CRUISE REPORT
Thermal Grid II

DIRECT AND INDIRECT MEASUREMENTS OF THE THERMAL BUDGET OF TWO LARGE HYDROTHERMAL SYSTEMS ON THE JUAN DE FUCA RIDGE.

R/V THOMPSON/JASON EXPEDITION
TO THE ENDEAVOUR SEGMENT, JUAN DE FUCA RIDGE

June 17th – July 3rd 2001

Funded by the National Science Foundation

Principal Investigator: H. Paul Johnson
Co-Principal Investigator: Susan L. Hautala
Co-Investigator: Christopher D. Jones

University of Washington
Seattle, WA 98195-7940

Compiled by Tor Bjorklund

TABLE OF CONTENTS

Cruise Participants

H. Paul Johnson	UW	johnson@ocean.washington.edu
Susan Hautala	UW	susanh@ocean.washington.edu
Chris Jones	UW	cjones@apl.washington.edu
Janet Voight	Field Museum	jvoight@fieldmuseum.org
Matt Pruis	UW	mpruis@ocean.washington.edu
Irene Garcia-Berdeal	UW	irene@ocean.washington.edu
Lisa Gilbert	UW	lgilbert@ocean.washington.edu
Tor Bjorklund	UW	tor@ocean.washington.edu
Bill Fredericks	UW	billf@u.washington.edu
Sheryl Bolton	UW	bolton@u.washington.edu
Ko-ichi Nakamura	GSJ	koichi@gsj.go.jp
Leif Thomas	UW	leif@ocean.washington.edu
Kelly O'Connell	URI	koconnell@gso.uri.edu
Jamie Turner	HCC	jamiesharene@hotmail.com
Chad Findley	MarTech intern	

Jason Team

Martin Bowen	WHOI	mbowen@whoi.edu
Will Sellers	Tom Crook	Francis Taylor
Mark Bokenfohr	Bob Elder	Jim Varnum
Jon Howland	Peter Collins	

Science WATCH Schedule

Bill [4 to 8]	**Janet [8 to 12]**	**Lisa [12 to 4]**
Matt	Susan	Irene
Leif	Kelly	Tor
Ko-ichi	Sheryl	Jamie
Chad		Chris X

