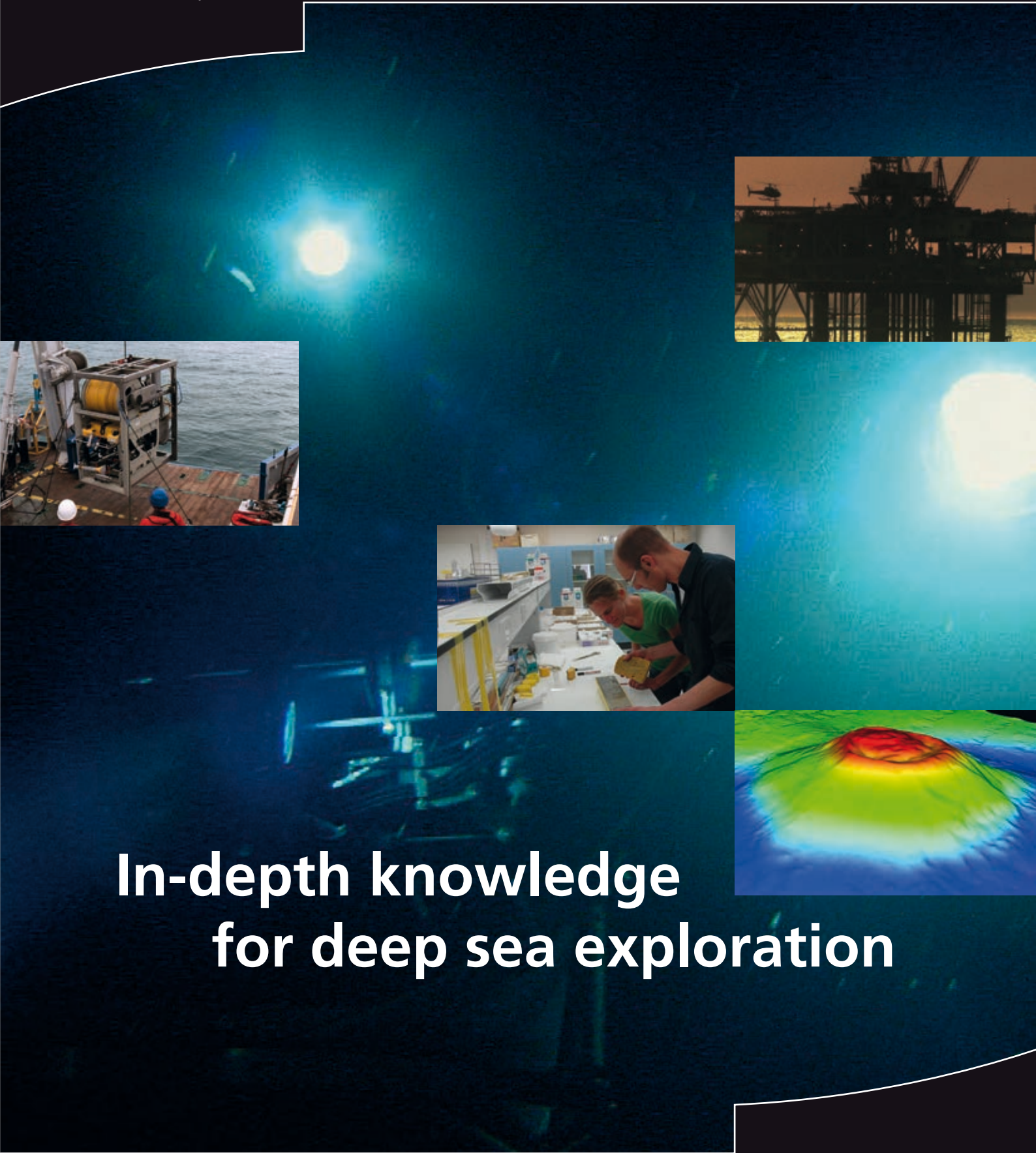




Netherlands Deep Sea Science & Technology Centre



**In-depth knowledge  
for deep sea exploration**



# Royal Netherlands Institute for



Independent  
research for  
a sustainable  
management  
of emerging  
open ocean  
resources

In 2050, an estimated 10 billion people will inhabit our planet. Will there be enough sources of raw materials, food, water and energy? Emerging sources, such as deep sea mining of valuable ores, or oil and gas exploration in deep water are great possibilities to fill our planet's future needs of resources. However they must be developed and utilized in a way that is coping with the general threats of climate change, the loss of biodiversity by habitat destruction, overfishing, and pollution. It is difficult but crucial to maintain a delicate balance between People (corporate social responsibility), Profit (generation of continuous earnings over a prolonged period), and Planet (protection of the environment).

