CORK 2013 Cruise Report

Juan de Fuca Ridge

RV Point Sur Cruise PS1310

June 15-18, 2013, Astoria, Oregon to Astoria, Oregon

Co-Chief Scientists: Maurice Tivey, Jonathan Ware, Woods Hole Oceanographic Institution

R/V Point Sur Captain: Rick Verlini

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CORK 2013 Expedition Summary

The 2013 CORK expedition on the RV Point Sur was organized in response to the deferral of our originally scheduled dive cruise with Alvin and Atlantis. Due to Alvin certification issues the NSF decided that the originally scheduled cruise programs for September needed to be deferred to a later date. The issue with the CORK program was that we had deployed two instruments on the seafloor at holes 857D and 1025C in 2012 that were due to be recovered this year. The premise of the CORK 2013 program was to test the data offload capability after a year-long deployment and to test an autonomous vehicle data offload "data mule" application. The battery life of the seafloor optical modems was designed for a year long deployment. The maximum battery life was estimated to be about 600 days, so that 1 year would be comfortably within that window. By not returning to the instruments in 2013 meant we put the entire program at risk of failure. Thus, we needed to somehow get out to the CORKs and download data and turn the units off to preserve battery life. NSF agreed to provide some shiptime days in 2013 to go out and do a data offload using our lowered CTD optical modem configuration. The RV Point Sur schedule provided the best fit in terms of time, our personnel availability and cost.

We had some concerns with the RV Point Sur primarily because the weather window for the Juan de Fuca region of the Northeast Pacific is marginal in June and the ship does not have Dynamic Positioning (DP) or a bow thruster. Thus, maintaining the ship position on station would be a challenge. The Point Sur does have dual variable pitch propellers however. Despite the drawbacks, it was felt that this was our best option to get the data off the seafloor CORK nodes and to demonstrate the optical modem capabilities. This was a quick response kind of effort and we had to find a window where the WHOI group would have personnel available in a short time frame. The WHOI optical comms group worked out that Jon Ware and Maurice Tivey could carry out the objectives in this quick response scenario.

The RV Point Sur departed Astoria at 06:30 PDT on June 15 and arrived at CORK site 857D at 09:41 PDT on June 16. The Point Sur CTD rosette was used as the frame for mounting our optical modem hardware. The niskin water bottles were removed to provide more room on the frame, although we were able to leave the Point Sur's Seabird CTD installed. The CTD-Optical modem was deployed at 09:58. Weather was relatively good with winds about 11 kts from the east (124 degrees) and 1-2 foot seas. We received acoustic response from the 857D at 2180 m depth (range 282 m). There was some confusion about the depth as the depth estimated from the CTD and altimeter was 100 meters shallower than the CORK depth of 2420 m. This unfortunately contributed to several hours of ship operations trying to get within the 100 range to establish an optical link. After several transits across the area with the CTD in tow and trying to predict the position of the CTD (we did not have any ultra short baseline (USBL) to guide our positioning), we decided to believe our original estimate of depth of 2420 m and lowered the CTD beyond the altimeter's estimate. It turned out that a bottom nepheloid layer was creating a reflective layer 100 meters above the actual seafloor. We moved the ship to directly over the known CORK 857D location and lowered the CTD to 2365 m meters. Once we got within 100 meters of the seafloor we established an optical link. At 87 m range we obtained a 5Mbit/s link and then at 69 meters range we established a 10

Mbit/s link. The link was established at 23:28 6/16 PDT and then we commenced data download of 245 Mb of data. Unfortunately, a software glitch with file names meant we needed to enter file names by hand for a number of files before automatic download was able to take over. Download was finished at 00:47 6/17 PDT. We came up on the winch to test the range of the 10 Mbit/s link. The link was dropped at a range of 98 m as expected. We then successfully used the acoustic command channel to turn the optical modem off at 01:05 6/17 PDT. The CTD was on deck by 02:15 6/17.

