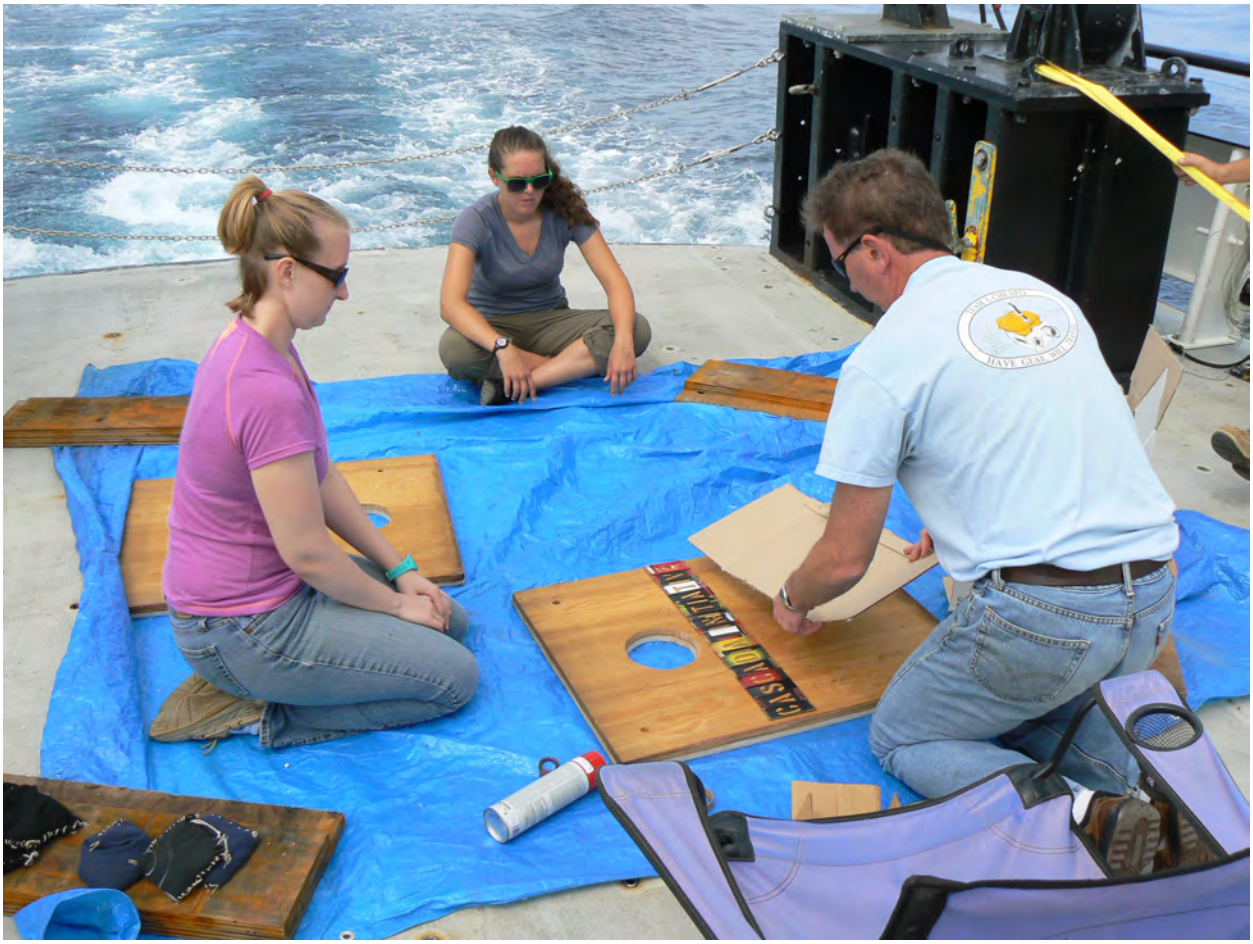
Cascadia Initiative

Cruise OC1307C *R/V Oceanus*

(Cascadia 2013 Leg 4)

August 1, 2013 – August 10, 2013

Newport, Oregon to Newport, Oregon



William Wilcock, University of Washington

Douglas Toomey, University of Oregon

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Background

As part of the 2009 American Recovery and Reinvestment Act (ARRA) spending, NSF's Earth Sciences (EAR) and Ocean Sciences (OCE) divisions each received $5M in facility-related investment. The funds are targeted toward Facilities that support EarthScope and GeoPRISMS science objectives, with an initial emphasis on onshore/offshore studies of the Cascadia margin. The ARRA funds have been used by UNAVCO, IRIS, and OBSIP to improve seismic and geodetic datasets in the Cascadia region, including improvements to real-time GPS capabilities, densification of the onshore seismic networks, and the construction and deployment of an array of 60 ocean-bottom seismographs (OBS) for offshore community experiments.

The Cascadia Initiative (CI) is an onshore/offshore seismic and geodetic experiment that addresses questions ranging from the structure of the megathrust and its potential for large earthquakes to volcanic arc structure, and to the formation, deformation and hydration of the Juan de Fuca and Gorda plates. An article in the GeoPRISMS Newsletter (Spring 2011, issue No. 26) described CI scientific objectives, the outcome of an open community workshop held in October 2010 to develop deployment plans for the offshore component of the experiment, and formation of the Cascadia Initiative Expedition Team (CIET). Over its planned 4-year data acquisition period, the offshore portion of the Cascadia Initiative will involve the deployment and recovery of ~280 OBSs at ~160 different sites and a total of about 25 cruises.

Cruise Objectives and Assessment

The objective of OC1307C was to deploy 23 OBS built by the Woods Hole Oceanographic Institution (WHOI). Thirteen of these are ARRA instruments and 10 were built with funds from the Keck Foundation. All 23 instruments were to be deployed in the Year 3 configuration. Both the science party and OBS personnel worked close to a 24-hour schedule to get all of the instruments deployed while the weather permitted.

We successfully deployed all 23 OBS (Figure 1 and Table 3). Because of OBS communication problems with WHOI ARRA OBSs at two early sites and efforts to mitigate the risk of loosing acoustic communications for additional deployments, the deployment plan was modified – 4 sites were exchanged with sites planned for SIO instruments and 1 site was exchanged with a site planned for the Nabelek/Braunmiller Gorda/Blanco experiment. The OBS will record continuously until their recovery in summer 2014.

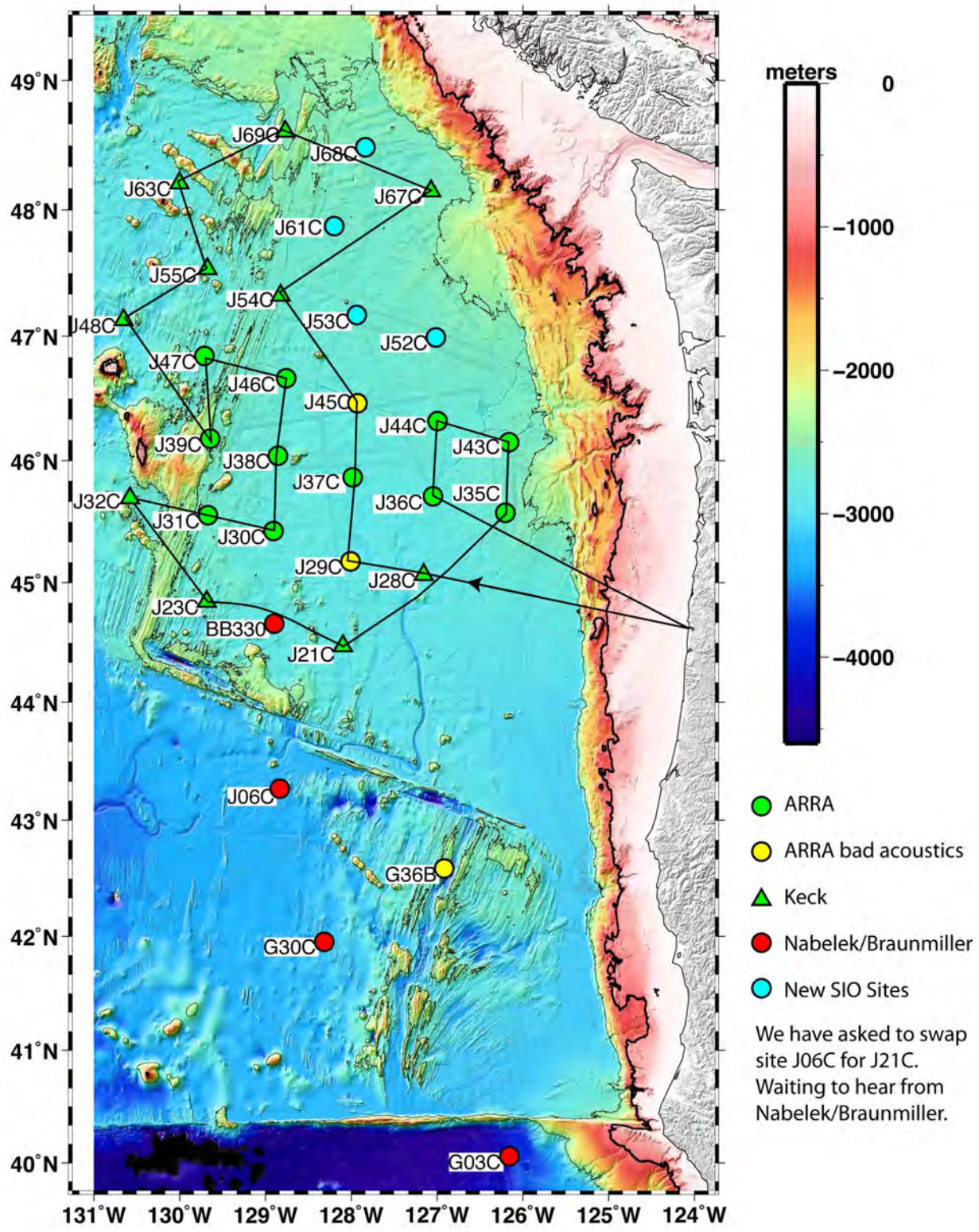

Figure 1. OC1307C cruise track with deployment sites indicated. Also show are sites with bad acoustics (yellow), new SIO sites to be deployed on Leg 5 (cyan), and sites that the Nabelek cruise will deploy later in 2013.

OC1307C Science Party

William Wilcock	Chief Scientist in Charge	University of Washington
Douglas Toomey	Co-Chief Scientist	University of Oregon
Alan Gardner	OBS Technician	Woods Hole Oceanography Institute
Tim Kane	OBS Technician	Woods Hole Oceanography Institute
Daniel Kot.	OBS Technician	Woods Hole Oceanography Institute
Ben Pietro	OBS Technician	Woods Hole Oceanography Institute
Molly O'Neill	Graduate Student	University of Oregon
Ye Tian	Graduate Student	University of Colorado, Boulder
Robert Skouman	Graduate Student	Miami University, Ohio
Miles Bodmer	Graduate Student	University of New Mexico
Christina King	Graduate Student	University of Rhode Island
Erik Arnesen	Marine Technician	Oregon State University

OC1307C Oceanus Crew

Jeff Crews	Master
Tony Monocaldilos	Second Mate
Mike Ribera	Chief Engineer
Jay Jean-Bart	Engineer
Chip Millard	Engineer
Doug Beck	Bos'n
Jeff Artingstall	AB
Eugene Otto	AB
Kris Alberty	Cook
Joy DeRosa	Steward

Cruise Narrative

This cruise departed on August 1, 2013 from Newport, Oregon. This is the fourth Cascadia leg of the 2013 field season and the first of 3 deployment legs. Our objective is to deploy 23 WHOI ocean bottom seismometers (OBSs), 10 of which are Keck OBSs and 13 of which are ARRA OBSs.

Tuesday, July 30. Chief Scientist William Wilcock, co-chief Doug Toomey and graduate students arrived in Newport. The WHOI Ocean Bottom Seismograph group arrived on two days earlier to prepare instruments.

Wednesday, July 31. WHOI OBSIP group continued work preparing the OBSs and loaded the ship. The science team moved on board and finalized plans for the deployment order, which is shown in the figure below.

