

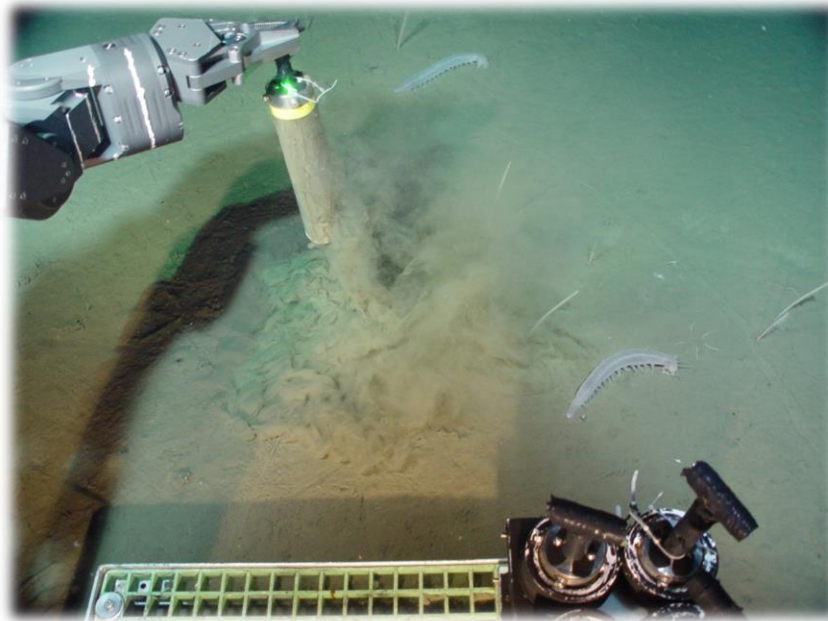
Purpose of this document

This document is intended to demonstrate ONE method of using the core Tube on Ropos. There may be different priorities or different techniques required.

Introduction

Core Tubes are used to take a sample of the bottom with the ROV. This sample can typically be kept quite undisturbed considering the journey it will take. This is the process in short: A plastic tube with a 2.85" OD is pressed into the sediments on the bottom. This pushes material into the tube and at the same time, pushes water out the top of the tube. The material is trapped in the tube and the tube pulled out of the bottom. The tube is then placed in a holster and recovered to the surface.

Coring is done regularly and has been evolving over the years under the influence of different users and studies. The following document explains how it is currently done but the process can be adapted or changed to suit the goals of the client.