We then proceeded to transit to the second CORK site 1025C and arrived at 10:11 6/17 PDT. Weather continued to be good with light seas 1-2 ft and 13 kt winds from the east (110 degrees). The CTD was deployed at 10:23 6/17 PDT. This area also had the same bottom layer reflector about 100 m above the actual seafloor at 2606 meters. At 11:17 we established acoustic communication contact with the CORK and at a range of 61 m we established an optical link at 5 Mbit/s. At 11:23 we were able to establish a 10 Mbit/s link and proceeded to download the accumulated data files (approx. 252 Mbytes of data). We had the same technical issue with file names requiring some hand-entered filenames. Optical file transfer was completed by 12:17. We used the acoustic command and control to turn off the optical modem and then started up on the winch. The CTD was on deck at 13:38 6/17 PDT. That was the end of the science operations and we proceeded to transit back to the port of Astoria, Oregon. We arrived back in Astoria at 16:00 on 6/18 PDT.

In summary, we were able to download data from the two CORKs using the optical modem from a ship of opportunity (the Point Sur with no DP or bow thruster and no USBL navigation –any of which would have helped streamline operations). Data transfer in each case took approximately one hour but part of this time was used to troubleshoot datafile name issues something that can be solved to shorten the actual time needed. The optical link was established within 100 meters range of the bottom observatories. The optical modems for both CORKs were turned off to save battery life and also so that future visits to the CORKs by other scientists could unplug the modem safely if required.

Cruise Participants

Name	Employer	Role	Expertise
Maurice Tivey	WHOI	Chief Scientist	Geophysics
Jonathan Ware	WHOI	PI	Engineering
Stian Alesandro	MLML	Marine Tech	Marine Tech
Rick Verlini	MLML	Captain	
Daniel Ryan	MLML	1st mate	
Bobby Daniels	MLML	AB (2nd mate)	
Angelica Mendez	MLML	AB	
Kim Gardner	MLML	AB	
Barrett Carpenter	MLML	Chf Engineer	
Jack Valariega	MLML	Engineer	

Tara Pastuzck MLML Cook

Operations Log Cruise PS-1310

Note: Local time: 7 hrs behind GMT

Date/Time UTC	**Local Time**	**Comments**
13:30 jd=166 Sat. 6/15	06:30 Sat. June 15	Departed Astoria In transit all day
16:00 6/16 Sun. jd=167	09:41 Sun June 16	Arrived at CORK 857D site 48 deg 26.50866'N 128 deg. 42.65288'W depth 2420 m
		Ship pinger acoustic depth is 2450 m Winds 124 degrees at 10 kts Swell from W-SW
16:58 6/16 jd=167	09:58 6/16	CTD in the water Stopped just below hull while setting up winch control
17:11 6/16 jd=167	10:11	Ship position 48 deg 26.477'N 128 deg 42.710'W CTD going down at 60 m/min
17:35 6/16 jd=167	10:35	CTD at 1400 m. No acoustic response
17:49	10:49	CTD at 2180 m Acoustic response received from CORK 857D modem Range 282 m Slow winch to 30 m/min
17:55	10:55	Stopped winch Wire out 2250 m CTD altimeter (Seabird digiquartz model) reads 60 m. That makes depth 2250+60=2310 m at least 100 meters shallower than predicted. Acoustic ship 12 khz depth 2449 m Pressure depth from optical modem depressor 2281 m Slant range 188 m 2281+188
17:56	10:56	Winch out at 30 m/min
17:58	10:58	Winch stopped at 2275 m. Altimeter is 30 m OM slant range is 144 m
18:05	11:05	Winch in to 50 m off bottom on altimeter Wire out 2338 m

