

Uni-FlowX

Controlled Flow Excavation System



1 Introduction

The Controlled Flow Excavation system has been developed continuously over the last decade to produce the most robust, reliable and controllable seabed excavation system available today.

Controlled Flow Excavation System offers various advantages over other dredging techniques.

Benefits include:

- No physical contact with the seabed or seabed assets
- No need to dispose of spoil
- Real-time sonar imaging of the work site and progress
- Continuously variable power
- Utilisation from small, economic vessels
- Effective on a wide range of substrates, including sand, rock dump and clays.

Overview: Controlled Flow Excavation Equipment

2.1 Digger System

The Digger is a variable power, remotely operated, subsea tool, which excavates by a process known as “ Controlled Flow Excavation” (CFE).

A low pressure, high volume flow of water is generated by a propeller within the underwater unit and directed vertically downwards at the area to be excavated. When the water column meets the seabed, it breaks up the soil surface and raises it into suspension. The suspension is dispersed into the surrounding water and carried from the site according to the prevailing current or tide. In still water conditions dispersal is more local and berms are formed around the excavation.

A particular benefit of the CFE technique is that excavation is carried out without any physical contact with the seabed and therefore structures within the soil such as valves or pipes may be uncovered without any risk of damage. Typically, the tool is operated 3-5m above the seabed although this may be reduced in shallow water or to provide a more localized excavation. Another important

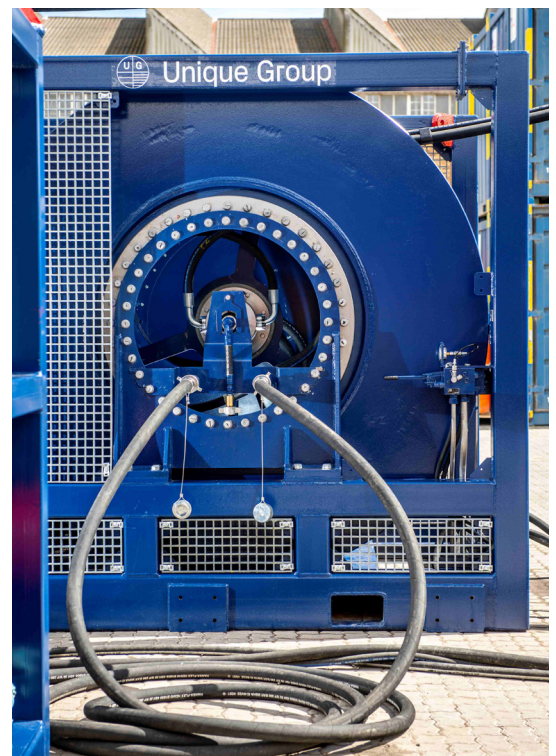
advantage of the technique is the ability to completely remove all the soil from around and within complex shapes.

Because of these attributes, the technique is now routinely used within the offshore industry for excavating live pipelines and damage-sensitive structures such as well heads and manifolds and in soils ranging from silt, sand and gravel to rock dump, drill cuttings and clays.

The Digger is a completely self-contained and integrated system and is designed specifically for installation and operation from vessels equipped with dynamic positioning or accurate mooring capabilities. The spread typically consists of an underwater excavation unit, deployment system, power pack, control cabin, survey and control instrumentation.

2.2 Operating Envelope

The Digger is aligned with the vessel by means of one or two guide wires (depending on tool configuration) and as such the system uses the positioning system of the vessel to maintain station. The main limiting factor for the tool is movement in the vertical plane. The maximum swell acceptable is 3m, provided that the vessel is capable of maintaining location. Useful work time is usually limited by the abilities of the vessel rather than the Digger.



2.3 The Digger

The Digger consists of a robust vertical tubular housing in which a heavy-duty propeller is mounted. The propeller is directly driven by a powerful, reliable hydraulic motor, which is powered from a deck-mounted hydraulic power unit. The propeller generates a broad, high volume, relatively low velocity water column that excavates the seabed material and disperses it laterally.

When the tool is moved over the seabed it forms a trench with a berm on either side. Raising and lowering the tool within its operational envelope (between 2 and 15 meters above the seabed) increases or decreases the area of the excavation.

The shape, depth and rate of excavation produced by the Digger depend on a combination of variables:

- Altitude of the tool above the seabed
- Excavation power
- Speed and direction of the tool over the work area
- Seabed material being excavated

Using the sonar image for reference the Digger operator is able to adjust these parameters to provide the required excavation profile.

2.4 Deployment System

The Digger is deployed from a purpose built over side handling system, which can be fitted to any vessel with sufficient deck space. The system requires 6m of vessel side free from obstruction if sea fastened directly to the deck. Alternatively, the system can be mounted on beams to clear vessel bulwarks. The Digger is deployed on a main lift wire with one or two independent one ton clump weights set 5m apart. The tool is fitted with outrigger arms, which slide on the guide wires. The purpose of the guide wires is to maintain the orientation of the tool with that of the vessel. This allows the Digger operator to have a reliable reference for the sonar display in relation to the work area. Once the Digger is deployed it mirrors the movement of the surface vessel very closely in all planes for most practical purposes.

