

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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Crete, Gregory Beadle, Samuel Baldwin and Andrea LeBarage



1. Purpose

2. Participating personnel

CDR Joe Pica	Ship's Master
Mashkoor Malik	Cruise coordinator
LT Kyle Byers	Field Operations Officer
Colleen Peters	Senior Survey Technician
Lorraine Anglin	ONMS Representative
Andrea LeBarge	Mapping watch stander
Christopher Paul	Mapping watch stander
Elena Crete	Mapping watch stander
Gregory Beadle	Mapping watch stander
Samuel Baldwin	Mapping watch stander
Denise Gordon	NCDDC CIMS team
McKinley Freeman	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.

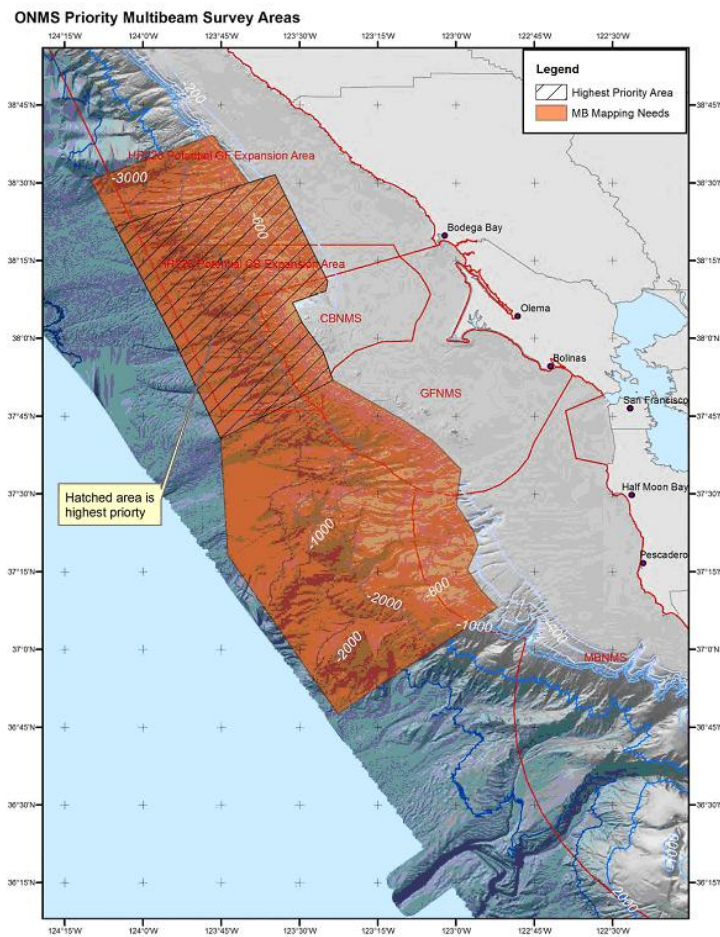


Figure 1: Survey areas showing priorities

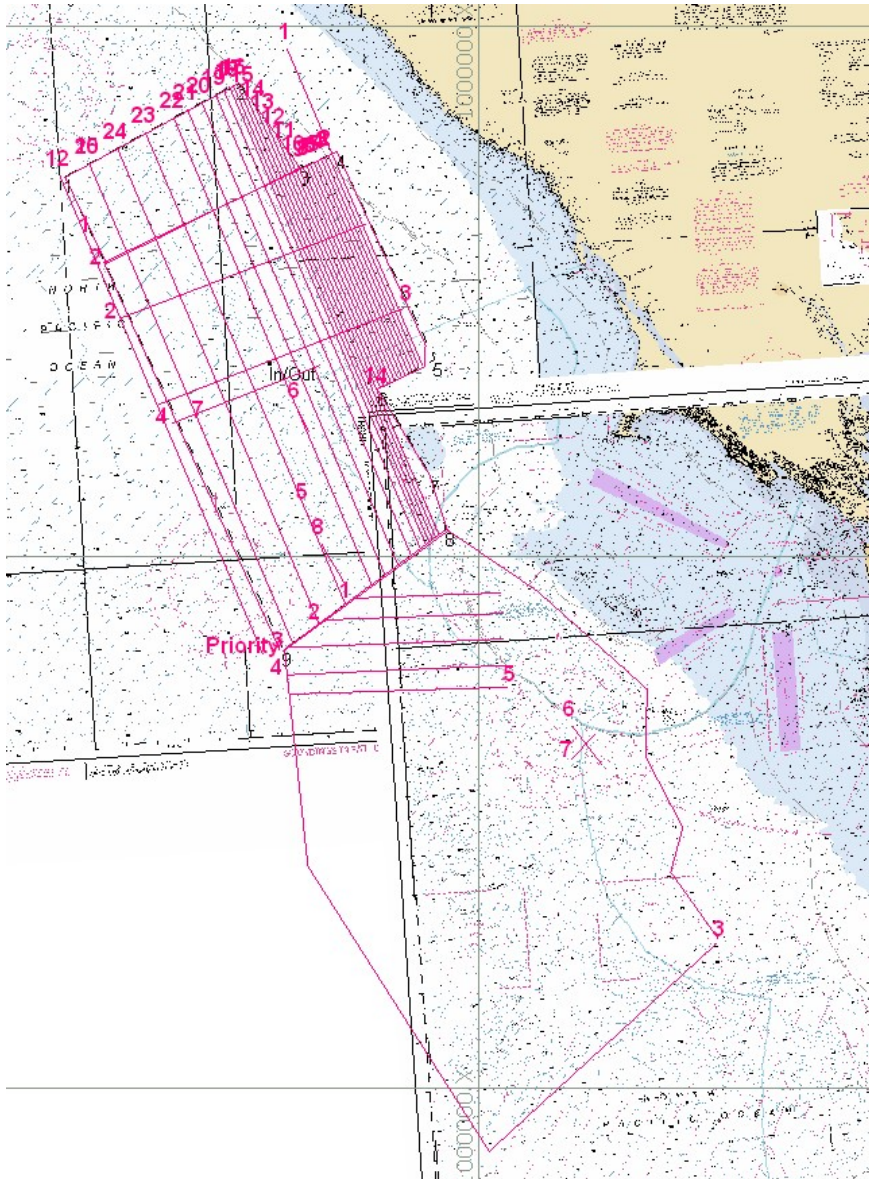


Figure 2: Screen shot of HYPACK showing different lines run during the survey. Image credit: NOAA.

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.

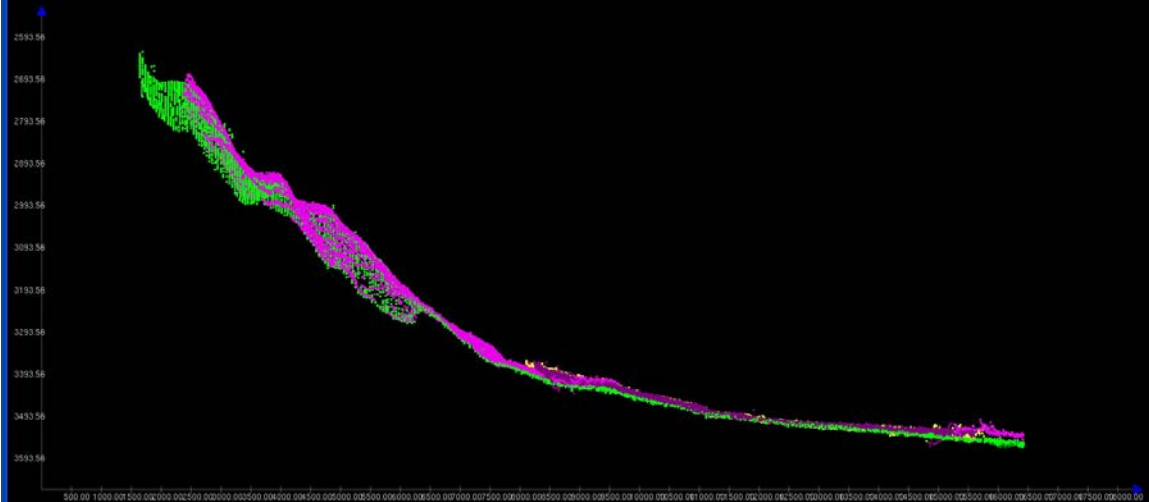


Figure 3: Screen grab of subset editor in CARIS HIPS showing agreement of cross lines (pink) with main scheme lines. Image credit: NOAA

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).