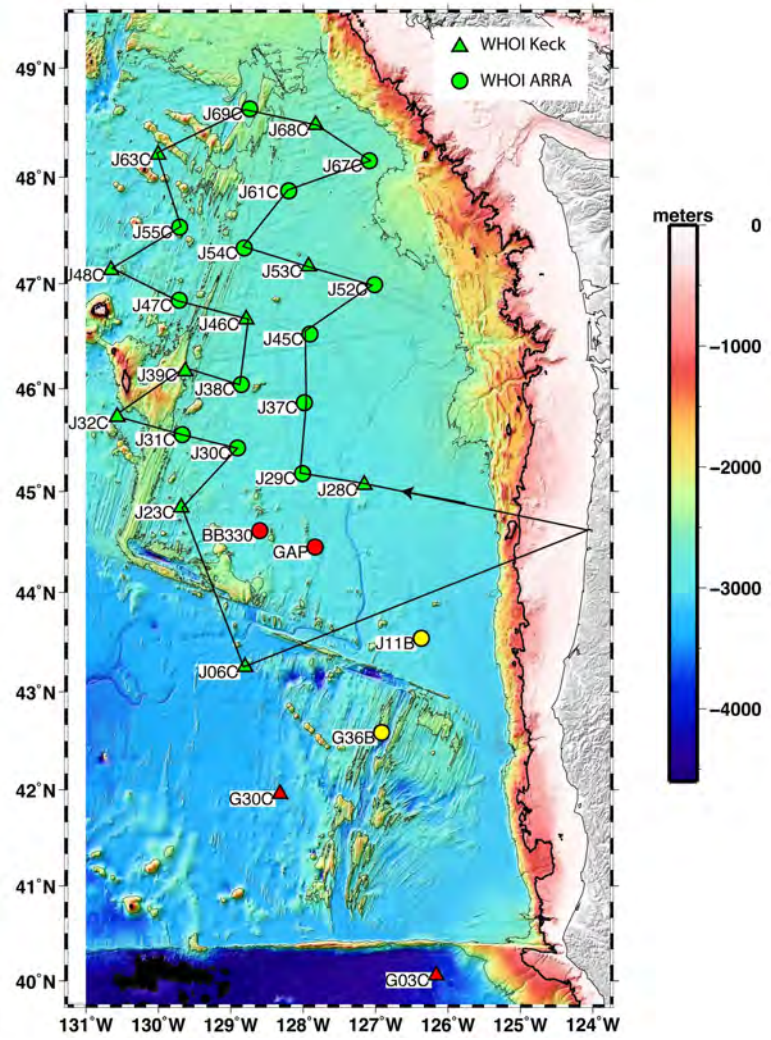

Figure 2. Map of the cruise plan and deployment sites for 23 WHOI OBSs finalized prior to the cruise. This plan was modified while at sea due to instrumentation issues, as described below.

Thursday, August 1. The science meeting is held at 09:00 local time (LT) science on board the *R/V Oceanus*. The science party secured gear in main lab. The safety drill was held at 10:30 LTfollowed by departure at 11:00 LT. The seas were near calm.

Friday, August 2. The first OBS deployment was at site J28C.

1) Station J28C

On Station:	8/2/2013 06:40 UTC (8/1/2013 23:40 LT)
OBS Type:	WHOI Keck No. S87
Deploy Time:	8/2/2013 6:43 UTC
Deployed Position:	45° 03.823' N, 127° 09.382' W
Water Depth:	2885 m
Range to which tracked	Tracked to bottom
OBS on Seafloor:	8/2/2013 7:54 UTC
OBS Fall Speed:	40.6 m/min
Start Acoustic Survey:	8/2/2013 08:17 UTC
Disable Acoustic Release:	8/2/2013 09:42 UTC
Depart Station:	8/2/2013 09:42 UTC
Time on Station:	3 hr 02 min

The first survey exceeded the maximum number of samples (99) allowed by the M-Cal location software at a spacing of 50m. The survey was repeated with a spacing of 150 m. The survey was completed successfully, but more time was spent on site than anticipated.

The second OBS deployment was at site J29C

2) Station J29C

On Station:	8/2/2013 13:23 UTC (8/2/2013 06:23 LT)
OBS Type:	WHOI ARRA No. T109
Deploy Time:	8/2/2013 13:23 UTC
Deployed Position:	45° 10.555' N, 128° 00.509' W
Water Depth:	2853 m
Range to which tracked	2598 m
OBS on Seafloor:	N/A
OBS Fall Speed:	N/A
Start Acoustic Survey:	N/A
Disable Acoustic Release:	N/A
Depart Station:	8/2/2013 15:54 UTC
Time on Station:	2 hr 31 min

Immediately after deployment the first couple of ranges were not correct. Alan changed the range/gain parameters and the ranging then worked well. We followed the instrument down to near the seafloor. However, we lost contact at a slant range of 2598 m in a water depth of 2852 m. We decided to run a survey pattern in the hope that we could improve the acoustic environment. The survey began at 14:30 UTZ. Tim and Alan switched out the deck box. The new one was S/N 34687. There was still no response using the new deck box with original transducer cable. We then switched to a new transducer cable. The deck box was pinging at rate greater than once per second, which was not correct. We returned to deck box 42805 with the new transducer cable and turned off the ADCP which eliminated a 4-s noise/ping (1455 Z). The pings now led to a bottom echo being received indicating that the transducer was working. The survey completed a 270˚ pattern but

there was still no response. The ship went overhead of the drop position and we used the 8011A deck unit (Mr. Good Box; 1512 Z). At 1520 Z we were back over the drop site and deployed the transducer over the side. At 1527 Z we have repeatedly tried with the 8011A with transducer over side. Numerous enable commands and various power/sensitivity modes were tried (1530 Z). There was still no response. We tried ranging at a variety of power levels. At 1540 Z we tried several ranges with the Teladyne/Benthos unit which used the hull transducer. No luck. At 1542 Z we sent disable command to put the OBS into low power mode if it is still listening. No survey position was obtained for J29C. This is the third time a WHOI ARRA has lost acoustic communications in the past two years.

The third OBS was deployed at station J37C

3) Station J37C

On Station:	8/2/2013 19:50 UTC (8/2/2013 12:50 LT)
OBS Type:	WHOI ARRA, No. T106
Deploy Time:	8/2/2013 19:56 UTC
Deployed Position:	45° 51.857' N, 127° 59.114' W
Water Depth:	2884 m
Range to which tracked	Tracked to bottom
OBS on Seafloor:	8/2/2013 20:46 UTC
OBS Fall Speed:	60m/min
Start Acoustic Survey:	8/2/2013 20:56 UTC
Disable Acoustic Release:	8/2/2013 21:43 UTC
Depart Station:	8/2/2013 21:50 UTC
Time on Station:	2 hr 00 min

The weather is good with winds at ~10 knots from 315˚ and seas at ~4 feet. The OBS did not receive an acoustic signal until 20:00 UTC. At about 20:20 UTC the 3.5 kHz echo sounder was mistakenly turned on for about 1 minute. After this was quickly fixed, all went well. The survey was completed successfully.

The fourth OBS was deployed at station J45C

4) Station J45C

On Station:	8/3/2013 01:34 UTC (8/2/2012 18:34 LT)
OBS Type:	WHOI ARRA, No. T105
Deploy Time:	8/3/2013 01:35 UTC
Deployed Position:	46° 31.255'N, 127° 54.290'W
Water Depth:	2775 m
Range to which tracked	N/A
OBS on Seafloor:	N/A
OBS Fall Speed:	N/A
Start Acoustic Survey:	N/A
Disable Acoustic Release:	N/A
Depart Station:	8/3/2013 05: 38 UTC
Time on Station:	4 hr 4 min

The deck Box did not receive any responses from the OBS. Alan adjusted the signal power and sent several enable commands but there was still no response. A 1000 m CDT cast was began but was aborted to reduce noise in communicating with the OBS. The ADCP and the crane hydraulics were also turned off to reduce noise. At 02:11 UTC the Deck Box crashed and had to be rebooted. Enable

codes were sent at every power level and a different Deck Box was tried still but there was still no response. Three disable commands were sent with no reply.

The CDT cast was restarted and the decision was made to deploy a Keck in place of an ARRA at the next site. While the CTD cast was in progress a shallow dunk test of ARRA OBS 102 was undertaken with the Morgan crane – this OBS had been scheduled for the next. ARRA OBS 102 did not fail during the shallow dunk test and was secured back on deck.

The CTD reached a depth of 1000 m. On the CTD accent at 50 m it was noticed that the pump status was off and at 28.3 m communication was lost.

We decided to conduct a deep water test of ARRA OBS 113 on the CTD wire. The OBS was moved into position with main crane and then lowered into the water using the CTD winch with plans to take it to 2000 m depth. However, the snap load was too large because the OBS did not sink quickly enough to maintain tension on the wire and the deep water test had to be aborted. ARRA OBS 113 did not fail while it was in the water.

The OBS at site J45C remained on the seafloor with no survey data available. The ship set course to station J54C at 8 knots which after some discussion had been identified as a good site for a Keck OBS in the event no more WHOI ARRAs are deployed. The WHOI crew prepared a Keck for deployment.

Saturday, August 3. Following the failure of acoustics on the second ARRA OBS, William and Doug discussed options and sent the following email to CIET for input:

All,

Following is an update on OC1307C, whose objective is to deploy 13 ARRA and 10 Keck instruments (WHOI).

We have deployed 4 OBSs thus far (1 Keck and 3 ARRA instruments). Two of 3 ARRA instruments lost acoustic communication on the way to the seafloor. One did so within a few hundred meters of the seafloor, the other did not communicate at all. Recall that from the 2012 deployments there were two WHOI ARRA instruments out of 15 that also lost communications. Currently, those two sites are being visited by the Thompson with ROPOS and hopefully they will be recovered, as that would provide us with crucial information on why the acoustics are problematic.

If we cannot troubleshoot the problem here at sea, then we will need to make choices. Most likely we will not continue to deploy the ARRA instruments. In which case, we have 9 remaining Keck instruments to deploy. Note that these two instruments use a different design and different cables for the acoustics, so we are thinking that the Kecks are good to go.

Attached is a map that shows our proposed deployment sites for the 9 remaining Keck instruments. In choosing which sites to deploy we prioritized as follows (form highest to lowest): (a) near the subduction zone, (b) near the JdF ridge, (c) mid-plate sites.

We will arrive at J54C at 0800 LT to deploy a Keck OBS. Subsequently, we will begin troubleshooting efforts with the ARRA instruments. If not successful, we will proceed with the plan above unless we hear otherwise.

