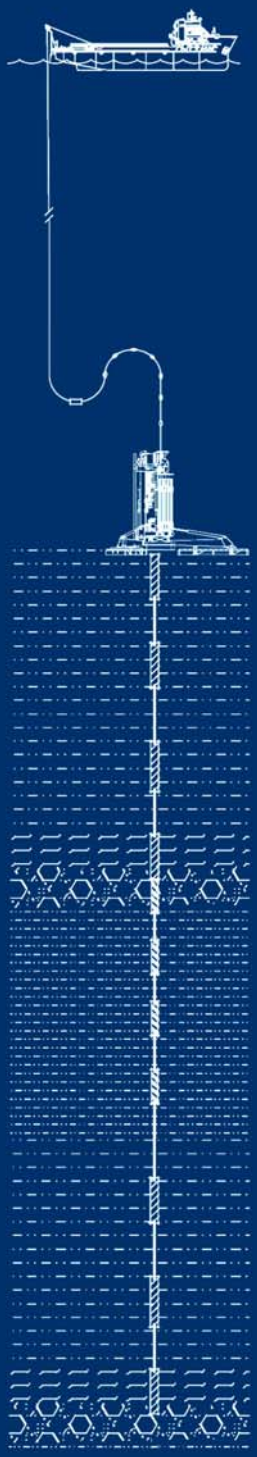
BENTHIC GEOTECH



PROD Technology

PROD, the Portable Remotely Operated Drill is a fully self contained, remotely operated sea floor drilling system. PROD operates on the seabed and is powered and controlled from a support vessel via an umbilical. Benthic Geotech is currently operating two systems: PROD1 and the next generation drilling system PROD2 & PROD3.

In the same hole, PROD can switch between rotary coring, piston coring and in situ testing at the dictate of the seabed geology or the clients' data requirements.

Once PROD has landed on the seabed, the drill is completely isolated from vessel movements. PROD provides sample and data quality that is superior to ship-mounted systems that rely on heave compensation. In addition, PROD's capacity to drill provides a superior dataset to single stroke, seabed frames that often fail to exceed 20m penetration, particularly where hard obstructions are encountered.

Two rotary magazines hold PROD's sampling barrels, in situ test tools, rods and casing. Depending on tool size, the magazines carry up to 260m of tools, enabling a penetration capability of up to 100m. Tools are delivered between the drill head and the magazines via a pair of hydraulically actuated manipulators. All drill related operations are hydraulically powered. Sample barrels containing core are returned to the magazines after each run and unloaded once PROD is retrieved to the ship.

Drill attitude is monitored and corrected during seabed operations to ensure PROD remains vertical. Via remote monitoring of PROD's height relative to the seabed, a borehole depth accuracy of better than 25mm is typically achieved.

Ancillary features include pan and tilt cameras for visual inspection of all drill operations; an altimeter, compass; tilt sensors and thrusters for position and heading control during landing, recovery or repositioning. All drill operations and performance criteria are monitored and stored in real time.

Portable

PROD drill modules fit into a standard open-top 20' shipping container. Modified

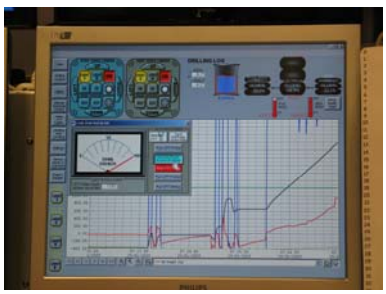
containers provide control, power management, and geotechnical laboratory and workshop facilities.

Unloading of the containers and installation on the vessel is undertaken by PROD operating crew and takes 3 – 4 days from arrival dockside.

PROD's portability enables cost-effective mobilisation utilising local vessels of opportunity or vessels already chartered to our clients.

Remotely Operated

PROD's functions are controlled by an operator on the ship via computers. Drilling



Document Number 5329 Rev7
Issue date: 15 September 2009

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actions such as advancing casing, make up of drill string, wash boring, rotary drilling, piston coring and in situ testing are precisely controlled using a combination of direct operator instruction and tried and tested proprietary software automation. Computer screens present all drilling parameters in real time, including bit weight, rotation speed, torque, elevator position, penetration rate, water pressure and flow rate, and current hole depth. Clients are provided with a digital log of drilling parameters which, once the geotechnical characteristics have been established, can be used as a supplementary tool for defining changes in seabed strata.

Drill

PROD1 incorporates a 100HP drilling unit and PROD2 & PROD3 incorporate 130HP drilling units. These are of sufficient power to handle all down-hole tools. The ability to switch between rotary drilling and in situ testing at operator instruction enables precise definition of the strength and extent of hard and soft seabed layers. This is not possible with single stroke seabed push frames.