18:14	11:14	Turn altimeter off to see is acoustic range in improved. No optical power seen
18:26	11:26	Winch in CTD to 2087 m depth (2160 m pressure depth)
18:31	11:31	Move ship northeast 100 m to get better angle and drift down on site
18:32	11:32	Better acoustic returns Ship 48 26.533'N 128 42.635'W OM range 334 m OM pressure depth 2115 m
18:34	11:34	Winch down on CTD to 2240 m
18:36	11:36	OM range 269 m
18:37	11:37	OM range 302 m
18:38	11:38	Lost acoustic response (ship too far away…?) CTD at 2240 m.
		Move ship to SW CTD at 2240 m altimeter 60 m OM pressure depth 2268
18:43	11:43	No acoustic response As ship moves SW try to hold ship at CORK location
18:51	11:51	Ship moving to SW
19:05	12:05	OM range 193 Ship 48 26.472 128 42.672
		OM range 196 Ship 48 26.482 128 42.663
		OM range 197 Ship 48 26.487 128 42.657
		OM range 198 Ship 48 26.496 128 42.652
		OM range 198 Ship 48 26.500 128 42.642
		OM range 199 Ship 48 26.499 128 42.641
		OM range 195 Ship 48 26.501 128 42.660
		OM range 194 Ship 48 26.504 128 42.670
		OM range 195 Ship 48 26.507 128 42.675
		OM range 194 Ship 48 26.505 128 42.680
19:15	12:15	Winch out 20 m
19:16	12:16	Winch stopped at CTD depth 2333 m OM pressure depth 2288 OM range 172 Ship 48 26.498 128 42.682
19:20	12:20	Winch out 20 m
19:21	12:21	Winch stopped at CTD depth 2353 m OM range 150 m Ship 48 26.501 128 42.684
19:31	12:31	Winch out 20 m

19:33	12:33	Winch stopped at CTD depth 2373 m
19:34	12:34	OM range 129 m OM pressure depth 2326 m Ship 48 26.505 128 42.696 Lost acoustics
19:36	12:36	Winch in 20 m
19:38	12:38	Winch stopped OM range 151 m Ship 48 26.499 128 42.694
19:41	12:41	Move ship to east towards CORK position
05:57 Jun 17	22:57 Jun 16	Ask bridge to move ship to CORK site and hold there 48 deg 26.50866'N 128 deg 42.65288'W the we'll wait for CTD to catch up range 351 m
06:02	23:02	Range 333 48 deg 26.634'N 128 deg 42.647'W
	23:04	Range 320 m 48 deg 26.615'N 128 deg 42.650'W
	23:08	Range 289 m 48 deg 26.595'N 128 deg 42.656'W
	23:10	Range 272 m 48 deg 26.576'N 128 deg 42.658'W
	23:12	Range 256 48 deg 26.559'N 128 deg 42.658'W
	23:14	Range 236 m 48 deg 26.549'N 128 deg 42.662'W
	23:16	Range 216 m 48 deg 26.538'N 128 deg 42.663'W
	23:18	Range 199 m 48 deg 26.513'N 128 deg 42.660'W
	23:19	Shipped has reached waypoint Stay at this location 48 deg 26.504'N 128 deg 42.659'W
	23:20	Altitude 87 m

		Range 179 m 48 deg 26.504'N 128 deg 42.659'W waiting for CTD to catch up with ship
	23:22	Range 159 Altitude 87 m 48 deg 26.495'N 128 deg 42.658'W
	23:23	Winch down 35 m
	23:26	CTD winch stopped altitude = 50 m Optical power can be seen 48 deg 26.457'N 128 deg 42.638'W
	23:28	Range 87 m Just connected at 5 mbit/sec 48 deg 26.508'N 128 deg 42.639'W
	23:30	Connection still up range now 69 m 48 deg 26.524'N 128 deg 42.630'W
	23:32	Power cycled bottom-unit Shows 245 Mb of data to transfer at 10mbit/sec
06:48 Jun 17 Jd=168	23:48	Come up on winch 30 m. Jon is fixing software code to deal with hand entered file names
07:05	00:05	CTD winch down 30 m to 48 m altitude
07:06	00:06	Optical link up and running again Begin download of files
07:47	00:47	Finished file transfers 247 Mb of data
07:47	00:47	Come up on winch 10 m (58 m)
07:49	00:49	Up another 10 m (68 m)
07:51	00:51	Up another 10 m (78 m)
07:53	00:53	Up 10 m (88 m)
07:55	00:55	Optical link (10 Mbit/sec) just broke Range 98 m
07:57 Jun 17	00:57	Used acoustic comms to turn off optical modem. Confirmed optical modem turned off
08:05 Jun 17	01:05	CTD coming up 30m/min
09:15	02:15	CTD on deck
09:30 Jun 17	02:30	Finished at 857D. Begin slow transit over to site 1025C
		In transit to site 1025C
17:11 Jun 17	10:11 Jun 17	Arrive at CORK 1025C 47 deg 53.2470 'N 128 deg 38.9190'W