Doug and William

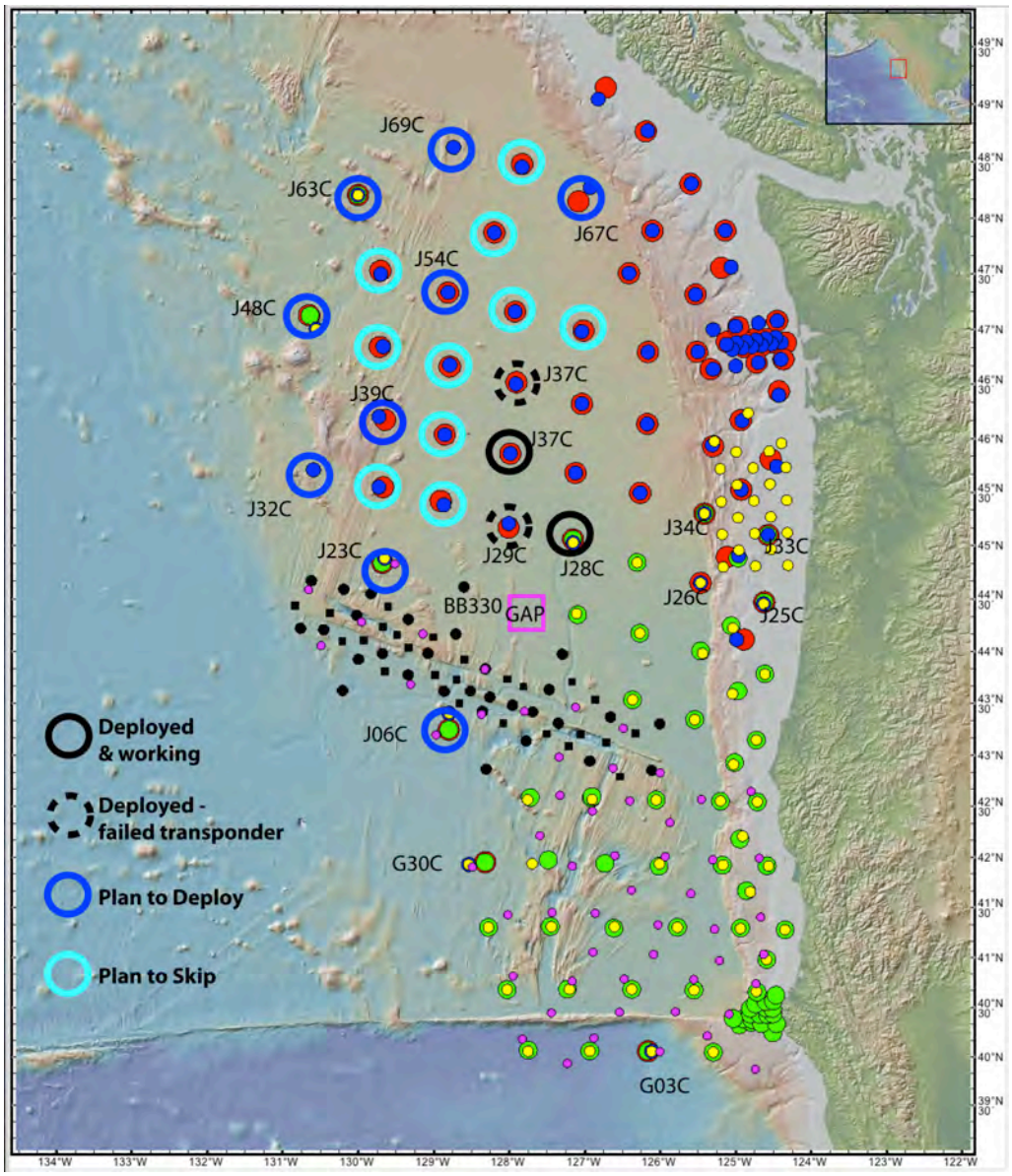

Figure 3. Map showing the sites to be deployed in the event that only Keck OBSs are used.

We arrive on site to deploy J54C (Keck) at approximately 0800 LT. The transit was completed at a moderate speed so that the WHOI team could sleep. The seas remained near calm and the winds light.

5) Station J54C

On Station:	08/03/2013 15:23 UTC (08/03/2013 8:23 LT)
OBS Type:	WHOI KECK No. S83
Deploy Time:	08/03/2013 15:26
Deployed Position:	47° 20.158' N, 128° 48.695' W
Water Depth:	2662 m
Range to which tracked	Tracked to bottom

OBS on Seafloor:	08/03/2013 16:32 UTC
OBS Fall Speed:	44m/min
Start Acoustic Survey:	08/03/2013 16:39 UTC
Disable Acoustic Release:	08/03/2013 17:30 UTC
Depart Station:	08/03/2013 22:30 UTC
Time on Station:	7 hr 7 min

The deployment and survey of J54C was completed successfully in just over 2 hours.

Following the OBS deployment the bottles were removed from the CTD and it was rigged with the acoustics of two ARRA OBSs; this was completed at ~1100 LT. Following lunch the CTD was deployed at 1143 LT. The CTD was lowered to 10 m with no failures. The CTD was then lowered to 200 m where it remained for 15 minutes. There were no failures. The CTD was then lowered down to 2000 m where it stayed for 2 hours and still there were no failures. In order to maximize the testing, another ARRA OBS was deployed via knuckle-boom crane to test acoustics. This ARRA went in the water at 1217 LT. The instrument was taken out of the water after 7 minutes without any failure. The CTD with two ARRA OBSs was brought up to the surface at 1438 LT and was back on deck at 1519 LT. Once the CTD was secure, the ship headed towards site J53C at 1524 LT.

Once on site J53C, four more ARRA OBSs were attached to the CTDat 1644 LT and the acoustics tested on deck at 1714 LT. The CTD wwas deployed at 1837 LT and teken down to 200 m. It stayed there for several minutes before going down to 2000 m. It reached 2000 m at 1834 LT where it remained for two hours. It returned to the surface at 2048 and was on deck at 2120 LT. The four ARRA OBSs did not fail during the test. The CTD and attached ARRA OBSs were secured on board. The ship began to transit at 2134 LT to J52C with the WHOI group resting. The plan is to resume testing in the morning. If all goes well then J52C would be the first site in an efficient path that would deploy the remaining OBSs at the 23 sites identified prior the cruise.

Sunday, August 4.

The removal of previously tested ARRA OBSs from the CTD started at 0600 LT. Four more ARRA OBSs were then attached to the CTD. After breakfast the acoustics were tested on deck before deploying the CTD at 0800. The CTD was lowered to 10 m where it stayed for 10 minutes and then lowered to 200 m where it stayed for 15 min. Finally it was lowered to 2000 m and reaching this depth at 0932 LT. The CTD started ascending at 1123 LT. The CTD was on deck at 1156 LT and secured with ARRAs put away at 1237 LT. Throughout the test the acoustic releases performed well.

The ship then started transiting at fishing speed (6 knots) toward a near shelf site J51C, while discussions continue on how to proceed. While not one of the original 23 sites identified for WHOI OBSs, J51C which lies east of J52C has been identified as a potentially good site to try another ARRA deployment because it is close to the continental shelf and thus more accessible to the Jason ROV in the event that the acoustics fail.

William and Doug summarize progress and propose the following plan to NSF, CIET and the WHOI IIC (~1400 LT):

All,

Note: At the end of this email are 2 questions which NSF and John Collins need to answer.

NSF: *I understand that Donna is on vacation and may be unreachable. I am thus cc-ing Rose Dufour.*

Following is a summary of our progress:

During the morning of Aug 3 we deployed a Keck OBS at J54C; it was surveyed successfully. We have thus deployed 5 of 23 OBSs; 9 Keck and 10 ARRA OBSs remain onboard. Subsequently, we began testing the acoustic releases of the remaining 10 ARRA OBSs; 6 were tested yesterday, another 4 this morning. Each test involved lowering the releases on the CTD to a depth of 200 m for 15 minutes, then 2000 m for two hours. All acoustic releases performed well, without problems.

This morning the Thompson arrived in Newport where the acoustic release of the ARRA instrument recovered from J11B was inspected. The 3 pin connector looked fine, the pressure tube was dry and, remarkably, a test of the acoustic release was successful. From all indications, we expect that J11B will have recorded seismic data as well, which is welcome news. The fact that the acoustic release could be enabled/disabled on shore is a puzzle. More importantly, we do not have a smoking gun for what has gone wrong with the acoustic releases when they are deployed on the OBSs.

The Thompson did visit G36B, but inclement weather and sloppy surface currents prevented a ROPOS dive.

Other things we do not know:

a) The successful test of all acoustic releases on the CTD does not guarantee that they will work when deployed. Maybe we have experienced our only two failures of the year, or just the first two.

b) What is causing the acoustic releases to fail.

Options:

Without knowing what is causing the failure of the ARRA acoustics, the WHOI team is understandably reluctant to deploy the remaining 10 ARRA OBSs.

Given that, we can either proceed with just deploying the KECK OBSs or, alternatively, come up with a deployment plan for the WHOI ARRA instruments that maximizes the chance of recovering them. Such a deployment plan would have the WHOI AARA instruments being deployed as near as possible to the continental shelf so that we could use an ROV for recovery if necessary (i.e., minimize transit time).

Such a plan would:

a) deploy WHOI Keck instruments farthest from shore (i.e., JdF ridge and sites to the west)
b) deploy WHOI ARRA instruments near the shelf and below 1000 m water depth
c) move some SIO and LDEO deployments further offshore.

Attached is a figure that summarizes this plan.

Key to this plan is getting confirmation from NSF that ROV time will be available next year to recover WHOI sites that do not have successful acoustics. To be clear, if we successfully survey in a WHOI AARA OBS, we will not need ROV time. If we cannot successfully survey in a WHOI AARA OBS, we would like to recover with an ROV.

In view of J11B looking to be in fine shape and likely carrying a full complement of data, we think this plan maximizes the scientific return while minimizing risks/costs.

While we wait for some response from NSF and CIET, our plan is to steam toward the site marked with a red box in the attached figure. Irrespective of whether or not NSF agrees to the plan above, we recommend

deploying a WHOI ARRA OBS at this site, which is just offshore from the Grays Harbor array. This deployment would use an acoustic release that has performed successfully on the CTD. Thus, if we fail to maintain acoustic contact with this instrument, then we have another data point that indicates that something is amiss in terms of how the acoustics respond when attached to the OBS package. Since this site is just off of Grays Harbor, I feel reasonably confident that it can be visited next year with an ROV.

The two questions which need answers:

1) Does NSF support the plan laid out above?
2) Can we proceed to deploy a WHOI AARA OBS at the site marked by the red box? This question is addressed to John Collins, in particular.

On the positive side, the seas are pleasant.

Doug and William

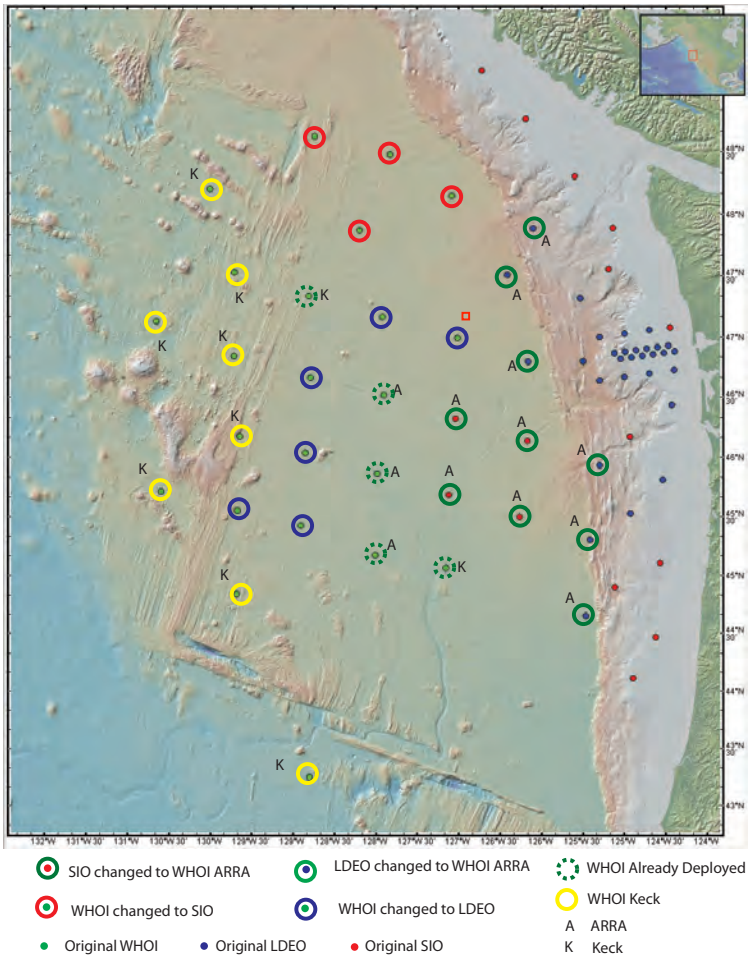

Figure 4. Proposed OBS deployment plan of August 4 that placed more WHOI ARRA OBSs near the continental shelf, as described in email above.

Several e-mail responses were received from the CIET – they were generally supportive but noted the extra time would be required for the LDEO deployment leg. Communications at sea have obviously changed over the recent years. In addition to the above email, we used VOIP to discuss options with John Collins. John was also in contact with Donna Blackman at NSF. At ~1500 LT the ship receives the following advice from NSF:

hi Doug

I just spoke with Collins by phone. I'd like to suggest that we hold off deploying anymore of the WHOI ARRA OBS- with known uncertainty and recent apparent increase in acoustic failure rate I think it is too much of a risk.

I understand your thinking about deploying the ARRA inboard, with backup plan being ROV recovery next yr if problem persists. However, we are not assured of JASON being available for Cascadia work in 2014 (a backup plan for other ROV is being discussed), so this uncertainty of potentially less experienced ROV group, on top of not-yet-proven data recording by the WHOI ARRA instrument just recovered puts the scenario outside my comfort window- all this informed by what we perceive about MGG and facilities 2014 budget limitations.

So my advice is to go with the plan to complete Keck OBS deployments and lets get the WHOI ARRA back to the lab so the problem can be sorted out. IF (if...) there's a chance to fit future deploy of confirmed working WHOI ARRA, we'll try to grab that opportunity if ship availability/funds are possible. Ill be in touch with Rose about that right now.

