



## Cruise Report

OSU R/V Oceanus  
OC1305C

Cascadia Initiative Leg 1  
June 3 to June 14  
Newport, OR – Newport OR

Matt Fowler  
Chief Scientist

***Captain and Crew:  
R/V Oceanus:***

Captain: Jeff Crews  
Chief Engineer: Mike Ribera  
1<sup>st</sup> Mate: Bob Overmon  
2<sup>nd</sup> Mate: Tony Monocandilos  
Engineer: Jay Jean-Bart  
Engineer: Chip Millard  
AB: Eugene Otto  
AB: John Saunders  
AB: Marc Simpson  
Sr. Steward: Kris Alberty  
Steward: Joy DeRosa

***Science Party:***

***Chief Scientist:***

Matt Fowler (OSU/NOAA)

***Marine Tech:***

Rob Hagg (WHOI)

***Woods Hole Oceanographic Institution OBS Team:***

Alan Gardner: Senior Engineer  
Tim Kane: Electrical Engineer  
Dave DuBois: Engineer  
Dan Kot Senior Mooring Tech

***SAIC Observer:***

Seth Mogk

***Apply to Sail Recipients:***

***California State Polytechnic University Pomona***

Hannah Mejia

***University of Minnesota***

Sara Kawalke

## **Introduction**

Cruise OC1305C aboard the R/V Oceanus was the first cruise of the 2013 Spring/Summer cruise season. Its purpose was to recover a portion of the array of Ocean Bottom Seismometers (OBS) deployed in 2012 as part of the National Science Foundation funded Cascadia Initiative. This community-based experiment represents a combined onshore-offshore seismic and geodetic study of the Cascadia Margin. See the following website for details of the year 1 and 2 science plan and for more information about the Cascadia Initiative <http://pages.uoregon.edu/drt/CIET> .

The objectives for this cruise were to recover 25 deep water OBSs built by Woods Hole Oceanographic Institution (WHOI). 10 OBSs were KECK type and 15 OBSs were ARRA type. While weather permitted, both the science party and the OBS team worked a 24 hour schedule to recover all the instruments as efficiently as possible.

For the majority of the 11 day cruise, seas were over 10', with winds constant at 30+kts. Conditions worsened in the southern extent of the array to 50 kts winds with one recorded gust of 98 kts which tore the awning off the bridge wing. Confused seas built to very steep 20-25 ft. swells forcing the cessation of all deck ops. Due to highly localized weather forecast, we transited 24 hours north to better conditions and resumed recovery operations while working our way back to southern KECK type OBSs.

Additional members of the science team included two graduate student observers, Hannah Mejia - **California State Polytechnic University Pomona** and Sara Kawalke - **University of Minnesota**, participating in the Apply to Sail program. This program is intended for graduate students and early career scientists interested in direct at sea experience, both in learning field techniques and OBS deployment, recovery and preliminary data processing.

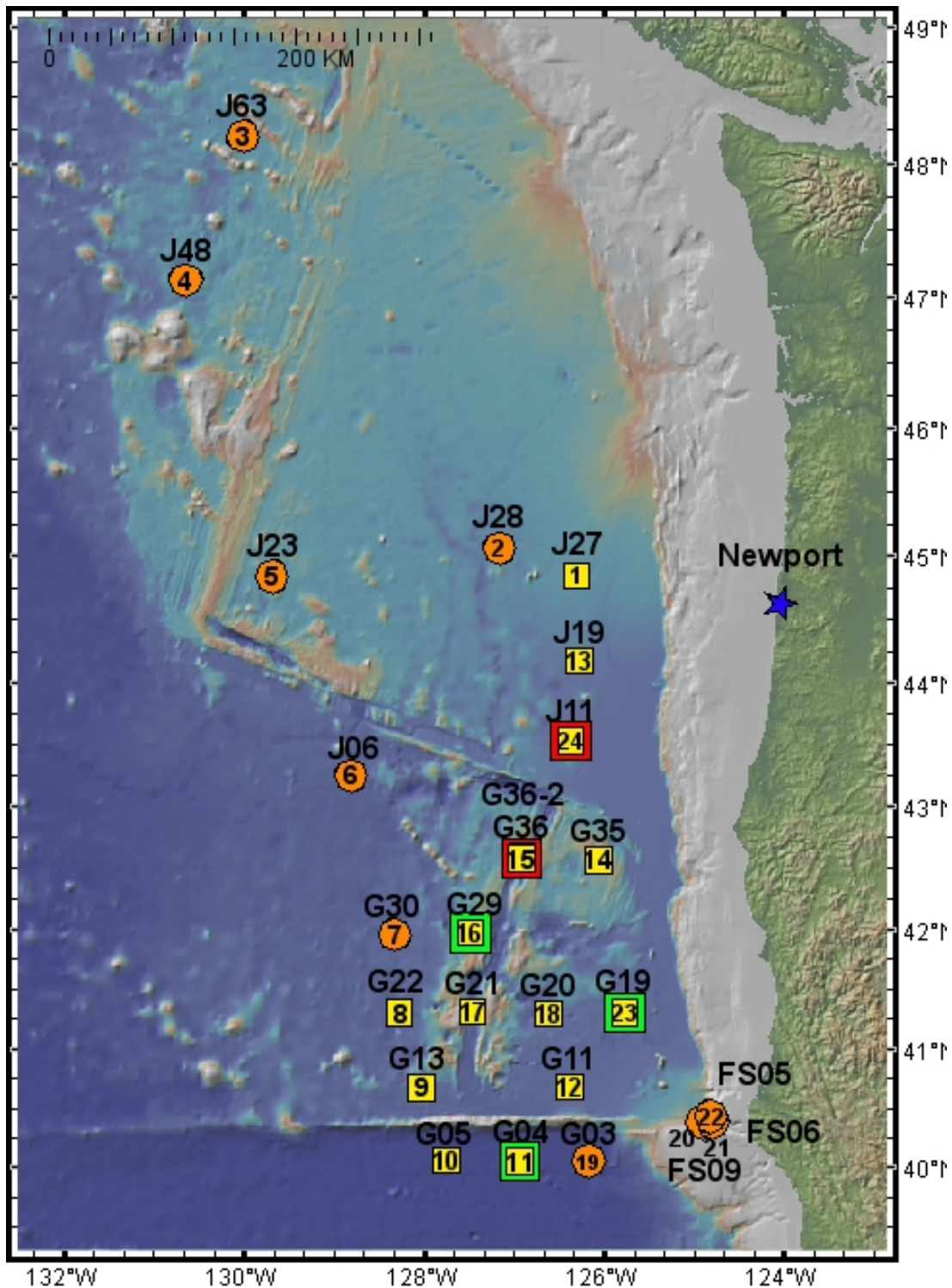
## **Deployment Site Selection:**

Deployment sites were initially selected through a series of committee meetings. The Cascadia Initiative Expedition Team (CIET), and the Amphibious Array Steering committee (AASC) and the co-chief scientists made slight modifications to avoid strong currents, seafloor hazards and areas of active shrimp and fish trawling ( sites < 1000 m).

While selecting OBS deployment sites, the team relied heavily on input from local fishermen, local fishing organizations in both Oregon and Washington. Native American tribes, Quileute and Quinault were both contacted to ensure the deployments did not impact their fishery rights.

Some sites were moved slightly to nearby no-trawl zones, specifically Essential Fish Habitats (EFHs) in Grays Canyon region and Nehalem Bank/Shale Pile, and others were moved near known "hangs" based on specific suggestions made by Scott McMullen of the Oregon Fisherman's Cable Committee.

Final deployment locations are shown in Figure 1 and are listed in Table 1 at the end of this document. Table 2 lists the deployment location vs. surveyed location with distance and bearing of OBS drift while freefall descending to the seafloor. The final surveyed location of J06B was a surprising 1529m from the deployment site. This instrument's log sheet showed three similar locations, intended, drop and bridge's position all recorded but were contradicted by survey. J06B surfaced near the surveyed site, supporting the accuracy of the WorkBoat location.

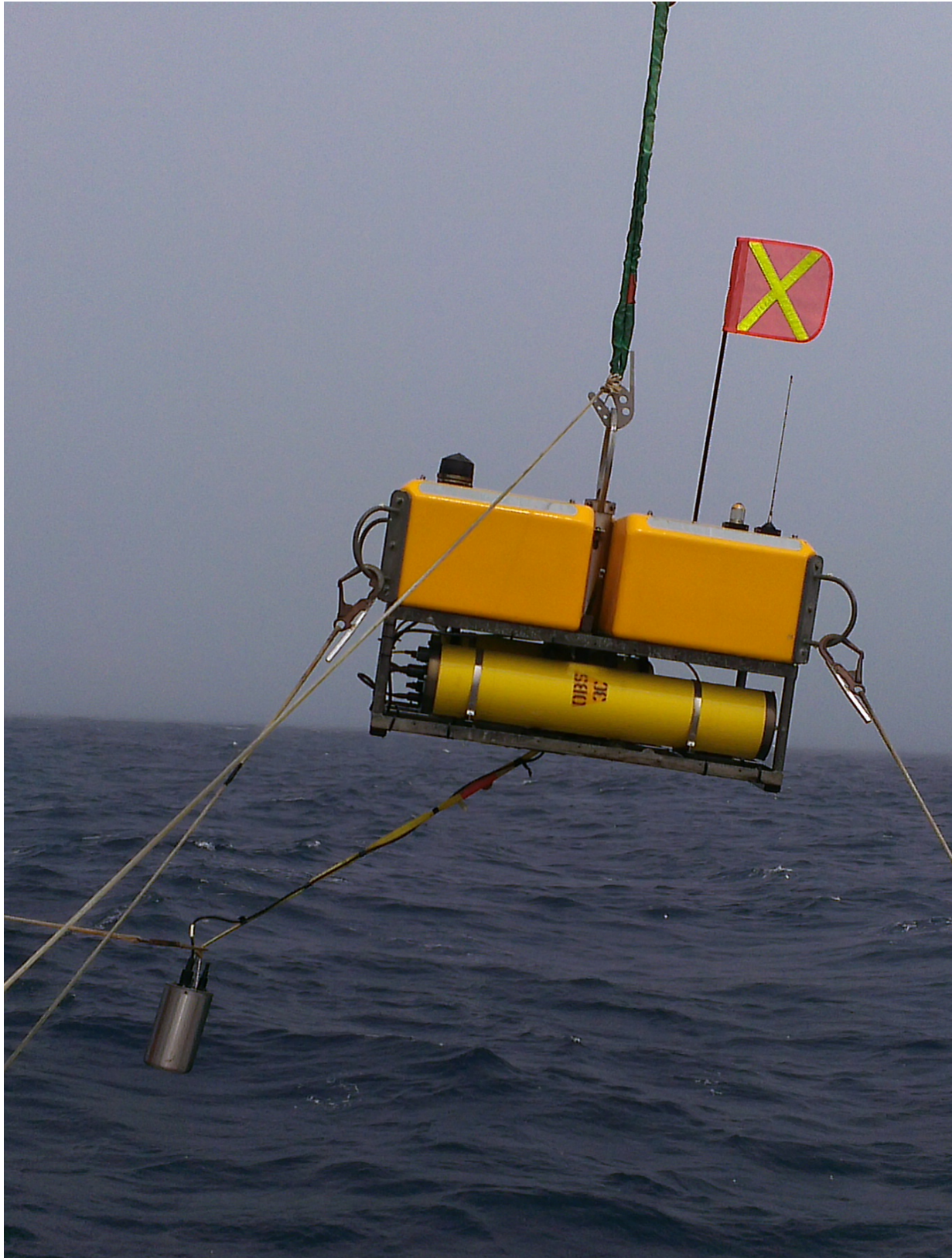


**Figure 1.** Map of OBS locations. Instruments recovered were 13 of 15 ARRA (yellow squares) and 10 KECK (orange circles) type OBS (photos below). Two ARRA type, J11B and G36B (yellow on red squares) were known to have malfunctioning acoustic releases and were unrecoverable. G04B, G19B and G29B (yellow on green squares) had been acoustically surveyed during the deployment leg, all others were acoustically surveyed using WorkBoat software before recovery. Recovery sequence number listed on station icon when possible.