Instrument Deployment Summary

Intrustment	No.	Term	Base type	Target No.	X (meters)	Y (meters)	Z (meters)	Heading angles	Site	Deployment time	Recovery time
MAVs-3	48	Long	Bag	90	492573	5310525	2191	163	MEF-El	06/30/2001 1:11	Long term
	49	Short	Bag	14	493168	5312211	2183	10	Clambed	06/22/2001 3:25	06/28/2001 12:02
	50	Short	Bag	11	493193	5312330	2180	225	Clambed	06/21/2001 22:20	06/26/2001 4:50
	50:2nd	Short	Bag	19	493327	5312719	2167	138	High Rise	06/28/2001 6:24	07/01/2001 1:53
	51	Short	Bag	17	493413	5312635	2163	200	Ventnor	06/22/2001 7:12	06/28/2001 9:12
	53	Short	Bag	35	492752	5310746	2198	141	MEF-East Hulk	06/23/2001 2:58	06/29/2001 7:51
	54	Short	Bag	34	492630	5310547	2192	60	MEF-S & M	06/23/2001 0:10	06/29/2001 6:53
	55	Short	Bag	4	493163	5312190	2184	343	Clambed	06/19/2001 16:54	06/22/2001 3:29
	55:2nd	Short	Bag	16	493162	5312183	2181	284	Clambed	06/22/2001 3:39	06/28/2001 12:10
	56	Short	Bag	20	493313	5312685	2180	330	High Rise	06/22/2001 8:36	06/28/2001 3:40
	57	Short	Bag	19	493312	5312731	2168	253	High Rise	06/28/2001 6:40	07/01/2001 2:07
	58	Short	Bag	6	493212	5312345	2184	260	Clambed	06/21/2001 20:24	06/26/2001 1:49
	58:2nd	Long	Bag	90	492791	5311230	2177	321	New Field	06/29/2001 18:24	Long term
	59	Short	Bag	41	492605	5310181	2198	210	Beach	06/23/2001 9:20	06/28/2001 2:57
	60	Short	Bag	44	492776	5311236	2179	90	New Field	06/23/2001 14:52	06/29/2001 22:02
	61	Short	Bag	25	492585	5310378	2195	166	MEF-Salut	06/22/2001 17:37	06/26/2001 9:23
	61:2nd	Long	Bag	34	492637	5310538	2191	135	MEF-S & M	06/29/2001 5:42	Long term
	65	Short	Bag	43	492777	5311216	2184	114	New Field	06/23/2001 13:53	06/29/2001 21:59
Spider	1	Short	Tripod	4	493171	5312186	2132.7	290	Clambed	06/19/2001 13:59	06/19/2001 16:41
	1	Short	Tripod	4	493171	531285	2188	215	Clambed	06/19/2001 16:50	06/19/2001 19:48
	1	Short	Tripod	4	493178	5312188	2185	340	Clambed	06/19/2001 19:53	06/22/2001 4:23
	1	Short	Tripod	14	493164	5312198	2183	75	Clambed	06/22/2001 4:23	06/24/2001 4:12
	1	Short	Tripod	48	493162	5312187	2181.1	208	Clambed	06/24/2001 23:30	06/25/2001 4:12
Tower	1	Short	Tripod	66	493316	5312726	2170		High Rise	06/28/2001 2:09	07/01/2001 4:13
Thermal Blanket	1	Short		31	492601	5310454	2193		MEF-MagLow	06/22/2001 20:04	06/23/2001 3:56
	1	Short		36	492750	5310507	2206		East of MEF	06/23/2001 4:23	06/25/2001 13:35
	1	Short		50	492704	5310484	2208		MEF	06/25/2001 14:04	06/26/2001 9:14
	1	Short		30	492603	5310453	2188.7		MEF-Milli-Q	06/29/2001 6:29	06/29/2001 16:27
	1	Short		36	4927756	5310502	2208.9		East of MEF	06/29/2001 16:53	06/30/2001 6:38
	1	Short		50	492711	5310476	2208		East of MEF	06/30/2001 7:04	07/01/2001 13:12
	1	Short		21	492843.8	5310867	2209		East of MEF	07/01/2001 14:58	07/01/2001 20:36

Instrument Deployment Summary

Intrustment	No.	Term	Base type	Target No.	X (meters)	Y (meters)	Z (meters)	Heading angles	Site	Deployment time	Recovery time
LT HOBO	33	Short		16	493164.6	5312191	2187		Clambed	06/24/2001 23:10	06/29/2001 17:28
		Long		6	492573.4	5310522	2192.247		MEF-EI	06/30/2001 1:02	Long Term
	34*	Long		34	492638.3	5310545	2192.509		MEF-S & M	06/29/2001 5:24	Long Term
	35*	Short		16	493170.8	5312185	2186.634		Clambed	06/24/2001 23:12	06/29/2001 17:26
		Long		90	492790.1	5311229	2181.417		Clambed	06/29/2001 18:31	Long Term
*Note-HOBO 34 and 35 are Double HOBOs, 34's bottom HOBO is a high temp HOBO											
MEF-Main Endeavour Field											
EI-Easter Island											

