Coastal Engineering Technical Note

THE REMOTELY OPERATED SEDIMENT CORING DEVICE (ROSCO)

PURPOSE: To describe a recent innovation for sampling of the nearshore zone during variable energy conditions.

BACKGROUND: To support numerical modeling of sediment transport and facilitate drafting of engineering design memoranda for shore restoration projects, it is necessary to understand the nature and distribution of sediments in the nearshore zone. Sediment sampling in the surf zone is traditionally accomplished using surface grab samplers or diver operated short core apparatus. Neither method permits sample retrieval during heavy wave or current conditions. The Remotely Operated Sediment Coring System (ROSCO) was designed and built in a joint effort by the Coastal Morphology Unit, Coastal Processes Branch and the Field Research Facility between January September 1985. The ROSCO (Fig. 1) was designed primarily for sediment

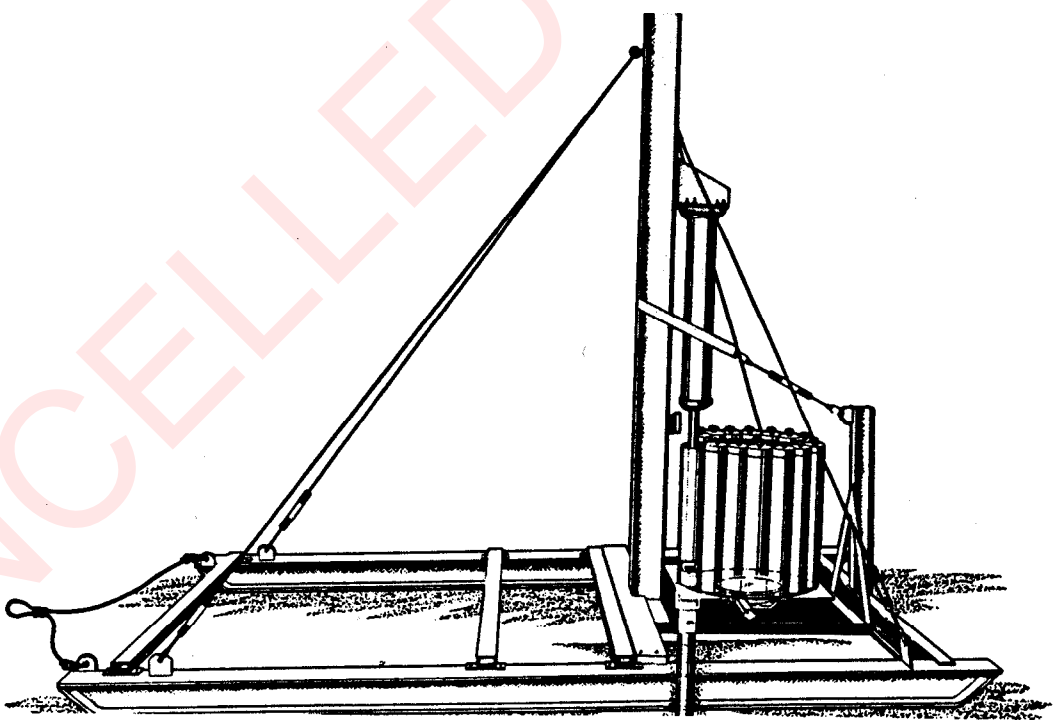

Figure 1. ROSCO mounted on a sea sled. The sled is approximately 4 m in length and 2 m wide. The sampler itself is approximately 1 m square and 3 m high.

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sampling of the nearshore zone in water depths up to 10 m but can also be utilized in other shallow water environments. The sample length on the prototype is 0.5 m.

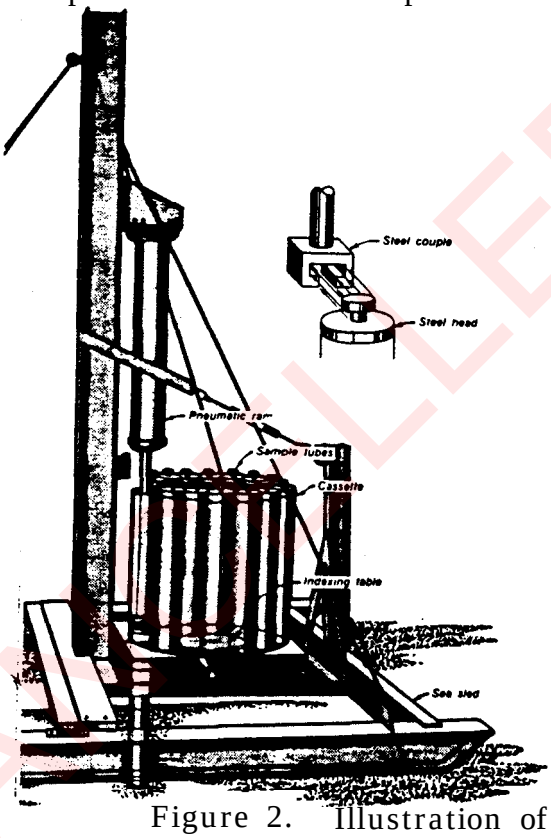
DESCRIPTION OF COMPONENTS:

1. Pneumatic Ram

The cores are individually emplaced and extracted by a 12.7 cm (5-in.) bore pneumatic ram yielding up to 4000 lbs of force at 150 psi (Fig. 2). A scuba bottle serves as the air source for powering the ram. The ram is fitted with a 5.1 cm (2-in.) steel shaft and has a 76.2 cm (30-in.) stroke length. A steel coupling fitted on the end of the shaft serves as the connection between the ram and the sample tubes (Fig. 2). Because of the weight and the extreme force exerted by the ram, a 15.2 cm (6-in.) steel I-beam is used to support the ram.

2. Indexing Table

A pneumatic indexing table is used to rotate and lock the cassette into position as each sample is taken (Fig. 3). The table is pre-set for 18



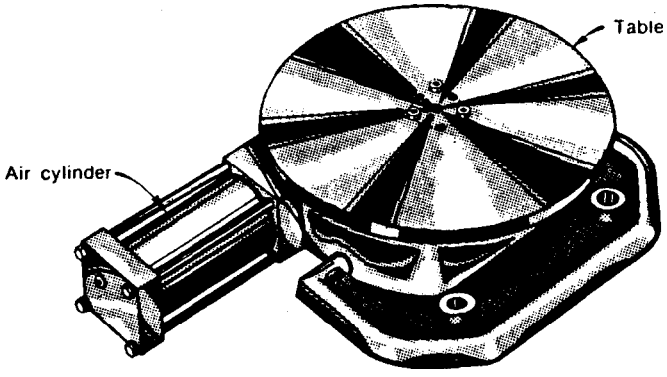


Figure 3. Pneumatic

Figure 2. Illustration of sampler components and a close up of the connection between the ram and the sample tube.

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positions corresponding to the number of tubes in the cassette. After a sample is taken with the ram, the indexing table is fired, rotating the cassette clockwise to align the next sample tube under the ram. The indexing table is rated for maximum working pressure of 80 psi and a maximum allowable load of 454 kilograms. Like the ram, it is powered with a scuba bottle.

3. Cassette

The cassette is used as 'a guide for the sample tubes and as protection for the samples against wave energy. The cassette is composed of 18 aluminum pipes 10cm (4-in. diameter) and two 0.6 cm (l/4-in.) aluminum plates; one welded at the top of the pipes and one at the bottom (Fig. 2). It is bolted onto the indexing table and guides the sample tubes in and out of position under the ram. The prototype cassette holds a maximum of 18 sample tubes. A plate of 1.2 cm (1/2-in.) nylon bolted to the base of the sampler provides a smooth surface on which the cassette turns.

4. Sample Tubes

The sample tubes are industry standard 7.6 cm (3-in.) stainless steel Shelby tubes. Figure 4 is a cross-section through a sample tube illustrating the components in their respective positions. Modifications to the tubes include a 0.3 cm (1/8-in.) steel ring welded to the inside at the bottom of the tubes to act as a stop for the core catcher. The core catcher is made of nylon and is used to prevent sample loss during and after sample recovery. A plastic liner placed inside the steel tubes from the top abuts the core catcher.. The plastic liners are withdrawn after a sampling run is completed and cut lengthwise to expose the sample. An aluminum ball valve is placed in the tubes and seated against the liner. The valve is used to create a vacuum in the sample tube during extrusion to increase sample recovery. Finally, a steel coupling is placed on top of the sample tube acting as the connection between the ram and the tubes. Future modifications will combine the ball valve and steel coupling to simplify sample tube preparation.

5. Control Elox

The control valves used for operation of the ROSCO are housed in a 46 Cm (18-in.) by 35 cm (14-in.) metal box. The box contains two single stage regulators with gauges for reading the pressure (one each for the ram and

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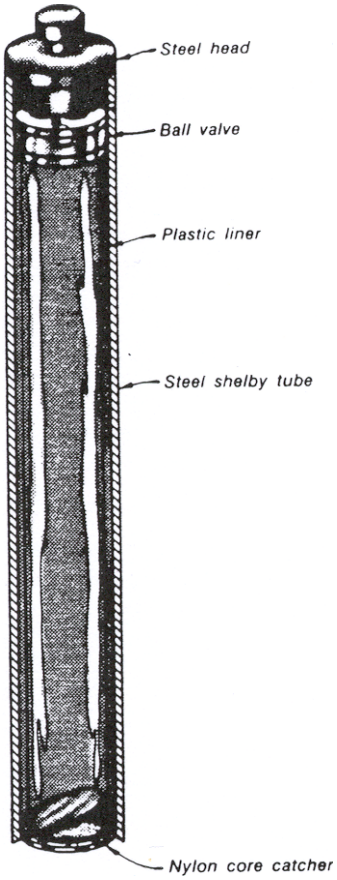

Figure 4. Cut-away of a sample tube depicting each component.