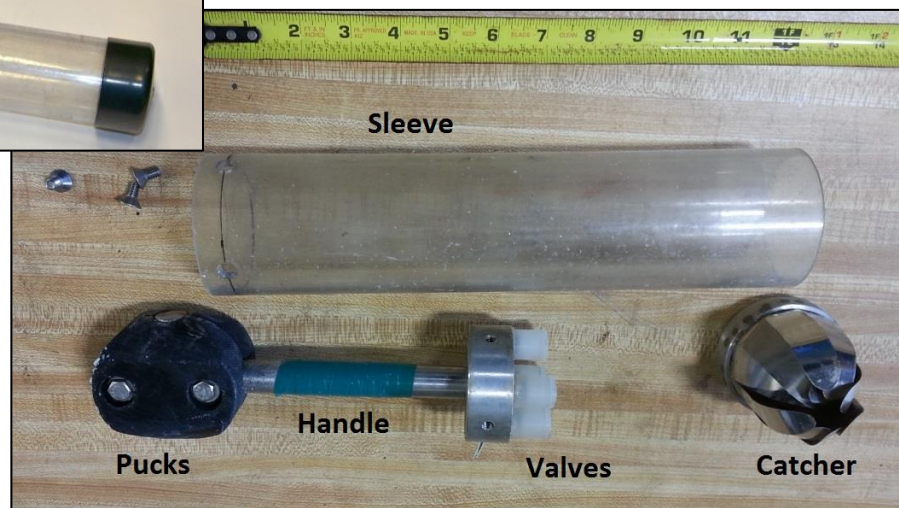
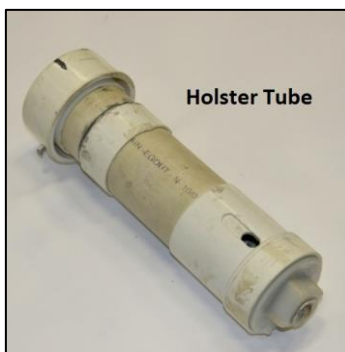
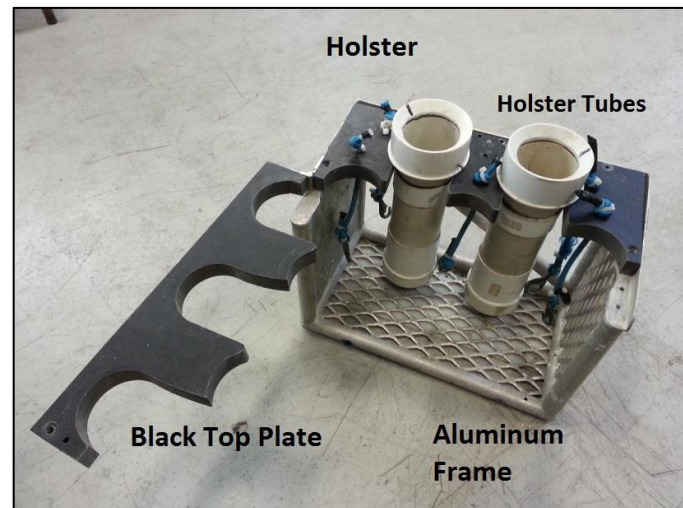
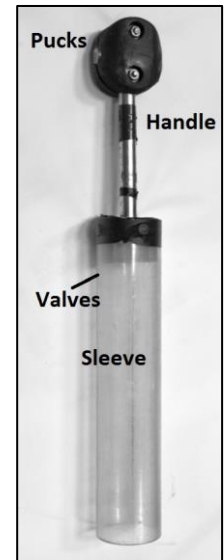


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Parts Description

- 1 Handle
 - a. Rubber Pucks- Two hockey pucks machined down and bolted onto the Stainless handle.
 - b. Stainless Steel Handle – A stainless steel weldment with holes in it for the four non return valves, the four bolts to hold the sleeve on , and the two bolts for the pucks.
 - c. Non return Valves (0 psi release pressure)
- 2 Sleeve – 2.85" OD CAB Tube with 0.12" wall.
- 3 Sleeve Bolts – ¼-20 flatheads, ½" long
- 4 Catcher - SS shim stock on a SS ring
- 5 Holster
 - a. Aluminum frame basket
 - b. Delrin Plate. Two piece black clamshell to hold holster tubes.
 - c. PVC holsters
 - i. White Holster tube
 - ii. Base Plug
 - iii. Rubber Bung
- 6 Rubber bands
- 7 Bungee and Hook
- 8 End caps (if necessary)



Working with the Cores

1. Preparing the Core Tubes.

Parts needed: Sleeves, Flathead screws, handles (with valves and pucks in place), a 5/64" Hex key and a roll of electrical tape.

- 1 Inspect the core tube parts for damage or missing parts.
 - a) The Handle - The valves and pucks should be secure on the handle. (See image above) There should be four valves in the base and two pucks bolted onto the other end. There are four bolt holes in the side of the base (See image below). All parts should be free of debris and clean. Be sure all the cores are marked with a number on the sleeve or coloured tape on the handle so they can be easily identified. Marking the pucks is usually not ideal because the handle will be in the manipulator when the core tube is used.
 - b) The Sleeve – The sleeve is a simple tube of CAB between 9" and 18" long. A normal length is 14". The terrain and purpose of sampling, influence this length. The tube should be clean and cut square on both ends and have four countersunk holes in one end (See image below).
- 2 Assembly of Core tube
 - a. Insert the handle into the sleeve with the holes aligned in photo below. Note that some handles have a shoulder. The handle in the image below does not.