		depth 2606 m winds 13 kts, direction 110
17:23 Jun 17 Jd=	10:23	Deploy CTD Location: 47 deg 53.305'N 128 deg 38.847'W 12 khz depth 2636 m stop winch at 10 m depth to adjust winch reading.
17:30 Jun 17	10:30	Winch going down 60 m/min
18:16 Jun 17	11:16	Approaching bottom We believe we have the same bottom reflecting layer showing shallower than actual. Will continue lowering slowy through to establish true bottom depth.
18:17	11:17	Have optical comms contact. Range 61 m Altitude 60 m 5 Mbit/sec link established
		Have same download issue of filename glitches. Need to hand enter filenames for download
18:23	11:23	Establish a 10 mbit/sec link
		Master unit (on CTD) has no file space left, so need to delete older download files from 857.
19:17	12:17	Finished transferring files
19:18	12:18	Turn off CORK optical modem power
19:20	12:20	Finished with optical comms work and confirm hat optical modem is turned off
19:22	12:22	CTD is coming up
20:38	13:38	CTD is on deck and secured
20:44 Jun 17	13:44	Ship underway to Astoria.
20:00 Jun 18	13:00	Off mouth of Columbia River
23:00 Tuesday Jun 18 Jd=169	16:00	At dock, Astoria END OF CRUISE

Equipment

We used the Seabird CTD rosette frame belonging to the Point Sur to mount our optical modem hardware (Figure XX) . The photo shows the configuration with a battery/power bottle and an electronics/SDSL command bottle. The optical modem receiver, acoustic modem, Seabird CTD and

transmissometer are in separate pressure housings. We left the original Point Sur CTD mounted but removed the Niskin bottles. There was also an altimeter.