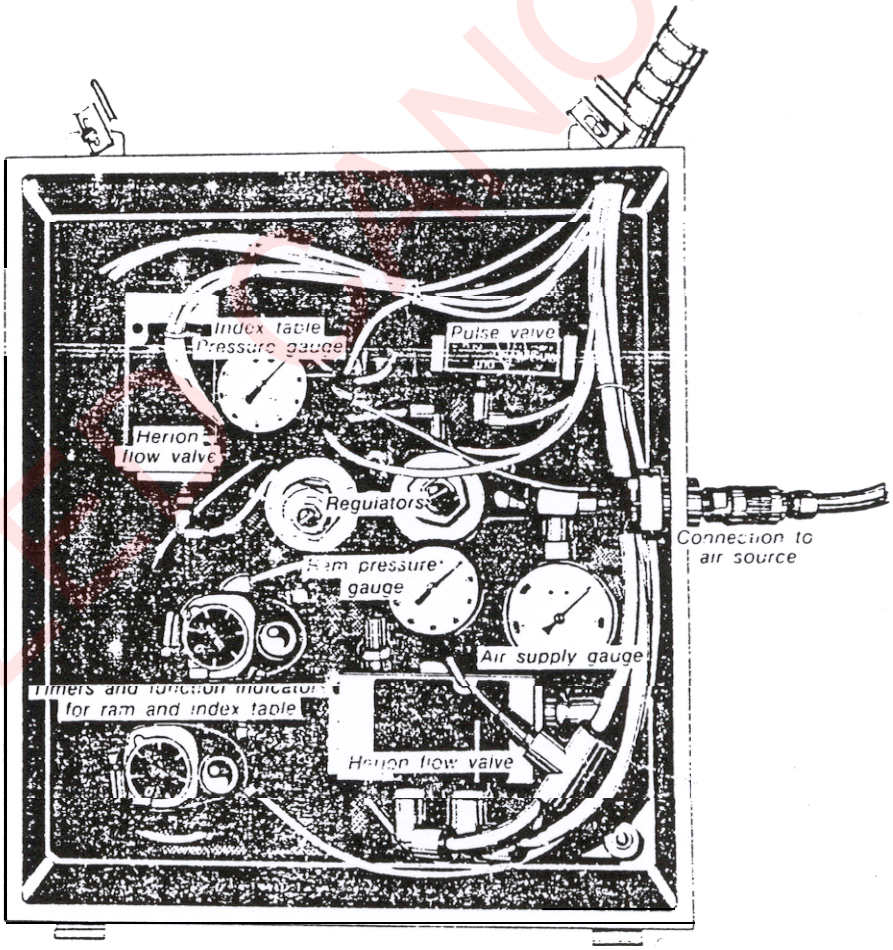

Figure 5. Top view of control box illustrating position of each component.

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Herion valves which control the flow direction, a pulse valve to control cassette rotation, two push button controls for firing the ram and indexing table, and two indicator lights to let the operator know that the functions of the ram and indexing table have been carried out. The control for the ram is fitted with a timer which sets the length of time that air enters the ram controlling the stroke length. Figure 5 is an illustration of the control box depicting the position of the components. The controls in the box are connected to their respective pneumatic components on the prototype sampler by 18 m of nylon tubing. The length of tubing is dependent on the distance from the operator to the sampler. To operate the sampler, bring the air pressure to 80 psi for the inndexing table and 120 psi for the ram. Push the control button for the ram (the indicator light will go black) and the ram will emplace and extract a sample tube. When the ram is fully withdrawn the indicator light will show green. Then. the control button for the indexing table is pushed (the indicator light will show black) causing the indexing table to rotate forward one position and lock. After this function the indicator light for the indexing table will show green and the sampler is ready for another sequence. The time required to take an average 0.5 m core is approximately 20 seconds.

SUMMARY: At present the ROSCO system is mounted on a sea sled and can be towed behind Coastal Engineering Research Center's CRAB or a large boat. With the ROSCO, short cores of bottom sediments in nearshore environments, inland bays, and lakes can be obtained. The ROSCO gives the coastal engineer the advantage of collecting data continuously over an extended period during foul weather conditions when sediment transport is usually at its maximum. This capability will provide a more complete record of the temporal and spatial variability of nearshore sediment characteristics.

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