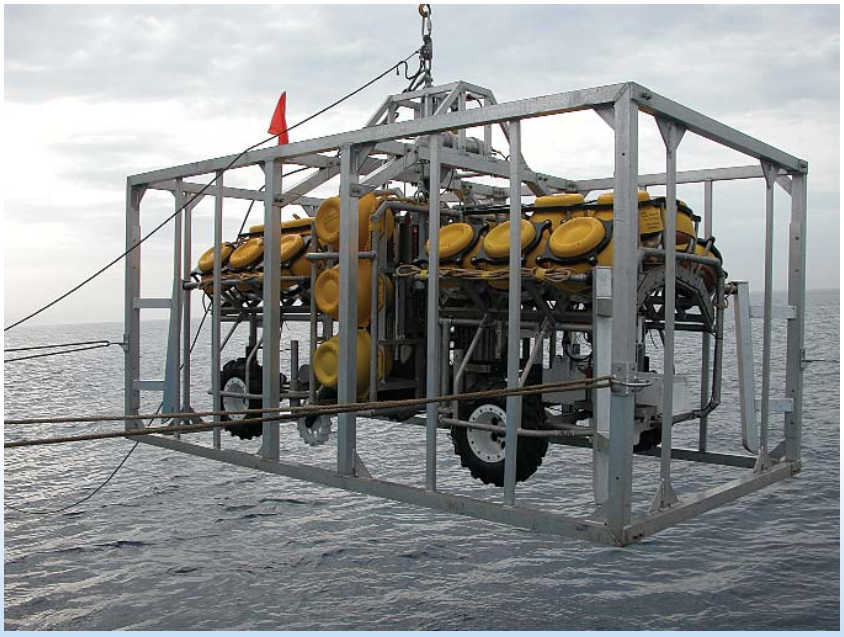
MOVE!'S IN DEPTH TESTING

D.J. Buijsman, J. van Heerwaarden, M. Laan, P. van Kralingen and E. Epping*

MOVE!, a new mobile platform for benthic research, has been tested at ~500 m water depth during an autumn cruise to the Gulf of Cadiz. Over the past 5 years, NIOZ has designed and constructed the core vehicle, the payload, several sensors, the video observation units, the video guarded deployment frame, and the local intelligence. Recently, the mission software for end-users has been finalised by NIOZ, allowing us for the first time to test the complete autonomous concept vehicle in 'deep' environments. The sediment in the testing area is classified as clay-silt, with an extremely soft and fluffy toplayer, and appeared quite a challenge for this mobile platform.

Growing scientific interest in spatial and temporal variability in benthic processes and the necessity for in situ observations urged us to extend current approaches and techniques with a mobile platform. A mobile platform would allow measurements and experiments distant from the area of landing-impact, a major drawback of static landers in current biogeochemical studies. The ability to visit multiple stations during a single mission would improve the spatial coverage of benthic processes within a limited area. In addition, long term deployments would enhance temporal coverage of observations, thereby overcoming the general snapshot character of short-term lander deployments. Thus, a vehicle was conceived that can function at a water depth of 6000 m, that has a moving range of over 1 kilometer, and that is able to cover 30 stations during a mission of up to 9 months in duration. Its modular design enables various end-users to hook up their payload modules if correctly interfaced, and renders MOVE! a highly versatile mobile platform. Being tested in previous years in shallow environments only, this deep test should demonstrate its applicability to 'deep' environments.