**Figure 2** WHOI - KECK type OBS. 10 of 10 recovered



**Figure 3** OBSIP – ARRA type OBS. 13 of 15 recovered



## ***OBS Description and Recovery Summary***

The 23 OBSs recovered on this cruise were of two different types, both designed and built by WHOI. The ARRA type are part of the OBSIP (Ocean Bottom Seismometer Instrumentation Pool) and were funded by the American Recovery and Reinvestment Act, while the KECK type were built with funding from the William M. Keck Foundation. Both instrument types have similar sensors and obtain similar data. The KECK instrument additionally has a three axis accelerometer. While both types have similar instrumentation, the platforms varied widely. ARRAs could be recovered in much worse conditions than could the KECKs. This proved problematic in the predominately KECK populated southern portion of the array when conditions deteriorated.

All twenty three instruments fit on the fantail of the R/V Oceanus, without stacking, and only a minimum of planning was required to fit and secure all OBSs on the deck. All instruments are battery operated and designed for autonomous operation for ~ 1 year. Deployment in 2012 was a standard drop with the instrument freefalling to the seafloor. They were recovered after acoustically triggering the releases to drop their anchor. Three of the 25 deployed, G04, G19, and G29, had acoustic surveys during the 2012 deployment cruise. Two instruments, J11B and G36B both were unresponsive to all attempts at communication from the deployment team and were considered to have malfunctioning acoustic releases. Before recovery the remaining 20 instruments required acoustic survey. 19 of these surveys were conducted using OSU laptop computer with WorkBoat navigation software (<http://www.seanav.com>). The FS09 site was surveyed with MCal navigation software (<http://www.seanav.com>) using WHOI laptop computer. Site G19B was surveyed using MCal to compare location with previous deployment survey. All surveys utilized the ship's hull-mounted transducer which initially circled with a radius of 0.5 times the water depth. As the weather degraded and the sea state increased, the circular survey pattern was abandoned and a triangular pattern was substituted. The triangle was centered over the OBS with the corners of the triangle 0.5 times the water depth. The triangle was a faster survey without sacrificing location quality. Additionally, the triangle could be laid out to avoid long portions of the survey being conducted in the "trough" during rough seas. Screen grabs of surveys are in appendix 1.

For the majority of the cruise, swells were 8-10 ft. and wind waves were 2-6 ft. For several days conditions in the southern extent of the array deteriorated. Winds built to a sustained 30-35 kts and seas built to 20-25 ft. As the forecast worsened, with winds forecast to reach 50+ kts the original ship track (Figure 4) had to be abandoned as first night operations then all operations had to be cancelled due to influence of a highly localized low pressure zone stalled near the coast. Based on best available weather forecasts and recommendation of Captain Jeff Crews, R/V Oceanus proceeded north for 24 hours to Station J19 (Figure 5) where conditions allowed the resumption of mooring operations. Conditions once again permitted 24 hour operations and with the wind and seas at our backs the vessel made 12+ kts between stations. Highly skilled ship maneuvering in heavy seas combined with outstanding deck operations and a general "can do" attitude by all involved rapidly got the cruise back on schedule. The decision to follow Captain Crews suggestion to head north and resume operations rather than staying south and waiting for conditions to improve was critical in the ultimate success of this cruise.

### ***Moorings:***

23 OBSs were recovered, 2 ARRA type, located at mooring site J11 and G36 were known to have malfunctioning acoustic releases. Neither of these OBS were recovered. An attempt was made on J11 however after ~1.5 hours of sending release commands and another 1.5 hours standing watch it was determined the acoustic release on J11 was not responding to release commands being sent from Oceanus.

**Instrumentation:**

All recorded DPG and 3 component seismic data. Of the 25 OBS deployed, 10 were KECK OBS (Figure 2), and carry a Guralp CMG---3T broadband seismometer, a Kinematics Episensor strong--- motion accelerometer, and a DPG. Timing on the Keck OBS is provided by a Seascan timebase. All the OBS sampled at 50 Hz; the low pass anti---alias filters passband edge is set to a 20 Hz And stopband edge to 24 Hz. The remaining 15 were of a new WHOI ARRA design. The WHOI designed ARRA OBS (Figure 3) 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 OBS carry a new chip---scale atomic clock (CSAC) manufactured by Symmetricom that provides significantly more accurate timing than the Seascan timebase used the other WHOI OBS. Floatation is provided by a syntactic foam pack.

We recovered all 23 of the instruments excluding G36 and J11. Only significant issues were the sensor ball on S87 at FS06B, which looks like it was moving all over the place for much of the year, and another sensor ball which got banged up on the way to the surface. It will be interesting to see what S87 actually recorded, and if the accelerometer shows significant motion as well.

Clocks have been quite good. Max drift from a Seascan was under .5 seconds, or ~2ms/day, many were quite a bit less. Max drift from a CSAC was 25 ms, or about 0.1 ms/day, most are 5~15 ms. The 25ms is just within the more stringent aging spec released last year.

No systems had an early battery failure, and there were no gaps in data availability for the Kecks (can't check for the ARRAs).

Data offloads have been uneventful. SAIC representative Seth Mogh worked through the filtering, and kept up with the offloads.

Acoustics were more or less flawless, with the exception of two chatty Keck releases. WorkBoat surveys were conducted for all stations (albeit a couple were very minimal), except for the last two stations which were done with M-Cal

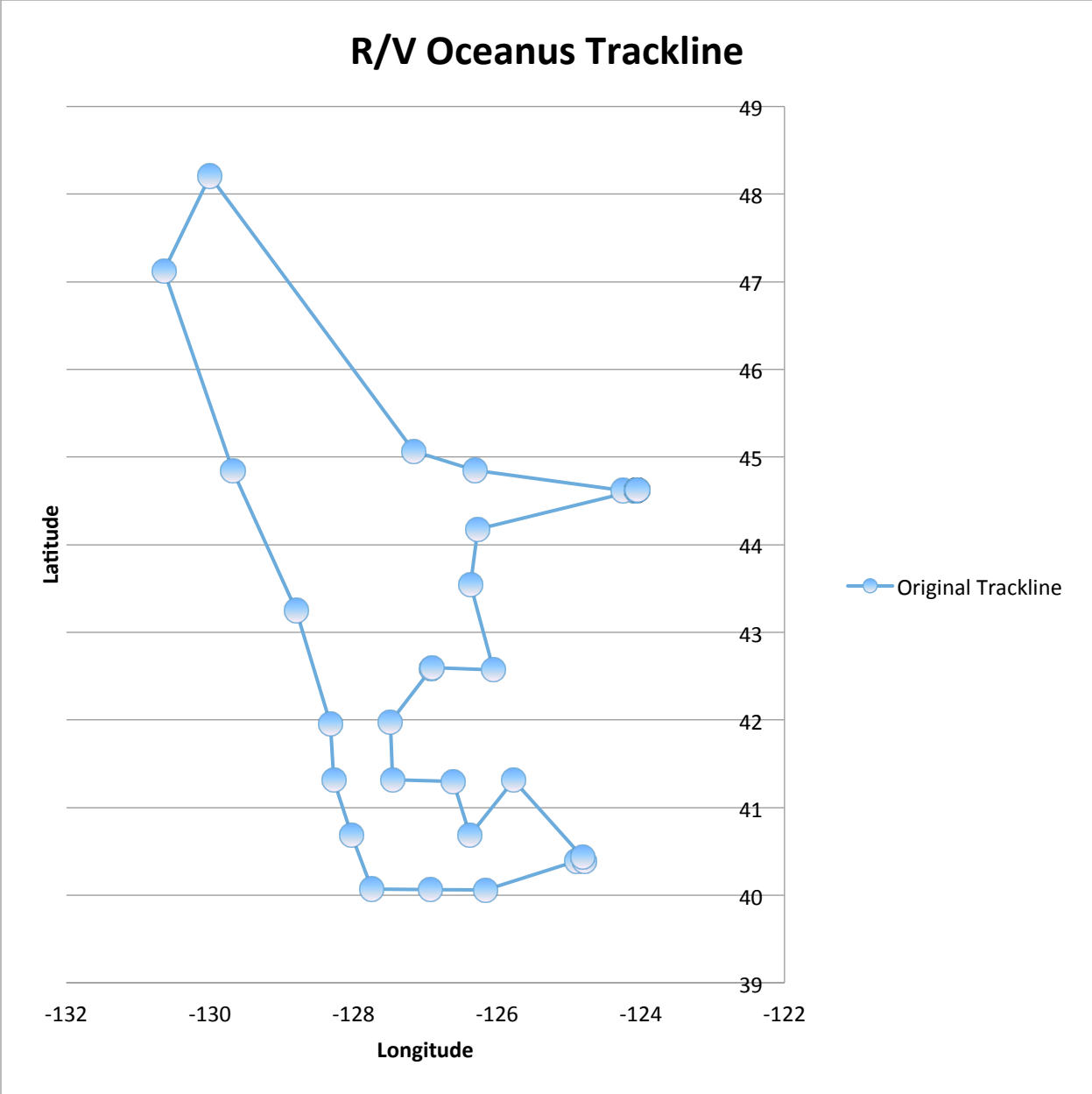


Figure 4 Original ships trackline. R/V Oceanus initially proceeded in a counterclockwise direction until weather forced change in route near S/W mooring sites.

