TECHNOLOGY TRANSFER:
HOW DREDGING AND SHIPBUILDING INNOVATIONS
ARE IMPROVING (MICRO)TUNNELLING OPERATIONS

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ABOUT IHC ▶ THIS IS IHC

DREDGING

OFFSHORE

MINING & TUNNELLING

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ABOUT IHC > DREDGING

PORTFOLIO

• Standard and Custom-built Hopper Dredgers
• Custom-build Cutter Suction Dredgers
• IHC Beaver™ Cutter Suction Dredgers
• Mechanical Dredging Equipment
• Dredge Line Components
• Dredging Systems & Automation
IHC COMPETENCES > TUNNELLING

- Excavation
- Transport of cuttings
- Positioning and propulsion
- Drive systems / hydraulics
- Automation and control
MICROTUNNELLING > 1990s/2000s
IHC TUNNELLING > FIELDS OF APPLICATION

A  (MICRO) TUNNELLING
B  PIPE RENOVATION
C  SHAFTBORING
D  TUNNEL INNOVATION
E  TUNNELLING EQUIPMENT
TUNNELLING

• Tunnelling equipment for the construction of road tunnels, railway tunnels, metro tunnels and hydropower tunnels
• Built on customer’s specification
• Flexible in diameter
• Tunnel built in the machine with concrete segments or shotcrete
• New and refurbished equipment
• Slurry transport system for excavated muck
MICROTUNNELLING

- Microtunnelling equipment for the construction of pipes for
  - water
  - gas
  - sewerage
  - etc.
- New and refurbished equipment
- Slurry transport system for excavated muck
- Scope includes the TBM, jacking station, power packs and control container

Innovative  First-rate quality  Custom-built solutions
INNOVATION

ELECTRIC DRIVE

CONCEPT
• MTBMs will be delivered with control cabinet and power distribution
• MTBMs can optionally be delivered with
  - Shaft jacking station
  - Intermediate jacking station
  - Hydraulic power pack for jacking station
  - Hyperbaric equipment
  - Guiding system
  - Bentonite lubrication system
  - Slurry pumps
  - Slurry flow/density meter
  - Separation plant
MICROTUNNELLING ➔ ELECTRIC DRIVE CONCEPT

• Surface
  - Step-up transformer supplies the active front end inverters on surface
  - The inverters supply a DC voltage to the tunnel power cable
• Tunnel
  - Tunnel cable is supplied by DC
  - Two wires transmit the current instead of three in the „classic“ AC configuration
  - The current load is doubled, but cable size is only slightly bigger
• MTBM
  - The DC line is split up to all power consumers underground incl. cutterhead motors and booster slurry pump
  - All equipment is located on a „trailer skid“ in the first pipe which results in a shorter overall MTBM (IP65)
MICROTUNNELLING ➤ ELECTRIC DRIVE CONCEPT

- IHC MTBMs are equipped with a frequency controlled synchronous motor drive train
- Flexible motor torque and voltage control by ruggedized frequency converters
- Intelligent power management optimizes use of cable capabilities
- Easy spare parts management due to modular design of drive system

ADVANTAGES

+ High efficiency compared to state-of-the-art cutter head drive trains
+ Decrease of machine weight and overall length
+ Minimizing the use of hydraulic fluids
+ No separate cabling for additional slurry booster pump needed
+ Overall positive benefit on environmental footprint due to saving energy
MOTIVATION > RADIOACTIVE GAUGE (RA)

• Uses ionizing radiation
• Robustness
• Industry standard

DISADVANTAGES OF RADIOACTIVE MATERIAL

• RSO certified crew
• Maintenance costs
RF WAVES EXPLAINED

water

SLOW
Time of flight is inversely proportional to the amount of total dry solids in water
Non-radioactive slurry density meter

- Uses harmless RF waves
- Measurement pipe fitted with a pair of antennas
- Antennas protected by a wear-resistant Irathane®
- No additional burden for safety regulations

- System components:
  - Measurement pipe
  - Radio electronics
  - Signal conditioner
PROOF OF CONCEPT > LAB ENVIRONMENT
PROOF OF CONCEPT  >  DREDGING TESTS
FIRST PRODUCT ➤ DREDGING
**TUNNELLING ➔ BENTONITE LAB TEST**
TUNNELLING ➤ FIRST SYSTEM INSTALLED
TUNNELLING ➤ FIRST SYSTEM INSTALLED
CONCLUSIONS

• Overlapping challenges in tunnelling and dredging allow for synergies in developments
• Technology transfer is part of IHC’s strategy for the development of the tunnelling division

RESULTS OF BOTH DEVELOPMENTS

• Higher efficiency of IHC’s MTBM systems due decreased energy consumption
• Shorter machine design and therefore time needed for excavation
• Gain experience of the RF meter in tunnelling environment in a field test on a TBM
• Further development of the RF meter as a compact system for a MTBM

AND BESIDES THAT...
**R&D > PIPE RENOVATOR**

**3D PIPE RENOVATION CONCEPT**

- Safer and less environmental impact during planned maintenance/replacement of pipes
- Low impact, especially in urban areas
- Lower risk for damages to existing infrastructure
R&D ➤ VERTICAL BORING MACHINE

- Suitable for soft ground and rock
- Applications in mining, utility works and foundation installation
- Lining installation during boring works ensuring stable shaft throughout
- Partial lining of shaft possible without changes to the VBM
- Proven gripper concept enabling accurate thrust control
- Compact topside equipment spread and vibration free shaft construction for application in congested areas
Hyperloop is a new mode of transportation with the potential to provide long-distance sustainable travel.

Pressurized vehicles travel in a tubular network on low air pressure, providing the ideal conditions for energy efficient travel by dramatically reducing air resistance.

The vehicles are electromagnetically suspended, therefore have no contact with the track eliminating rolling stock maintenance.
THANK YOU FOR YOUR ATTENTION!

Thank you for your attention!

THE TECHNOLOGY INNOVATOR.

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