- b. Insert screws all four screws loosely. Once they are all in, tighten with a Hex key (4 places) until the assembly can fit thru the holster tube. If the heads of the bolts stick out too far,

they will not fit through the bottom of the holster tube. Turn the handle and sleeve assembly upside down and insert into the holster tube handle first to easily check the fit.



- c. Tape around top edge of sleeve to prevent water leaking between the sleeve and handle. This helps prevent the sample from falling out of the tube.



The pucks and sleeve should be securely bolted on to the handle.

Optionally, a Catcher can be put on as well.

- a) Insert catcher with 'fingers' inside the sleeve. As tempting as it is, Do Not put your fingers through the catcher. They will try to grab you like a finger puzzle and they can be sharp.



- b) LIGHTLY Tape around interface between the sleeve and catcher to hold the catcher on. Give it a pull to make sure it is held tightly.
- c) Test fit in the holster tube. Too much tape or tape that is too thick will cause it to bind.



2. Loading the Holster

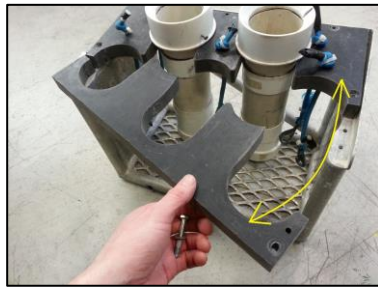
There are five white holster tubes in each holster. The black top plate of the holster opens with a single bolt. It swings open to release the white holster tubes. **DO NOT OVERTIGHTEN THIS BOLT.**



- 1) Check each holster tube trigger mechanism. The catch that pivots on the spring should move freely into the slot in the tube. Realign if necessary.
This is done by loosening the hose clamp and repositioning the mechanism.



- 2) Remove the bolt and swing the black plate open.



- 3) Place the five white holster tubes into the holster and close the plate.



4) Align holster tube.

Each holster tube has a trigger mechanism hose clamped onto the side of it. There is a small aluminum tang that pivots into a slot in the holster tube. This trigger assembly should be positioned so that it is away from harm and (ideally) visible to the ROV cameras. In general, this just means inboard to the holster. The primary goal here is to ensure the mechanism does not fail because it is pressed up against the holster.



5) Tighten the bolt after the tubes are aligned. **DO NOT OVER TIGHTEN.**

6) Plan which core tube will go in each holster tube. Organize the core tubes so that the tallest (longest) will be in the back relative to the main HD camera (Zeus Plus). This will make it easier and quicker for the arm operator to get the cores in and out of the holster.

Note that the holsters will be on opposite sides of the ROV. The image on the right is the holster on the Port side. The Starboard side will be a mirror image of this.



7) While holding the catch inside the slot, slide the assembled core tube into the white holster tube. Be sure to hold the catch while doing this and catch the lip of the sleeve inside the holster tube. The core tubes should not seat on the rubber plugs in the holster tubes. The entire purpose of the catch mechanism is to prevent this from happening.



8) Loop an elastic band around the handle and small screw in the holster. This keeps the Core tubes in place during launch when they are full of air.

9) Double check that all the triggers are in place and all handles have elastics.

10) Double check that the ¼-20 bolt holding the black holster top plate is snug. Do not overtighten.



3. Taking the Core.

The core is taken under the direction of the scientist who is working with them. Depending on the actual study being conducted the method of taking the core may vary. This is a list of considerations to help guide the process rather than a procedure.

- a) How deep should the core be? Remember that cores can be cut to different lengths or the sediment may be very shallow. Cores as long as 1.2m have been taken.
- b) How much water will be in the core?
- c) Does stratification matter? Be very clear about the angle of the core relative to the surface. If unspecified, the core should be taken perpendicular to the surface.
- d) Does quantity matter?
- e) Are you only interested in the surface of the sediment?
- f) There are likely to be several cores. How far apart should they be taken? Normally, undisturbed sediment is needed.
- g) How will the cores be processed? Do they need to be recovered immediately?