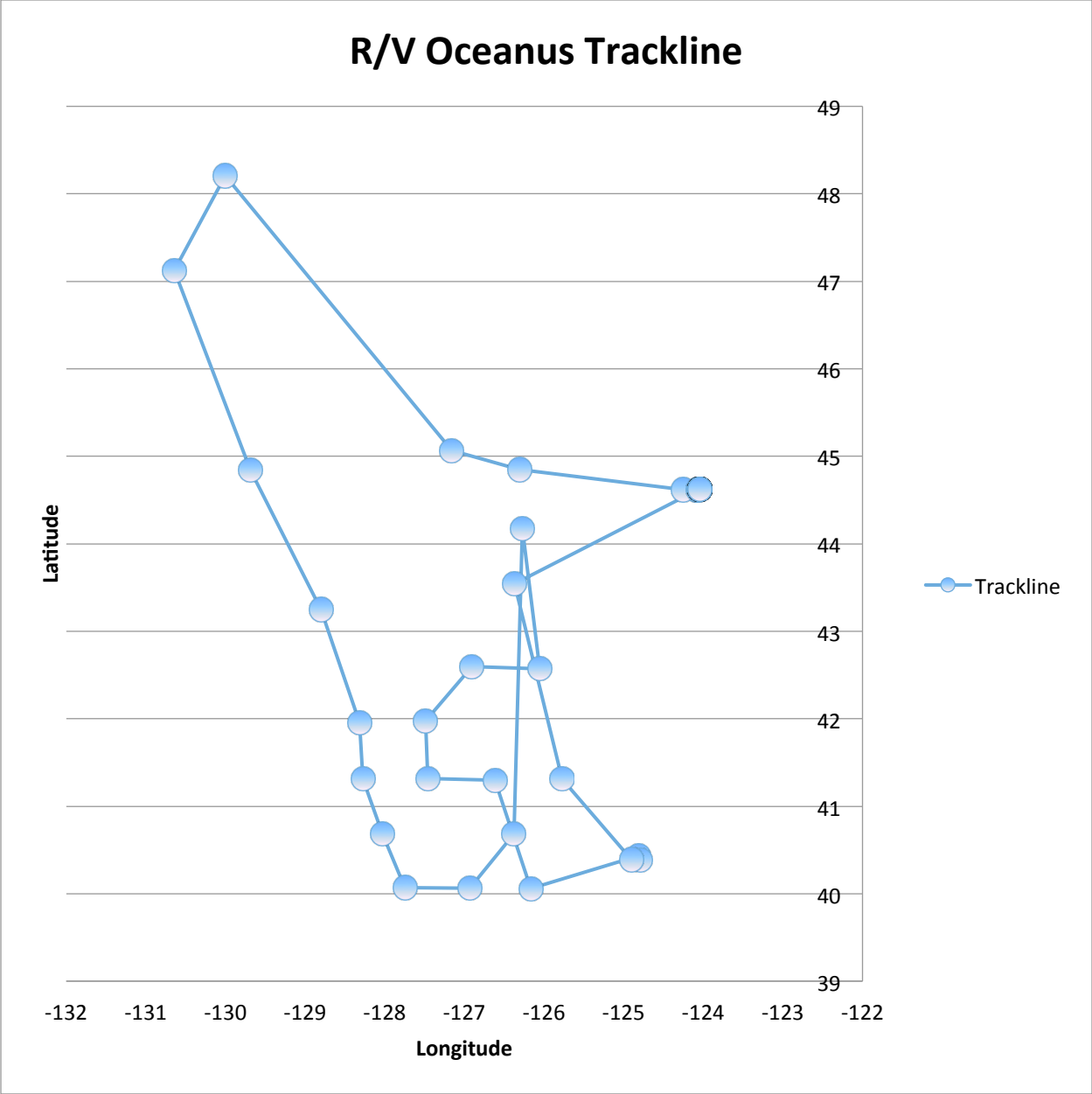


Figure 5. Ultimate actual trackline of R/V Oceanus including 24 hour transit due north.



## **CRUISE NARRATIVE:**

### **Day 1 Monday June 3, 2013**

#### **J27B Recovered**

We departed Newport at 12:00 after conducting sea tests of ship's propulsion. Fire and lifeboat drill soon followed.

First recovery location is at site J27B ~89NM from Newport. It is an ARRA type, instrument #T107 located at 2843m depth. Release enabled and acoustic survey was completed prior to anchor release at 22:23 instrument on surface at 23:25, on deck at 23:39

### **Day 2 Tuesday June 4, 2013:**

#### **J28 Recovered**

Arrived at site J28B at 03:29 PDT KECK #S83 located at 2885m depth. Acoustic survey was completed before anchor release at 05:19, on surface at 06:52, on deck at 07:02

### **Day 3 Wednesday June 5, 2013:**

#### **J63 and J48 Recovered**

Arrived at J63, 03:45 PDT after 20 hr transit. KECK #S84 was located at 2878m depth. Survey was completed before anchor release at 04:30, on surface at 06:03 on deck at 06:14

Arrived at J48 12:06 PDT. Keck #S82 was located at 2913m depth. Site surveyed prior to release of anchor at 13:20, on surface at 14:59, on deck at 15:06

### **Day 4 Thursday June 6, 2013:**

#### **J23, J06 and G30 Recovered**

Arrived at J23 02:51 PDT. KECK #S86 was located at 2699m depth. Site survey completed before anchor released at 03:53, on surface at 05:23 and on deck at 05:37

Arrived at J06 14:06 PDT. KECK #S88 located at 3248m depth. Surveyed prior to anchor release at 15:22 on surface at 17:12 and on deck at 17:20

Arrived at G30 23:56 PDT. KECK #S81 located at 3133m depth. Surveyed prior to anchor release at 01:50, on surface at 03:33 and on deck at 03:46

### **Day 5 Friday June 7, 2013:**

#### **G22, G13 and G05 Recovered**

Arrived at G22 06:26 PDT. ARRA #T108 was located at 3053m depth. Surveyed prior to anchor release at 08:12, on surface at 09:16 and on deck at 09:27

Arrived at G13 12:26 PDT. ARRA #T105 was located at 3232m depth. Surveyed prior to anchor release at 13:59, on surface at 15:09 and on deck at 15:17

Arrived G05 at 18:48 PDT. ARRA #T110 was located at 4483m depth. Surveyed prior to anchor release at 20:22, on surface at 21:55 and on deck at 22:07

**Day 6 Saturday June 8, 2013**  
**G04 and G11 Recovered**

Weather had turned against us. We were in 30-35 kt winds with confused seas of 15-20 then 20-25 ft. Forecast called for winds increasing to 50 kts.

Arrived G04 01:39. Recovered ARRA #T103 from 4379m depth. Surveyed prior to anchor release at 05:35, on surface at 07:10 and on deck at 07:36

After this recovery night operations were suspended due to high seas. KECK recoveries were also suspended due to high seas.

Arrived G11 at 07:46. Conditions worsening. 20-25 ft seas, winds blowing 35-40 kts. ARRA #T111 was located at 3138m depth. Acoustic survey completed prior to anchor released at 15:20, on surface at 16:23 and on deck at 16:37

Post recovery assessment was these were the absolute maximum conditions OBS should ever be recovered in. Bad weather conditions highly localized. A low pressure zone was stalled on N. CA coast, a high was offshore attempting to displace it. Pressure gradient caused high winds and seas off CA coast. Operations suspended in southern region and 24 hour transit north initiated.

**Day 7 Sunday June 9, 2013**  
**J19 Recovered**

After 24 hour transit to J19, conditions greatly improved. Localized storm still stalled near southern OBS stations. Improved conditions allowed 24 hour operations to resume as well as allow the R/V Oceanus to start making 12+ kts between stations.

Decision was made to skip J11 and G36B, both known to have malfunctioning acoustic releases. Abandoning these sites released ~10 hours back into the schedule.

Acoustic surveys had to be modified. Survey pattern was changed from circle roughly centered over OBS to a triangle pattern centered over OBS, this pattern allowed the bridge avoid the "trough" during the survey. Also, to save time, we started surveying at higher speeds. The combined change in pattern and velocity resulted in a reduction of "on station" time from ~60 minutes to under 20 minutes per survey.

Arrived J19 18:06 Conditions improving, seas 11-15ft. Winds 20-25 kts. ARRA instrument T114 was located at 2981m depth. Abbreviated acoustic survey was completed prior to release at 19:25, on surface 20:32, on deck 20:41

**Day 8 Monday June 10, 2013**  
**G35, G36B2, G29 and G21 Recovered**

Arrived G35 04:30 conditions improving, seas 10-14 ft ARRA instrument T109 was located at 2385m depth. Acoustic survey completed prior to release at 04:58 on surface 05:55 and on deck 06:17

Arrived G36B2 10:04 ARRA instrument T101, located at 2459m depth. Acoustic survey completed prior to release at 10:27, on surface 11:16, on deck 11:27

Arrived G29 15:30, ARRA instrument T104, located at 3243m depth. Acoustic survey not required at this site prior to release at 15:32, on surface 16:42, on deck 16:53

Arrived G21 20:27, ARRA instrument T102, located at 3178m depth. Acoustic survey completed prior to release at 20:49, on surface 21:57, on deck 22:07

**Day 9 Tuesday June 11, 2013**  
**G20, G03 and FS 05 Recovered**

Arrived G20 at 01:48, ARRA instrument T113 was located at 3164m depth. Acoustic survey completed prior to release at 02:22, on surface 03:30, on deck 03:37

Arrived G03 at 11:55, KECK instrument S89 was located at 4071m depth. Acoustic survey completed prior to release at 12:46, on surface 15:05, on deck 15:21

Arrived FS05 at 21:05, KECK instrument S80 was located at 2325m depth. Acoustic survey completed prior to release at 21:29, on surface 22:40, on deck 22:54.

**Day 10 Wednesday June 12, 2013**  
**FS06, FS09 and G19 Recovered**

Arrived FS06 at 03:55, KECK instrument S87 located at 2211m depth. Acoustic survey completed prior to release at 04:34, on surface 05:55, on deck 06:04.

Arrived FS09 at 06:50 KECK instrument S85 located at 2143m depth. WHOI team trained with M-Cal software. Acoustic survey completed by WHOI personnel prior to release at 07:53, on surface 08:57, on deck 09:04

Arrived G19 at 16:15, ARRA instrument T106 was located at 3097m depth. This site had been surveyed on deployment leg. WHOI team relocated using M-Cal software for training and comparison to previous software location. Survey completed prior to release at 16:54, on surface 17:59, on deck 18:24

**Day 11 Thursday June 13, 2013**

Arrived at J11 T112 08:00. We began issuing enable and release commands repeatedly for 2 hours. After 1 hour the bridge was manned with observers for a total of 3 hours. At noon, the effort was halted. We maintained position in the area with a less formal watch for 6 more hours while preparing for deMOB in Newport.