Donna Blackman
Program Director, Marine Geology & Geophysics
National Science Foundation, Ocean Sciences Division
(703)292-7978
dblackma@nsf.gov

For the science party, this was disappointing news. Doug and William were able to confer with Donna, via VOIP. Donna understood the issues clearly and indicated that she would discuss options with colleagues at NSF. Until then, we proceeded with a plan to deploy Keck instruments only. At 1710 LT we turned the ship away from our current heading (J51C, which is near the continental slope) and head northward toward J67C. The plan at this time was to deploy the rest of the Keck OBSs along the subduction zone and the mid-ocean ridge. We will be on site at 2220 LT.

During the day the crew and science party caught a number of albacore tuna which provided a fun diversion although the enthusiasm for fishing waned within the science party when it becomes clear that they are expected to participate in the gutting.

We reached site J67C late in the evening.

6) Station J67C

On Station:	08/04/2013 06:05 UTC (08/03/2013 23:05 LT)
OBS Type:	WHOI KECK No. S80
Deploy Time:	08/04/2013 06:12 UTC
Deployed Position:	48° 09.006' N, 127° 05.064' W
Water Depth:	2608 m
Range to which tracked	Tracked to bottom
OBS on Seafloor:	08/04/2013 07:16 UTC
OBS Fall Speed:	40.8m/min

Start Acoustic Survey:	08/04/2013 07:22 UTC
Disable Acoustic Release:	08/04/2013 08:31 UTC
Depart Station:	08/04/2013 08:33 UTC
Time on Station:	2 hr 28 min

The deployment and survey of J67C was completed successfully in a total time of 2.5 hours. Once the instrument was in the water the deck box gave incorrect values for several minutes. It was turned off and then back on to fix the problem. The Keck instrument was the bottom at 0016 LT. During the acoustic survey M-Cal stopped recording signals. After power cycling the deck box, M-Cal started working again. At 0040 LT M-Cal crashed and again and the deck box stopped receiving signals. The sensitivity of M-Cal was increased to 9 during re-initialization at 0048 LT. M-Cal was then able to complete the survey. Once finished the ship headed toward site J69C at 0133 LT.

Overnight, William addresses the following email to Donna Blackman, John Collins and Brent Evers:

Donna

I appreciate your efforts to look for options for recovering deep uncommunicative OBSs next summer.

We just successfully deployed a Keck at site J67C and are en route for J63C for deployment in the morning and then J48C for deployment in the afternoon (~ 4PM). The northern sites that we are bypassing could all potentially be filled in with SIO instruments but once we pass J48C we will start leaving gaps in the coverage of the Juan de Fuca ridge that will be hard to fill in and which were not all filled in year 1. Neither the LDEO or SIO cruises could get there without more ship time and from my understanding of the Oceanus schedule, it's full through October.

The WHOI OBS team were quite frustrated that none of the lowerings of the 10 remaining ARRA acoustic releases on CTDs to 2000 m for 2 hours replicated the problem with the transponders. Another way to look at it is that these lowerings provided a pretty substantial test that suggests the initial failure rate of 2 in 3 is not representative of what might be expected for deploying the rest. To the extent that these tests mimicked deployments they suggested that none of the remaining 10 would have failed. I realize that we are now a lot further offshore and thus in less accessible locations (although not too far from Axial Seamount) than the near shore sites we suggested earlier for ARRA deployments but my own thoughts are that a reasonable strategy would be to resume deploying ARRAs until another one fails.

There are 3 ~$100K ARRAS stuck on the seafloor at present which presumably are worth recovering, if not next year, the year after. The risk of deploying more until another one fails is that there might be 4 stuck on the seafloor but unless there really is an option to deploy the ARRAs when the Oceanus schedule opens up in November (the people who participated in that cruise said never again), there is a certainty with the current plan that a unique and unlikely to be repeated data set from the Juan de Fuca Ridge will be compromised.

Best Regards

William

Monday, August 5.

Both Brent and John Collins responded. Brent was supportive of the resuming deployments and John documented the statistics of the release failures. Donna Blackman followed up with the following e-mail that was sent to Doug, William, John Collins, Brian Midson and Rose Dufour at NSF and Brent Evers, Rob Woolley and Bob Woodward at IRIS

hi All
ok, I spoke with Brent and then with Rose & Brian this morning (PDT).

Based on these conversations I think we can go ahead with the CIET preferred plan to try deploying more WHOI ARRA OBS- ideally all of them.

Jason WILL be in the area in 2014 so a couple days adjustment to that schedule to pick up some errant OBS would be possible, if it becomes necessary. This appears simpler and more efficient than shipping the ARRA OBS back to WHOI and hoping to find the fix in time to (ship back and) deploy at the end of the 2013 season with Oceanus.

As you are aware, planning ARRA deploys in a pattern that would make for most efficient rescue effort (if needed in 2014) is the way to go. Lets make a start into this plan- keep us apprised is there continues to be acoustics going belly-up during deploy of the ARRA this leg, since its not clear that we could accommodate rescue of that full fleet 2014, with somewhat unknown locations.

thanks for your patience while we (I) work thru the options,
donna

We reached station J69C shortly after breakfast.

7) Station J69C

On Station:	08/05/2013 15:22 UTC (08/05/2013 08:22:45 LT)
OBS Type:	WHOI KECK No. S85
Deploy Time:	08/05/2013 15:33 UTC
Deployed Position:	48° 45.065' N, 128° 51.175' W
Water Depth:	2569 m
Range to which tracked	Tracked to bottom
OBS on Seafloor:	08/05/2013 16:36 UTC
OBS Fall Speed:	40.7m/min
Start Acoustic Survey:	08/05/2013 16:40 UTC
Disable Acoustic Release:	08/05/2013 17:29 UTC
Depart Station:	08/05/2013 17:29 UTC
Time on Station:	2 hr 7 min

The weather was cloudy with wind speeds of 10 knots from 315° and calm seas. The Keck OBS was deployed at 0833 LT and was in constant communication for the whole deployment. The instrument reached the bottom at 0936 LT and survey began shortly after at 0940 LT. The survey was completed at 1029 LT and ship headed toward site J63C to deploy another KECK OBS.

The ship reached site J63C in the mid-afternoon.

8) Station J63C

On Station:	08/05/2013 22:27 UTC (08/05/2013 15:27 LT)
OBS Type:	WHOI KECK No. S84
Deploy Time:	08/05/2013 22:31 UTC
Deployed Position:	48° 12.383' N, 130° 00.254' W
Water Depth:	2877 m
Range to which tracked	Tracked to bottom
OBS on Seafloor:	08/05/2013 23:43 UTC
OBS Fall Speed:	40 m/min

Start Acoustic Survey:	08/05/2013 23:47: UTC
Disable Acoustic Release:	08/06/2013 00:38 UTC
Depart Station:	08/06/2013 00:38 UTC
Time on Station:	2 hr 11 min

The sea state was calm with fog. There were no issues with deploying the Keck OBS which went into the water at 1531 LT and reached the bottom at 1643 LT. The survey was complete at 1743 LT and the ship tben departed for site J55C.

That evening William and Doug sent the following update to the CIET and NSF

Dear CEIT

Doug and I wanted to give NSF and CIET a quick update on the status of the WHOI OBS deployments.

After an exchange of e-mails overnight and this morning, it has been agreed by NSF that we should resume deployments of the remaining 10 WHOI ARRA instruments. The successful deep-water tests of all the acoustic releases on the ships CTD has frustrated efforts to diagnose the problem but given us some hope that the releases may be more reliable than the first 3 deployments suggested. If the ARRAs are not deployed the coverage of the Juan de Fuca Ridge will be severely degraded and it would be challenging and expensive to attempt to deploy them in the Fall. NSF have asked us to reconfigure the deployments so that the ARRAs go in sites that are most accessible for ROVs should additional acoustic releases fail. The have also asked us to keep them appraised of any additional failures.

Our plan is illustrated in the Figure below.

We are currently transiting to site J55C and the highlights of the plan are:
1. We have skipped 4 sites in the northern part of the array (light blue circles - J52C, J53C, J61C and J68C) in the hope that SIO Abalones can be deployed there. We will instead deploy at J35C, J36C, J43C, J44C.
2. We will deploy the first Keck at site J39C near Axial Seamount tomorrow afternoon on the grounds that it is very convenient to ROVs working on Axial Seamount.
3. If all goes well, all the rest of the WHOI ARRAs will be deployed in a corridor that roughly coincides with the transits between Newport/Astoria and Axial Seamount.
4. We are now out of contingency time for a return on August 11 so have sent an e-mail to John Nabelek and Jochen Braunmiller asking whether they would be willing to swap site J21C (formerly identified as the GAP) for site J06C. This would save us about 12 hours.

Best Regards

William and Doug

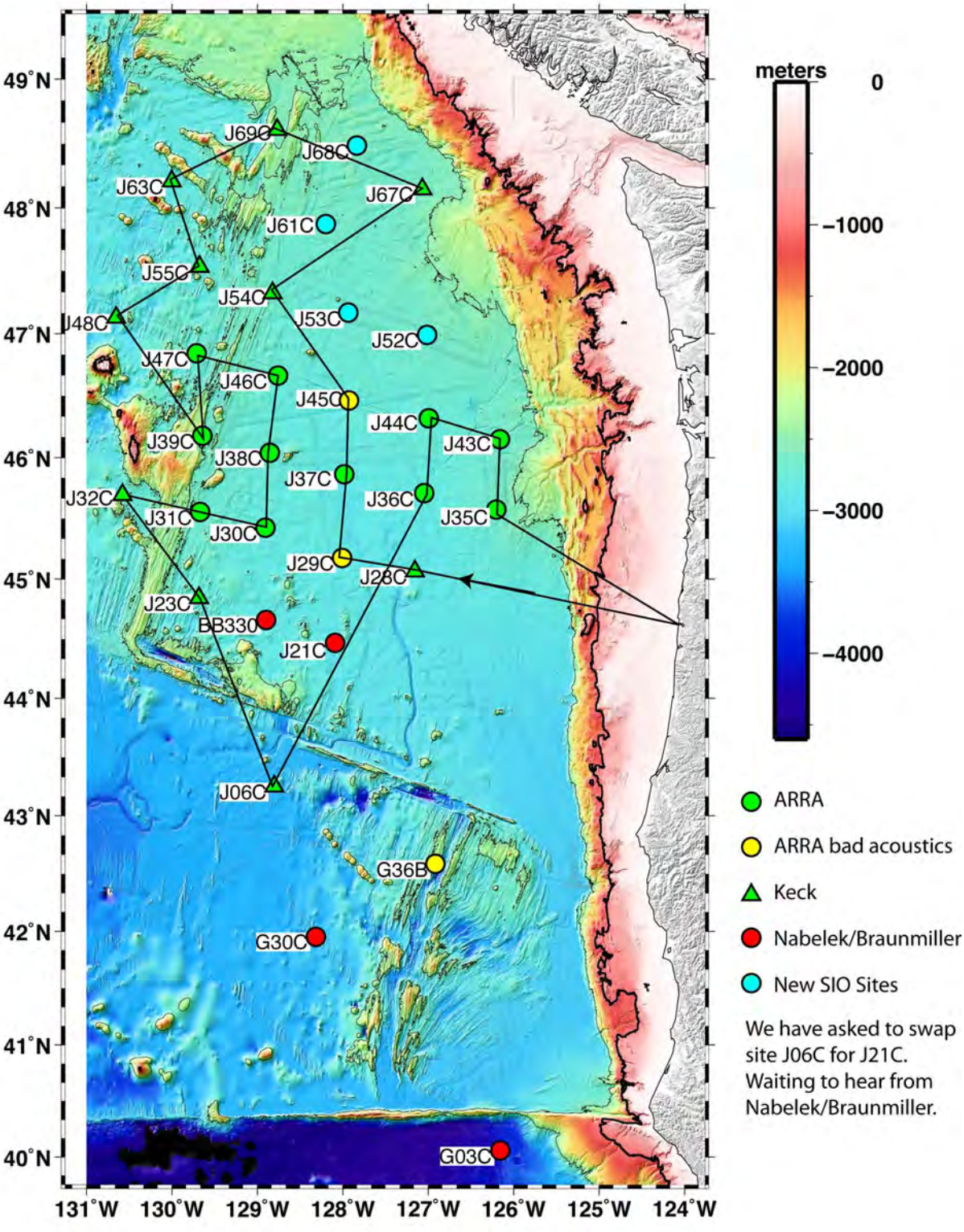

Figure 5. Revised deployment plan of August 5 that utilizes ARRA OBSs and places them in a corridor between Newport, OR and Axial Volcano.