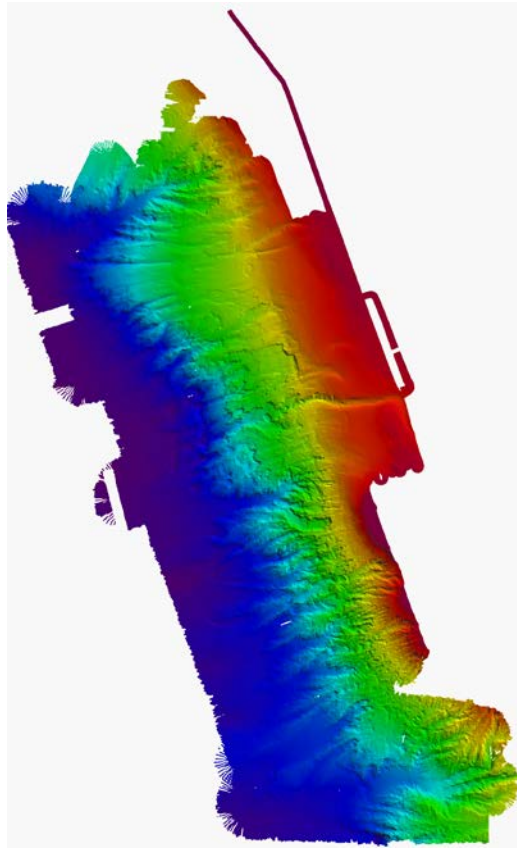


Figure 4: Images of the final grids (at 50 m) cell size resolution of the priority area 1 and 2.

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.