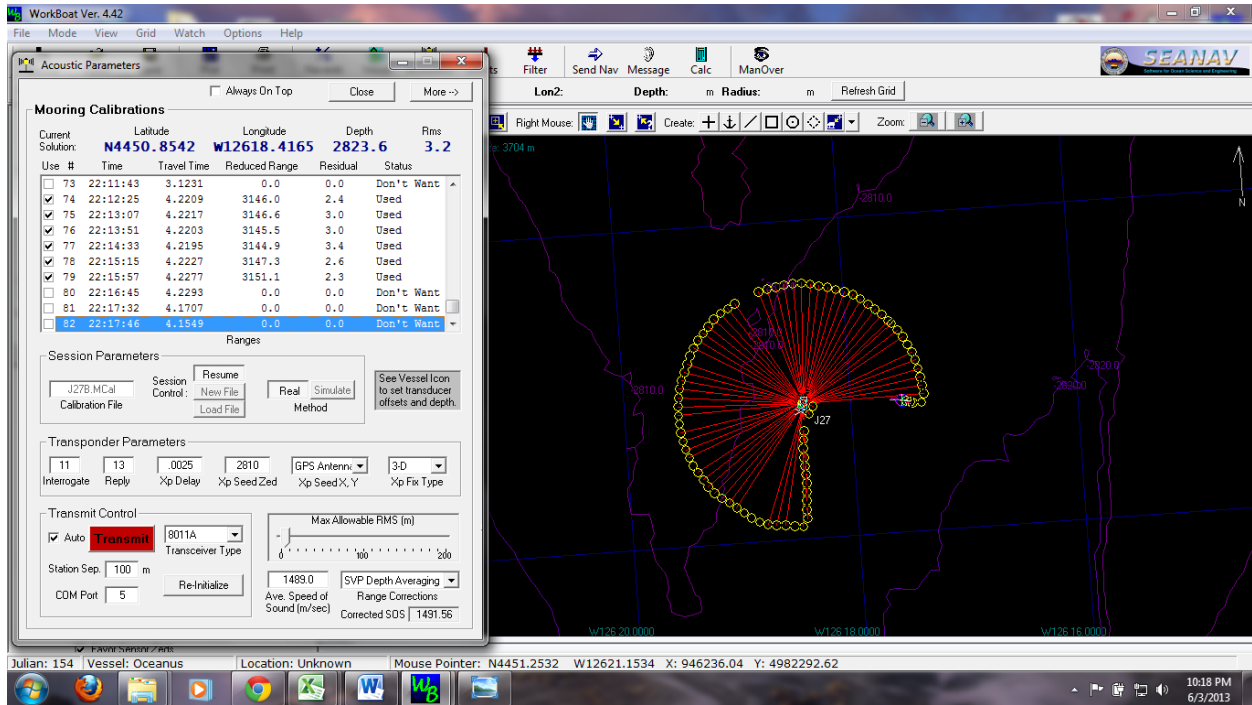
**Day 12 Friday June 14, 2013**

Arrived Newport OR, tied up dockside at 08:00. Demobilization completed by early afternoon Friday June 14.

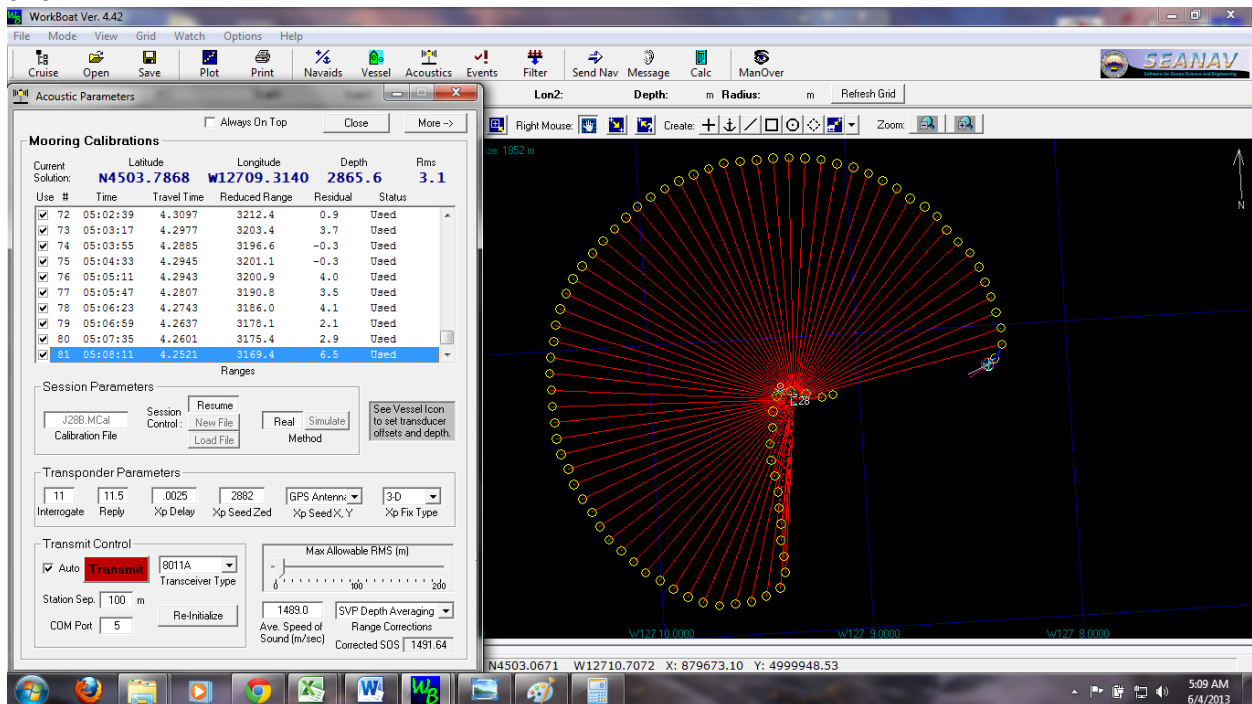
# Appendix 1

## Screen Dumps of WorkBoat acoustic surveys

### J27B



### J28B



# J63B

WorkBoat Ver. 4.42

File Mode View Grid Watch Options Help

SEANAV

Lon2: Depth: m Radius: m Refresh Grid

Right Mouse: Create: Zoom:

1852 m

J63B

W130.20000 W130.10000 W129.60000 W129.50000 W129.58000 W1

Julian: 156 Vessel: Oceanus Location: Unknown Mouse Pointer: N4812.9969 W13002.2655 X: 645757.48 Y: 5342237.91

4:51 AM 6/5/2013

### Acoustic Parameters

Mooring Calibrations

Use #	Time	Travel Time	Reduced Range	Residual	Status
70	04:13:48	4.2777	3188.5	2.4	Used
71	04:14:26	4.2715	3183.9	2.8	Used
72	04:15:04	4.2611	3176.1	3.2	Used
73	04:15:42	4.2527	3169.8	2.1	Used
74	04:16:20	4.2499	3167.8	1.7	Used
75	04:16:56	4.2467	3165.4	3.2	Used
76	04:17:34	4.2415	3161.5	7.1	Used
77	04:18:20	4.2091	0.0	0.0	Don't Want
78	04:19:06	4.1549	0.0	0.0	Don't Want
79	04:19:48	0.0000	0.0	0.0	Waiting...

Session Parameters

J63B.MCal Calibration File

Transponder Parameters

Interrogate: 11 Reply: 13 Xp Delay: .0025 Xp Seed Zed: 2880 GPS Antenn: 3-D Xp Fix Type

Transmit Control

Auto Transmit 8011A Transceiver Type

Station Sep: 100 m CDM Port: 5

Max Allowable RMS (m): 200

1489.0 Ave. Speed of Sound (m/sec) SVP Depth Averaging Range Corrections Corrected SDS: 1491.62

# J48B

WorkBoat Ver. 4.42

File Mode View Grid Watch Options Help

SEANAV

Lon2: Depth: m Radius: m Refresh Grid

Right Mouse: Create: Zoom:

1852 m

J48B

W130.41000 W130.40000 W130.39000 W130.38000 W130.37000 W130.36000

Julian: 156 Vessel: Oceanus Location: Unknown Mouse Pointer: N4708.9134 W13040.5912 X: 600338.38 Y: 5222522.62

1:00 PM 6/5/2013

### Acoustic Parameters

Mooring Calibrations

Use #	Time	Travel Time	Reduced Range	Residual	Status
71	12:53:27	4.2729	3185.0	2.2	Used
72	12:54:05	4.2693	3182.3	2.3	Used
73	12:54:43	4.2669	3180.5	1.2	Used
74	12:55:22	4.2683	3181.6	3.7	Used
75	12:55:59	4.2633	3177.8	4.9	Used
76	12:56:38	4.2579	3173.8	2.5	Used
77	12:57:15	4.2585	3174.3	2.2	Used
78	12:57:55	4.2475	0.0	0.0	Don't Want
79	12:58:39	4.2021	0.0	0.0	Don't Want
80	12:59:23	4.1507	0.0	0.0	Don't Want

Session Parameters

J48B.MCal Calibration File

Transponder Parameters

Interrogate: 11 Reply: 13 Xp Delay: .0025 Xp Seed Zed: 2880 GPS Antenn: 3-D Xp Fix Type

