DEEP KNOWLEDGE

CORE TECHNOLOGY // Free Fall Cone Penetrometer

ODIM FFCPT™

In situ geotechnical measurements

ODIM

more results with less effort

The ODIM FFCPT™ is an excellent tool for reconnaissance surveys to assist in the engineering design and analysis when used in conjunction with direct-pushed CPT or other direct sampling methods; it offers a rapid and reliable method for characterizing the seafloor sediment. It substantially increases the efficiency and cost-effectiveness of survey operations by allowing more data to be collected in less time.

The penetration record permits high resolution characterization of sediment layering and grain size and provides two independent means of evaluating undrained shear strength.

A sound velocity and pressure sensor is also included to measure water column speed of sound data. The collected data is analyzed using custom post-processing software, with the resulting interpretations being presented as depth-discretized profiles similar to a conventional piezocone penetrometer.

The FFCPT-660 has a water depth capability of 660m. Testing can be performed either on-station or from a vessel underway at speeds up to 6 knots using an ODIM Moving Vessel Profiler (ODIM MVP™). The ODIM MVP™ is a commercial winching/telemetry system for underway sound velocity profiling of the water column. Alternatively, the FFCPT can be deployed and recovered as a stand-alone instrument with a mechanical rope using a standard shipboard winch or capstan (in free-fall mode).

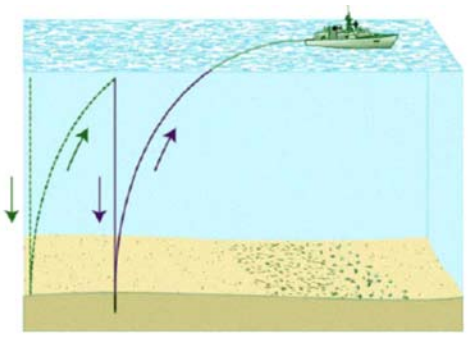
Deployment of the FFCPT from an ODIM MVP™ further improves the costly and time-consuming task of characterizing the seafloor sediment by providing continuous drops of the probe, allowing even more geotechnical data to be collected in a shorter amount of time. The MVP permits on-the-fly instrument configuration, real-time monitoring of the data stream and downloading of the 2 kHz impact data. The water column Sound Velocity profile can also be immediately acquired and displayed on the MVP control computer.

Real-time data collection and display. The ODIM FFCPT™ allows for real-time data collection and display though a simple yet sophisticated software interface.

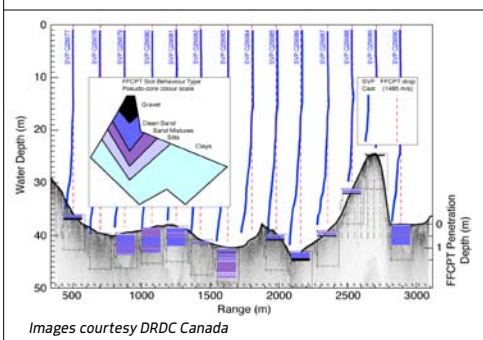
Seabed classification & ground truthing. The FFCPT provides "in-situ" measurements of the seafloor thus providing actual seabed characteristics. Because data can be collected in real-time the FFCPT can be used to ground truth multibeam and/or sidescan seabed classification technology.

Light weight and compatible. FFCPT deployments can be performed using the ODIM MVP™ technology or a variety of recovery winches / capstans, if the equipment permits free fall during deployment.

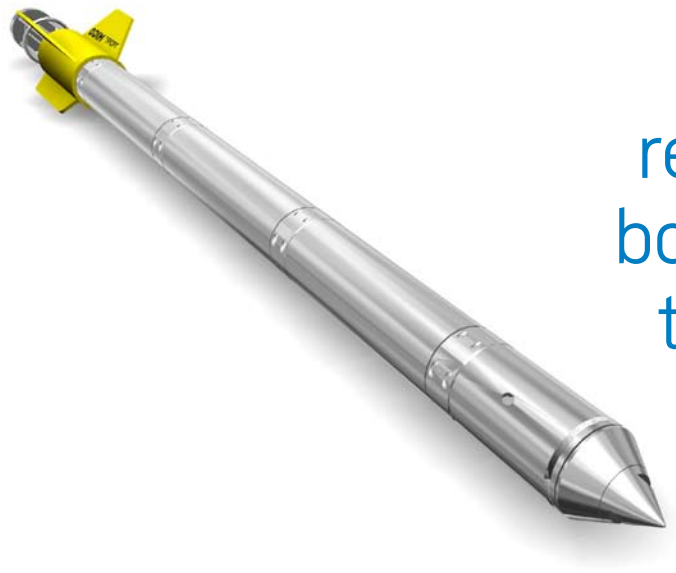
Various applications. The FFCPT can be used for geotechnical data collection on pipeline and cable route surveys, Naval Rapid Environmental Assessment surveys, hydrographic surveys (e.g. S-57 attribution), benthos mapping, dredging and other applications where seafloor sediment characteristics are required. When deployed with ODIM MVP™, FFCPT can be used to collect underway mid-water column data (SV&P / CTD).



