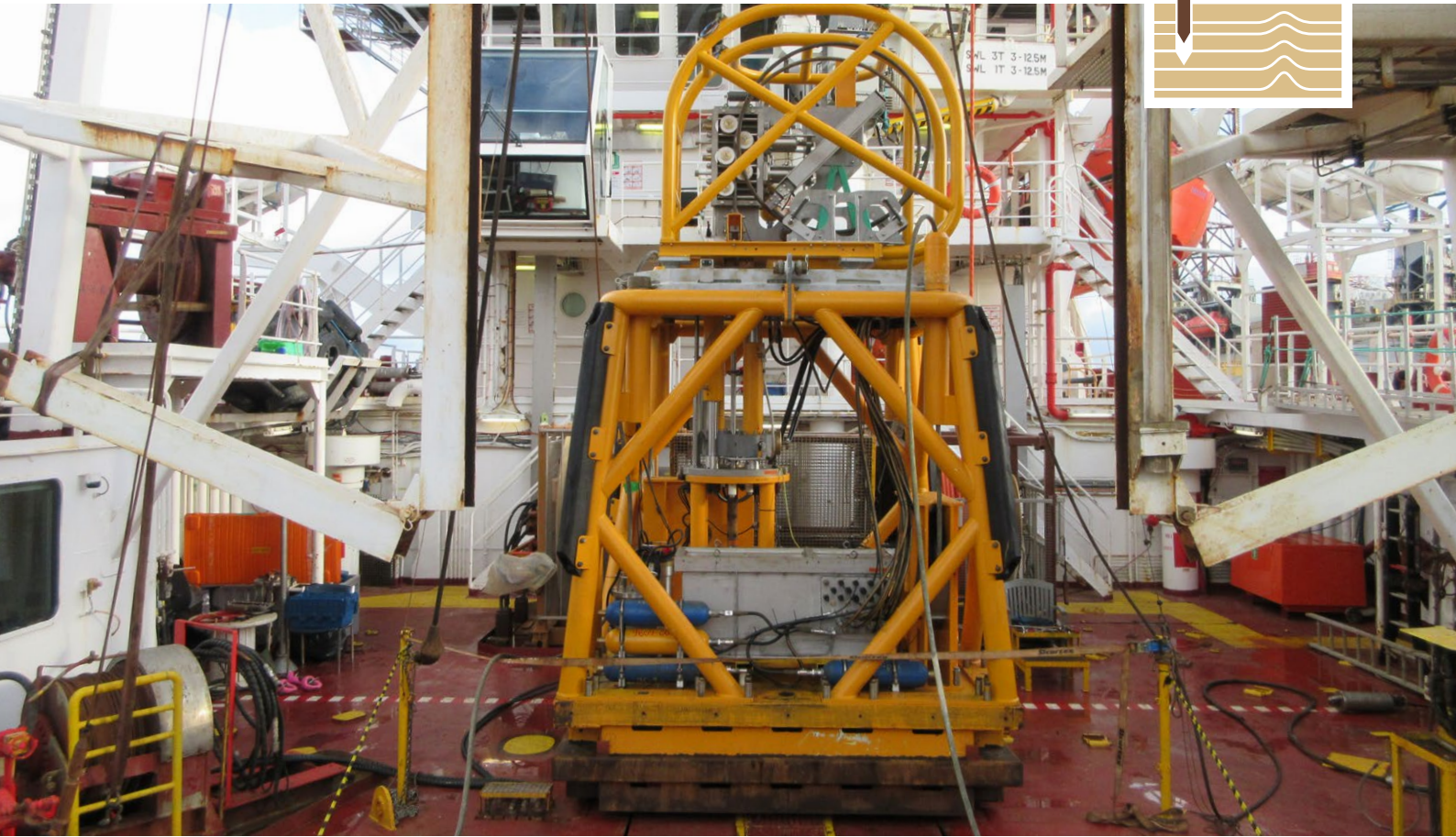




FUGRO SEACALF® MKIV – CONTINUOUS DRIVE

The Fugro SEACALF® MkIV is a novel seabed deployed Cone Penetration Test (CPT) system, employing a coiled push rod and a compact continuous thrust machine.

COMPACT AND EFFICIENT CPT SYSTEM

By using a novel combination of techniques, the new SEACALF® MkIV provides higher efficiency, a smaller system to handle and improved reliability compared to conventional seabed CPT systems.

The new continuous drive system (CDS) has been developed to improve reliability, to ease handling and to reduce build- and maintenance costs. Special clamping blocks improve the force transmission to the rod, resulting in an efficient system with a push- and pull capacity of 200kN and a very constant penetration rate, resulting in higher quality of CPT data. The drive system consists of simple components,

making it a reliable system that is small in volume and easy to maintain.

Traditional seabed CPT systems of this order typically employ manually assembled 1m push rods. The SEACALF® MkIV can employ such a conventional rod but can also be equipped with a coiled push rod. The coiled rod allows for compact storing and safe handling and can, thanks to an advanced straitening- and recoiling device, be coiled and stored inside a small frame.

The use of a coiled rod eliminates the need for manual rod handling, it creates a safer work environment and enables a significant reduction in deployment time.