In general, the cores are taken slowly so that the structure of the sediment is disturbed only minimally. It has normally been best to press the core straight into the sediment slowly and as deep as possible without disturbing the top section. Then pull the core with a steady upward motion to draw the sample out of the muck smoothly and cleanly. This movement is quicker but still not very fast. Shaking the core will mix the sample up and cause it to fall out of the sleeve. Loose rock and sandy material is very difficult to keep in place. The longer the core it is suspended off the bottom, the more likely it is that the sample will fall out so getting it into the holster tube as quickly as realistically possible is best.

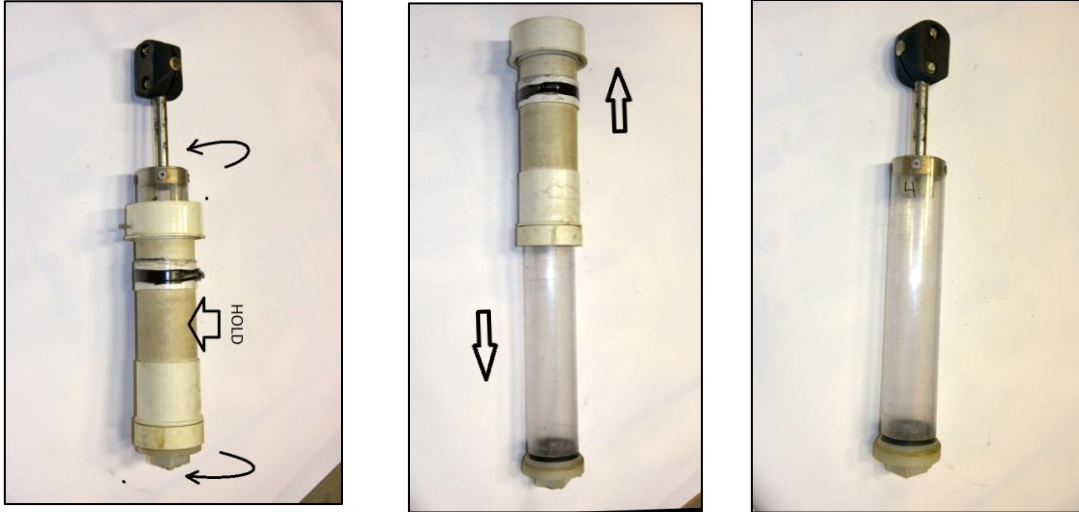
Catchers/Fingers have not been used very frequently as they reputedly smear the sides of the sediment inside the tube and make it more difficult to study the layers.

It is possible to shake out a core and try again unless there is a catcher installed.

4. Retrieving the Core.

- a) As soon as possible when the ROV lands on deck, be sure that all the cores are seated on the rubber plugs. Note any that have become dislodged. Unseating can be caused by several things: sediment releasing a lot of dissolved gases, rough weather, a poor seating when the core is replaced in the holster, a rough recovery, etc. Reseating the core tube is done simply by pushing the cores down on the plugs. You should be able to see water come out of the handle thru the valves. Often a ROPOS team member can aid with this or will have done it already. Unseated cores will often drain out into the holster tube.
- b) Remove the ¼-20 bolt from the Holster top black plate using a 7/16" or 11mm wrench.
- c) Carefully swing the black plate open and remove the white holster tubes with the core tubes in them. This is mostly easily done with two people and a 5 gallon bucket.
KEEP THE CORES UPRIGHT AT ALL TIMES.
- d) Remove the cores to a suitable location (inside lab).

- e) One core at a time, unscrew the white tube from the base plug. The handle and sleeve should rotate with the base plug. Be sure to keep some pressure on the handle so the sleeve is not pulled off the base plug. A pipe wrench or large crescent will be helpful here.



- f) Once the base is completely unscrewed, slide the white tube up over the handle and sleeve while holding the plug in place.
g) Process core as desired.
h) Securely screw the base plugs back into the white holster tubes before returning them to the ROV for loading into the holster. Holster tubes with loose bases will not fit in the holster.

Caps and sleeve material are readily available before the cruise. A Core Extraction tool is also available. The Extraction tool is used to push the core out of the sleeve once the handle has been removed.



5. Mounting the holster

Equipment required: 4 1 ½" long 5/16" bolts, 2 x ½" wrenches, swing arm in place, empty holster.

