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NOAA SHIP OKEANOS EXPLORER R-337 "America's Ship for Ocean Exploration"

EX0907 Mapping Field Trials IV

Habitat Characterization

Cordell Bank & Gulf of Farallones National Marine Sanctuaries Expansion Area

> July 14, 2009 to July 23, 2009 Astoria, OR to San Francisco, CA

CRUISE REPORT

By

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1. Purpose

2. Participating personnel

CDR Joe Pica Mashkoor Malik LTjg Kyle Byers Colleen Peters Lorraine Anglin Andrea LeBarge Christopher Paul Elena Crete Gregory Beadle Samuel Baldwin Denise Gordon McKinley Freeman

Ship's Master Cruise coordinator Acting Field Operations Officer Senior Survey Technician ONMS Representative Mapping watch stander MCDDC CIMS team NCDDC CIMS team

3. Mapping sonar setup

NOAA Okeanos Explorer (EX) is equipped with a 30 kHz Kongsberg EM 302 multibeam sonar and a 3.5 kHz Knudsen sub-bottom profiler (SBP 3260). During this cruise EM 302 bottom bathymetric / backscatter along with water column data were collected. Knudsen Sub-bottom profiler was only operated for the purposes of testing interference between EM 302 and Knudsen on 15-16 July 2008 up to depth of ~ 2000 m and was found to work satisfactorily simultaneously with EM 302 with no interference observed in EM 302.

The ship used a POS-MV ver. 4 to record and correct the multibeam data for any motion. C-NAV GPS system provided DGPS correctors with position accuracy expected to be better than 2.0m.

All the corrections (motion, sound speed profile, sound speed at sonar head, draft, sensor offsets) are applied during real time data acquisition in SIS ver. 1.04. XBT casts (Deep Blue, max depth 760 m) were taken every 6 hours (0000, 0600, 1200 and 1800 local time). XBT cast data were converted to SIS compliant format using NOAA Velociwin ver. 8.92 Plus.

Data acquisition plan

The data were collected during transit from Astoria, OR to working grounds (15-16 July) in vicinity of Cordell bank NMS. Active data acquisition in working grounds was carried out 16 - 22 July.

Due to large depth variations the lines were planned to run parallel to the contour lines and the whole area was divided into 4 sub areas with line spacing of 750 m, 1500 m, 3000 m and 6000 m respectively.

Most of the shallow water areas (with depths < 400 m) demanded line spacing of 750 m. Throughout the survey, the EM 302 data provided 3-5 times water depth coverage. The weather got worst on 18 July with 7-12 ft swell from the North and remained rough until the end of the survey. As the northbound lines caused the ship to pitch heavily, a lot of bubble sweep down episodes were observed in the northbound lines, which caused the sonar to loose bottom track. Also during heavy weather the sonar suffered from decreased swath coverage and therefore a lot of additional lines were run to fill in the data holidays.



Figure 1: Survey areas showing priorities



Figure 2: Screen shot of HYPACK showing different lines run during the survey. Image credit: NOAA.

Data processing:

Onboard processing of bathymetric data was done in CARIS HIPS ver. 6.1 during which the data were cleaned in 'Swath Editor' and 'Subset Editor'. No tidal corrections were applied during post processing, however, no appreciable differences were observed between different lines by not applying tidal corrections.

The cross lines yielded a favorable comparison between main scheme lines and cross lines.



Figure 3: Screen grab of subset editor in CARIS HIPS showing agreement of cross lines (pink) with main scheme lines. Image credit: NOAA

The bathymetric data resulted in ~ 50 m grid cell sizes in deeper (> 2000 m) waters while the data density allowed much higher grid cell resolution (~ 20 m) in shallower waters (< 200 m).



Figure 4: Images of the final grids (at 50 m) cell size resolution of the priority area 1 and 2.

Onboard processing of water column data remained minimal due to the difficulty in discerning biological targets from noise in the water column data. Water column data from all the survey have been provided with the cruise data.

Onboard processing of bottom backscatter data were conducted using UNH research tool 'Geocoder'. The results obtained during fair weather are encouraging but during the days when the weather was choppy, a lot of bubble sweep down issues degraded bottom backscatter data quality severely. At the time of filing of this report, we are not sure whether they weather effects can be taken care of during post processing. Also the ship is expected to contact Kongsberg, Inc regarding these backscatter artifacts.