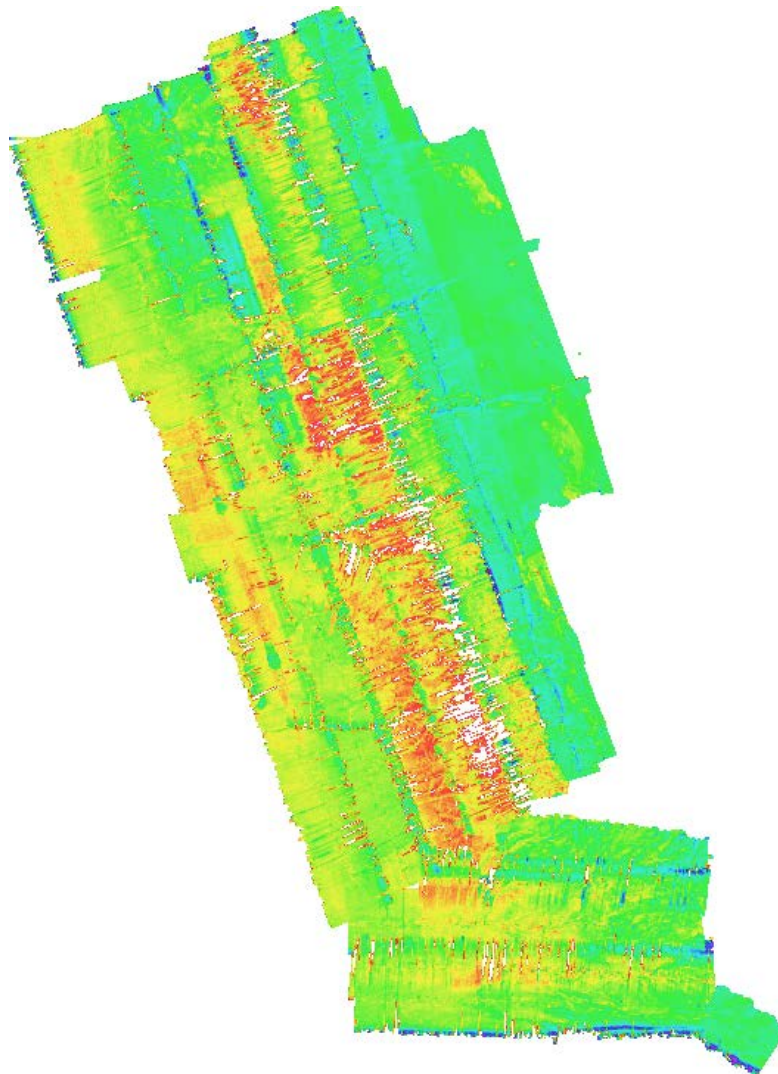


Figure 5: Backscatter mosaic results with 40 m grid cell size. Severe degradation of backscatter data due to bubble sweep down is clearly visible in the central region of the survey.

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.

4. Cruise Calendar

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 San Francisco	24	25	27

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.

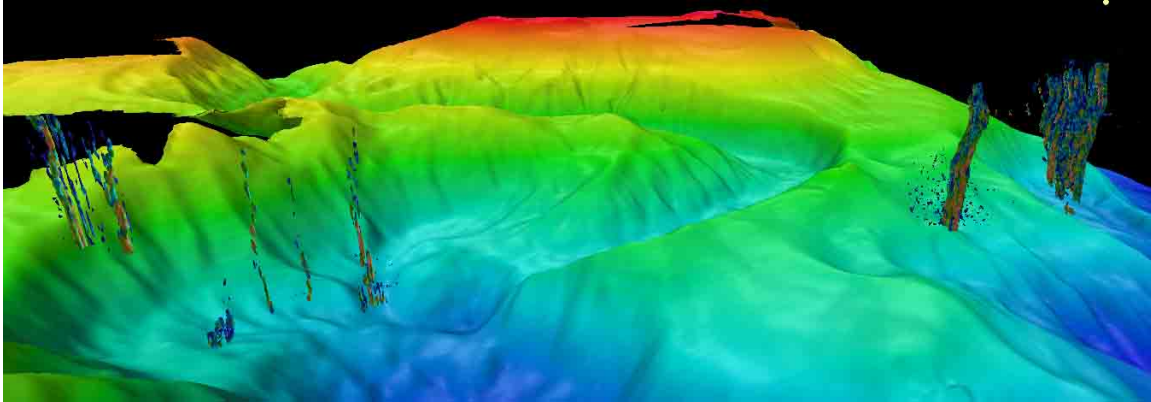


Figure 6: At least five plume sites visible with multibeam.

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.