Transmit Control

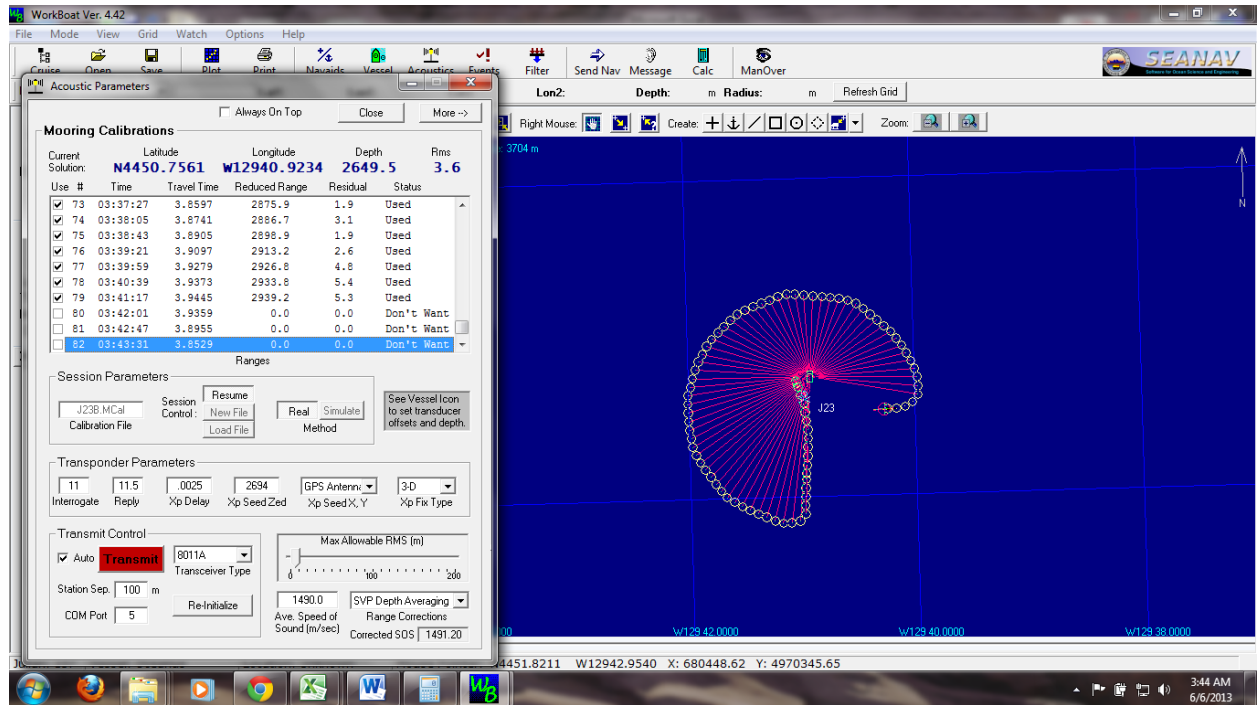
Auto Transmit 8011A Transceiver Type

Station Sep: 100 m CDM Port: 5

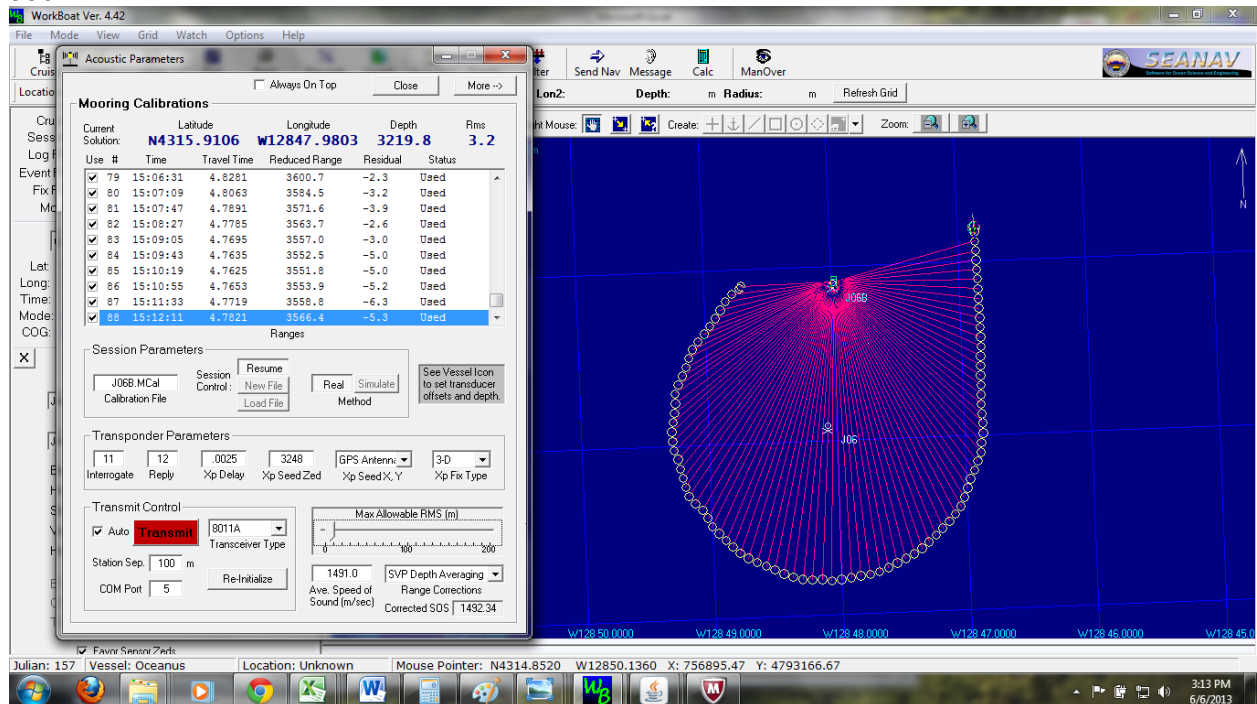
Max Allowable RMS (m): 200

1489.0 Ave. Speed of Sound (m/sec) SVP Depth Averaging Range Corrections Corrected SDS: 1491.66

# J23B

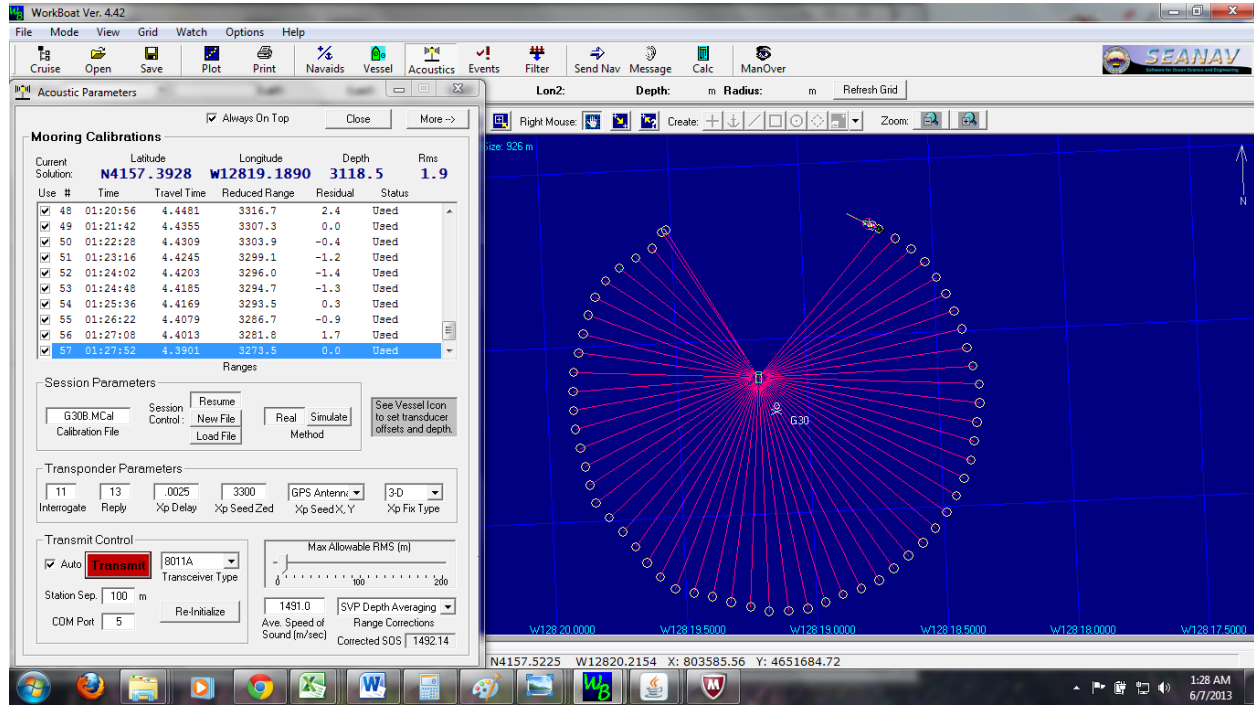


# J06B

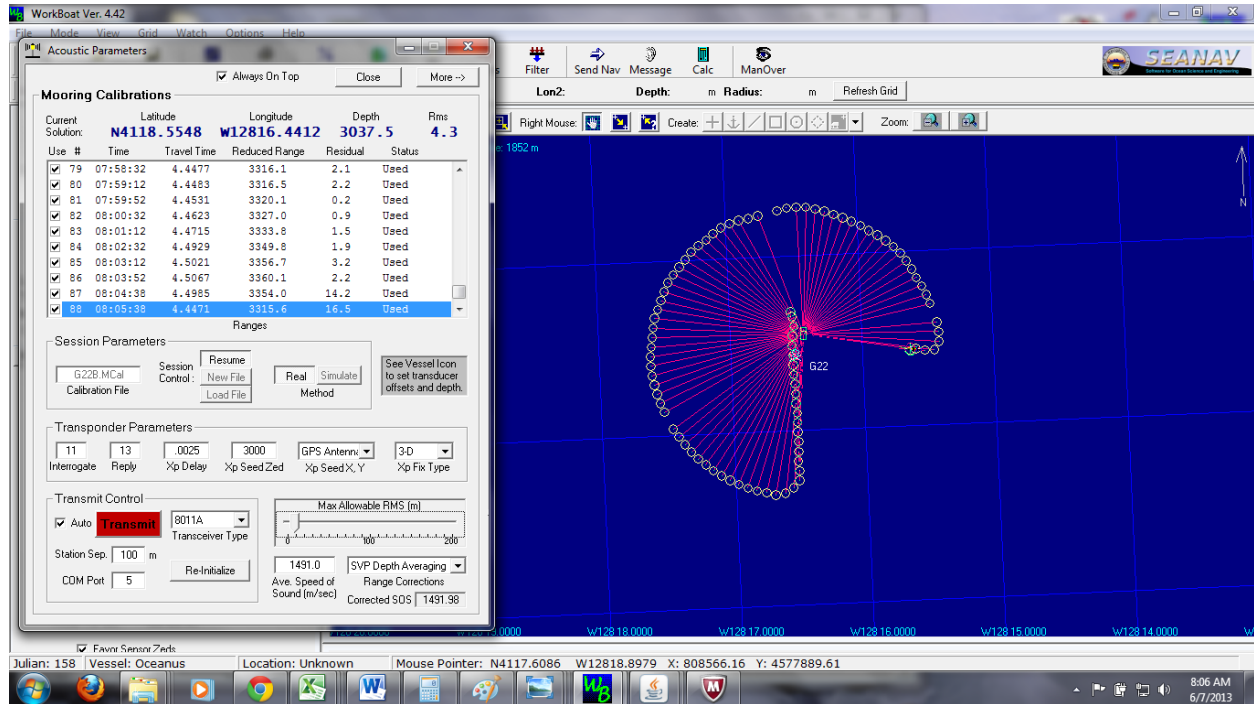




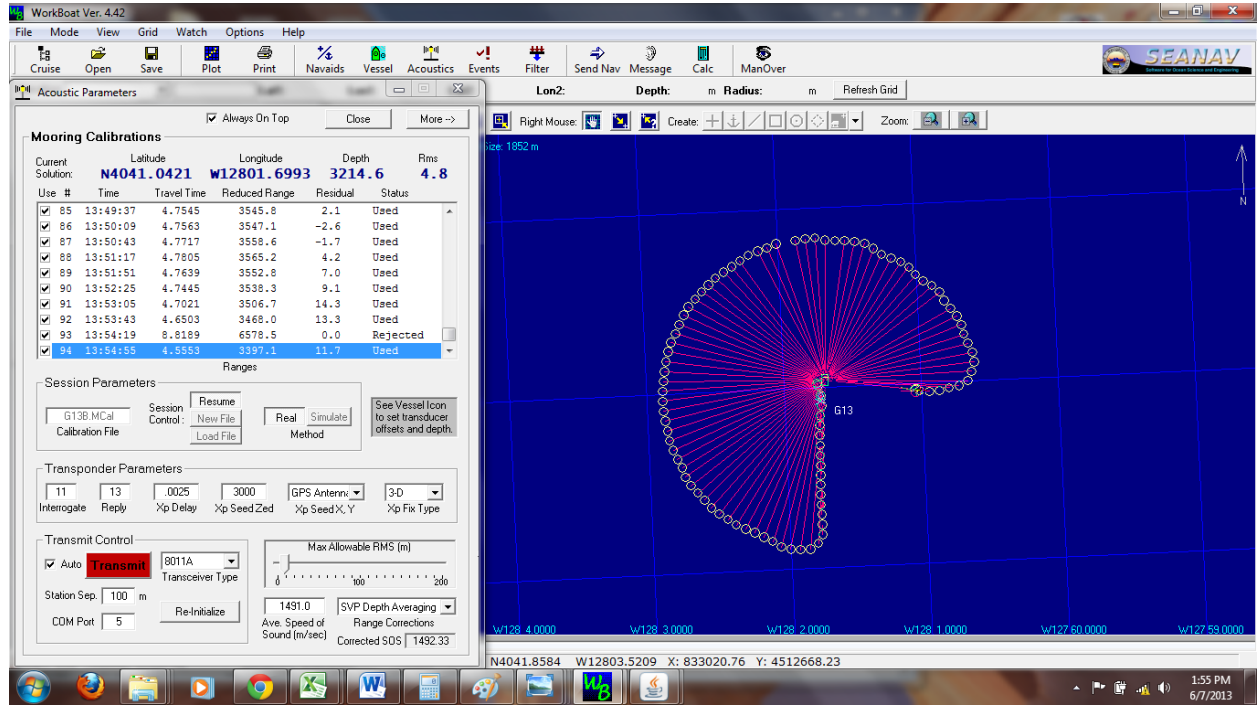
# G30B



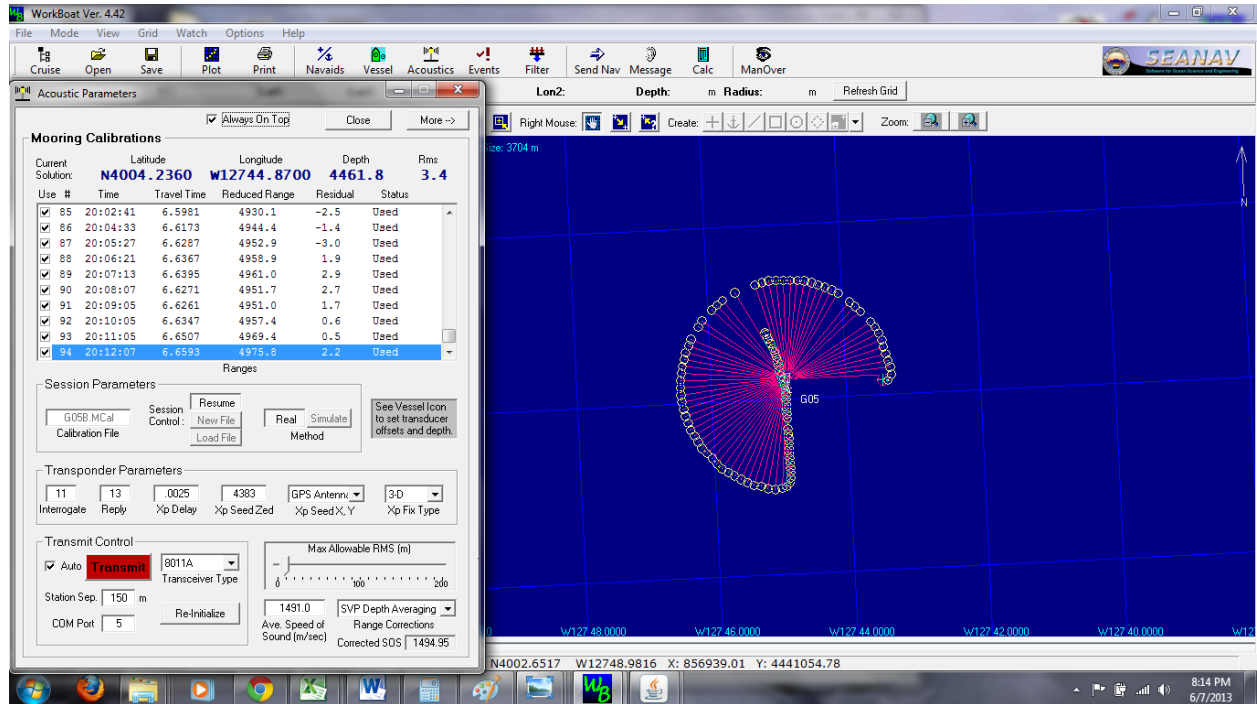
# G22B



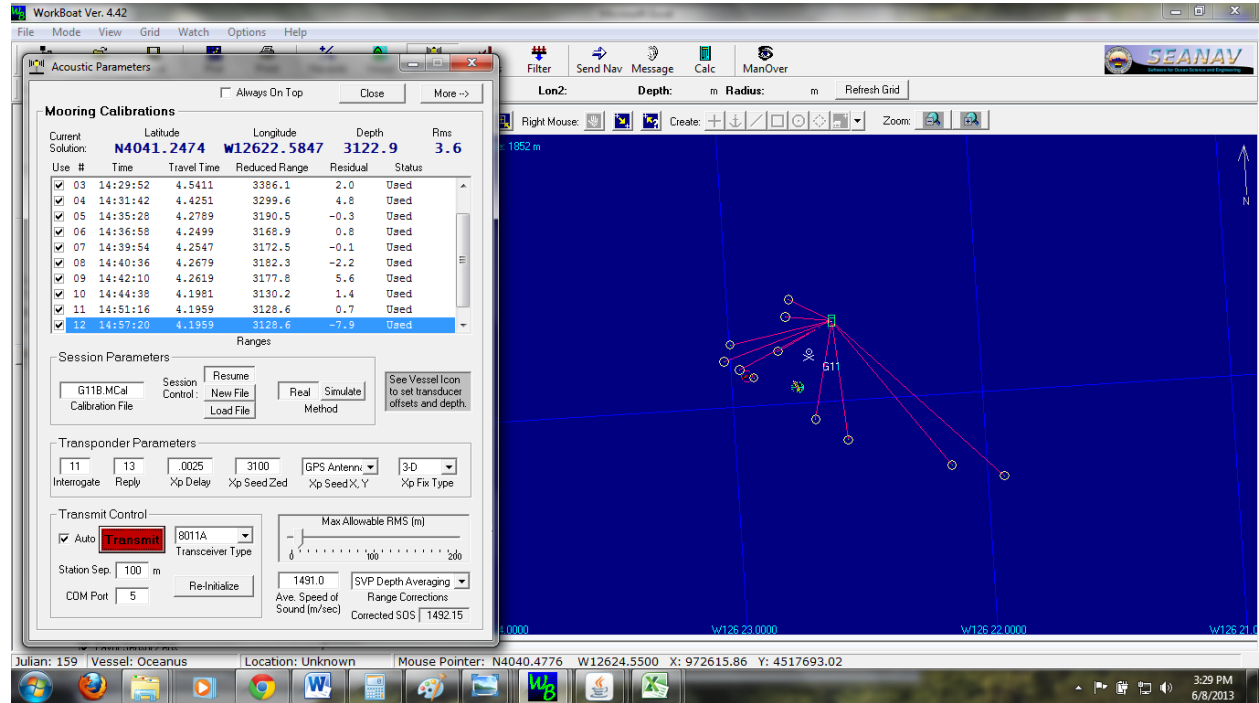
# G13B



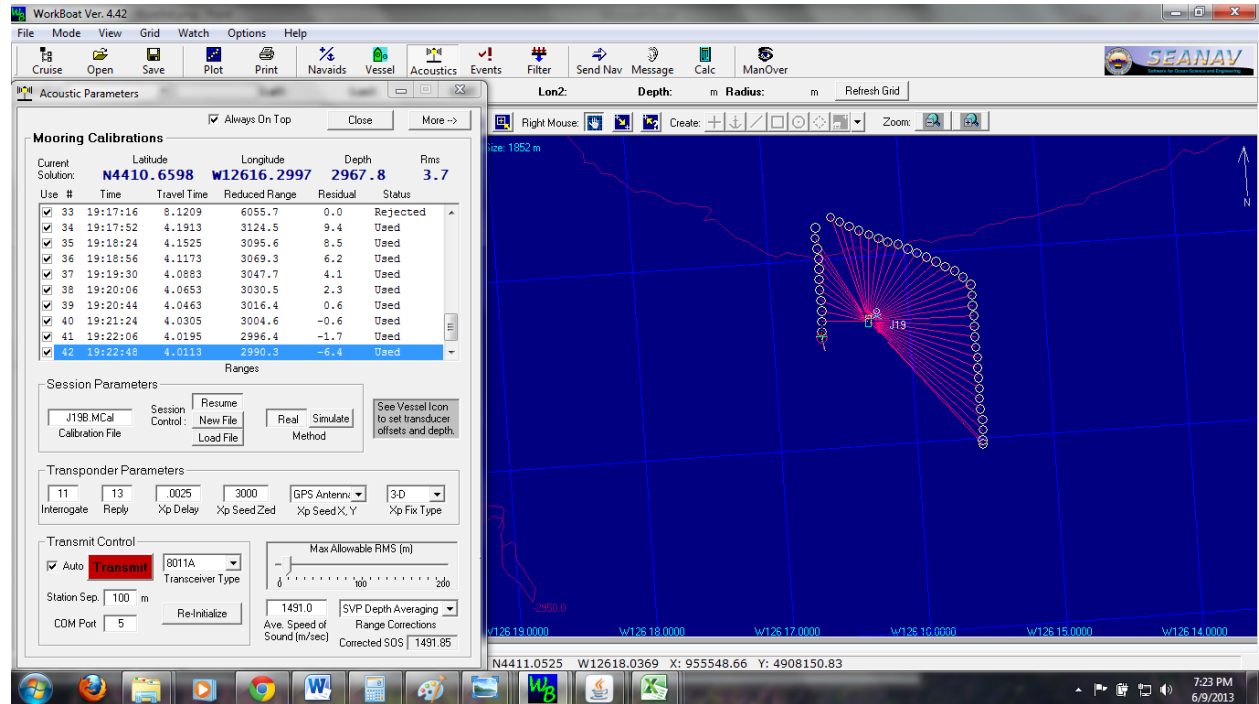
# G05B



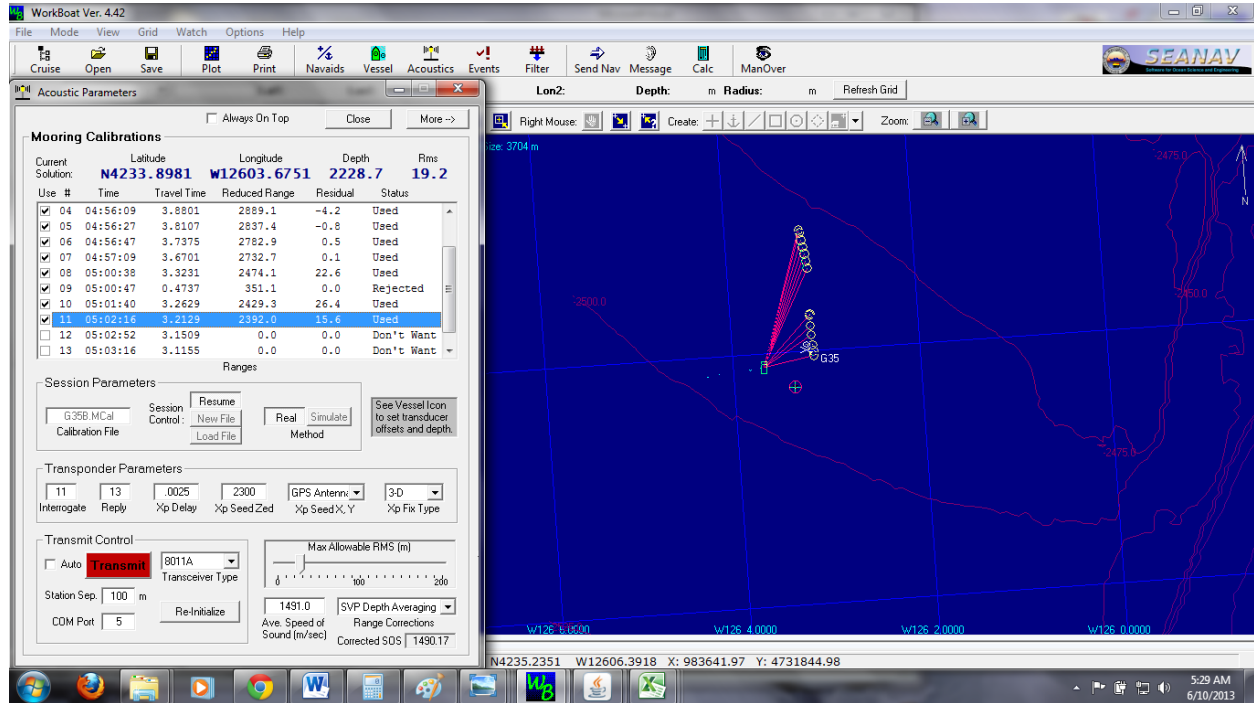
# G11B



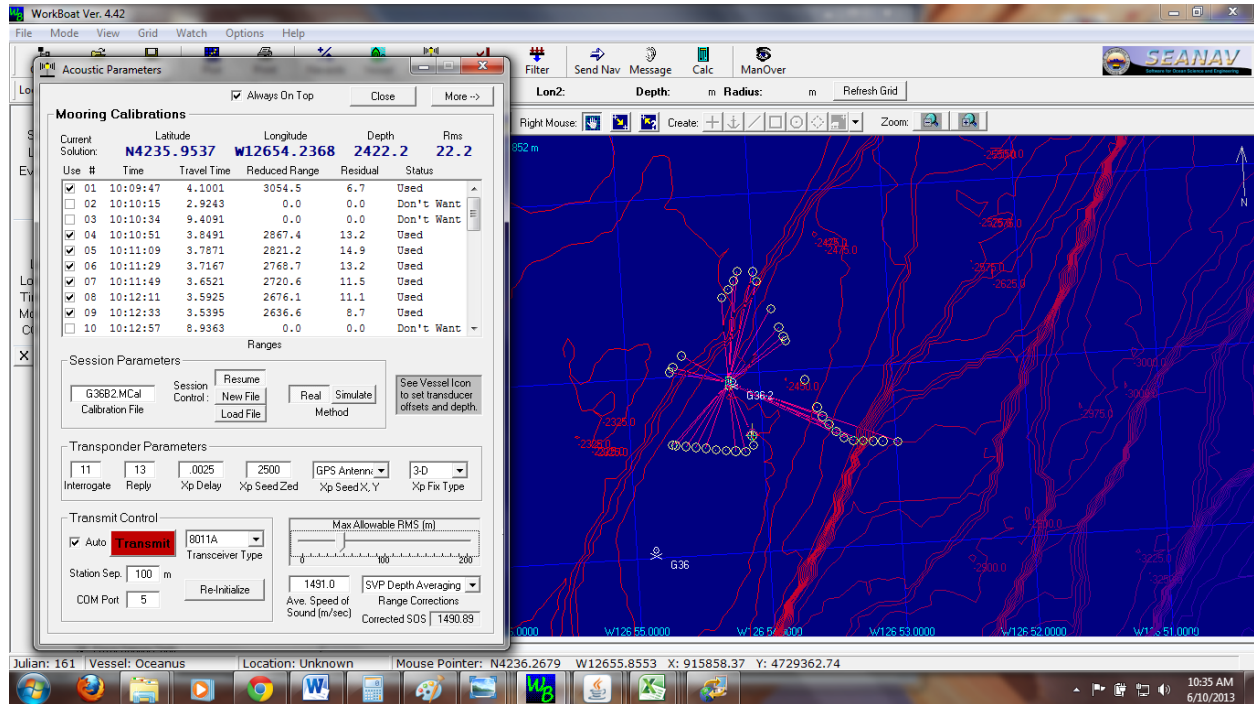
# J19B



# G35B



# G36B



# G21B

WorkBoat Ver. 4.42

File Mode View Grid Watch Options Help

Cruise: Oceanus

Location: Oceanus

Lat: 41 19.6  
Long: 127 27.7  
Time: 20:52.5  
Mode: GPS-2  
COG: 270.8

Acoustic Parameters

Mooring Calibrations

Use #	Time	Travel Time	Reduced Range	Residual	Status
38	20:44:59	4.3967	3278.6	-1.1	Used
39	20:50:11	3.5401	2639.4	0.0	Rejected
40	20:50:24	4.5351	3381.8	2.3	Used
41	20:50:43	4.5315	3379.1	0.6	Used
42	20:51:01	4.5333	3380.5	-0.6	Used
43	20:51:19	4.5387	3384.5	0.1	Used