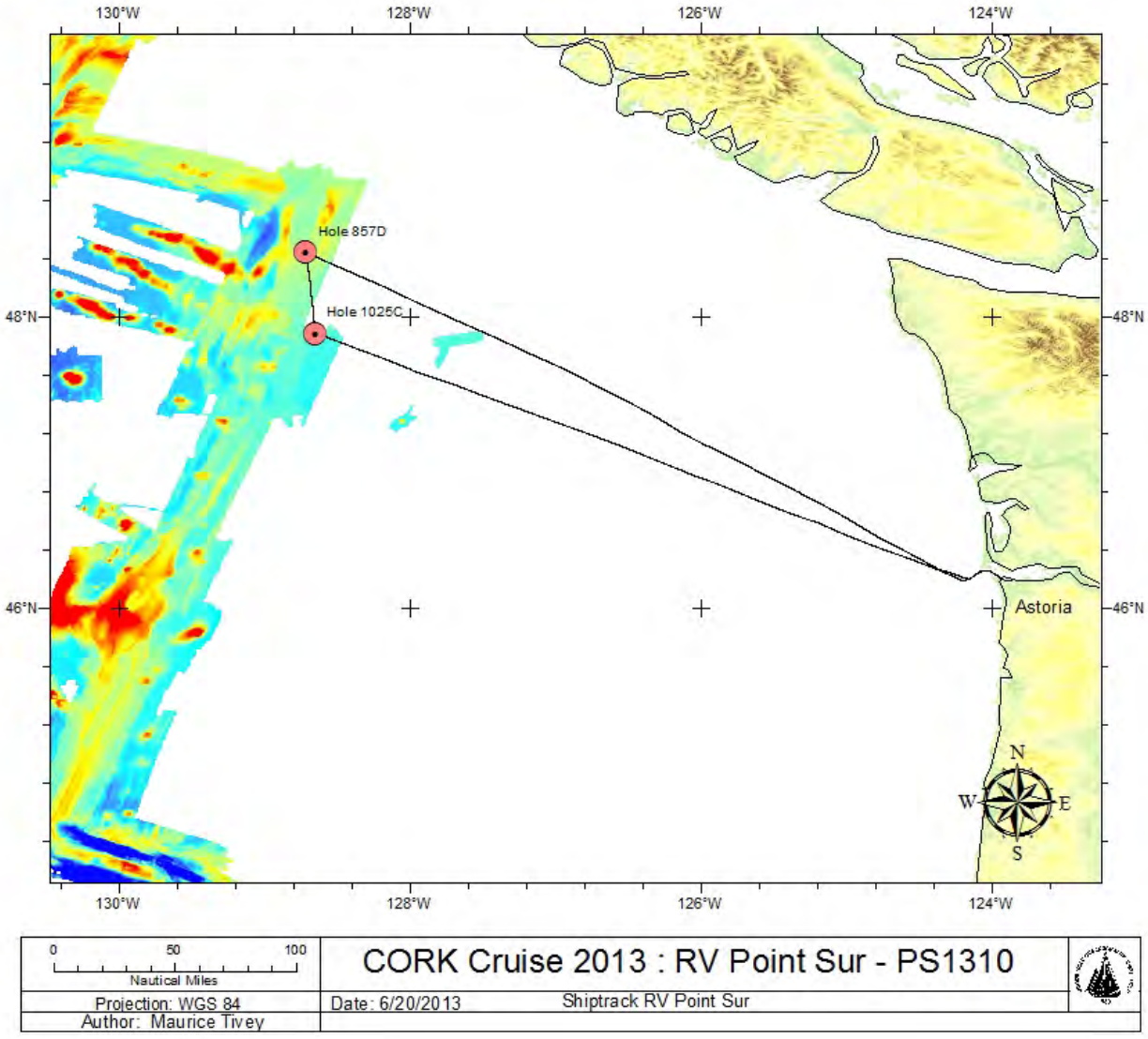

Figure 1. Ship trackline for Point Sur cruise PS1310

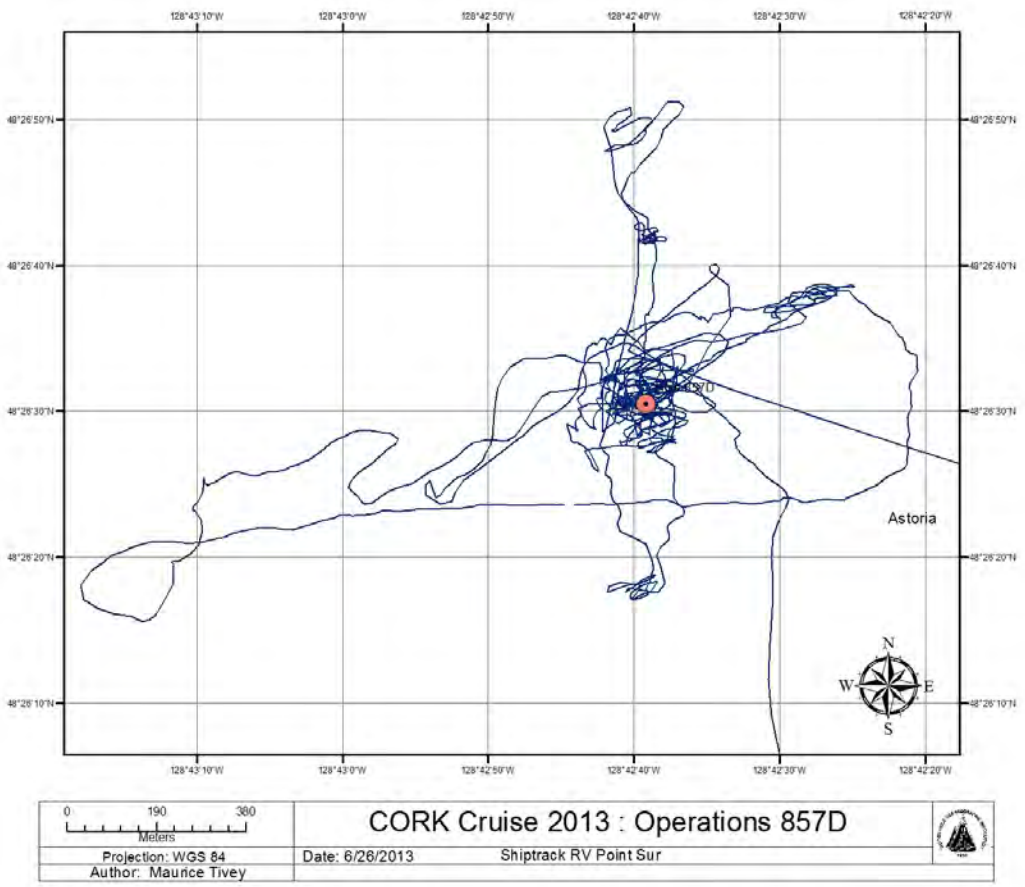

Figure 2. Ship navigation plot showing ship movement around CORK 857D.