2.5 Main Hydraulic Power Pack

The Digger is powered by a deck mounted hydraulic power pack. Power is infinitely variable and is directly controlled by the operator from the control cabin. Electric power packs are preferred for ease of maintenance, but diesel packs are available for those vessels where power is at a premium.

2.6 Jetting Sub Assembly (Optional)

Where hard ground is expected, the Digger may be fitted with a water jetting sub assembly which directs a 1 ½" jet of water at approximately 30 bar and up 6000 liters per minute directly at the seabed from the center of the Digger water column. Jetting is carried out simultaneously with Digger excavation and has proved most effective in firm to stiff clays encountered in the Gulf of Mexico. The motive power for the jet is provided from a deck mounted six-stage centrifugal pump powered by a 650 HP diesel engine.

2.7 Control Cabin

A control cabin will be provided to operate the Digger. The cabin is fitted with monitors which relay the sonar image, the Digger and pump remote control boxes are mounted on the operator's desk, which allows one man to vary excavation power instantly whilst referencing the seabed beneath the tool in real time on the sonar display.

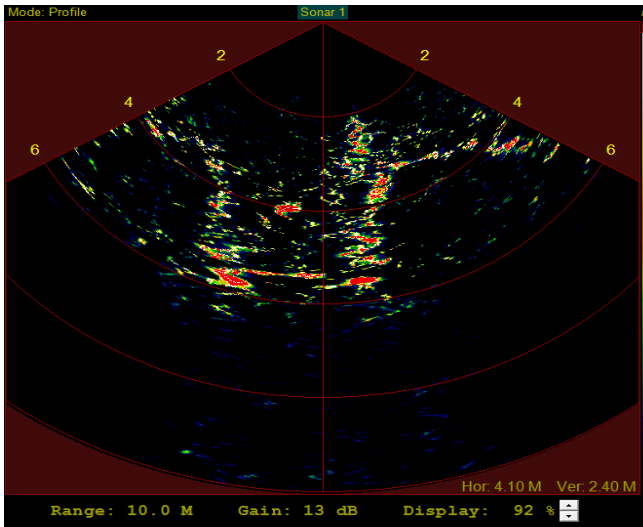
2.8 Survey and Control Equipment

The Digger is fitted with dual real-time sonar, which enables the operator to view the seabed beneath the tool in two planes, allowing the operator to visualize the seabed in three dimensions. The sonar allows the operator to work regardless of the amount of debris generated.

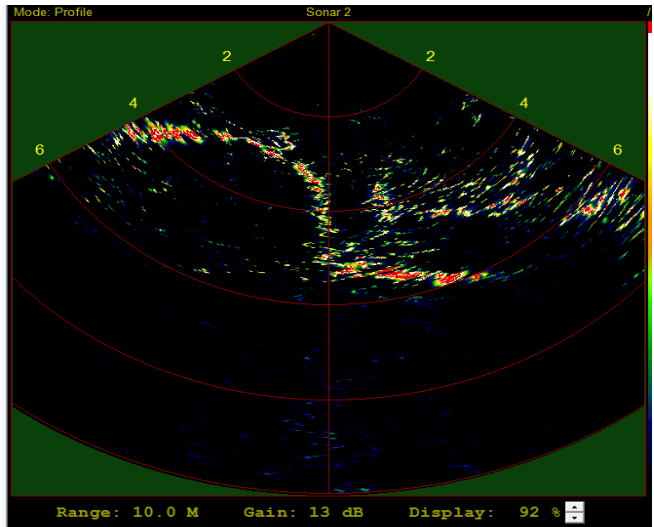
The sonar system used on the Digger is the Gemini NBI multibeam sonars. This system gives the same degree of visibility and control as previous systems but has a significant advantage.

The system is PC controlled from the control cabin allowing the data to be continuously recorded throughout the excavation process if

required. If necessary, the data collected can be post-processed to provide three-dimensional color renderings of the seabed.



Above is a cross section of 20" pipeline in a 2m trench



Above same pipeline on the longitude

Our tool is fitted with dual heads positioned 90 degrees to each other so we can see cross section and Longitude at same time as demonstrated above. The signals from these instruments are brought to the surface through an armored electrical umbilical and displayed on monitors in the control cabin.

3 Overall Application

- › Pipeline and cable trenching (Pre & Post)
- › Free-span corrections
- › Pipeline de-burial and exposure
- › Seabed leveling and preparation
- › Rock-dump dispersal
- › Sand-wave leveling
- › Salvage and decommissioning

Soil Types:

- › Sand and Gravel
- › Rock-Dump
- › Mud and Silt
- › Clays up to 50Kpa with the option of using jets for 50Kpa+
- › Drill Cuttings

Optional Jetting Capabilities:

Our Jetting attachment is an optional add-on to the described system above. It can be used along with any of the mentioned applications described above. The jetting system is generally used for sea bed conditions above 50Kpa shear strength.



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