Rotary Coring

Coring of rock and strong sediments is undertaken using Benthic Geotech's proprietary Thin Kerf rotary core barrels. Coring runs are 2.7m in length. PROD1 recovers core of 44mm and PROD2 & PROD3 recovers 72mm dia. core. Each barrel is fitted with its own drill bit that is used only once downhole. This ensures minimal disruption in the event of a blocked drill bit during borehole progression.

Sediment Sampling

Sediment sampling is performed using Benthic's patented Hydraulic Tether Piston Core barrels. Sampling can be undertaken at

any depth within the borehole. The piston coring mechanism eases the flow of sample into the barrel. This, combined with careful design of cutting shoe geometry, controlled penetration of the barrel and precise borehole depth measurements, ensures samples and data of the highest quality.

During controlled sampling, the cessation of soil flow into the barrel is detected by pressure changes, immediately arresting penetration to avoid excessive stress on the samples.

A proprietary iris-style catcher is used to retain the complete soil sample during withdrawal from the hole and storage on PROD. All recovered core is retained in transparent plastic liners, which are end capped, sealed with tape and stored in vibration proof core boxes onboard the vessel.

Casing & Drilling Mud

PROD carries 40m of casing for each deployment, which can be installed to stabilise the borehole.

Clearance of borehole debris is assisted via the injection of polymer mud concentrate, as and when required.

In Situ Testing

Multiple in situ testing tools are carried during a single deployment of PROD to the seabed.

PROD deploys industry standard 10cm^2 Piezocone Penetrometers (PCPT). PCPT tools measure & transmit tip pressure, sleeve friction and water pressure data in real time.

In very soft to firm, fine grained soils, PROD deploys a Ball Penetrometer (BPT) to accurately define the strength of very soft seabeds. The BPT offers the additional benefits of cyclic sounding to measure the cyclic resilience of fine grained soils, combined with pore water pressure measurement.

Additionally, PROD is equipped with proprietary downhole vane, Seismic PCPT and patented Hydrocarbon Analysis System, enabling real time monitoring of hydrocarbons while drilling.

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PROD1 Key Specifications

Height	5.8m
Deck footprint (vertical, legs raised)	2.3 m x 2.3 m
Weight in air	Nominal 11 tonnes
Weight in water	Nominal 8.5 tonnes
Maximum operating water depth	2,000m
Maximum sampling penetration depth	125m
Maximum casing depth	40m
Drill tool size	B
Piston Core Barrels	
Core diameter	44mm
Core length	2.75m /barrel
Rotary Diamond Core barrels	
Sample diameter	44mm
Run length	2.70m /barrel
Maximum push thrust	6+ tonnes
Rotary coring power	100 hp
In Situ Testing	
Data transmission	12 bit, wireless, acoustic transmission via drill string via optical fibre to vessel
Tools penetration capability	Penetration to 100m below seabed
PCPT diameter x length	36mm x 2m, followed by drill rods
BPT diameter x length	60mm diameter steel sphere attached to a 200mm long x 20mm diameter push rod
Downhole Vane	100mm x 50mm cruciform, 200 kPa soil
Downhole Seismic CPT	2 x triaxial geophones. 2 x 100 joule hammer seismic source. 290mV/in/sec sensitivity
Hydrocarbon Analysis System	Methane sensitivity 300nmol/l to 1mmol/l

PROD drilling, sampling and subsea technologies and methods are protected by international patents, patents pending and patent applications.

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BENTHIC GEOTECH

PROD2 & PROD3 Key Specifications

Height	5.8m
Deck footprint (vertical, legs raised)	2.4m x 2.4m
Weight in air	Nominal 14 tonnes
Weight in water	Nominal 10 tonnes
Maximum operating water depth	3,000m
Maximum sampling penetration depth	85m
Maximum casing depth	40m
Drill tool size	88mm
Piston Core Barrels	
Core diameter	75mm
Core length	2.75m /barrel
Rotary Diamond Core barrels	
Sample diameter	72mm
Core length	2.75m /barrel
Maximum push thrust	8+ tonnes
Rotary coring power	130 hp
In Situ Testing	
Data transmission	12 bit, wireless, acoustic transmission via drill string via optical fibre to vessel
Tool penetration capability	Penetration to 85m below seabed
PCPT diameter x length	36mm x 2m, followed by drill rods
BPT diameter x length	60mm diameter steel sphere attached to a 200mm long x 20mm diameter push rod
Downhole Vane	100mm x 50mm cruciform, 200 kPa soil
Downhole Seismic CPT	2 x triaxial geophones. 2 x 100 joule hammer seismic source. 290mV/in/sec sensitivity
Hydrocarbon Analysis System	Methane sensitivity 300nmol/l to 1mmol/l

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