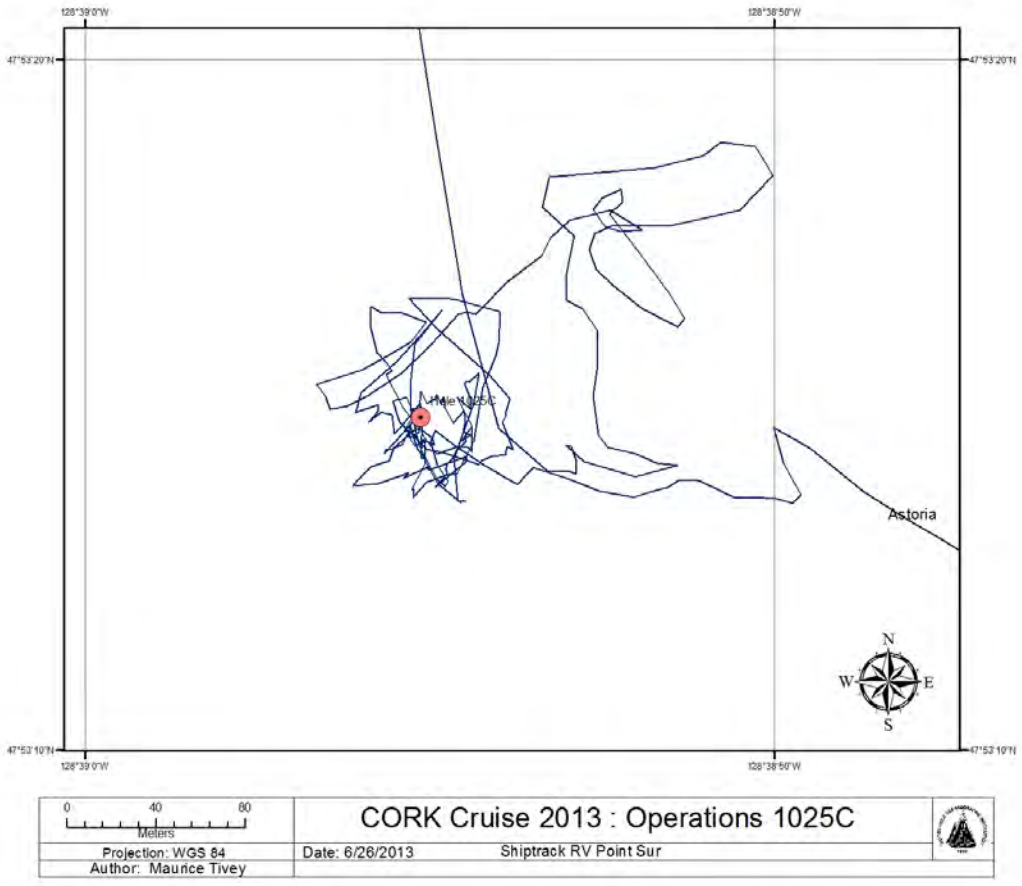

Figure 3. Ship navigation plot showing ship movement around CORK 1025C.

CORK Operations Photos

Photo 1 Stern view of RV Point Sur

Photo 2. Optical modem receiver mounted on CTD frame

Photo 3. Photo showing seabird CTD, acoustic modem to left and transmissometer in foreground.