44	20:51:39	4.5483	3391.7	-1.0	Used
45	20:51:57	4.5611	3401.2	-1.7	Used
46	20:52:17	4.5769	3413.0	-4.7	Used
47	20:52:35	4.5761	3412.4	-22.2	Used

Session Parameters

Transponder Parameters

Transmit Control

Max Allowable RMS (m)

Station Sep: 100 m

CDM Port: 5

1491.0 Ave. Speed of Sound (m/sec)

1492.22 Corrected SOS

Depth: m Radius: m Refresh Grid

Julian: 161 Vessel: Oceanus Location: Unknown Mouse Pointer: N4118.1984 W12729.0743 X: 878059.16 Y: 4582271.54

8:53 PM 6/10/2013

# G20

WorkBoat Ver. 4.42

File Mode View Grid Watch Options Help

Cruise: Oceanus

Location: Oceanus

Lat: 41 19.6  
Long: 127 27.7  
Time: 20:52.5  
Mode: GPS-2  
COG: 270.8

Acoustic Parameters

Mooring Calibrations

Use #	Time	Travel Time	Reduced Range	Residual	Status
51	02:15:26	4.3927	3275.5	-3.3	Used
52	02:15:50	4.4207	3296.4	-1.3	Used
53	02:16:12	4.4459	3315.2	-4.5	Used
54	02:17:02	4.5189	3369.7	-3.6	Used
55	02:17:26	4.5583	3399.1	-5.8	Used
56	02:17:50	4.6051	3434.0	-2.8	Used
57	02:18:14	4.6503	3467.7	-7.3	Used
58	02:18:38	4.7053	3508.7	-7.1	Used
59	02:19:00	4.7585	3548.4	-6.6	Used
60	02:20:22	4.7265	3524.5	14.2	Used

Session Parameters

Transponder Parameters

Transmit Control

Max Allowable RMS (m)

Station Sep: 100 m