Target Files

TN 129

TGT#	Xpos	Ypos	Lat	Lon	UtmX	UtmY
1	5468.30	7805.29	47 57.84594	-129 -5.48252	493179.08	5312314.03
2	5450.80	7785.09	47 57.83504	-129 -5.49657	493161.58	5312293.86
3	5448.02	7751.10	47 57.81670	-129 -5.49879	493158.77	5312259.89
4	5451.10	7674.58	47 57.77541	-129 -5.49633	493161.75	5312183.40
5	5514.35	7752.73	47 57.81758	-129 -5.44558	493224.98	5312261.44
6	5494.70	7840.08	47 57.86472	-129 -5.46134	493205.47	5312348.78
7	5502.55	7847.82	47 57.86889	-129 -5.45505	493213.31	5312356.51
8	5518.74	7846.11	47 57.86797	-129 -5.44206	493229.47	5312354.78
9	5516.69	7808.15	47 57.84749	-129 -5.44370	493227.38	5312316.84
10	5520.77	7817.10	47 57.85232	-129 -5.44042	493231.47	5312325.78
11	5482.70	7826.06	47 57.85715	-129 -5.47097	493193.47	5312334.78
12	5494.46	7819.63	47 57.85368	-129 -5.46153	493205.21	5312328.34
13	5506.75	7816.08	47 57.85177	-129 -5.45167	493217.47	5312324.78
14	5453.74	7688.96	47 57.78317	-129 -5.49421	493164.40	5312197.77
15	5449.72	7686.84	47 57.78202	-129 -5.49743	493160.39	5312195.65
16	5461.73	7677.32	47 57.77689	-129 -5.48779	493172.37	5312186.12
17	5695.68	8134.83	47 58.02377	-129 -5.30008	493406.43	5312643.18
18	5694.94	8102.66	47 58.00641	-129 -5.30068	493405.65	5312611.03
19	5609.48	8211.36	47 58.06507	-129 -5.36925	493320.47	5312719.78
20	5601.93	8176.13	47 58.04606	-129 -5.37531	493312.90	5312684.58
21	5607.59	6381.65	47 57.07771	-129 -5.37076	493316.47	5310890.78
22	5450.68	6051.13	47 56.89935	-129 -5.49667	493159.40	5310560.57
23	4611.76	6348.50	47 57.05982	-129 -6.16977	492322.12	5310858.88
24	4844.08	5867.51	47 56.80027	-129 -5.98336	492553.47	5310377.78
25	4866.06	5868.18	47 56.80063	-129 -5.96573	492575.41	5310378.42
26	5073.19	6268.63	47 57.01672	-129 -5.79954	492782.75	5310778.45
27	4891.06	5939.60	47 56.83917	-129 -5.94567	492600.47	5310449.78
28	5058.90	6265.94	47 57.01527	-129 -5.81101	492768.47	5310775.78
29	4842.68	5942.63	47 56.84080	-129 -5.98449	492552.16	5310452.87
30	4885.65	5930.13	47 56.83406	-129 -5.95001	492595.06	5310440.32
31	4892.31	5948.48	47 56.84396	-129 -5.94467	492601.73	5310458.65
32	4873.93	6020.61	47 56.88288	-129 -5.95941	492583.47	5310530.78
33	4932.01	6025.69	47 56.88562	-129 -5.91282	492641.47	5310535.78
34	4920.24	6036.75	47 56.89159	-129 -5.92226	492629.73	5310546.85
35	5043.89	6232.75	47 56.99736	-129 -5.82304	492753.45	5310742.62
36	5040.79	5995.46	47 56.86931	-129 -5.82554	492750.05	5310505.43
37	4914.75	5914.79	47 56.82578	-129 -5.92667	492624.09	5310424.95
38	4917.97	5995.27	47 56.86921	-129 -5.92408	492627.41	5310505.39
39	5488.40	6040.85	47 56.89380	-129 -5.46640	493197.06	5310550.25
40	4892.43	5651.49	47 56.68370	-129 -5.94457	492601.47	5310161.78
41	4896.07	5672.92	47 56.69526	-129 -5.94165	492605.13	5310183.20
42	4856.41	5631.44	47 56.67287	-129 -5.97348	492565.47	5310141.78
43	5067.12	6711.90	47 57.25592	-129 -5.80441	492777.24	5311221.56
44	5065.72	6723.37	47 57.26211	-129 -5.80553	492775.86	5311233.02
45	5148.53	6467.37	47 57.12397	-129 -5.73909	492858.22	5310977.02
46	5540.12	7598.77	47 57.73450	-129 -5.42490	493250.53	5312107.51
47	5384.35	7590.38	47 57.72997	-129 -5.54988	493095.02	5312099.31
48	5450.80	7679.24	47 57.77792	-129 -5.49656	493161.46	5312188.05
49	5881.63	7494.81	47 57.67840	-129 -5.15089	493591.32	5312003.20
50	4994.90	5973.65	47 56.85754	-129 -5.86236	492704.20	5310483.68
51	5126.70	6821.48	47 57.31505	-129 -5.75661	492836.86	5311331.02