1. Empty the holster. The bolt heads will need to be accessible on the inside of the holster. This is much more difficult with holster tubes in place.
2. Be sure you have the correct side. The starboard holster will not fit on the port side.
3. Optional - Unlock the swing arm. It is easier to do this with the swing arm free as the holster sits up against the skid when stowed.
4. Put the holster in place to be sure it will fit as intended. There may be more than one set of bolt holes. The holes which mount the holster higher off the ground are normally used.
5. Bolt the holster onto the swing arm end. It is best to have the bolt heads on the holster side and the nuts on the swing arm side. Use lock washers rather than nyloks for quicker work.
6. Test the motion of the swing arm and the security of the holster. The ROV can put a lot of force on these.



Appendix A. Bill of Materials

Bill of materials for one set of 5 core tubes. Spare are additional (see spares column for desired quantity of spares)

Assembly	Part	Qty on Holster	Spares	Description	Part Number	Supplier
Handle	Rubber Pucks	10	4	Hockey puck machined down	Na	Cdn Tire
Handle	Stainless Handle	5	2	SS 316 weldment	Push Core T-Handle.dwg	
Handle	Non return Valves	20	10	Non return valves	46600-042	VWR.com
Handle	Bolts, pucks	2	2	SS hex head with nylock hex nuts	1/4"-20 x 1 1/4"	Fastenal
Handle	Screws, sleeve	20	20	Counter sunk socket head 316 SS	1/4"-20 x 3/8"	Fastenal
Sleeve	Sleeve	5	5	CAB ~9" long	2 5/8" ID 1/8" wall	IOS
Sleeve	Catcher	(5)	(2)	Spot welded shim stock on ring	Push Core Catcher.dwg	
Frame	Aluminum frame	1	0	Aluminum weldment	Core tube Basket.dwg	
Frame	Top Plate	1	0	1" water cut delrin sheet	Core Tube front plate.dwg Core Tube back plate.dwg	
Frame	Plate screws	4	2	316 SS Hex bolts	1/4-20 x 2"	Fastenal
Frame	Hinge	1	1	4" long 1" wide	SS	Slegg
Frame	Hinge Screws	4	0	#10 SS Flat head screws x 1 1/4"	SS	Slegg
Frame	Bolts, mounting	4	4	SS hex head bolts with nyloks, washers	5/16-18 x 1 1/2"	Fastenal
Holster tube	Holster Top	5	2	3"-4" PVC Adapter		Slegg
Holster tube	Holster body	5	2	3" PVC pipe	14" long	Slegg
Holster tube	Holster Bottom	5	2	3" PVC Drain clean out body		Slegg
Holster tube	Bottom Plug	5	2	3" PVC Drain clean out plug		Slegg
Holster tube	Rubber Bung	5	2	Rubber stopper size 1 3/2	59580-502	VWR.com
Trigger Catch	Catch (Trigger)	5	5	Watercut aluminum 3/16" sheet	0338 Core Holster Trigger	Watercut
Trigger Catch	Trigger Brackets	10	10	Watercut aluminum 3/16" sheet	0339 Trigger Brackets	Watercut
Trigger Catch	Spring	5	5	302SS torsion spring	9287K147	Mcmaster
Trigger Catch	Stand off	5	5	18-8 SS female stand off	91125A466	Mcmaster

Trigger Catch	Screw	10	10	10-32 x 3/8" 18-8 SS Thread locking screw	93705A260	Mcmaster
Super long Core	Sleeve	1	2	3" CAB ~1m long	2 5/8" ID 1/8" wall	IOS
Super long Core	Hook	1	0	Heavy wall hook	2" long 1/4" material Galvanized steel	Slegg
Super long Core	Hose clamp	1	0	#56 SS		
Super long Core	Bungee	1	0	1m Bungee for securing core		

Appendix B. Document Revisions

<u>Rev #</u>	<u>Date</u>	<u>Name</u>	<u>Changes in Document</u>
0	2014-02-18	Ian Murdock	Original
1	2015-11-04	Ian Murdock	Touch up and add detail.
2	2016 10 12	Ian Murdock	Change to trigger system