IHC Systems

Dedicated to Efficient Dredging

Dredge Profile Monitor

(IHC DPM®)

The technology innovator.
‘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
Efficient Dredging starts with dredging in the right place and at the right depth. Dredging in the wrong locations and over-dredging can involve major energy wastage and costs. Under-dredging may mean being called back to finish the job correctly. All dredging scenarios of this kind mean high costs for the dredging contractor, and even the client, and they can also have a negative impact on the hydrodynamic and environmental aspects of the dredging job.

In terms of the operations of cutter suction (CSD) or wheel dredgers, the need for accurate dredging implies that operators must know the position of the cutter or wheel relative to the actual dredging profile at all times, together with its exact geographical coordinates. In addition, operators must be able to make adjustments whenever they are needed. It is also desirable to have automation routines that can help operators to achieve this goal, so their performance isn’t impaired by fatigue, lowered attention levels, traffic or other dredging process parameters.

IHC Systems’ Dredge Profile Monitor (DPM®) matches these requirements seamlessly. It provides an ongoing picture of two groups of parameters. These are:
- the three-dimensional position of the cutter/wheel relative to vessel reference points
- the three-dimensional position of the vessel relative to the water surface and its orientation to the projected and/or really dredged profile in a local grid.

These relational data, if combined with geographical data obtained from tidal receivers, DGPS or a survey system, for example, provide the dredge operator with an adequate picture of the correct geographic location and dredging depth and profile.

The DPM® provides both adequate and ergonomic presentation and optional automation routines. Alone or in combination, it enables CSD operators to just dredge as efficiently as possible. This is evidenced by the fact that a large number of CSDs in the world have an IHC DPM®.

**Benefits**

Efficient dredging involves superb equipment... and its outstanding presentation for the operator.
Typical System Architecture

The IHC Systems DPM® function draws on proven hardware and software, including a programmable logic controller network (PLC) monitored by a fast PC-based, server-client, supervisory, control and data acquisition (SCADA) network.

The core of the system is a separate, dedicated PC containing the DPM® algorithms and models. These run on a shared Microsoft Windows and IHC Systems’ Digisys platform. The software is dongle-protected to prevent unauthorised use.

The PLCs manage the standardised signal isolation and signal processing to and from the connected instrumentation and sensors, and—depending on the eventually specified configuration and extent of options—the drives for the ladder and swing winches and the spud carrier.

The supervisory control and data acquisition system (SCADA), also referred to as the Human-Machine Interface (HMI), is the link between the operator and the presentation, control and instrumentation components. Touch-operated TFT screens present coloured process values and statuses on functionally designed screen pages using standardised diagrams, symbols, bar graphs, imitated analogue indicators, numbers and words. Functions are also initiated and controlled on these touch screens.

Currently, the DPM® function is in most cases an integrated and/or distributed part of a larger monitoring and automation system such as IHC Systems’ dredging control system (see brochure DCS, available on the website). However, the function can also be supplied in a stand-alone version and it is then described as a DPM® system. In both versions the content and extent of sensor equipment varies with the functionality that is ultimately specified.
Sensors, transmitters and/or actuators

Depending on the particular DPM® and dredger configurations as well as required options, IHC Systems-made rugged sensors and other connected equipment may include:

- vertical angle transmitter of the ladder position
- water-hammer-resistant ladder-trunnion draught measurement, maintainable without dry docking
- analogue spud carrier linear position measurement
- heading measurement (gyro compass)
- list and/or trim measurements
- contactless limit switches for spud carrier begin/end positions and ladder up/down positions
- paid-out length measurements for the ladder and swing winches
- radio tidal measurement
- DGPS and/or survey systems
- repeater swing-status signal lamps for the dredger’s instrument panel
- relevant I/O to sensors and/or actuators and/or data communication links of the spud carrier and ladder winch drives.
Typical functionality

Depending on the specific DPM® functionality and options, the dredger and her principal components are presented on the touch screen as ‘dressed wire models’ in the context of the dredging profile and by reference to the waterline and the vessel’s centreline. Top, side and back views of the dredger, including the ladder, spuds and spud carrier, are displayed with detailed cutter/ wheel and bathymetric information in a digital terrain model (DTM) of the dredge profile. The latter can be obtained from in-survey data or inserted by hand.

The touch screen allows for the online adjustment of operational parameters, while configuration parameters can be entered off-line. Transgressing set points generates audible and visible alarms. Presentation colour preferences, zoom and shift functions are available. Local grid resolution can be adjusted off-line. In the DCS-integrated version, screen pages are available for fault diagnosis and alarms.

Equipment geared to performance

The DPM’s local grid presentation may be interfaced with data from tidal measurements, DGPS, and survey systems and so on, resulting in the availability of absolute geographical position x-y-z presentation. Of course, the ultimate DPM accuracy cannot exceed DGPS or survey system accuracy.

IHC DPM® options

Anchor position estimator function
This option uses some of the sensor and transmitter equipment described on the last page to make sophisticated calculations using the data obtained. It also presents the estimated anchor and swing winch wire positions within the dredging context. This helps to determine the point of spud changing and prevent damage.

Automatic ladder winch control function
This feature controls the ladder winch in relation to the desired position of the cutter head or bucket wheel in the predetermined profile. It helps to prevent dredging over-depths and incorrect profiles.

Automatic step function spud carrier
This option provides automatic spud carrier steps of adjustable length, either in the channel centreline, or at other defined positions along the dredging width scale.
Combinations

DPM and ACC

An IHC DPM® function/system may be combined with an automatic cutter controller – IHC ACC® – in the same hardware and software environment. No significant additions are required, except for specific ACC sensors and I/O capacity. The combination delivers the integrated presentation and unremitting automation of the entire swing, profile dredging, spud carrier stepping and the pumping process for a CSD. It comes in two versions.

ACC® version 1 has been programmed for control functions using more conventional methods, whereas version 2 incorporates Artificial Intelligence routines, considerably broadening the span of control to include very difficult operational challenges. Either ACC® version offers a dedicated mix of the functionality below.

• **Automatic motion control** includes swing motion control, ladder motion control and spud carrier motion control, which are geared to one another by the pattern coordination function.
  - Swing motion control
  - Ladder motion
  - Spud carrier motion control

• **Automatic pump control** governs the flow in the discharge pipeline for a maximum of three dredge pumps. Multiple pump control modes can be provided, depending on the chosen ACC® version:
  - Basic pump control
  - Vacuum relief valve control
  - Mixture transport control by Artificial Intelligence for up to 3 inboard pumps
  - Extended mixture transport for the remote control of up to 4 boosterpumps up to 15 kilometres
  - Swing production control optimises production in relation to soil properties
  - Cutter production control minimises spillage.

For a detailed overview see the IHC Systems ACC® brochure.