52	5118.22	6815.96	47	57.31207	-129	-5.76341	492828.39	5311325.51
53	5094.69	6790.43	47	57.29830	-129	-5.78229	492804.86	5311300.02
54	5122.20	6815.61	47	57.31189	-129	-5.76022	492832.36	5311325.16
55	5097.55	6855.85	47	57.33360	-129	-5.78000	492807.80	5311365.41
56	5120.34	6813.43	47	57.31071	-129	-5.76171	492830.50	5311322.98
57	5120.60	6814.29	47	57.31117	-129	-5.76150	492830.76	5311323.84
58	5121.94	6815.04	47	57.31158	-129	-5.76043	492832.10	5311324.59
59	5121.94	6815.04	47	57.31158	-129	-5.76043	492832.10	5311324.59
60	5121.94	6815.04	47	57.31158	-129	-5.76043	492832.10	5311324.59
61	5121.94	6815.04	47	57.31158	-129	-5.76043	492832.10	5311324.59
62	5121.94	6815.04	47	57.31158	-129	-5.76043	492832.10	5311324.59
63	5577.94	7777.39	47	57.83089	-129	-5.39455	493288.49	5312286.02
64	5729.25	7832.52	47	57.86064	-129	-5.27315	493439.59	5312340.95
65	5628.79	8073.50	47	57.99067	-129	-5.35376	493339.59	5312581.95
66	5602.01	8220.85	47	58.07019	-129	-5.37524	493313.03	5312729.28
67	5615.56	8205.62	47	58.06197	-129	-5.36437	493326.54	5312714.04
68	5623.46	8151.34	47	58.03268	-129	-5.35803	493334.36	5312659.77
69	5710.20	7850.04	47	57.87009	-129	-5.28843	493420.60	5312358.49
70	5621.02	8178.52	47	58.04735	-129	-5.35999	493331.96	5312686.94
71	5615.70	8215.28	47	58.06718	-129	-5.36426	493326.69	5312723.69
72	5615.07	8220.86	47	58.07019	-129	-5.36476	493326.07	5312729.27
73	5615.61	8210.53	47	58.06462	-129	-5.36433	493326.59	5312718.95
74	5611.60	8207.53	47	58.06300	-129	-5.36755	493322.59	5312715.95
75	5606.59	8207.52	47	58.06300	-129	-5.37156	493317.59	5312715.95
76	5601.59	8207.52	47	58.06299	-129	-5.37558	493312.59	5312715.95
77	5701.86	8126.60	47	58.01933	-129	-5.29513	493412.59	5312634.95
78	5456.92	7702.15	47	57.79029	-129	-5.49166	493167.59	5312210.95
79	6140.14	8619.27	47	58.28519	-129	-4.94347	493850.59	5313126.95
80	5957.03	8121.12	47	58.01637	-129	-5.09039	493667.28	5312629.19
81	5044.09	6192.06	47	56.97540	-129	-5.82289	492753.59	5310701.95
82	5051.97	6183.45	47	56.97075	-129	-5.81657	492761.45	5310693.33
83	5074.02	6284.14	47	57.02509	-129	-5.79888	492783.59	5310793.95
84	5026.63	6144.43	47	56.94970	-129	-5.83690	492736.10	5310654.36
85	5137.17	6234.20	47	56.99814	-129	-5.74820	492846.59	5310743.95
86	5056.92	6673.14	47	57.23500	-129	-5.81259	492767.01	5311182.82
87	5235.26	7100.65	47	57.46570	-129	-5.66950	492945.59	5311609.95
88	5239.09	7244.71	47	57.54344	-129	-5.66643	492949.59	5311753.95
89	5208.16	7150.64	47	57.49268	-129	-5.69125	492918.59	5311659.95
90	4863.04	6014.77	47	56.87973	-129	-5.96815	492572.59	5310524.95
91	4986.47	5969.70	47	56.85541	-129	-5.86912	492695.78	5310479.74
92	5031.30	6005.98	47	56.87498	-129	-5.83315	492740.59	5310515.95
93	5635.93	7056.48	47	57.44187	-129	-5.34803	493345.54	5311565.32
94	5635.93	7056.48	47	57.44187	-129	-5.34803	493345.54	5311565.32
95	5635.93	7056.48	47	57.44187	-129	-5.34803	493345.54	5311565.32
96	6278.33	8559.62	47	58.25300	-129	-4.83260	493988.45	5313067.17
97	5424.09	6067.16	47	56.90800	-129	-5.51800	493132.87	5310576.63
98	5424.09	6067.16	47	56.90800	-129	-5.51800	493132.87	5310576.63