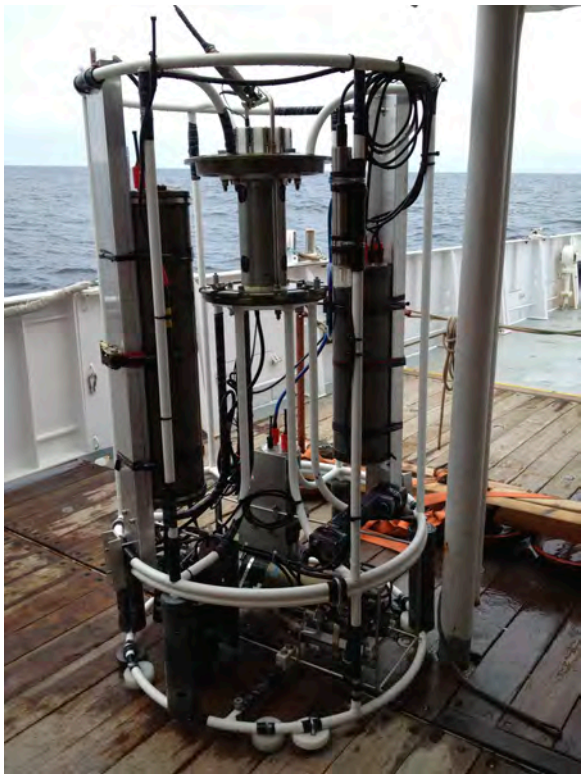

Photo 4. CTD frame showing the main optical communication hardware installed. Bottle on left is battery housing. Bottle on right is the electronics control bottle.

Figures from 2012 deployment

Photo 5. 8/24/2012 (RGB.20120824_083255_505) CORK 857D showing the optical modem (left) and the 'new' CORK logger to the right of the optical modem. An ODI UWMC connects the new logger with the optical modem. The'old' CORK logger is seen to the rear of the CORK platform.

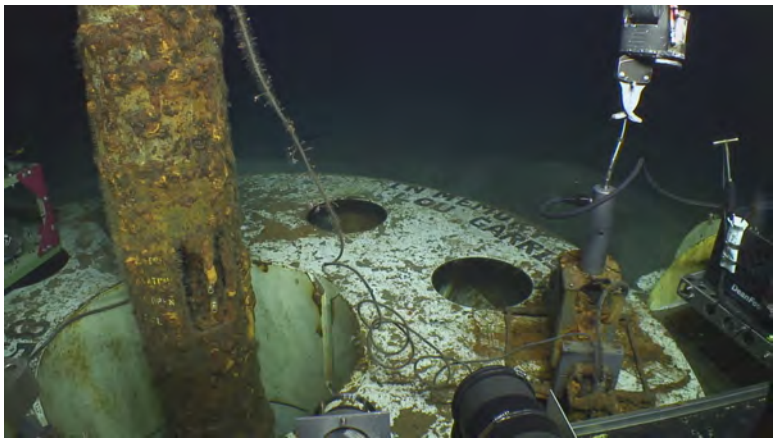

Photo 6. 8/24/2012 (RGB.20120824_091245_445) connecting to the old logger using the SeaCon UWMC, CORK 857D.

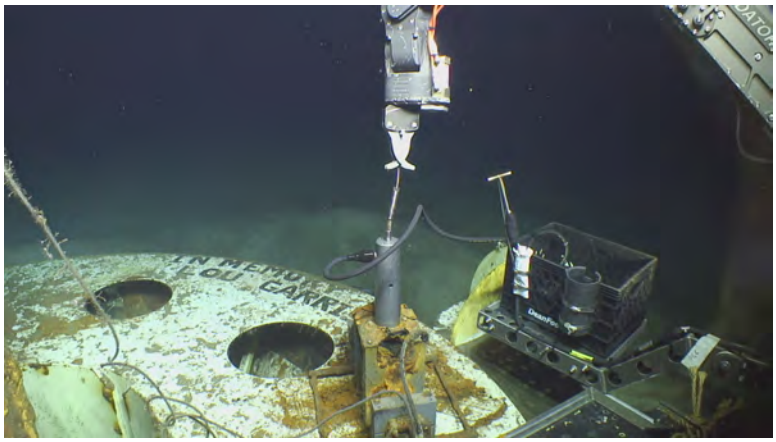

Photo 7. 8/24/2012 (RGB.20120824_092305_428) connecting to the old logger using the SeaCon UWMC, CORK 857D.

Photo 8. 8/24/2012 (RGB.20120824_111105_161) view of the CORK 857D from a distance with optical lander and new cork logger (left) in the foreground.

Photo 9. 8/24/2012 (RGB.20120824_123934_904) CORK 857D with optical lander and new cork logger (left) and old cork logger (right).