Figure 5: Backscatter mosaic results with 40 m grid cell size. Severe degradation of backscatter data due to bubble sweep down is clearly visible in the central region of the survey.

The latest patch test for the EM 302 was performed in May 2009 which showed only a pitch bias of 0.7 degrees. These patch test values were used during data acquisition throughout this cruise.

July 2009						
Mon	Tue	Wed	Thu	Fri	Sat	Sun
13 Mission party onboard the ship except Baldwin and Crete	14 Baldwin and Crete arrived 1030. Left Astoria, OR 1230	15 In transit to the working grounds.	16 Arrived at working grounds ~ 1400	17 Mapping in Priority 1 and 2 of expansion areas	18 Weather getting worse with very little useable data in north bound line	19 Weather still preventing data collection northbound
20 Mapping in ONMS areas wrapping up. Running cross lines	21 Mapping in ONMS areas wrapping up	22 Mapping in Dump site. USS Independence investigation	23 Return to SanFrancisco	24	25	27

4. Cruise Calendar

5. Daily cruise log

(ALL TIMES LOCAL PDT)

14 July 2009

Ship sailed at 1230. Original sailing at 0900 was delayed due to flight cancellation of Baldwin and Crete who spent ~ 36 hrs traveling from Durham, NH to Astoria, OR. Mission party met with Peters and Malik to discuss briefly cruise objectives and introductions. Lt Byers also welcomed the mission party and briefed about essential safety issues. Initial orientation with mission control room and mapping operations along with XBT operations was provided by Peters.

15 July 2009

Ship is in transit to working grounds off the coast of CA.

16 July 2009

Ship passed over several plume sites during 15/16 night. The ship was directed to make another pass and resulted in finding more than 3 plume sites in addition to the one detected in the May 2009 mapping field trial cruise. Arrived at working grounds and started mapping.



Figure 6: At least five plume sites visible with multibeam.

17 July 2009

Ship continued to work in the sanctuary expansion areas priority 1 and 2.

18 July 2009

The weather has been progressively getting worst. Large swells (~ 5-10 ft) are causing ship to pitch and the bubble sweep down is causing EM 302 to loose bottom track. Reducing survey speed to 5 kts helped little bit but still the data quality during north bound lines is degraded severely. Discussions are in progress to re-run these north bound lines at the end of the survey.

19 July 2009

The weather is still bad for the north bound lines and north bound lines have to be run again to make useable data. The survey was broken off to fill in few holidays left in the shallow part of the survey. Resumed main scheme lines.

20 July 2009

Mapping in the area with lot of bubble sweep down episodes.

21 July 2009

Finished with running main scheme lines. Now running lines to fill in the holidays. Over night the ship transited to the ammunition dump site and started mapping in the dump site, located in priority 3 area. No noticeable items were detected in the dump site. The backscatter data were processed but due to bad weather did not provide any useful information about the type of the material.

22 July 2009

After finishing dump site, the ship made few passes over reported wreck of USS Independence and located an object which seemed to be a wreck of a ship ~ 190 m long.



Figure 7: A plan view of USS Independence located in position 123.1346 W, 37.4779 N

6. Tables of data files collected

XBT Locations:

Date	Time	XBT/CTD Filename	Lat	Long	Remarks
	(GMT)			_	
071409	21:54	TD_00001	46 5.28N	124 12.19W	
071509	18:04	T6_00002	42 38.31N	124 55.33W	
071609	04:07	TD_00003	40 54.43N	124 44.95W	
071609	20:48:	T6_00004	38 45.17N	123 43.38W	
071709	01:22	T6_00005	38 10.94N	123 26.78W	
071709	07:28	T6_00006	3819.26N	123 31.69W	
071709	13:08	T6_00007	38 23.64 N	123 34.79 W	
071709	20:22	TD_00008	38 13.50N	123 31.77W	
071809	01:05	TD_00009	38 29.28N	123 41.20W	
071809	07:13	TD_00010	38 9.85N	123 33.38W	
071809	13:03	TD_00011	38 19.17N	123 38.75W	
071809	19:04	TD_00012	38 2.30N	123 33.91W	
071909	01:24	TD_00013	38 33.1N	123 47.89W	
071909	07:12	TD_00014	37 51.51N	123 31.21W	
071909	13:00	TD_00015	38 9.53N	123 41.54W	
072009	01:07	TD_00016	37 55.23N	123 29.21W	
072009	12:52	TD_00017	38 34.04N	123 53.85W	
072009	21:17	TD_00018	40 54.50N	124 44.95W	
072109	01:13	TD_00019	38 29.77N	124 01.68W	
072109	07:10	TD_00020	37 55.27 N	123 45.97W	
072109	12:57	TD_00021	37 55.27N	123 45.97W	
072109	21:22	T6_00022	38 13.63N	123 29.87W	
072209	01:30	TD_00024	38 7.48N	123 44.23W	
072209	08:07	TD_00025	37 45.03N	123 25.23W	
072209	13:01	TD_00026	37 40.36N	123 30.00W	
072209	20:37	TD_00027	37 31.19N	123 09.03W	

Cruise	Date	File Name	Location	Remarks
Day No.	071509	0000 20090715 003242 FX	Transit	Transit
2	0/1507	0000_20000715_003242_EX	Transit	
		0001_20090715_012502_EX		Transit
		0002_20090715_072501_EX		Transit
		0003_20090715_132502_EX		Transit
		0004_20090715_164528_EX		Transit
		0005_20090715_183657_EX		Transit
		0006_20090715_223507_EX	Plume site	Transit
3	071609	0007_20090716_034420_EX	Plume site	Transit
		0008_20090716_063022_EX	Plume site	Transit
		0009 20090716 064152 EX	Plume site	Transit
		0010 20090716 081122 EX	Plume site	Transit
		0011 20090716 081931 EX	Plume site	Transit
		0012 20090716 083615 EX	Plume site	Transit
		0013 20090716 085824 EX		Transit
		0000 20090716 202221 EX		Transit
		0001 20090716 211442 EX		Transit
		0002 20090716 222054 EX	Priority 1 & 2	Start of box
4	071709	0003 20090717 000030 EX	Bodega Canyon head	Start of new day (GMT)
		0004 20090717 004209 EX		End line, start turn
-		0005 20090717 010429 EX		End turn, start line
		0006 20090717 033320 EX		End line, start turn
		0007 20090717 034453 EX		End turn, start line
		0008 20090717 060129 EX		End line, start turn
		0009 20090717 060513 EX		End turn, start line
		0010 20090717 084137 EX		End line, start turn
		0011 20090717 985053 EX		End turn, start line
-		0012 20090717 110840 EX		End line, start turn
		0013_20090717_111704_EX		End turn, start line
		0014_20090717_134258_EX		End line, start turn
		0015_20090717_134952_EX		End turn, start line
		0016_20090717_160823_EX		End line, start turn
		0017_20090717_161358_EX		End turn, start line
		0018_20090717_183849_EX		End line, start turn
		0019_20090717_184336_EX		End turn, start line
		0020_20090717_210151_EX		End line, start turn
		0021_20090717_211503_EX		End turn, start line
5	071809	0022_20090718_000317_EX		End line, start turn
		0023_20090718_003452_EX		End turn, start line
		0024_20090718_032527_EX		Begin turn line
		0025_20090718_032911_EX		Begin main line
<u> </u>		0026 20000718 045042 EV		water column targets
		0020_20090/18_045945_EX		End turn, start line
 		0027_20090718_030040_EX		End turn, start furn
		0029 20090718 110310 EV		End turn start line
1	1	10027 20070710 110310 LA	1	Lina turn, start inte

Multibeam files collected during the cruise:

		0030 20090718 155921 EX	End line, start turn
		0031 20090718 162109 EX	End turn, start line
		0032 20090718 172547 EX	End line, start turn
		0033 20090718 173446 EX	End turn, start line
		0034 20090718 174629 EX	End line, start turn
		0035 20090718 234628 EX	End turn, start line
6	071909	0036 20090719 020554 EX	End line, start turn
	0,12,02	0037 20090719 023945 EX	End turn, start line
		0038 20090719 073214 EX	End line, start turn
		0039 20090719 075741 EX	End turn start line
		0040 20090719 130932 FX	Preserve file size same line as line 39
		0041 20090719 184643 FX	Turn to S/B to fill holiday
		0042 20090719 200343 FX	Find turn, start line to fill holiday
		0043 20090719 214422 FX	
		0044 20090719 220557 EX	End south hound fill line
7	072000	0044_20090719_220337_EX	Bogin transit to payt holiday
7	072009	0045_20090720_014232_EX	Eilling in holiday northward
		0040_20090720_023807_EA	Transit line
		0047_20090720_030330_EA	Filling in holidou porthword
		0048_20090720_033343_EA	Finnig III honday hordiward
		0049_20090720_040012_EX	Filling in helide and the set
		0050_20090720_043814_EX	Filling in holiday southward
		0051_20090720_051109_EX	Filling in helide most hand
		0052_20090720_053458_EX	Filling in holiday northward
		0053_20090720_061144_EX	Filling in random holidays while
		0054 20000720 071047 EX	New line to preserve data file size
		0055 20000720 121040 EX	Transit 6 hours alanced
		0055_20090720_131949_EA	End transit, o flours etapsed
		0057_20090720_135514_EA	End line, start turn
		0057_20090720_135519_EX	End fine, start turn
0	072100	0038_20090720_194029_EA	
0	072109	0039_20090721_014035_EA	Turn line continued
		0060_20090721_014240_EX	New line continued
		0001_20090721_022001_EA	The southward
		0062_20090721_072105_EX	End line, start turn
		0063_20090721_082212_EX	End turn, start line
		0064_20090721_130342_EX	Line continued, incremented to
		0065 20000721 151048 EX	conserve me size.
		0005_20090721_151048_EA	DOS multipation DOSMU schooted
		0000_20090721_133809_EA	Fost turn start line
		0007_20090721_105350_EA	End turn, start time
		0008_20090721_170928_EA	
		0069_20090721_171824_EX	End turn, start cross line;
		0070 20000721 200807 EX	End cross line, start turn transit turn
		0070_20090721_200807_EX	End turn, start cross line
0	072200	0071_20070721_210231_EA	stort turn line
7	072209	0072 20090722 001527 EX	Start curin line
		0074 20000722 015724 EX	Tum ling
		0075 20000722 022727 EV	
		0075_20090722_024527_EX	Transit line
		0077_20000722_040717_EX	
		0077,20090722_040717_EX	Survey line south
		0078_20090722_045949_EX	I ransit line

	0079_20090722_054732_EX		Survey line south
072209	0000_20090722_065138_EX	Munitions Dump Site	Dump site line 0
	0001_20090722_072053_EX		Transit to dump site line 1
	0002_20090722_073000_EX		Beginning line 1
	0003_20090722_073009_EX		Dump site line 1
	0004_20090722_084538_EX		Turn from line 1 line 2
	0005_20090722_090147_EX		Dump site line 2
	0006_20090722_111113_EX		Transit from line 2 to line 3
	0007_20090722_114947_EX		Dump site line 3
	0008_20090722_140255_EX		Transit from line 3 to line 4
	0009_20090722_142455_EX		Dump site line 4
	0010_20090722_170333_EX		End line, start turn
	0011_20090722_171901_EX		End turn, start Dump site line 5
	0012_20090722_192918_EX		Transit to USS Independence
072209	0000_20090722_200531_EX	USS Independence	Continue transit to USS Independence
	0001_20090722_203850_EX		1 st Independence survey line
	0002_20090722_210542_EX		Broke line, continue line
	0003_20090722_211805_EX		Turn line
	0004_20090722_212738_EX		NW/b detect target
	0005_20090722_215904_EX		Turn line
	0006_20090722_221848_EX		SW/b line-
			bubble sweepdown-
			lost bottom
	0007_20070722_223056_EX		N/b detect target
			S/b detect target
	0008_20090722_225705_EX		

7. Table of Cruise Statistics

Dates	JD197 to JD203
Weather delays	0 days
Total non-mapping days	0 days
Total survey mapping days	7 days
Total transit mapping days	2.5 days
Line kilometers of survey	2477 km
Beginning draft	4.34 m (bow) 4.42 m (stern)
Average ship speed for survey	7.9 kts

8. Data results: overview of exploration area