## **A maritime knowledge-driven infrastructure for sustainable explorations**

The International Seabed Authority (ISA; 1994) was founded to set up internationally binding regulations for the utilization of the seabed beyond national jurisdiction. Protection against potential harmful effects of commercial exploitation of the deep-sea is one of ISA obligations. Deep Sea Mining includes the exploitation of materials such as polymetallic sulphides, manganese nodules, cobalt-rich ferromanganese crusts, rare earth elements, and oil and gas exploration, including methane hydrates. Sound knowledge of the deep sea is crucial for assessing potential environmental impacts on the communities at the sea floor and in the overlying water column before engaging on such activities, as well as the time it takes for ecosystems to recover.

## **More than a century of worldwide marine research**

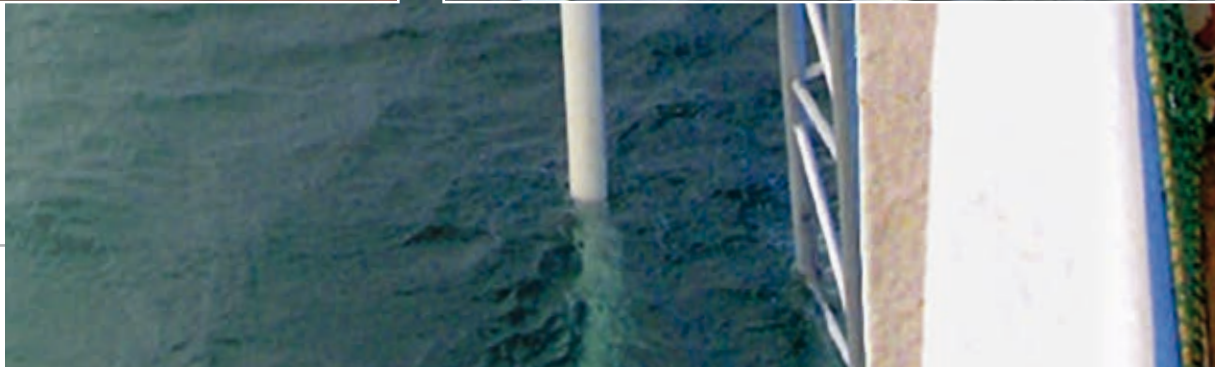
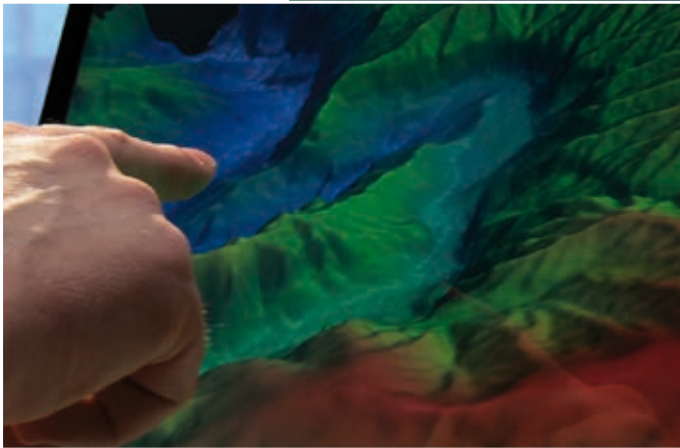
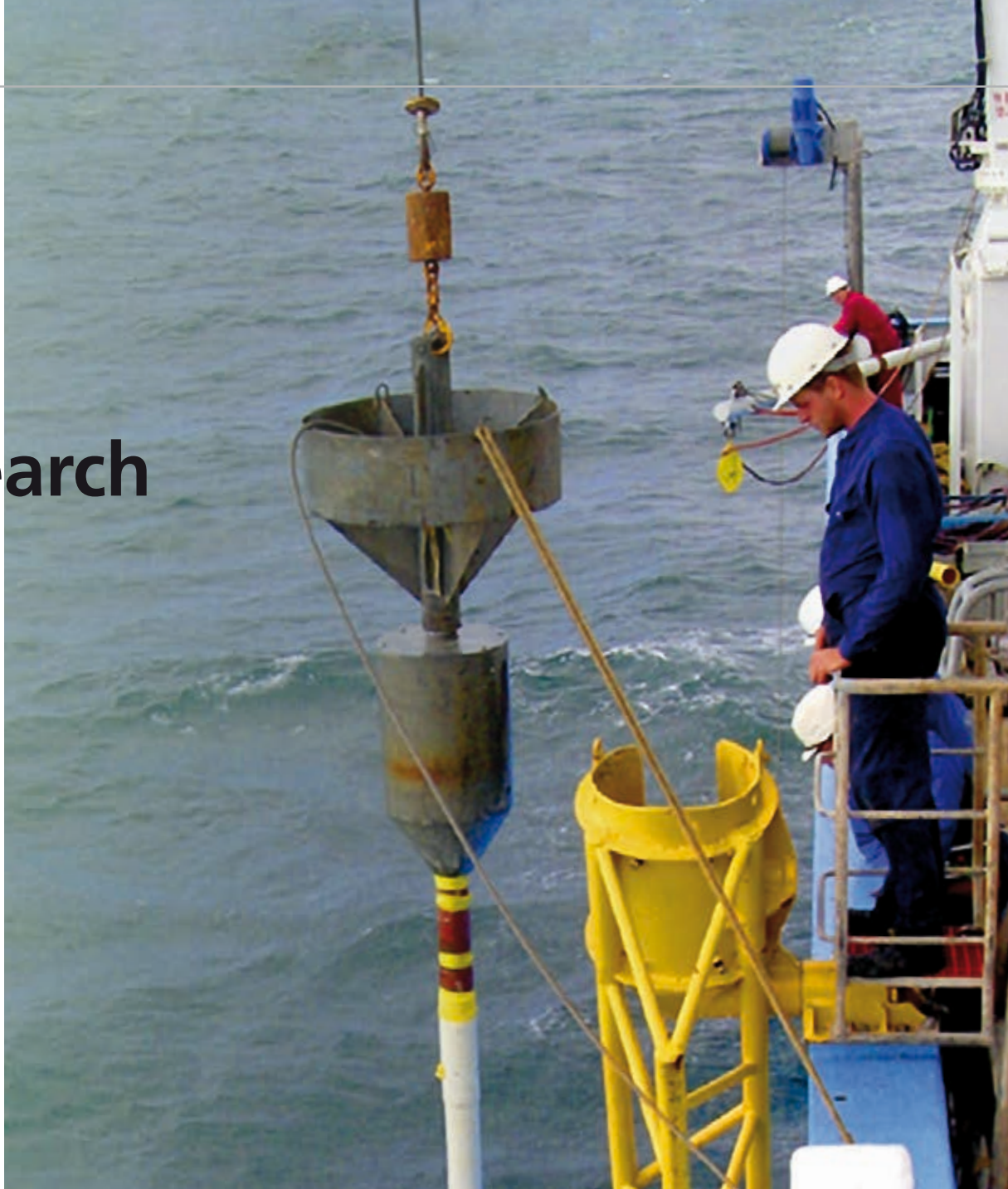
With a history of almost 140 years of worldwide research in estuaries, coastal seas and open oceans; from the tropics to polar regions, we can address these possibilities either by ourselves, or in cooperation with our national science partners in the Maritime Consortium of Environmental Science and Technology (MUST): Deltares, IMARES and TNO.

Close cooperation between fundamental and applied research focusing on the deep sea has been geared towards exploring the sedimentary environment, reconstruction of the geological history and the biogeochemical functioning of the oceans. New techniques are continuously developed for this research and technical innovation has been instrumental for many of the research projects carried out, often in close collaboration with industry.

Applied research includes exploration strategies for Deep Sea Mining and identification of the potential environmental impacts, either directly on the communities at the sea-floor and in the overlying water column, as well as indirectly by the sediment plume generated by the activity. New techniques are developed for the analyses of precious metals in different materials and settings.