John Nabelek responded positively to the suggestion of swapping site J06C with the GAP site which has been renamed J21C.

We reached site J55C in the evening.

9) Station J55C

On Station:	08/06/2013 04:23 UTC (08/05/2013 21:23 LT)
OBS Type:	WHOI KECK No. S89
Deploy Time:	08/06/2013 04:35 UTC
Deployed Position:	47° 31.829' N, 129° 42.467' W
Water Depth:	2794.7 m
Range to which tracked	Tracked to bottom after 600 m
OBS on Seafloor:	08/06/2013 05:43 UTC
OBS Fall Speed:	40 m/min
Start Acoustic Survey:	08/06/2013 05:47 UTC
Disable Acoustic Release:	08/06/2013 06:35 UTC
Depart Station:	08/06/2013 06:35 UTC
Time on Station:	2 hr 12 min

The DPG was found not to be working at 21:16 LT so was swapped. This did not fix problem so at 21:23 LT the WHOI techs swapped the cable which fixed the problem at 21:28 LT. It was noticed that the depth was ~50 m different from the reported depth of the site but the coordinates were checked and found to be correct. At 22:50 LT early in the survey it was noticed that the 3.5 kHz echo sounder was on and it was switched off. After that the survey went smoothly. We decided to transit slowly to next site in order to give the WHOI team a rest

Tuesday, August 6.

We were on site at J48C before breakfast.

10) Station J48C

On Station:	08/06/2013 13:32 UTC (08/06/2013 06:32 LT)
OBS Type:	WHOI KECK No. S88
Deploy Time:	08/06/2013 13:37 UTC
Deployed Position:	47° 07.811' N, 130° 39.086' W
Water Depth:	2999.4 m
Range to which tracked	Tracked to bottom after 600 m
OBS on Seafloor:	08/06/2013 14:50 UTC
OBS Fall Speed:	40.6 m/min
Start Acoustic Survey:	08/06/2013 14:54 UTC
Disable Acoustic Release:	08/06/2013 15:47 UTC
Depart Station:	08/06/2013 15:47 UTC
Time on Station:	2 hr 15 min

The sea state was near calm and the skies clear until we started surveying, then there was lots of fog. At 07:54 LT the deck box read ~985 m many times. It is possible that the boat was moving back on site after moving away. At 08:45 LT M-Cal was mistakenly closed after reaching 270°. It was reloaded in about 1 min and the survey completed.

The plan for the ARRA OBSs which will be the next 6 deployments was to lower them in with the Morgan crane and check the acoustics before releasing. In rough seas this might lead to problems with snap loads but in the near calm conditions we are experiencing it is straightforward. There was a longer than usual transit to the next site because of our desire to deploy the first ARRA at a site very near Axial seamount.

We reached on station J39C in the mid-afternoon.

11) Station J39C

On Station:	08/06/2013 21:56 UTC (08/06/2013 14:56 LT)
OBS Type:	WHOI ARRA No. T102
Deploy Time:	08/06/2013 22:06 UTC
Deployed Position:	47° 10.578' N, 129° 38.663' W
Water Depth:	2683 m
Range to which tracked	Tracked to bottom after 600 m
OBS on Seafloor:	08/06/2013 22:51 UTC
OBS Fall Speed:	60 m/min
Start Acoustic Survey:	08/06/2013 22:55 UTC
Disable Acoustic Release:	08/06/2013 23:41 UTC
Depart Station:	08/06/2013 23:41 UTC
Time on Station:	1 hr 45 min

The deployment and the survey went very smoothly and we continued in good weather to the next site passing a large dry-bulk carrier ship.

12) Station J47C

On Station:	08/07/2013 03:19 UTC (08/06/2013 20:19 LT)
OBS Type:	WHOI ARRA No. T110
Deploy Time:	08/07/2013 03:26 UTC
Deployed Position:	46° 50.595' N, 129° 42.820' W
Water Depth:	2707 m
Range to which tracked	Tracked to bottom after 600 m
OBS on Seafloor:	08/07/2013 04:16 UTC
OBS Fall Speed:	54 m/min
Start Acoustic Survey:	08/07/2013 04:19 UTC
Disable Acoustic Release:	08/07/2013 05:03 UTC
Depart Station:	08/07/2013 05:03 UTC
Time on Station:	1 hr 44 min

Again the deployment went very smoothly. The power needed to be recycled on the deck box to get M-Cal to record but otherwise the survey went well. The WHOI team decided that they were fresh enough to work through the night and so we continue on to the next site in excellent weather.

Wednesday, August 7.

13) Station J46C

On Station:	08/07/2013 09:06 UTC (08/07/2013 02:06 LT)
OBS Type:	WHOI ARRA No. T107

Deploy Time:	08/07/2013 09:08 UTC
Deployed Position:	46° 39.851' N, 128° 47.342' W
Water Depth:	2773 m
Range to which tracked	Tracked to bottom after 600 m
OBS on Seafloor:	08/07/2013 09:57 UTC
OBS Fall Speed:	57 m/min
Start Acoustic Survey:	08/07/2013 10:00 UTC
Disable Acoustic Release:	08/07/2013 10:44 UTC
Depart Station:	08/07/2013 10:44 UTC
Time on Station:	1 hr 38 min

It was foggy and misting for this deployment but the seas remained excellent and everything went very smoothly. We moved directly on to the next site

14) Station J38C

On Station:	08/07/2013 14:06 UTC (08/07/2013 07:06 LT)
OBS Type:	WHOI ARRA No. T113
Deploy Time:	08/07/2013 14:15 UTC
Deployed Position:	46° 2.3749' N, 128° 51.1716' W
Water Depth:	2759 m
Range to which tracked	Tracked to bottom
OBS on Seafloor:	08/07/2013 15:01 UTC
OBS Fall Speed:	60 m/min
Start Acoustic Survey:	08/07/2013 15:04 UTC
Disable Acoustic Release:	08/07/2013 15:49 UTC
Depart Station:	08/07/2013 15:49 UTC
Time on Station:	1 hr 43 min

The OBS was deployed in calm seas, accompanied by fog and Dall's porpoises. At 07:12 LT the ARRA OBS was in the water and suspended right under the surface. As for recent ARRA OBS, the acoustics were tested to make sure there was a response. Early in the survey at 08:11 LT, M-Cal and deck box stopped communicating. Power was cycled on the deck box and it started working. At 08:13 LT the deck box was not responding so the power was turned up which fixed the problem. We left station J38C at 08:49 LT for station J30C and arrived there at lunchtime

15) Station J30C

On Station:	08/07/2013 19:13 UTC (08/07/2013 12:13 LT)
OBS Type:	WHOI ARRA No. T103
Deploy Time:	08/07/2013 19:18 UTC
Deployed Position:	45° 25.457' N, 128° 54.4141' W
Water Depth:	2820 m
Range to which tracked	Tracked to bottom
OBS on Seafloor:	08/07/2013 20:05 UTC
OBS Fall Speed:	60 m/min
Start Acoustic Survey:	08/07/2013 20:10 UTC
Disable Acoustic Release:	08/07/2013 21:00 UTC
Depart Station:	08/07/2013 21:00 UTC
Time on Station:	1 hr 47 min

The OBS was deployed in calm seas and clear sky. At 12:15 LT the ARRA OBS was held right below the surface of the water to confirm acoustic signal. Then it was released and was in constant contact as it traveled down to the bottom. We moved directly to the next station

16) Station J31C

On Station:	08/07/2013 23:56 UTC (08/07/2013 16:56 LT)
OBS Type:	WHOI ARRA No. T104
Deploy Time:	08/08/2013 00:02 UTC
Deployed Position:	45° 33.182' N, 129° 40.355' W
Water Depth:	2649
Range to which tracked	Tracked to bottom
OBS on Seafloor:	08/08/2013 00:43 UTC
OBS Fall Speed:	64 m/min
Start Acoustic Survey:	08/08/2013 00:47 UTC
Disable Acoustic Release:	08/08/2013 01:28 UTC
Depart Station:	08/08/2013 01:28 UTC
Time on Station:	1 hr 32 min

The OBS was again deployed uneventfully in calm seas and partially clear skies. A whale was sighted <100 m away on the starboard side and then astern as the OBS descended. Deck box needed to be power cycled to get M-Cal working properly. There was relief that all 6 Juan de Fuca ridge ARRA are in place with out incident and we notify NSF and CIET. We modified our deployment plan to visit J21C not J06C which has been handed off to the Nabelek/Braunmiller cruise, and to do J35C and J43C before J44C and J36C since near margin sites are a priority and we suspected that another ARRA failure might halt deployments. We arrive at the first of three keck sites in the evening

17) Station J32C

On Station:	08/08/2013 05:19 UTC (08/07/2013 22:19 LT)
OBS Type:	WHOI Keck No. S81
Deploy Time:	08/08/2013 05:21 UTC
Deployed Position:	45° 42.819' N, 130° 36.098' W
Water Depth:	2790 m
Range to which tracked	Tracked to bottom
OBS on Seafloor:	08/08/2013 06:29 UTC
OBS Fall Speed:	41 m/min
Start Acoustic Survey:	08/08/2013 06:33 UTC
Disable Acoustic Release:	08/08/2013 07:19 UTC
Depart Station:	08/08/2013 07:19 UTC
Time on Station:	2 hr 0 min

While approaching site it was noticed that the 3.5 kHz depth of 2790 m was 200 m shallower than the expected depth of 2977 m (this is one of the sites not occupied in year). Inspection of GeoMapApp bathymetry showed that there was no multibeam at the site in the Global Multiresolution Topography (GMRT) synthesis so the site was moved 500 m west to coincide with some. The deployment was uneventful and we moved on towards site J23C which is a 6 hour transit.

Thursday, August 8.

18) Station J23C

On Station:	08/08/2013 13:15 UTC (08/08/2013 06:15 LT)
OBS Type:	WHOI Keck No. S82
Deploy Time:	08/08/2013 13:21 UTC
Deployed Position:	44° 50.6450' N, 129° 40.9613' W
Water Depth:	2674
Range to which tracked	Tracked to bottom
OBS on Seafloor:	08/08/2013 14:27 UTC
OBS Fall Speed:	40 m/min
Start Acoustic Survey:	08/08/2013 14:33 UTC
Disable Acoustic Release:	08/08/2013 15:14 UTC
Depart Station:	08/08/2013 15:14 UTC
Time on Station:	1 hr 59 min

Weather was foggy and wet. Sea state was very calm. After deployment we headed to site J21C which was another longer transit. We slowed down for a few minutes while we passed a refrigerator! Shortly after 14:00 the ship passed through a large pod of Dall's porpoises and northern right whale dolphins. There were probably over 100 all together. They were interested in the boat and followed us for quite some time.

19) Station J21C

On Station:	08/08/2013 21:49 UTC (08/08/2013 14:49 LT)
OBS Type:	WHOI Keck No. S86
Deploy Time:	08/08/2013 21:52 UTC
Deployed Position:	44° 32.034' N, 128° 02.306' W
Water Depth:	2876
Range to which tracked	Tracked to bottom
OBS on Seafloor:	08/08/2013 23:02 UTC
OBS Fall Speed:	41 m/min
Start Acoustic Survey:	08/08/2013 23:05 UTC
Disable Acoustic Release:	08/08/2013 23:54 UTC
Depart Station:	08/08/2013 23:54 UTC
Time on Station:	2 hr 5 min

The sea state was calm and the deployment went very smoothly. We headed to station J35C which was nearly a 9 hour transit arriving in the early hours.

Friday, August 9.