Concept drawing showing FFCPT in use with MVP for Military Oceanography and seabed classification
Image courtesy DRDC Canada



Images courtesy DRDC Canada



A valuable, time-saving tool to reduce the number of bottom grabs required to distinguish various sediment types

FFCPT Sensor Specifications

The standard ODIM FFCPT™-660 carries the following sensors: three accelerometers, two pressure sensors, an optical (mudline) sensor and an SVP sensor. These sensors collect the data necessary to obtain estimates of the sediment composition, shear strength, presence of layering and other empirical parameters.

Accelerometers:

Three accelerometers (Nose Cone Module):

- LO-g: 5g range, used to measure deceleration in softer sediments (very soft silts and clays).
- Mid-g: 25g range, used to measure deceleration in harder sediments (hard clays).
- HI-g: 100g range, used to measure deceleration in very hard sediments with high penetration resistance (dense sands and gravel).

The three distinct ranges for deceleration measurement ensure a high resolution and reliability of data. The acceleration data is used in profiling the dynamic penetration resistance and undrained shear strength of the sediment. The accelerometer values presented are nominal values, which vary depending on the actual calibration of the instrument.

Pressure Sensors:

Two 1000 PSI pressure sensors:

- Hydrostatic pressure sensor located in the tail (Bail Module), used to measure hydrostatic pressure as the FFCPT free falls through the water column. Data from this sensor is used mainly for arming and triggering purposes.
- Pore pressure sensor, located in the Nose Cone Module, measures the dynamic pore pressure during penetration. This data facilitates sediment classification and evaluation of undrained shear strength. The calculation of undrained shear strength is only valid in fine-grained sediments (those which maintain undrained conditions).

Optical Mudline Sensor:

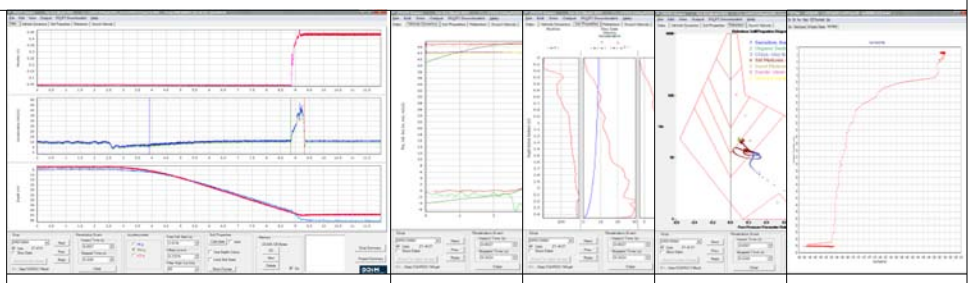
The optical mudline sensor, located in the Nose Cone Module, is used to confirm that penetration has occurred in softer sediments, i.e. fluid mud, where the deceleration can be insignificant. During impact, with a more resistant sediment such as gravel, it can be useful in confirming that little to no penetration has occurred.

Sound Velocity and Pressure Sensor (SVP):

The sound velocity and pressure sensor is an AML Oceanographic Sound Velocity and Pressure (SVP) Smart Sensor. The SVP sensor is housed in the Bail Module.

FfcptView

FfcptView processing software provides an interface which allows configuration of the instrument as well as uploading and downloading of data files. It also simplifies the process of viewing, analyzing and interpreting the data.



Data | Vehicle Dynamics | Soil Properties | Robertson Chart | Sound Velocity

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Photo courtesy DRDC Canada

Physical Characteristics	Diameter:	88mm (3.47")
	Length:	1943mm (76.5")
	Weight:	60kg (132lbs) in air 49.7kg (110lbs) in water
	Construction:	316 Stainless Steel
	Rated depth:	660m (2165ft)
Specifications	Data Sampling Rate:	2,000 Hz
	Data Capacity (self-logging):	up to 200 drops (battery life)
	Data Capacity (with MVP):	CompactFlash Card capacity
	Typical Penetration Depths:	3m (mud), 1m (silt), 0.25-0.5 (gravel & sand)

ODIM FFCPT™ is an economical and efficient means of conducting in situ geotechnical profiling of the seabed. It is a robust device designed to free-fall through the water column, impact the seabed and record acceleration and pore pressure data at a high sample rate (2 kHz).

Typical applications include geotechnical site investigation for cable and pipeline routes, sediment classification and acoustic ground-truthing, geo-environmental studies, military oceanography and route survey in support of naval applications.

Because the FFCPT is modular in nature, additional (optional) modules can be added to the probe to provide different instrument packages and seabed penetration characteristics.

Contact ODIM Brooke Ocean for more details.