

# Nautical depth port of Delfzijl

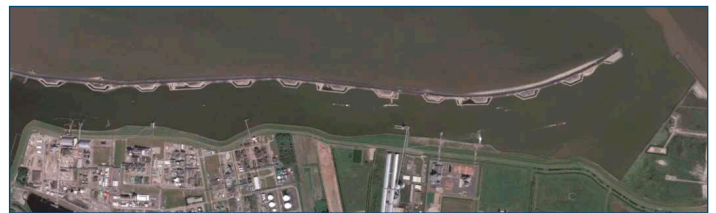
## Case study

*In the 4 km long entrance channel of the port of Delfzijl a muddy sediment layer (fluid mud) of several meters thick restricts the nautical accesibility of the port.*

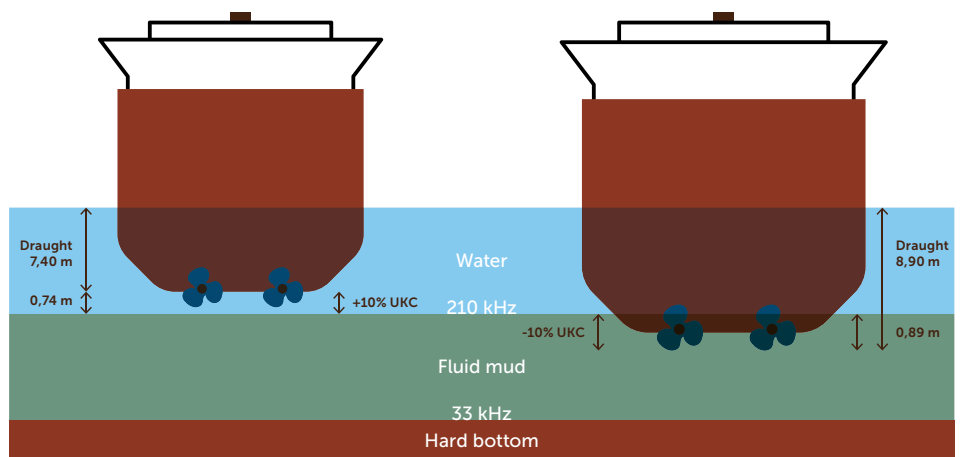
### Sustainable Port Management

Wiertsema & Partners together with Flanders Hydraulics Research investigated for Groningen Seaports the influence on the manoeuvrability of a vessel when sailing with a small and negative under keel clearance in the port of Delfzijl by performing a full scale field test.

A performed simulator study (2012) showed that manoeuvring at smaller under keel clearances with respect to the high frequency echo sounding than currently accepted (-10%) is possible in the port of Delfzijl. A first full scale field test with 14% under keel clearance was performed in 2013 to validate the conclusions of the simulator study. A second full scale field test was performed in May of 2015 to verify the manoeuvrability at negative under keel clearances in fluid mud.



### Increase in nautical depth



1



SEMASO B.V. is a sister company of Wiertsema & Partners B.V. and Marine Sampling Holland B.V.



#### Contact

Feithspark 6  
Tolbert, The Netherlands

6 Queen's Drive  
Taunton, United Kingdom

E [info@semaso.com](mailto:info@semaso.com)  
W [www.semaso.com](http://www.semaso.com)



# Nautical depth port of Delfzijl

## Case study



### Sediment in-situ characterization methods

Several surveys (210 kHz) and in situ measurements were performed to characterize the sediment layer before, during and after the field trial. The in-situ density profiles were measured with the SoniDens at different locations. The device uses ultrasound to determine the density of the sediment. For validation of the in-situ density measurements and further characterization of the sediment, samples were taken using a recently inhouse developed Sludge Sampler. The rheological tests were performed in our laboratory.

### Results

Summarizing it can be stated that based on the trial runs an UKC between 0% and roughly +14% (up to 20%) has a significant influence on the vessel's behaviour. It should be noted that the current minimum operational UKC of +10% is already in the unfavourable range. Based on the trial runs, no reduced manoeuvrability is expected for an UKC less than +10% to penetration in to the sediment up to an UKC of -5%.

### Implementation

Since the 1st of May 2016 Groningen Seaports has implemented a new policy related to maximum draft in the outer harbour of Delfzijl. After extensive simulations and full scale field tests in the harbour, it has been established that under certain conditions it is safe to navigate above and even in the fluid mud layer with negative under keel clearance (UKC). This increases the present nautical accesibility of the port.

### Publication

Barth, R.; van der Made, C.; Bourgonjen, L.; van Dijken, J.; Vantorre, M.; Verwilligen, J. (2016). Manoeuvring with negative underkeel clearance – 2nd full scale field test in the port of Delfzijl. 4th International Conference on Ship Manoeuvring in Shallow and Confined Water (MASHCON), Hamburg.



#### Contact

Feithspark 6  
Tolbert, The Netherlands

6 Queen's Drive  
Taunton, United Kingdom

E [info@semaso.com](mailto:info@semaso.com)  
W [www.semaso.com](http://www.semaso.com)