MAIN BENEFITS

- **Constant penetration rate**
Constant penetration rate of 20 mm/s independent from required thrust.
- **High CPT data quality**
No negative effect on CPT data caused by varying penetration rates.
- **Compact storing and safe handling**
- **Improved safety, reduced deployment time**
No more manual rod handling, making the system safer to service and easier to deploy.
- **Longer lifetime, less maintenance**
The system consist of simple components making it easy to maintain. Due to the improved force transmission, the rods, either coiled or built from conventional 1m sections, will be longer operational. Coiled rods can easily been replaced.

SEACALF® MKIV- CONTINUOUS DRIVE

TECHNICAL SPECIFICATIONS

General

Weight submerged	max 260 kN
Height	5.5 m
Footprint	3 x 3 m
Rated water depth	3000 m
Push capacity	0 – 200 kN
Pull capacity	0 – 200 kN
Penetration length	0 – 55 m
Penetration rate	20 mm/s

Sensors

Communication	Fibre Optic
Seabed System Sensors	Roll and Pitch
Thrust Machine Sensors	Thrust, displacement, velocity
System Diagnostics	Various pressure and displacement sensors

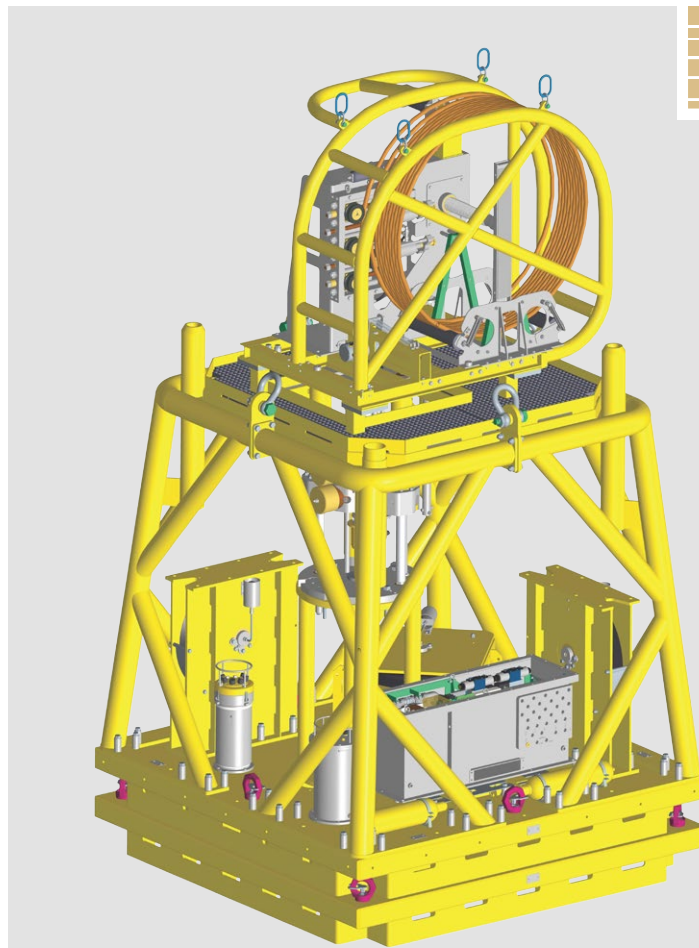
Sensors and communication

Piezo-cone penetrometer 10 cm ² , 15 cm ²	Cone resistance, Sleeve friction, Pore pressure
Electrical Conductivity cone	Electrical conductivity (S/m)
Temperature Cone	Temperature (°C)
Seismic Cone	Shear wave velocity (m/s)
Natural Gamma cone	Natural gamma ray (CPS)
Magnetometer cone	Magnet flux density, magnetic field horizontal and vertical angle (T, °)
Piezo-probe	Pore pressure (MPa)
Vane Shear Test	Torsional moment, calculated undrained shear strength

COMPONENTS

The Fugro SEACALF® MkIV system comprises the following components:

Push rod - Thick-walled cylindrical tube, used for advancing the penetrometer to the required test depth. Coiled during transport and storing, straightened by mechanical device upon CPT testing. Or, also possible, built from conventional 1m sections.



SEACALF® MkIV System equipped with the coiler unit

Piezo-cone penetrometer (CPTU or PCPT) - Cylindrical terminal body mounted on the lower end of the push rod, including a cone, a friction sleeve, a filter and internal sensing devices for the measurement of cone resistance, sleeve friction, pressure and inclination. By default, a standard 10 cm² piezo-cone penetrometer is employed, but other penetrometer sizes can also be used (e.g. 5 cm² or 15 cm² piezo-cone penetrometers)

Continuous Drive System - Machine providing thrust to the push rods so that the required constant rate of penetration is controlled. The thrust machine provides a nominal force of 200 kN. Nominal penetration and retraction rate is 20 mm/s. Cyclic testing is also possible.

Deployment frame - Frame for mounting and handling, providing reaction weight for the thrust machine. Weight and size of the frame may be adjusted to suit expected soil conditions, vessel and handling options.

Data acquisition and control system - Apparatus and software, including sensors, data transmission apparatus, recording apparatus and data processing apparatus.

FUTURE DEVELOPMENTS

Sea trials were successful and indicated that the requirements set in the original design philosophy are met. The SEACALF® MkIV system proved to be efficient and robust, providing similar or better performance compared to existing systems.

The current design of the SEACALF® MkIV mainly focusses on servicing the offshore wind industry and traditional oil and gas industry, but the concept offers many opportunities for a wide range of applications.