# Sea Research



# Sentinel V

## Your 5-Beam ADCP!



[www.rdinstruments.com/followV.aspx](http://www.rdinstruments.com/followV.aspx)



**TELEDYNE**  
**RD INSTRUMENTS**  
*Everywhere you look™*  
[www.rdinstruments.com](http://www.rdinstruments.com)



## RV Pelagia: tools & capabilities

- 1 RV Pelagia
- 2 Hipap 100 USBL acoustic direction finder
- 3 Kongsberg EM-302 Multibeam Echosounder
- 4 Bottom penetrating echosounder
- 5 Seismic Array (Sleeve Guns)
- 6 CTD Rosetta frame with water samplers
- 7 Ultra-clean-CTD Frame 'Titanium' with Pristine® water samplers
- 8 Deep Sea Mooring with ADCP, current meter and Sediment Trap
- 9 Agassiz Trawl for quantitative deep-sea bottom trawling
- 10 Deep Digging Dredge (Triple-D) for sampling benthic macrofauna
- 11 Multi-Corer for multiple small samples of surface sediments
- 12 Box Corer for large samples of surface sediments
- 13 Piston Corer for sampling long (10-20 m) sediment cores
- 14 Altrap Bottom Lander with larvae collector
- 15 Albex multi-purpose Bottom Lander for measurements and experiments at the sea floor
16. BoBo Bottom Lander with downward-looking ADCP current meter
17. Mobile underwater vehicle (MOVE)
18. Remotely operated vehicle (ROV)



Zwarte Pad 1  
1781 AH Den Helder  
P.O. Box 114  
1780 AC Den Helder

phone +31 (0)223 616 641  
fax +31 (0)223 615 391

[info@damendenhelder.nl](mailto:info@damendenhelder.nl)  
[www.damendenhelder.nl](http://www.damendenhelder.nl)

# DAMEN

DAMEN SHIPYARDS DEN HELDER

Member of the DAMEN SHIPYARDS GROUP



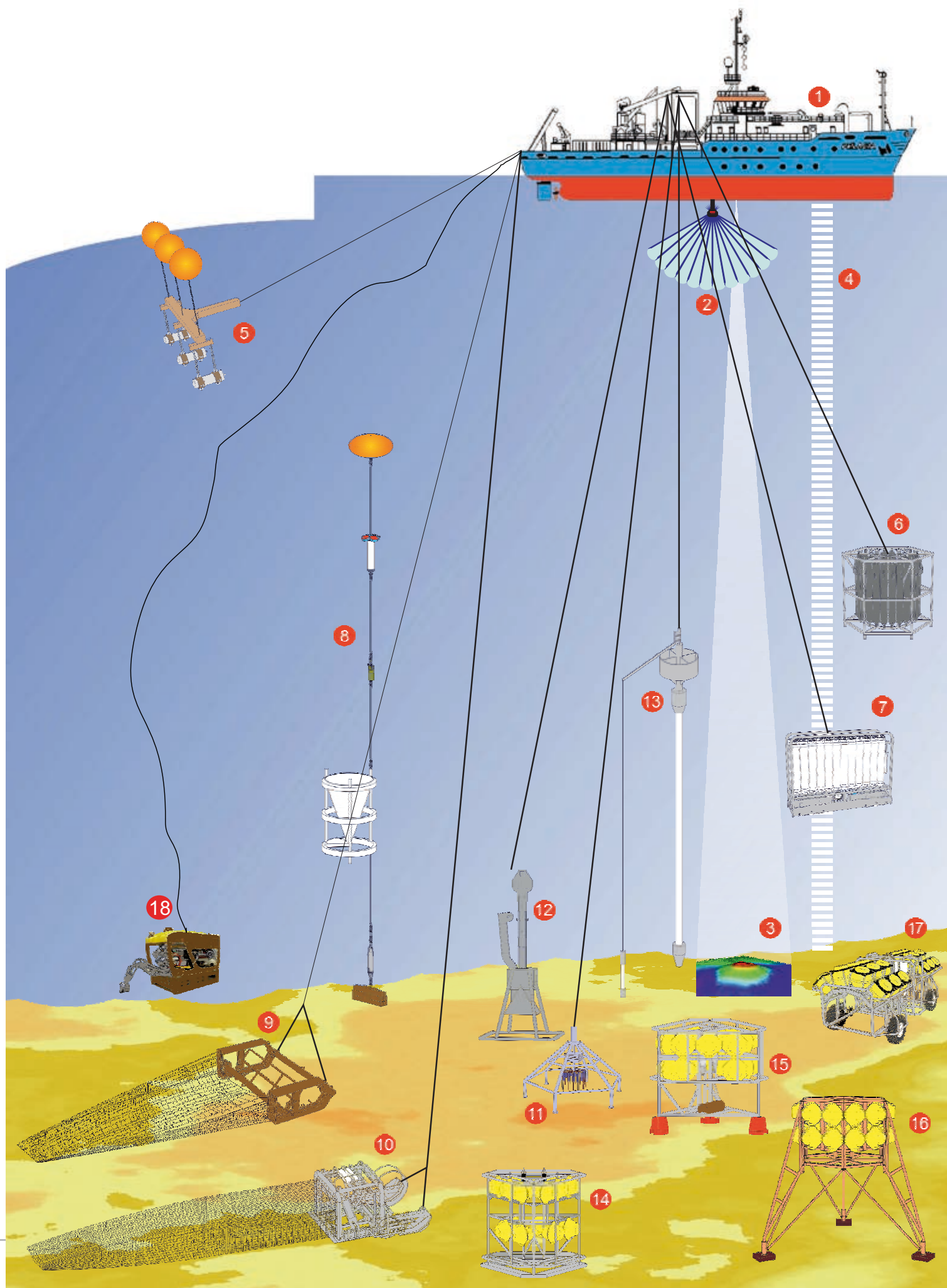
Schilderweg 253  
1792 CJ Oudeschild  
P.O. Box 605  
1792 ZG Den Burg  
The Netherlands