20) Station J35C

On Station:	08/09/2013 08:25 UTC (08/09/2013 01:25 LT)
OBS Type:	WHOI ARRA No. T114
Deploy Time:	08/09/2013 08:29 UTC
Deployed Position:	44° 29.929' N, 126° 16.078' W
Water Depth:	2685
Range to which tracked	Tracked to bottom
OBS on Seafloor:	08/09/2013 09:13 UTC
OBS Fall Speed:	61 m/min

Start Acoustic Survey:	08/09/2013 09:16 UTC
Disable Acoustic Release:	08/09/2013 10:02 UTC
Depart Station:	08/09/2013 10:02 UTC
Time on Station:	1 hr 37 min

At 01:29 LT the OBS ARRA was lowered into water to be tested. At 01:30 LT the OBS was deployed. The deployment and survey went uneventfully and we headed to site J43C at 03:02 LT.

21) Station J43C

On Station:	08/09/2013 13:33 UTC (08/09/2013 06:33 LT)
OBS Type:	WHOI ARRA No. T111
Deploy Time:	08/09/2013 13:39 UTC
Deployed Position:	46° 08.281' N, 126° 10.312' W
Water Depth:	2674 m
Range to which tracked	Tracked to bottom
OBS on Seafloor:	08/09/2013 14:27 UTC
OBS Fall Speed:	60 m/min
Start Acoustic Survey:	08/09/2013 14:32 UTC
Disable Acoustic Release:	08/09/2013 15:12 UTC
Depart Station:	08/09/2013 15:12 UTC
Time on Station:	1 hr 39 min

At 06:39 LT OBS ARRA was lowered into water to be tested and it was then deployed and surveyed uneventfully. We headed to site J44C at 08:12 LT. The weather was overcast and there were 3 ft swells.

22) Station J44C

On Station:	08/09/2013 18:40 UTC (08/09/2013 11:40 LT)
OBS Type:	WHOI ARRA No. T101
Deploy Time:	08/09/2013 18:45 UTC
Deployed Position:	46° 19.391' N, 127° 02.342' W
Water Depth:	2744 m
Range to which tracked	Tracked to bottom
OBS on Seafloor:	08/09/2013 19:33 UTC
OBS Fall Speed:	57 m/min
Start Acoustic Survey:	08/09/2013 19:38 UTC
Disable Acoustic Release:	08/09/2013 20:20 UTC
Depart Station:	08/09/2013 20:20 UTC
Time on Station:	1 hr 40 min

At 11:47 LT ranges were no good. At 11:52 LT the first good set of ranges were obtained after Alan fiddles with deck box. At 12:41 LT the deck box had to be power cycled before it started transmitting and receiving ranges for the survey. We left for the final OBS site J36C arriving in the later afternoon

23) Station J36C

On Station:	08/09/2013 23:47 UTC (08/09/2013 16:47 LT)
OBS Type:	WHOI ARRA No. T108
Deploy Time:	08/09/2013 23:51 UTC

Deployed Position:	45° 41.167' N, 127° 7.362' W
Water Depth:	2842 m
Range to which tracked	Tracked to bottom
OBS on Seafloor:	08/10/2013 00:41 UTC
OBS Fall Speed:	54 m/min
Start Acoustic Survey:	08/10/2013 00:44 UTC
Disable Acoustic Release:	08/10/2013 01:34 UTC
Depart Station:	08/10/2013 01:34 UTC
Time on Station:	1 hr 47 min

The weather had worsened slightly and so the instrument was deployed without testing the acoustics in the water while attached to the crane. The last deployment and survey was completed with no problems. We notified NSF and the CIET of the our success and headed back to Newport, OR. The plan was to arrive at 10:00 LT the next day which gave us some extra time so we spend about 2 hours following tuna boats and fishing with some success. The seas were a little rougher than we had become accustomed to.

Saturday, August 10.

We arrive in Newport, OR at 1000 LT to summer fog and cool temperatures. The WHOI ARRA OBS recovered by the TGT/Jason effort is dockside and appeared to have disk full of data. The science team demobilizes and all depart Newport that day.

OBS Operations

OC1307C deployed 23 WHOI OBSs at 23 sites as part of the Year 3 oceanographic component of the Cascadia Initiative. The 23 sites are located on the Juan de Fuca plate and Pacific plates (Fig. 1).

Of the 25 OBS deployed, 13 were of a new WHOI design, the construction of which was funded through the American Recovery and Reinvestment Act (ARRA). The WHOI-designed ARRA OBS (Table 2) carry a Trillium Compact intermediate-period seismometer and a Cox-Deaton-Webb Differential Pressure Gauge (DPG). The Quanterra Q330 datalogger and Quanterra Baler-44 storage device are housed in a short aluminum (7075) pressure housing, while a smaller diameter but longer aluminum cylinder holds the lithium battery pack. The ARRA OBSs carry a new chip-scale atomic clock (CSAC) manufactured by Symmetricom that provides significantly more accurate timing than the Seascan timebase used in the other WHOI OBSs. Floatation is provided by a syntactic foam pack. The remaining 10 OBSs were funded by the W.M. Keck Foundation (Table 1), and carry a Guralp CMG-3T broadband seismometer, a Kinemetrics Episensor strong-motion accelerometer, and a DPG. Timing on the Keck OBS is provided by a Seascan timebase. All the OBSs sampled at 50 Hz; the low pass anti-alias filters passband edge is set to a 20 Hz and stopband edge to 24 Hz.

All of the OBS were deployed off the starboard side using the Oceanus' Morgan knuckle-boom crane. Because of excellent weather initial OBS preparation and electronics check-out were done while underway with final checks were done either as we approached the site or on site. We attempted to track all of the OBSs acoustically as they fell to the seafloor. The acoustics for the ARRA OBS at site J29C failed as it approached the seafloor and those for the ARRA OBS at site J45C never worked in the water. Two instruments failed similarly last year. The reason for these failures is unclear although it may be possible to diagnose the problem since one of last year's failed instruments was recovered with the ROPOS ROV (see Appendix A). The 21 OBSs with working acoustics were surveyed acoustically with the M-Cal commercial software by steaming out to a range of one water depth, following a circular path at one water depth for about 270° and returning back over the OBS. The deployed (drop) and surveyed OBS locations are listed in Table 3.

Table 1. ARRA OBS Configurations

Site	OBS ID	Nanometrics S/N	DPG S/N	DPG Version	Q330 Tag ID	Q330 Firmware Version	Baler44 Tag	CSAC Element S/N	Edgetech BART S/N	Novatech Radio S/N	Radio Frequency
J44C	T101	3021	43	old	4512	1.145	16503	1104CS00303	35744	B07-027	154.585
J39C	T102	3029	60	old	4513	1.145	16500	1103CS00255	35731	U03-080	159.480
J30C	T103	3022	005	6.2	4514	1.145	16496	1104CS00354	35743	Y05-014	160.725
J31C	T104	3004	6004	6.3	4515	1.145	17062	1106CS00447	35738	U03-073	154.585
J45C	T105	3007	004	6.2	4516	1.145	16501	1104CS00379	35747	V10-090	159.480
J37C	T106	3001	6019	6.3	4517	1.145	16502	1102CS00239	35745	U03-093	160.785
J46C	T107	3006	042	6.0	4518	1.145	16499	1104CS00304	35740	V10-089	159.480
J36C	T108	3018	012	6.2	4519	1.145	71951	1101CS00193	35748	B07-030	154.585
J29C	T109	3002	44	old	4520	1.145	16504	1104CS00362	35733	V10-092	159.480
J47C	T110	3020	54	old	4521	1.145	16512	1104CS00353	35741	U03-086	160.725
J43C	T111	3023	005	6.0	4522	1.145	16286	1106CS00594	35735	B07-031	154.585
J38C	T113	3024	45	old	4524	1.145	16511	1103CS00281	35732	U03-085	160.725
J35C	T114	3008	49	old	4525	1.145	17061	1102CS00227	35734	B07-028	154.585

All Edgetechs receive at 11 kHz and transmit at 13kHz

Table 2. Keck OBS Configurations

Site Number	OBS ID	Guralp CMG-3T S/N	DPG S/N	DPG Version	Kinemetrics Episensor S/N	WHOI Episensor Board	Q330 Tag ID	Q330 Firmware Version	Baler14 Tag ID	QEP-1 Tag	EP-ADC-1 Tag	Seascan Timebase	Edgetech Release Board #1	Edgetech Release Board #2	Novatech VHF Radio S/N	Radio Frequency
J67C	S80	T3G38	6010	6.3	2867	11	2006	1.145	06392	117267	116633	0110	31653	31642	V10-093	160.785
J32C	S81	T33996	6014	6.3	2864	08	2007	1.145	06393	117246	116635	0133	31654	31665	U03-079	159.480
J23C	S82	T3L04	6009	6.3	2797	01	0002	1.146	06394	117244	116637	1040	31644	31630	U03-090	160.785
J54C	S83	T3G37	035	6.0	2836	03	2009	1.145	06395	117245	116636	0318	31645	31656	V10-084	159.480
J63C	S84	T3L02	6022	6.3	2865	02	2010	1.145	06396	117274	116625	1043	31657	31646	V10-094	160.785
J69C	S85	T3G30	6005	6.3	2862	09	2011	1.145	06397	117268	116638	1044	31647	31658	U03-082	160.725
J21C	S86	T3J97	6016	6.3	2870	05	2012	1.145	06398	117269	116631	1050	31648	31659	Y05-016	160.785
J28C	S87	T3L46	048	6.0	2866	07	2015	1.145	06399	117273	116652	1213	31666	31663	U03-075	154.585
J48C	S88	T33999	6011	6.3	2863	04	2016	1.145	06514	117271	116639	1217	31650	31661	U03-072	154.585
J55C	S89	T3G41	6003	6.3	2868	10	2188	1.145	06401	117272	116634	1221	31651	31662	U03-091	160.785

All Edgetechs receive at 11 kHz; all release #1 boards transmit at 11.5kHz; all release #2 boards transmit at 13kHz

Table 3. Drop and Survey positions of WHOI OBSs

Site	Drop Position (Planned)			Survey Position			Date Deployed
	Latitude (Dec.)	Longitude (Dec.)	Depth (m)	Latitude (Dec.)	Longitude (Dec.)	Depth (m)	
J28C	45.06372	-127.15637	2884.8	45.0617	-127.1567	2888.5	2-Aug-13
J29C	45.17592	-128.00848	2852.79				2-Aug-13
J37C	45.86412	-127.98523	2884.3	45.8635	-127.9853	2885.8	2-Aug-13
J45C	46.52092	-127.90483	2775				3-Aug-13
J54C	47.33597	-128.81158	2662	47.3358	-128.8113	2666.2	3-Aug-13
J67C	48.15010	-127.08440	2608	48.1510	-127.0868	2581.1	5-Aug-13
J69C	48.62747	-128.73915	2569	48.6270	-128.7386	2544	5-Aug-13
J63C	48.20678	-130.00423	2877	48.2047	-130.0053	2845.3	5-Aug-13
J55C	47.53048	-129.70778	2794.7	47.5315	-129.7078	2754.9	6-Aug-13
J48C	47.13018	-130.65143	2994.4	47.1295	-130.6507	2939.7	6-Aug-13
J39C	46.17630	-129.64438	2683	46.1761	-129.6438	2656.1	6-Aug-13
J47C	46.84325	-129.71367	2707	46.8440	-129.7139	2678.9	7-Aug-13
J46C	46.66418	-128.78903	2773	46.6645	-128.7894	2743.6	7-Aug-13
J38C	46.03958	-128.85286	2759	46.0389	-128.8536	2730.5	7-Aug-13
J30C	45.42428	-128.90690	2819.6	45.4261	-128.9100	2785.7	7-Aug-13
J31C	45.55303	-129.67258	2649	45.5519	-129.6724	2624	7-Aug-13
J32C	45.71365	-130.60163	2790	45.7145	-130.6030	2755.5	8-Aug-13
J23C	44.84408	-129.68269	2674	44.8438	-129.6810	2652.8	8-Aug-13
J21C	44.5339	-128.0384	2876	44.5342	-128.0376	2846.8	8-Aug-13
J35C	45.4988	-126.2680	2685	45.4995	-126.2683	2655.2	9-Aug-13
J43C	46.1380	-126.1719	2673.5	46.1370	-126.1725	2644.6	9-Aug-13
J44C	46.3232	-127.0390	2744	46.3240	-127.0407	2742	9-Aug-13
J36C	45.6861	-127.1227	2842	45.6865	-127.1252	2811.6	9-Aug-13

*** Magenta indicates that site was not surveyed and acoustics are not working**

Table 4. CTD Locations and Depths

CTD Number	Station Name	Deployment Date	Deployment Time	Latitude	Longitude	Cast Depth	File	Notes
1	J45C	8/3/13	03:06	46° 31.264'N	127° 54.291'W	1000 m	cast01.hex	
2	None	8/3/13	18:43	47° 19.440'N	128° 48.702'W	2000 m	cast02.hex	Testing releases
3	None	8/4/13	00:39	47° 13.993'N	128° 17.780'W	2000 m	cast03.hex	Testing releases
4	J52C	8/4/13	15:08	46° 59.530'N	127° 00.979'W	2000 m	cast04.hex	Testing releases

Deployment Site Bathymetry

The following 4 figures show bathymetry at the two deployment sites not occupied in year 1.

