, A4 Off ground, A5 At grnd, A8 Man depth ctrl) and rows for various system states. A red 'A6 Alarm' indicator is active. Below the grid, the 'Actual pipe state' is shown as 'A6 Alarm'. At the bottom, there are buttons for 'Pipe alarm' and 'Reset'. The interface also shows ship speed (0.0 knots) and pump speed (0%) indicators.

Diagnostic information



Miniature dredge console

assisting that other operator's sense, the ears.

A Radio Control panel, normally used for assistance at hopper self-emptying operations, was further developed into a miniature 'spare dredge console' for the cases that bad weather, busy traffic

practice they seldom use this apparatus.

Now some features, more common to IHC crew, as they are one of the pillars under their leading position in dredging shipbuilding, are worth mentioning:



All players around the integrated dredging and navigation console

or any circumstance would require the deployment of a second hand. Such a person is always ready on board for calling up. This miniature dredge console gave the intended crew an enormous feeling of back-up safety and reassurance, and largely helped them to overcome fears about over-responsibility and overburden. So strong is this feeling that in dredging

- The system rests on a solid control concept which applies decentralized PLC's. These PLC's communicate over redundant connections. Hierarchically situated 'above' the PLC network a redundant Human Machine Interface System ends in rugged PC's, running under Windows and SCADA software.
- Some properties of automation,

irritating DEME's crew, were stripped ruthlessly. Then automation systems were further developed in the new context. Automatic Setup Control allows the operator to bring the whole vessel in the required mode within seconds.

- IHC data logger software provides reports and possibilities to trace the vessel's behaviour. Furthermore it informs external data loggers and the so-called BIS System, required by Belgian Waterways Authorities on board of dredgers.
- Diagnostic presentation is part of IHC's automation systems. It provides information on start- and running conditions of the vessel's subsystems. Malfunctioning sensors are detected, uphold conditions marked. So the operator can easily do from the bridge anything that facilitates economic and safe operation of the ship. This software was extended considerably, giving yet more facilities to do the job undisturbed.
- As usual, IHC sensors and measurements form the backbone of robust and reliable information provision to all 'higher' systems.

Extensive simulation and Factory Acceptance Tests gave the prospect that no circumstance on board should harm the concept or would disappoint operators. Components and systems got the green light for installation and commissioning aboard of MARIEKE, which was the first ship to take advantage of the new phenomenon. The future of the one man-operated bridge seemed certain.

#### MARIEKE, proof of the pudding

Setting foot on MARIEKE's or REYNAERT's bridge, one is struck with amazement for the first minutes. No long rows of control consoles with all those blinking lamps, switches, pushbuttons, control levers, buzzers fluorescent mimic diagrams and anything that made dredgers' bridges so intriguing in the past! Naturally, chart tables, VHF, radars, gyrocompass and that kind of stuff is present, but the general impression is one of plainness and tranquillity. There is only that massive, though harmonious U-shaped

console with the steering wheel at the centreline, its dim video monitors and then, indeed, some control components, nicely ordered in rectangulars. So far so good, let's return to the story.

The proof of the pudding is in the eating, as the proverb goes. The basin trials of MARIEKE saw all involved people gathering again, unanimously dedicated to make a success of the new thing. The crew were intensively trained and assisted to venture dredging with such a revolutionary concept. Commissioning- and software-engineers did the last adjustments and made it entirely sure that nothing could ground the system. At the backstage, Mr. Robert Engels, DEME's long trusted dredgemaster had entirely and heartily grasped the innovation.

Appointed to train DEME's crew members he spoon-fed them with it, taking away human hesitations and fears, so encouraging them to dredge with vessels like MARIEKE and REYNAERT – and their successors!

The days of sea trials came. MARIEKE's installations were thoroughly commissioned, loaded, adjusted and improved where needed. As to the one man-operated bridge, nothing is to say. It simply worked!

After MARIEKE was transferred to her owners some maiden trips were made – and became successes. MARIEKE and her crew easily won the ecological and economic competition with such a first rate 'mother' like PALLIETER and her well experienced crew. As there is no other difference between the ships than the one man-operated bridge, conclusions are obvious and need not to be told here.

### **The granddaughters of PALLIETER**

MARIEKE's crew became accustomed to the merits of the one man-operated bridge and began to request for further developments. They will see them without doubt. DEME and IHC are already analyzing a next generation. This generation will bring further improved presentation and diagnosis. It will provide information with yet more sense for relevancy and more eye for the human being. The number of

presentation displays will be reduced. Before all things, a search will be done to remove all things from the bridge that can be removed. Highly interesting is a feasibility-study on so-called adaptiveness. Adaptiveness is a mathematical method with which the number of required adjustments is being reduced, while software learns them from itself. A nice first example is the system on MARIEKE which does 'informed guesses' on overflow losses.

The next generation of the concept will take the best of abilities of people, so dedicated in developing MARIEKE en REYNAERT, since DEME already ordered two following sister-vessels. These 'granddaughters' of PALLIETER, to be named BRABO and BREYDEL, will be the terrain of their extended exercises within a year.



### **Outcome and perspective: a new era in dredging**

It goes without doubt that the successful introduction of the one man-operated bridge will foster new developments. Crews will grow accustomed with the concept and the method of operation. Inventive as humans are, they will without doubt find methods to improve the success. IHC will build new vessels for DEME and the exchange of fascinating ideas will continue flowing. As one main player in

the process postulates it: 'This is not the time to lean back. It is not the end, it is only the beginning. The beginning of a new era in dredging.' – as is the strong feeling of all people involved. And they may be right! Anyone with affinity to dredging will understand that this innovation is a challenge to dredging contractors and dredging shipbuilders for coming years.

### **A story of dedicated people.**

This is the story of beginning a new era in dredging. Indeed, it is a story of enterprises sitting on large amounts of knowledge, practice and experience. Yes, it is a story of organizations who have a long track record of cordial and lasting relations. And yet, above all it is the story of dedicated people who surpassed beyond all that. People who were wise enough listening to their intuition, people who had the moral courage to build on mutual trust, people who adventured to expose myths and apparently hidden failures and – to dredge with a totally different 'feeling' ship. Dedicated people, mentioned and not mentioned, who took the risk to go with each other without knowing where they would come out. One may be sure that such an approach carries a lot of innovative promises for the whole dredging and shipbuilding world: a new era indeed!



*One-man operated bridge*