CDM Port: 5

1491.0 Ave. Speed of Sound (m/sec)

1492.19 Corrected SOS

Depth: m Radius: m Refresh Grid

Julian: 161 Vessel: Oceanus Location: Unknown Mouse Pointer: N4119.9686 W12641.7262 X: 943951.96 Y: 4589296.55

2:21 AM 6/11/2013

# G03B

WorkBoat Ver. 4.42

File Mode View Grid Watch Options Help

Acoustic Parameters

Mooring Calibrations

Current Solution: Latitude **N4003.4774** Longitude **W12609.8063** Depth **4050.9** Rms **3.9**

Use #	Time	Travel Time	Reduced Range	Residual	Status
<input checked="" type="checkbox"/>	90	12:30:14	5.8923	4399.8	-0.5 Used
<input type="checkbox"/>	91	12:30:40	3.9181	0.0	0.0 Don't Want
<input checked="" type="checkbox"/>	92	12:31:08	5.8983	4396.9	-2.3 Used
<input checked="" type="checkbox"/>	93	12:31:36	5.8895	4397.8	-3.9 Used
<input checked="" type="checkbox"/>	94	12:32:04	0.8571	638.4	0.0 Rejected
<input checked="" type="checkbox"/>	95	12:32:30	5.9059	4410.0	-5.2 Used
<input checked="" type="checkbox"/>	96	12:32:56	5.9205	4420.9	-5.4 Used
<input checked="" type="checkbox"/>	97	12:33:22	5.9339	4430.9	-5.7 Used
<input checked="" type="checkbox"/>	98	12:33:48	5.9509	4443.6	-7.4 Used
<input checked="" type="checkbox"/>	99	12:34:14	5.9773	4463.3	-6.0 Used