phone +31 (0)222 312 661  
fax +31 (0)222 310 249

[info@damentexel.nl](mailto:info@damentexel.nl)  
[www.damentexel.nl](http://www.damentexel.nl)









# Polar operations



## The Arctic: a sensitive environment

The oil and gas industry is increasingly interested in Arctic explorations because this region experiences substantial warming and its ice cover is rapidly melting. However, conditions are still harsh and the biologically highly productive Arctic region also contains vitally important fishery grounds and nursery areas for many different fish species, which in turn form the main food stock for large populations of marine mammals and birds. With the environment already being under stress due to climate change, economic development potentially brings additional risks.



## What can we offer?

Together with industry, our scientists are geared towards investigating effects of oil and gas exploration and production on the sedimentary environment. Research on past sedimentary environments includes investigating conditions suitable for oil source rock deposition by the analysis of sediment samples. Mitigation planning will ask for monitoring studies of the major local food webs, including studies of the distribution and productivity of various species and studies of the hydrography, driving the food supply towards hotspot ecosystems, such as cold water coral reefs. With our high technology deep sea instruments, we are able to cover all aspects of studying the Arctic ecosystem.



## JM SERVICES

REFRIGERATION SYSTEMS  
ELECTRICAL ENGINEERING

COMPRESSED AIR SYSTEMS  
LAB VANS

Watertoren 11  
3247 CL Dirksland  
The Netherlands

T (+31)187 60 57 15  
E [info@jmservices.nl](mailto:info@jmservices.nl)  
I [www.jmservices.nl](http://www.jmservices.nl)