Photo 10. 8/25/2012 (RGB.20120825_042919_172) CORK 1025 with optical lander (left) and cork logger (right).

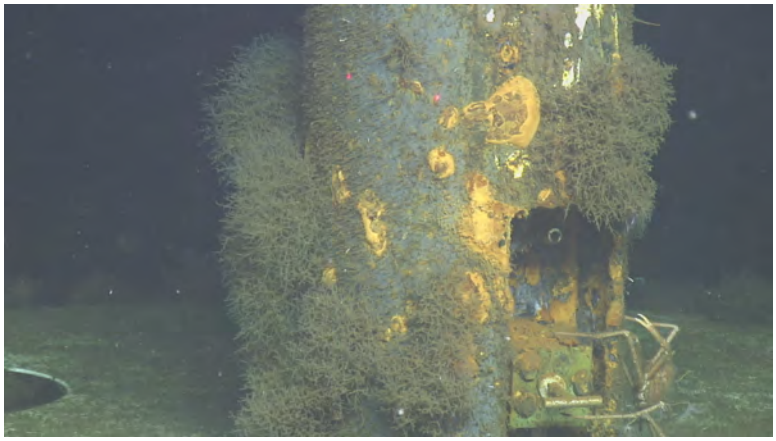

Photo 11. 8/25/2012 (RGB.20120825_043159_864) CORK 1025 showing pressure connection prior to attempting to hook up .

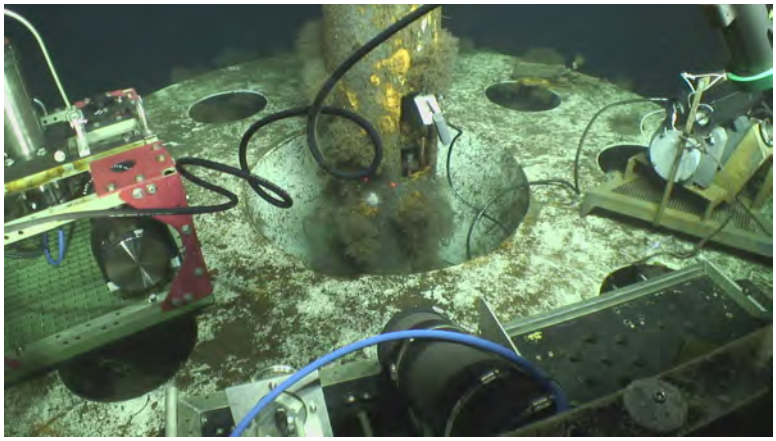

Photo 12. 8/25/2012 (RGB.20120825_052942_810) CORK 1025 showing pressure connection hooked up to CORK logger and logger connected to the optical modem.

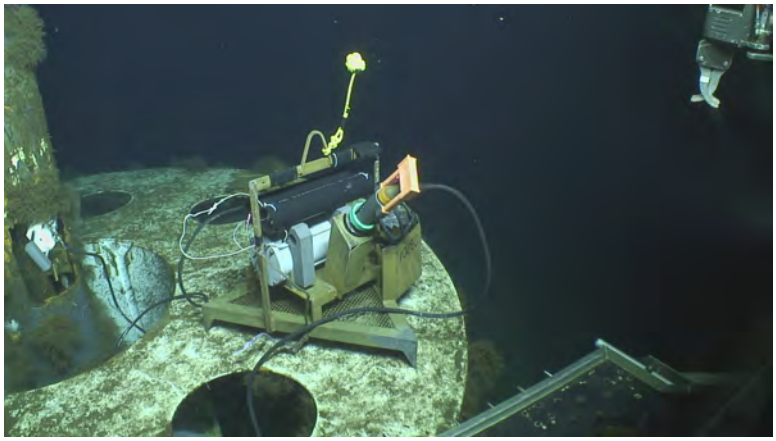

Photo 13. 8/25/2012 (RGB.20120825_055712_733) CORK 1025 showing CORK logger being interrogated using an ODI connection to the ROV.

Photo 14. 8/25/2012 (RGB.20120825_055842_722) CORK 1025 showing final configuration of CORK logger (right) and optical modem (left).