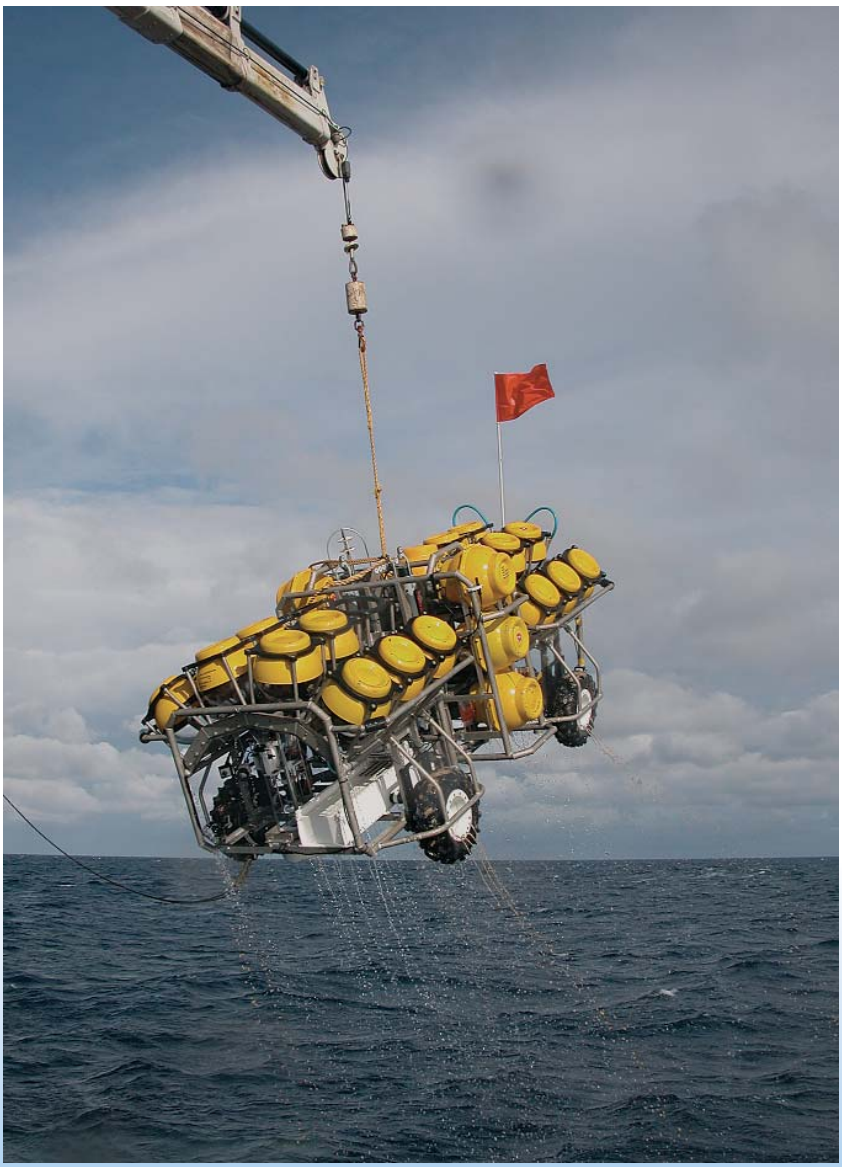
A new scenario had been designed to deploy MOVE! alongside the ship, whereas earlier deployments were made from the rear. This new strategy allows MOVE! to be deployed with a minimum of effort in a very controlled way; safe and fast, even at moderate windspeed (5-6 Bft). MOVE! was deployed from a cage under video guidance at four different positions, located on the summit of a mud volcano, as well as in the valleys between the mounds. Shots from the cage video unit repeatedly showed MOVE! to be



MOVE! is lowered to the sea floor while suspended within a deployment frame to avoid damage during touch down. The lowering and subsequent release from the frame is monitored via real-time video.

Corresponding author: epping@nioz.nl

MOVE! is back to the surface, having released 450 kg of ballast after the mission at the sea floor.



MOVE! is lifted on board to be serviced and prepared for the next mission.

positioned extremely gently on the sea floor and a flawless retrieval of the deployment cage.

The first deployment was most elucidatory, as it demonstrated a serious electrical short cut. The diagnosis of events after the mission showed that the program was reset shortly after initiation at the sea floor. Closer inspection revealed that the battery packs were completely emptied, that the titanium containers for electronics were seriously corroded, and a potential of 25 V between various subunits of MOVE!; all indicative of an electrical short cut, which could ultimately be traced to 2 malfunctioning Birns connectors.

During subsequent deployments, the program was executed perfectly which allowed the testing of a benthic chamber unit, and of mobility subroutines to fine-tune the decision-criteria for the local intelligence. The benthic chamber module has a storage capacity of 150 water samples, sufficient for some 30 chamber incubations to study the exchange of solutes between the sediment and water column. After some minor shipboard modifications, this unit performed excellently and can be considered ready for use. The mobility performance of the vehicle on these extremely fluffy sediments, however, is still unsatisfactory. A video reconstruction showed that MOVE! ran for a few meters only, gradually burying itself too deep into the sediment to proceed. Preliminary suggestions to counter this problem for extremely soft sediments would simply be a reduction in drop weight (now 50 kg/wheel pressure) or an increase in wheel-sediment contact surface area. This will be a major issue for the next test cruise.