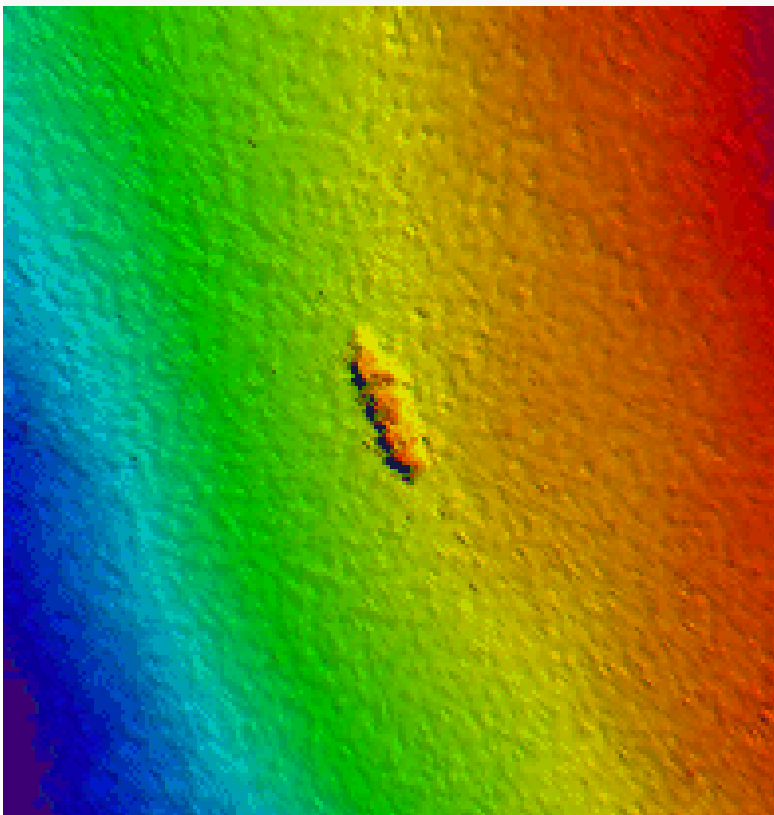


Figure 7: A plan view of USS Independence located in position 123.1346 W, 37.4779 N

6. Tables of data files collected

XBT / CTD locations

Date	Time (GMT)	XBT/CTD Filename	Lat	Long	Remarks
071409	21:54:31	TD_00001	46 5.28N	124 12.19W	
071509	18:04:04	T6_00002	42 38.31N	124 55.33W	
071609	04:07:31	TD_00003	40 54.43N	124 44.95W	
071609	20:48:52	T6_00004	38 45.17N	123 43.38W	
071709	01:22:41	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		T6_0022	38 13.63N	123 29.87W	
072209	01:30	TD_0024	38 7.48N	123 44.23W	
072209	08:07	TD_0025	37 45.03N	123 25.23W	
072209	13:01	TD_0026	37 40.36N	123 30.00W	
072209	20:37	TD_0027	37 31.19N	123 09.03W	

Multibeam files collected during the cruise

Cruise DayNo.	Date	File Name	Location	Remarks
	071409			
2	071509	0000_20090715_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
				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_095053_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 Water column targets

		0026_20090718_045943_EX	End line, start turn
		0027_20090718_050646_EX	End turn, start line
		0028_20090718_103400_EX	End line, start turn
		0029_20090718_110310_EX	End turn, start line
		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
		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_EX	Preserve file size, same line as line 39
		0041_20090719_184643_EX	Turn to S/B to fill holiday
		0042_20090719_200343_EX	End turn, start line to fill holiday
		0043_20090719_214422_EX	
		0044_20090719_220557_EX	End south bound fill line.
7	072009	0045_20090720_014232_EX	Begin transit to next holiday.
		0046_20090720_023807_EX	Filling in holiday northward
		0047_20090720_030330_EX	Transit line.
		0048_20090720_033345_EX	Filling in holiday northward
		0049_20090720_040012_EX	Transit line.
		0050_20090720_043814_EX	Filling in holiday southward
		0051_20090720_051109_EX	Transit line.
		0052_20090720_053458_EX	Filling in holiday northward
		0053_20090720_061144_EX	Filling in random holidays while heading north to begin next full line
		0054_20090720_071947_EX	New line to preserve data file size.
		0055_20090720_131949_EX	Transit, 6 hours elapsed
		0056_20090720_133514_EX	End transit, new line south
		0057_20090720_133519_EX	End line, start turn
		0058_20090720_194029_EX	Northbound
8	072109	0059_20090721_014033_EX	Turn line
		0060_20090721_014240_EX	Turn line continued
		0061_20090721_022001_EX	New line 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 conserve file size.
		0065_20090721_151048_EX	
		0066_20090721_153809_EX	POS malfunction- POSMV rebooted
		0067_20090721_163536_EX	End turn, start line
		0068_20090721_170928_EX	End line, start turn

		0069_20090721_171824_EX		End turn, start cross line; Water column data
		0070_20090721_200807_EX		End cross line, start turn- transit-turn
		0071_20090721_210251_EX		End turn, start cross line
9	072209	0072_20090722_000108_EX		start turn line
		0073_20090722_001537_EX		Start cross line eastward
		0074_20090722_015726_EX		Turn line
		0075_20090722_022727_EX		Survey line south
		0076_20090722_024527_EX		Transit line
		0077_20090722_040717_EX		Survey line south
		0078_20090722_045949_EX		Transit line
		0079_20090722_054732_EX		Survey line south
DUMP SITE				
	072209	0000_20090722_065138_EX		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
USS Independence				
	072209	0000_20090722_200531_EX		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		