

# FUGRO SEADEVIL®

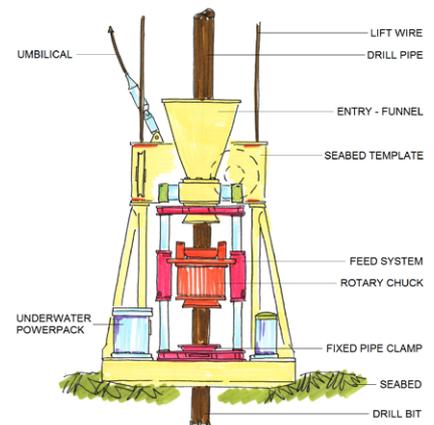
**The SEADEVIL® is a seabed-located, geotechnical sampling tool that improves data quality when drilling soft and/or highly variable formations. It is an ideal solution for reducing the duration of projects that require multiple site investigation methods, such as drilling, direct push intervention and free fall intrusion.**

The SEADEVIL® - named after a deepwater fish with large jaws - is a hybrid system that, by combining both vessel-based and seafloor drilling, delivers the best of both worlds. It provides a vertical control system (VCS) at seabed to control seafloor penetration independent of vessel heave.

## APPLICATION

The VCS manages the descent of the drill string without being influenced by vessel movement above. This delivers improved control of rate of penetration and hence the weight on bit. The result is a higher quality borehole, which is important when sampling and testing in soft or highly variable soils.

The VCS enables operations that are dependent on penetration rate or bit weight to be controlled at the seabed and at any depth below it. Changeover between drilling- and non-drilling mode (seafloor push) can be carried out at sea, with minimal reconfiguration of the seabed template and no requirement for heavy lifts. The seafloor template has a footprint of just 3 x 3 metres, allowing it to fit through smaller moonpools at midship. Deployment here provides an extended, safe weather window compared to those from the aft deck or overside.



*Current operational system.*

## EQUIPMENT DETAILS

The VCS is contained within a protective seabed template. Inside this is a feed system containing a rotary chuck, which lowers and raises the drill pipe or PCPT string in a controlled manner. The pipe clamp secures the drill string during testing and, by the use of inserts in the chuck; the clamping range can be reduced to smaller sizes for clamping PCPT string or sample tubes.

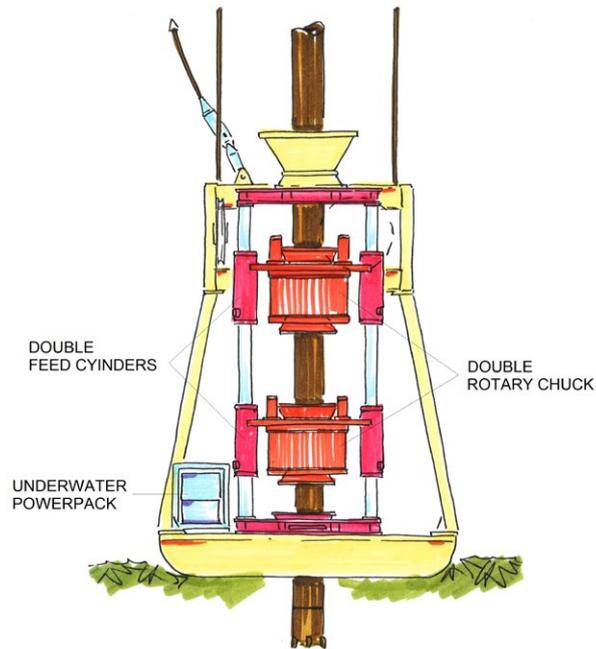
The twin line tensioned lift cables between the vessel and the seafloor template allow deployment and alternating of single drive tools as long samplers and CPT strings.

Real-time observation of operations, including touchdown at seafloor, is possible by means of two cameras mounted on the seafloor template.

The VCS is controlled by the driller at deck using a combination of a touchscreen and control buttons. An array of diagnostic sensors is integrated in the system to provide the driller and the engineers information on the operational status of the machinery.

**The VCS brings better sample quality, efficiency and safer operations:**

1. Combines the benefits of vessel-based drilling and seafloor drilling, particularly:
  - a. Maximum depth below seafloor is comparable to conventional vessel drilling, i.e. >250 m in highly variable soils
  - b. Borehole stability is comparable to conventional vessel drilling due to mud supply and control from the vessel.
  - c. Drilling capabilities exceed conventional vessel drilling in shallow water for difficult ground conditions requiring high weight on bit (WOB)
  - d. Full suite of seabed investigation tools for vessel drilling can be deployed, including borehole geophysical logging and pressure coring
  - e. Deepwater efficiency for geotechnical testing and sampling is comparable to seafloor-based drilling
  - f. Depth control and soil disturbance is similar to seafloor-based drilling and to hard-tie systems or active heave compensation systems on conventional vessel drilling
2. Allows changeover on location at sea between drilling mode and non-drilling mode (e.g. single-stroke cone penetration testing and sampling etc.) operations, within about 5 hours.



*Future system.*

**TEST PROCEDURE**

Drilling procedures are similar to the standard Fugro procedures.

At the start of a borehole the drill string is lowered until the bit lands on the closed pipe clamp. Then the drill string is clamped by the chuck and the string is lowered by the feed system through the opened pipe clamp.

This approach allows accurate determination of seafloor or bottom of the borehole. After drilling and performing an in situ test the SEADEVIL® will lift the drill string, including the downhole tool,

repeating the process with every test/sample sequence.

SEADEVIL® operations in non-drilling mode are similar to drilling mode. The chuck and feed system are used to push CPT rods or a sampler into the soil at a constant speed. The current system has a stationary pipe clamp and single rotary chuck (unpowered in rotation) allowing discontinuous 1 m vertical feeds. A future double-rotary chuck system will have continuous intrusive capability and will also be powered in rotation at seabed.

**Technical specifications of current system**

Maximum water depth	3,000 m
Dimensions (SBF including UGF, h x w x d)	5,1 x 3 x 3 m
Mass (underwater)	14 ton (additional ballast of 2 x 2.8 ton)
Capacity	200 kN @ 2 cm/s and 100 kN @ 8 cm/s
Clamping range	125 – 220 mm
Clamping in seabed push mode (depends on inserts)	36 mm
Maximum opening clamp	250 mm
Maximum stroke	1 m
Maximum rotating speed of drill string	300 rpm
Feed rate	0 - 8 cm/s
Duration mode change	4-5 hours
Additional devices	2 x underwater cameras
Remarks	Specifications subject to change without notice