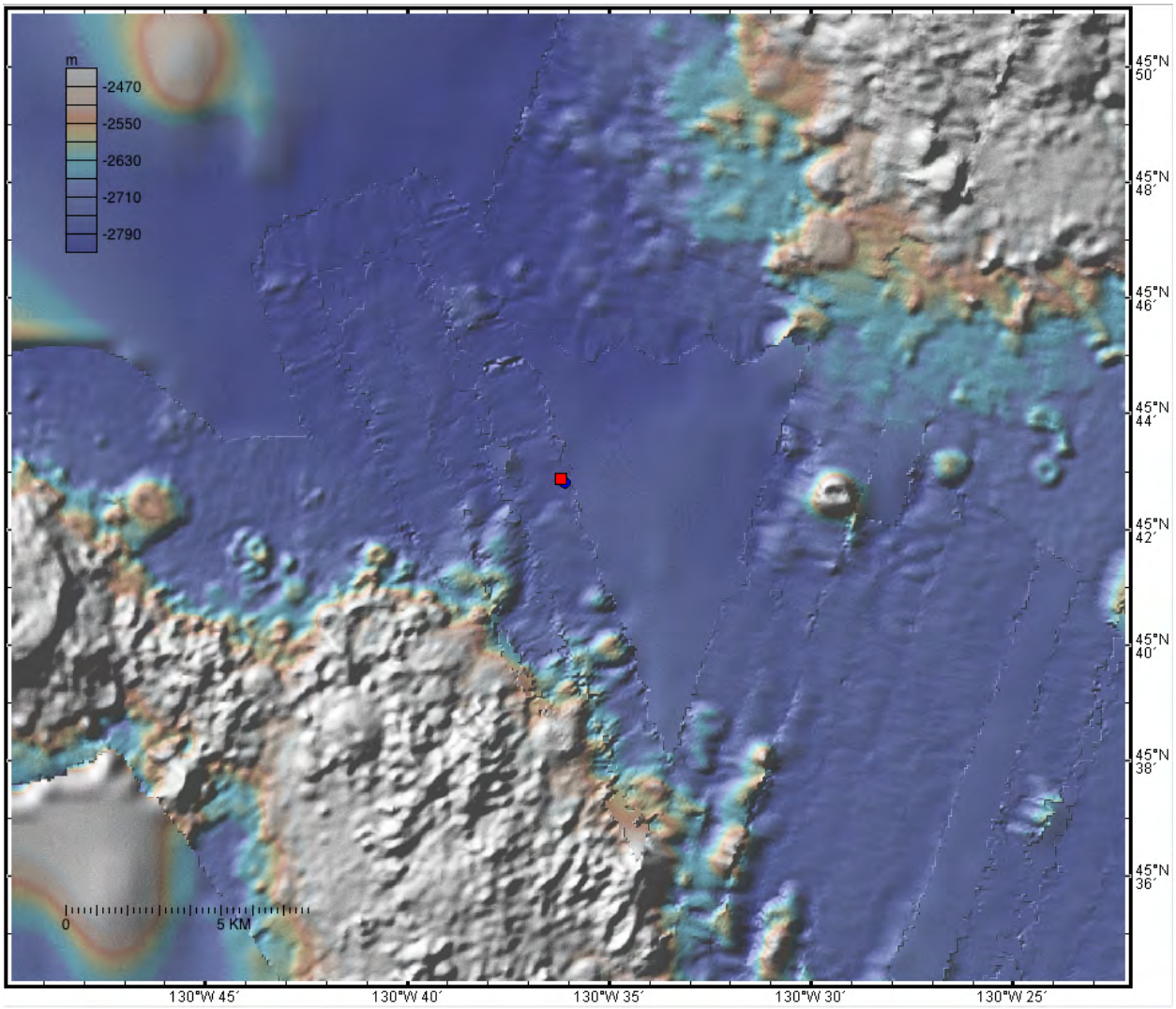

Figure 6. Regional view of bathymetry near OBS drop site J32C with a blue circle at the planned location and a red box at the surveyed location.

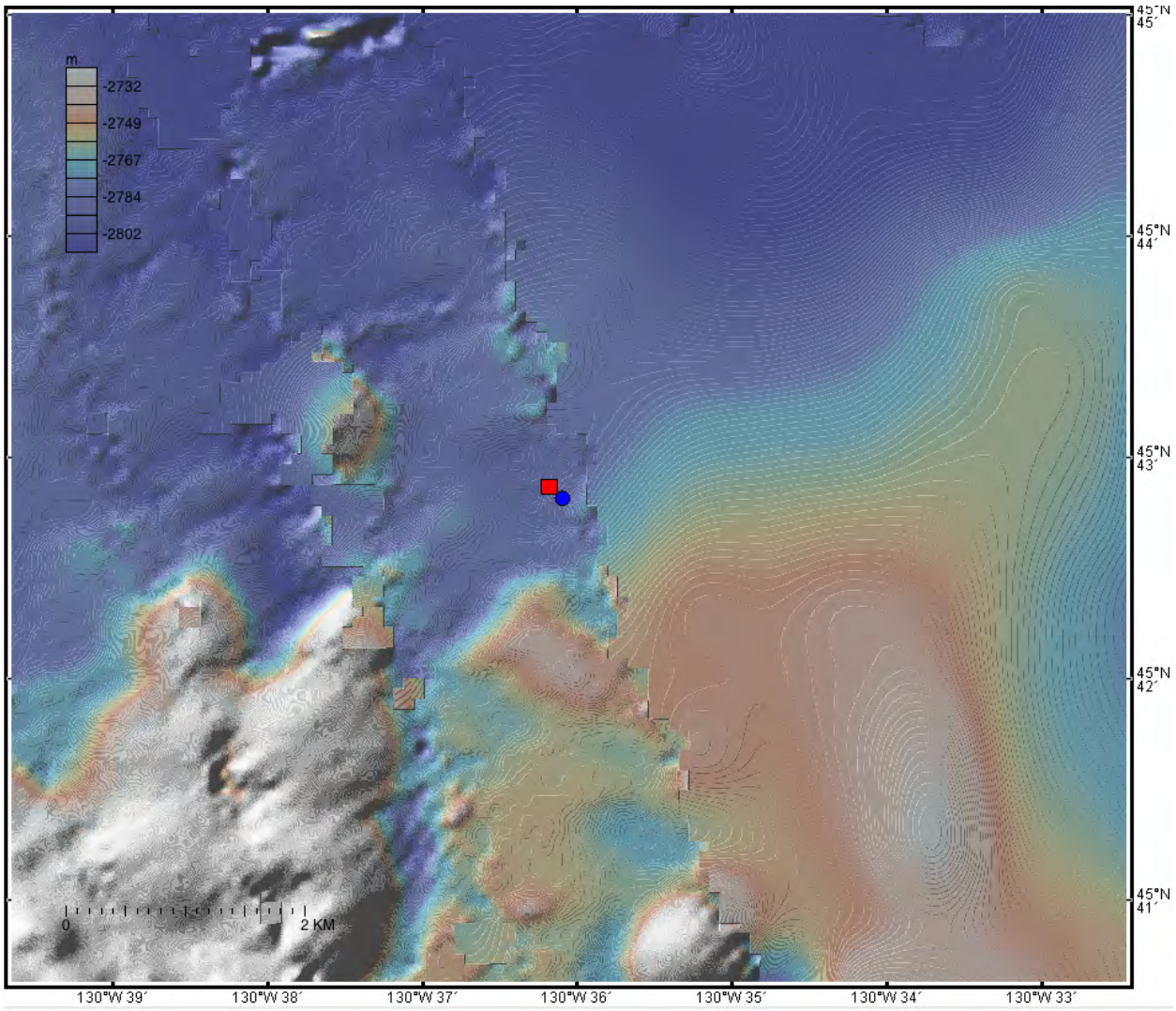

Figure 7. Close in view of bathymetry near OBS drop site J32C with a blue circle at the planned location and a red box at the surveyed location.

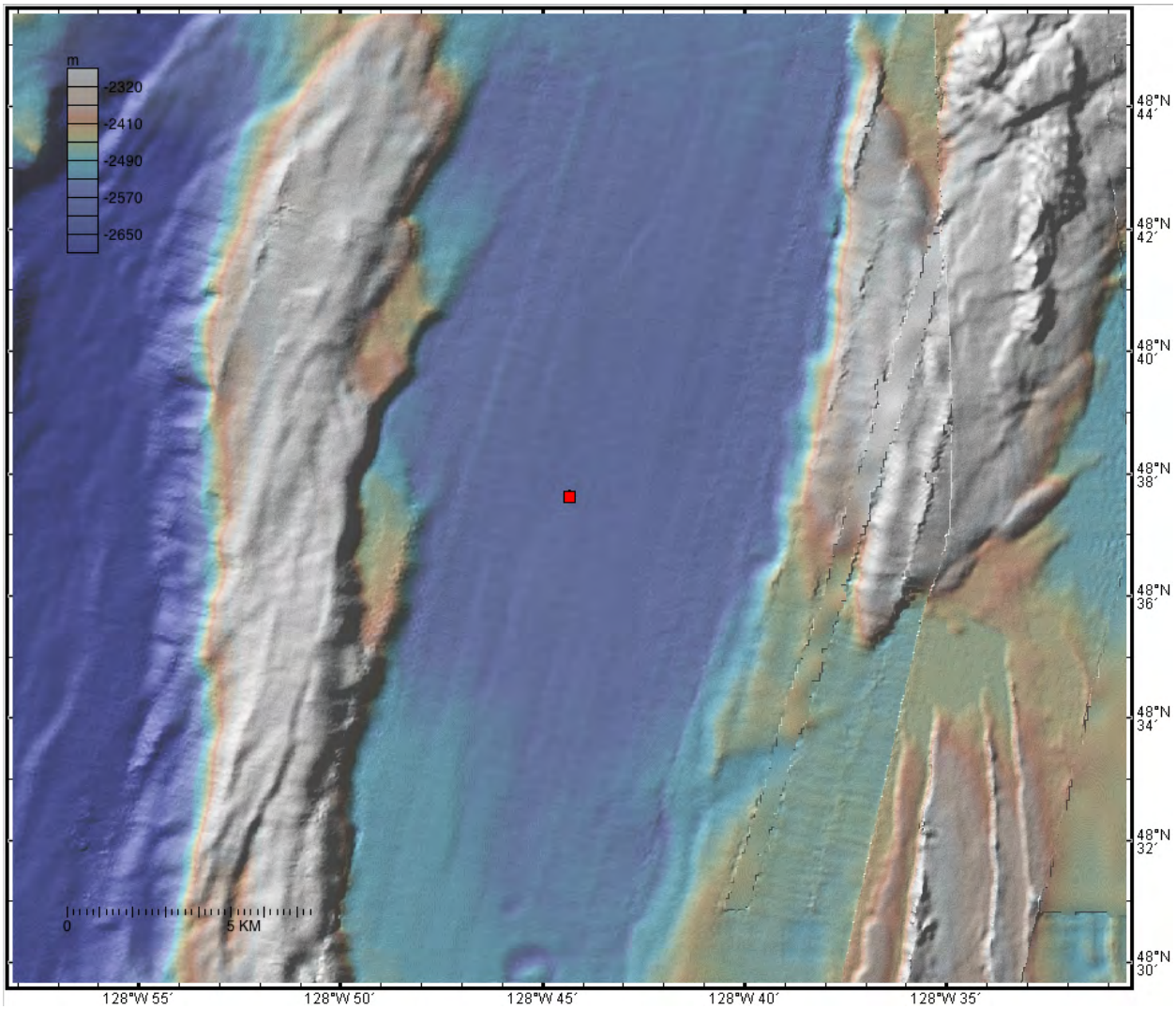

Figure 8. Regional view of bathymetry near OBS drop site J69C with a blue circle at the planned location (obscured) and a red box at the surveyed location.