# Hi-Tech for the Deep Sea

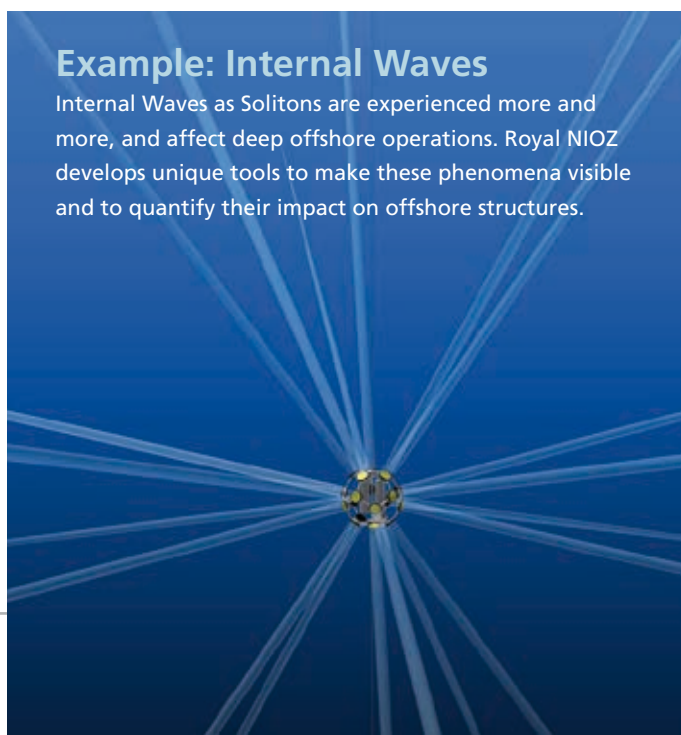
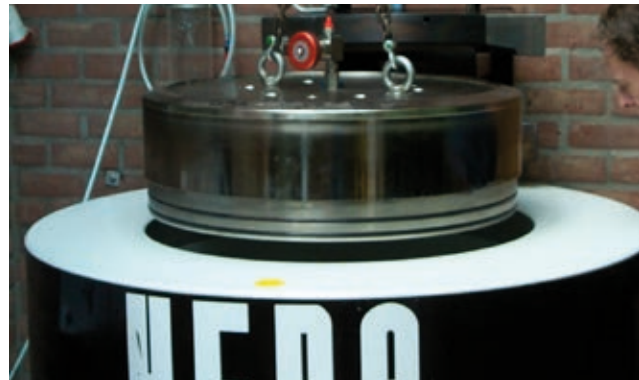
Relying on a 40 years track-record in deep sea technology the Deep Sea Centre manages to supply effective, innovative and robust solutions for the deep sea community.

## We can support you with:

- Sea operations support
- Instrument development
- Pressure testing up to 700 bar
- Equipment rental
- Ocean going research vessels
- Sea trials and measurements
- Specialized mobile laboratories

## Well-equipped workshops:

- Deep Sea Electronics
- Deep Sea Instrumentation
- Deep Sea Mechanical



## Example: Internal Waves

Internal Waves as Solitons are experienced more and more, and affect deep offshore operations. Royal NIOZ develops unique tools to make these phenomena visible and to quantify their impact on offshore structures.



[www.deepseacentre.nl](http://www.deepseacentre.nl)



NIOZ Royal Netherlands Institute for Sea Research is an institute of the Netherlands Organization for Scientific Research (NWO).

**NIOZ**  
Landsdiep 4  
1797 SZ 't Horntje, Texel  
The Netherlands

PO Box 59  
1790 AB Den Burg  
Texel  
The Netherlands

T +31 (0)222 369 300

[www.nioz.nl](http://www.nioz.nl)



The Netherlands Deep Sea Science & Technology Centre has been established within Royal NIOZ to bring together researchers from various disciplines and technical departments to respond to issues related to mining and oil & gas exploration in deep sea environments. The centre has knowledge of potentially threatened ecosystems, physical and chemical conditions at great depths, deep sea and sea floor microbiology, geology and biogeochemistry.

Prof. Gert-Jan Reichart  
Chief Scientist  
[gert-jan.reichart@nioz.nl](mailto:gert-jan.reichart@nioz.nl)  
T +31 (0)222 369 397



Ir Marck Smit  
Chief Engineer  
[marck.smit@nioz.nl](mailto:marck.smit@nioz.nl)  
T +31 (0)222 369 308



**Hydrografische en  
oceanografische  
systemen**

  
**nautikaris**  
[www.nautikaris.com](http://www.nautikaris.com)



*Signature Series*  
-Revolutionizing current and  
wave measurements



CURRENT AND WAVE MEASUREMENTS IN THE OCEAN, LAKE AND LABORATORY  
[www.nortek-as.com](http://www.nortek-as.com)



**MTI Holland BV**  
**Dredging, Mining and Offshore  
Technology Development Center**



- Sustainable Marine Operations
- Workability & Safety

- Soil Equipment Interaction
- MTI Dredging Consultants

- Training Institute for Dredging
- Mining Advisory Services

[www.mtiholland.com](http://www.mtiholland.com)