Session Parameters

Transponder Parameters

Transmit Control

Julian: 162 Vessel: Oceanus Location: Unknown Mouse Pointer: N4002.8811 W12614.0493 X: 991969.54 Y: 4449043.71

12:37 PM 6/11/2013

# FS05

WorkBoat Ver. 4.42

File Mode View Grid Watch Options Help

Acoustic Parameters

Mooring Calibrations

Current Solution: Latitude **N4023.1989** Longitude **W12453.9787** Depth **2316.1** Rms **4.0**

Use #	Time	Travel Time	Reduced Range	Residual	Status
<input checked="" type="checkbox"/>	41	21:21:08	0.7157	531.5	0.0 Rejected
<input checked="" type="checkbox"/>	42	21:21:33	3.3599	2502.1	6.8 Used
<input checked="" type="checkbox"/>	43	21:21:57	14.7885	11019.4	0.0 Rejected
<input checked="" type="checkbox"/>	44	21:22:19	6.2213	4634.6	0.0 Rejected
<input checked="" type="checkbox"/>	45	21:22:42	3.2643	2430.9	3.6 Used
<input checked="" type="checkbox"/>	46	21:23:03	3.2433	2415.2	1.4 Used
<input checked="" type="checkbox"/>	47	21:23:25	3.2277	2403.6	-1.1 Used
<input checked="" type="checkbox"/>	48	21:23:47	11.9595	8911.1	0.0 Rejected
<input checked="" type="checkbox"/>	49	21:24:09	3.2227	2399.9	-0.1 Used
<input checked="" type="checkbox"/>	50	21:24:32	0.3833	283.8	0.0 Rejected

Session Parameters

Transponder Parameters

Transmit Control

Julian: 162 Vessel: Oceanus Location: Unknown Mouse Pointer: N4023.7814 W12455.3233 X: 591479.67 Y: 4472308.16

9:25 PM 6/11/2013



# FS06

WorkBoat Ver. 442

File Mode View Grid Watch Options Help

Acoustic Parameters

Always On Top Close More ->

Current Solution: Latitude **N4022.8728** Longitude **W12447.1152** Depth **2198.1** Rms **4.1**

Use #	Time	Travel Time	Reduced Range	Residual	Status
<input checked="" type="checkbox"/>	33 04:13:59	3.1573	2350.8	5.0	Used
<input checked="" type="checkbox"/>	34 04:14:23	3.1261	2327.5	4.3	Used
<input checked="" type="checkbox"/>	35 04:14:47	3.0971	2305.9	2.6	Used
<input checked="" type="checkbox"/>	36 04:15:11	3.0761	2290.3	0.5	Used
<input checked="" type="checkbox"/>	37 04:15:35	0.5401	400.6	0.0	Rejected
<input checked="" type="checkbox"/>	38 04:15:59	3.0575	2276.4	-0.9	Used
<input checked="" type="checkbox"/>	39 04:16:23	3.0541	2273.9	-4.0	Used
<input checked="" type="checkbox"/>	40 04:16:47	3.0609	2278.9	-2.9	Used
<input type="checkbox"/>	41 04:17:11	3.4159	0.0	0.0	Don't Want
<input checked="" type="checkbox"/>	42 04:17:35	3.0955	2304.7	-2.6	Used

Session Parameters

FS06.MCal Calibration File

Transponder Parameters

Interrogate: 11 Reply: 12 Xp Delay: .0025 Xp Seed Zed: 2200 GPS Antenn: 3-D

Transmit Control

Auto Transmit 9011A Transceiver Type

Station Sep: 100 m CDM Port: 5

Max Allowable RMS (m): 1491.0

Ave. Speed of Sound (m/sec): 1490.0

Corrected SOS: 1490.27

Julian: 163 Vessel: Oceanus Location: Unknown Mouse Pointer: N4023.6353 W12450.8907 X: 597752.89 Y: 4472116.93

4:26 AM 6/12/2013

# FS09B

M-Cal Ver. 1.07

File Mode View Grid Watch Options Help

Cruise Open Save Plot Navids Vessel Calc ManOver

Location Lat1: Lon1: Lat2: Lon2: Depth: m Radius: m Refresh Grid

Mooring Cal Tools

Transmit Control

Transmit Use Auto Transmit with Station Separation of 100 meters. Re-Initialize Deckset

Current Solution

Latitude **N4026.3200** Longitude **W12448.5093** Depth **2161.1** RMS **6.1**

Use #	Time	Elspsd	Range	Resid.	Status
<input checked="" type="checkbox"/>	46 14:36:05	3.0353	2257.9	-8.6	Used
<input checked="" type="checkbox"/>	47 14:36:31	3.0665	2281.1	-9.2	Used
<input checked="" type="checkbox"/>	48 14:36:57	3.1017	2307.4	-10.6	Used
<input checked="" type="checkbox"/>	49 14:37:23	3.1429	2338.0	-11.4	Used
<input checked="" type="checkbox"/>	50 14:37:49	3.1895	2372.7	-11.6	Used
<input checked="" type="checkbox"/>	51 14:38:15	3.2397	2410.1	-13.4	Used

Stations

Max Allowable RMS Error (m): 1491.0

Seed Zed: 2143 GPS Antenn: 3-D Ave. Speed of Sound (m/sec): 1489.0

C:\Program Files\MCal\CJET2013\fs09.MCal Calibration File

Done With Mooring Cal

GRID SPACING: 1.000 mn. Vert Size: 1852 m

Left Mouse: Right Mouse: Create: Refresh Grid

Julian: 163 Vessel: My Vessel Location: Your Location Mouse Pointer: N4025.9238 W12450.1936 X: 344220.07 Y: 4477333.41

Table 1:

Surveyed Locations									
Site	Deg Min			Deg Min			Decimal		Depth
	Latitude	N/S	Longitude	E/W	Latitude	Longitude			
J27B	44	50.8542	N	126	18.4165	W	44.84757	-126.30694	2823
J28B	45	3.7868	N	127	9.314	W	45.06311	-127.15523	2865
J63B	48	12.325	N	130	0.1153	W	48.20542	-130.00192	2856
J48B	47	7.6895	N	130	38.3089	W	47.12816	-130.63848	2877
J23B	44	50.7561	N	129	40.9234	W	44.84594	-129.68206	2649
J06B	43	15.9106	N	128	47.9803	W	43.26518	-128.79967	3219
G30B	41	57.3928	N	128	19.189	W	41.95655	-128.31982	3118
G22B	41	18.5548	N	128	16.4412	W	41.30925	-128.27402	3037
G13B	40	41.0421	N	128	1.6993	W	40.68404	-128.02832	3214
G05B	40	4.236	N	127	44.87	W	40.0706	-127.74783	4461
G04B	40	3.654	N	126	55.992	W	40.0609	-126.9332	4379
G11B	40	41.2474	N	126	22.5847	W	40.68746	-126.37641	3122
J19B	44	10.6598	N	126	16.2997	W	44.17766	-126.27166	2967
G35B	42	33.8981	N	126	3.6751	W	42.56497	-126.06125	2228
G36B	42	35.9537	N	126	54.2368	W	42.59923	-126.90395	2422
G29B	41	58.587	N	125	46.331	W	41.97645	-125.77218	3243
G21	41	18.962	N	127	27.2227	W	41.31603	-127.45371	3155
G20	41	17.921	N	126	36.8	W	41.29868	-126.61333	3140
G03B	40	3.4774	N	126	9.8063	W	40.05796	-126.16344	4050
FS05B	40	23.1989	N	124	53.9787	W	40.38665	-124.89965	2316
FS06B	40	22.8728	N	124	47.1152	W	40.38121	-124.78525	2198
FS09B	40	26.32	N	124	48.5093	W	40.43867	-124.80849	2161
G19B	41	18.484	N	125	46.331	W	41.30807	-125.77218	3097

G04B, G19B and G29B, in red, were surveyed on the 2012 deployment cruise.

Table 2

Surveyed Locations				Deployed Location				Descent Drift Estimate					
Site	Latitude		Longitude		Latitude		Longitude		Depth (m)	Distance (m)	Bearing (deg)		
	deg	min	N/S	deg min	E/W	deg min	N/S	deg min					
J27B	44	50.8542	N	126 18.4165	W	44 50.8370	N	126 18.4450	W	ARRA	2843	49	49
J28B	45	3.7868	N	127 9.3140	W	45 3.8360	N	127 9.3750	W	KECK	2885	121	138
J63B	48	12.3250	N	130 0.1153	W	48 12.3840	N	130 0.1980	W	KECK	2878	149	136
J48B	47	7.6895	N	130 38.3089	W	47 7.6670	N	130 38.3720	W	KECK	2913	89	62
J23B	44	50.7561	N	129 40.9234	W	44 50.6500	N	129 40.9750	W	KECK	2699	208	19
J06B	43	15.9106	N	128 47.9803	W	43 15.0880	N	128 48.0660	W	KECK	3248	1529	4
G30B	41	57.3928	N	128 19.1890	W	41 57.3080	N	128 19.1230	W	KECK	3133	181	329
G22B	41	18.5548	N	128 16.4412	W	41 18.4510	N	128 16.5050	W	ARRA	3053	212	24
G13B	40	41.0421	N	128 1.6993	W	40 40.9560	N	128 1.7350	W	ARRA	3232	167	17
G05B	40	4.2360	N	127 44.8700	W	40 4.1760	N	127 44.8780	W	ARRA	4483	111	5
G11B	40	41.2474	N	126 22.5847	W	40 41.1560	N	126 22.6830	W	ARRA	3138	218	39
J19B	44	10.6598	N	126 16.2997	W	44 10.7110	N	126 16.2320	W	ARRA	2981	130	223
G35B	42	33.8981	N	126 3.6751	W	42 34.0590	N	126 3.2050	W	ARRA	2385	707	245
G36B-2	42	35.9537	N	126 54.2368	W	42 35.9590	N	126 54.2010	W	ARRA	2459	49	258
G21	41	18.9620	N	127 27.2227	W	41 19.0020	N	127 27.3150	W	ARRA	3178	148	119
G20	41	17.9210	N	126 36.8000	W	41 17.9590	N	126 36.8240	W	ARRA	3164	78	154
G03B	40	3.4774	N	126 9.8063	W	40 3.5520	N	126 9.7640	W	KECK	4071	150	203
FS09B	40	26.3200	N	124 48.5093	W	40 26.2160	N	124 48.4490	W	KECK	2143	210	336
FS06B	40	22.8728	N	124 47.1152	W	40 22.8200	N	124 47.1910	W	KECK	2211	145	47
FS05B	40	23.1989	N	124 53.9787	W	40 23.1870	N	124 54.0080	W	KECK	2325	46	61