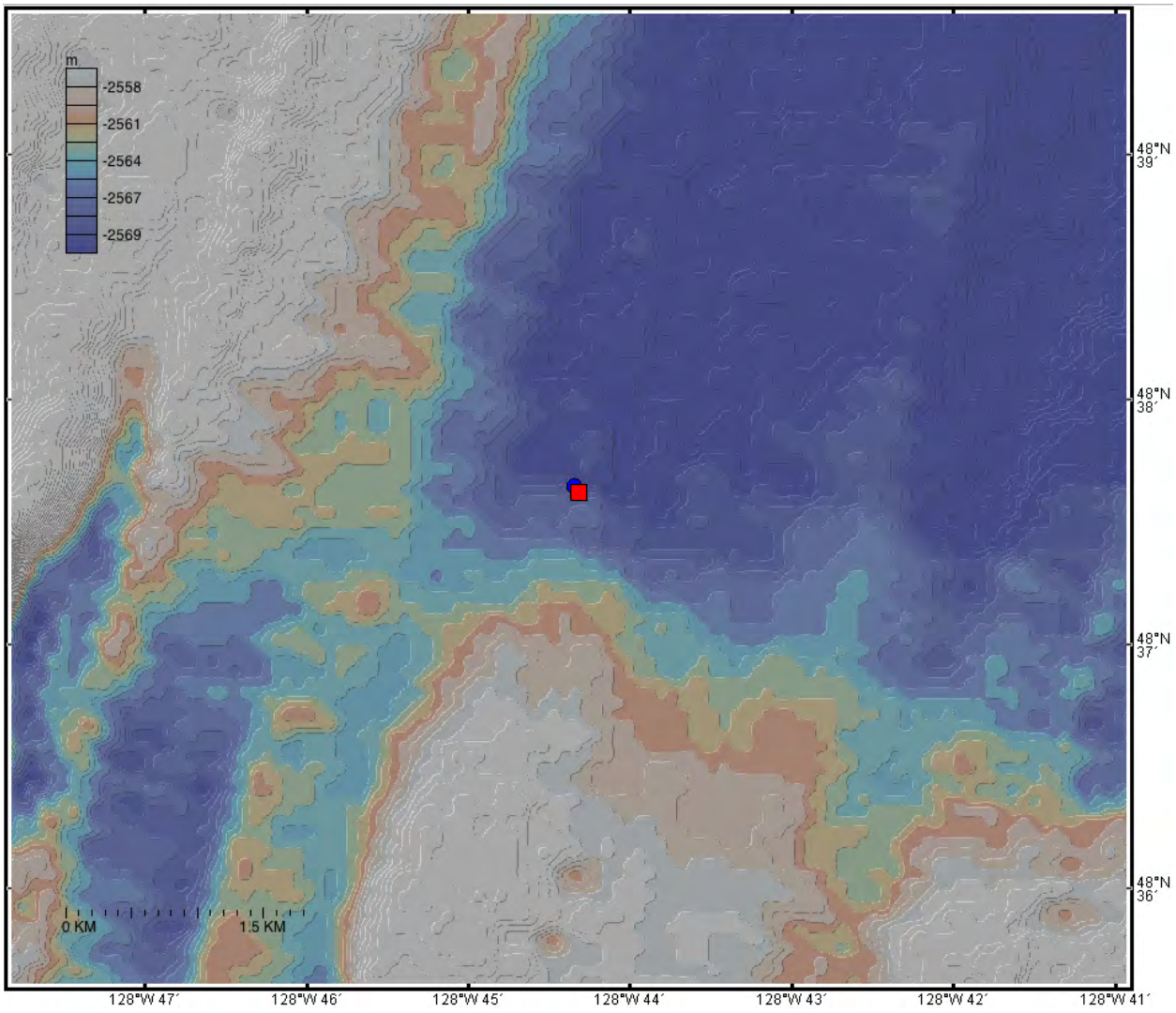

Figure 9. Close in view of bathymetry near OBS drop site J69C with a blue circle at the planned location and a red box at the surveyed location.

Acknowledgements

This cruise was supported by the U.S. National Science Foundation. We thank Captain Jeff Crews, Chief Engineer Mike Ribera, and the officers and crew of the *R/V Oceanus* for helping to make this cruise a success. Shipboard technician Erik Arnesen provided considerable help with shipboard data systems and ensured OBS deck operations and CTD deployments went smoothly. Donna Blackman (NSF) and John Collins (WHOI) provided valuable input that allowed us to complete our cruise objectives.

Appendix A: Summary Report for R/V Thompson and ROPOS Recovery of WHOI ARRA OBS J11B

August 6, 2013 by Giora Proskurowski, Co-Chief Scientist Leg 3 VISIONS13, TN299

Pre-dive Input Information:

J11B- Position of ship during deployment-
43° 32.428'N 126° 22.060'W (43.5405, -126.3677)
Water depth 3002m
Currents at deployment were 0.05m/s in both the North and East components, assuming a 55m transit time to bottom, suggested a max drift of ~230m to the NE (165m drift to N, 165m drift to E)

ROPOS Dive R1625 began Aug 3, 2013 at 0118h UTC, with a dive target corresponding to the last known position of OBS J11B—the ship's position during deployment. Analysis of full water column currents at the time of the OBS deployment in 2012 suggested drift during descent would set the package to the north and east, up to 230m. A "expanding square" survey pattern was developed that prioritized (at least in chronology) the north and east directions, with consecutive lines spaced 75m apart (Figure A1, and attached csv trackline). ROPOS was equipped with a Kongsberg Mesotech 675kHz scanning sonar set to scan 180°, at "high-resolution", with a range of 100m.

ROPOS reached the bottom, 3003m, at 0325 UTC with a heading 085. Immediately, a target was identified at the far end of the sonar range to the north, about 100m away. The search pattern was abandoned and the vehicle driven towards the target. The OBS was a very defined sonar target, scaled approximately to the size of the package (2m x 1m); on the sonar display the target did not appear pink (highest reflectance) but was at the high end of the reflectance scale (white and blue). At 0328 UTC ROPOS visually confirmed the OBS position at 43° 32.4812'N 126° 22.0387'W, approximately 100m NNE from the deployment location.

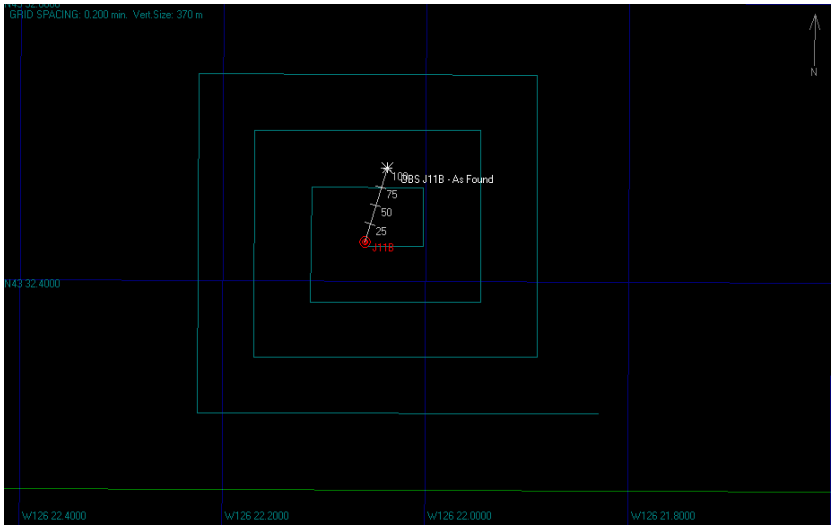

Figure A1. Dive target (OBS deployment location), as found position, and planned search pattern that was never executed.

After a very brief visual inspection of the OBS for damage to pressure cases, and a physical inspection to verify that the release weights were secure, ROPOS hooked the OBS lifting bale to a strap attached to the vehicle through-hull lift. At 0341 UTC ROPOS was pulled tight to the LARS winch and raised off bottom with the OBS secured beneath. ROPOS and the OBS were recovered at 0659 UTC. During ascent special attention was paid to monitoring the cameras for bubbles that might indicate compromised pressure cases.

Dive R1625 Information:

OBS As-found Location
43° 32.4812'N 126° 22.0387'W
Total Bottom Time:
16 minutes
Total Dive Time:
5:44 h

Once onboard the OBS was treated cautiously as there was quite a bit of concern on the part of the crew regarding the condition of the lithium batteries. The pressure cases were verified to be cold using a handheld infrared thermometer, and the benign OBS was transferred to the back deck and secured.

The following morning the vacuum plug was removed and vacuum inside the pressure case was verified. Following email and phone conversations with Alan Gardner and John Collins more diagnostics were performed, including opening the battery pressure case, and testing the acoustics. There was no water or visible signs of corrosion inside the battery pressure case and the acoustic release battery had measured voltages (relative to black wire gnd) of orange 10.28V, red 19.09V, yellow 9.83V. We were able to successfully communicate with the OBS acoustics at Tx/Rx 11.0/13.0 kHz using a Teldyne U-9000 deckbox and transducer, sending an enable code, pinging and then disabling.

OBS J11B was offloaded onto the Oregon State Hatfield Marine Science Center dock on August 4th.

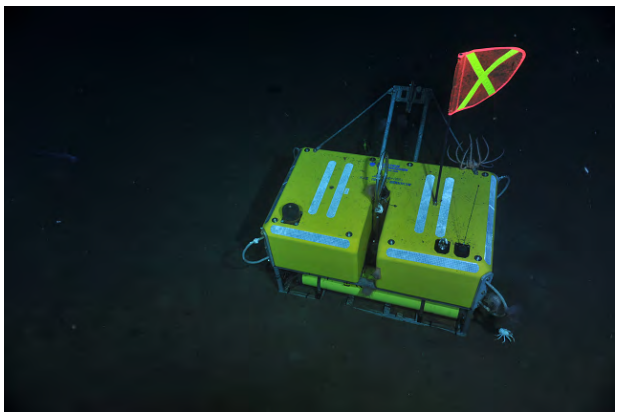

Figure A2. OBS J11B at As-Found location, ~100m NNE from initial deployment position, at 3003m depth.

	Longitude	Latitude
J11B-1	-126.914845	42.582875
J11B-2	-126.9148083	42.58288
J11B-3	-126.9139183	42.5828883
J11B-4	-126.91393	42.58359
J11B-5	-126.9157383	42.58358
J11B-6	-126.9157467	42.5822117
J11B-7	-126.913835	42.58222
J11B-8	-126.9129883	42.5822267
J11B-9	-126.9130117	42.5842767
J11B-10	-126.9166783	42.584255
J11B-11	-126.91665	42.5815483
J11B-12	-126.9120617	42.581575
J11B-13	-126.9121067	42.5849483
J11B-14	-126.91759	42.58492
J11B-15	-126.9175517	42.5808667
J11B-16	-126.9110467	42.58091

Table A1. Waypoints of planned “expanding square” search pattern.

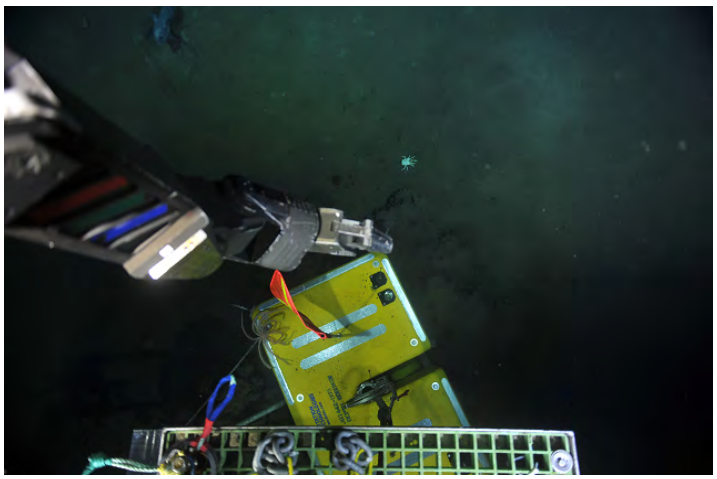

Figure A3. Liftoff of OBS, attached via lifting bale and strap hook to ROPOS through-hull lift, 16 minutes after ROPOS arrived on the bottom.