MAVs

No.	Date & Time	UMT(X)	UMT(Y)	Depth (m)	Alt. (m)	Heading		Event	
47	01/06/23 10:00:02.00	492574.53	5310137.23	2198.103	3.1	239.475		Mav 47 is in sight and is not up right	
	01/06/23 10:02:06.00	492574.53	5310137.23	2200.307	1.1	160.955		Orientation of Mav 47 is 155	
	01/06/23 10:04:50.00	492574.53	5310137.23	2201.179	30	127.3		Jason has Mav 47 **Recovered**	
	01/06/23 11:07:48.00	493114.15	5310523.26	2102.598	30	213.259	10047	stop ADCP	
	01/06/23 11:07:58.00	493114.15	5310523.26	2102.722	30	220.216	10047	stop CTD	
	01/06/23 11:10:43.00	493115.45	5310543.43	2103.325	28.8	235.306	10047	start ADCP 308001	
	01/06/23 11:11:01.00	493115.45	5310543.43	2103.582	27.5	223.2	10047	start 308012	
	01/06/23 11:11:51.00	493115.45	5310543.43	2103.615	29.9	215.291	10047	no look on the ADCP, trying to cycle power to it.	
	01/06/23 11:12:25.00	493122.67	5310545.77	2103.929	29.5	223.407	10047	ACDP is in communicato, but for some reason is not sending data up.	
	01/06/23 11:15:44.00	493149.64	5310565.66	2109.137	16.6	123.225	10047	elevator with in site.	
	01/06/23 11:16:04.00	493149.64	5310565.66	2109.181	15.4	102.794	10047	To get to elevator from west, must rise up small wall	
	01/06/23 11:19:09.00	493158.21	5310556.26	2108.867	6.2	58.904	10047	Big yellow glass balls	VID_GRAB
	01/06/23 11:19:56.00	493158.21	5310556.26	2110.108	4.9	72.277	10047	Jim shoots and he scores. Mav in culvert tube.	
	01/06/23 11:23:19.00	493342.44	5310453.11	2111.163	3.6	78.889	10047	Mav 10047 is secure in the tube	
48	01/06/22 20:40:10.00	492572.81	5310525.9	2190.955	3.4	134.78		Pisking up Mav 48 from Easter Island	
	01/06/22 20:40:45.00	492574.85	5310525.47	2192.364	2.4	135.465		Got Mav 48 on Jason **Recovered**	
	01/06/22 21:47:39.00	493155.24	5310555.49	2111.452	3.9	25.877		Mav 48 in the elevator	
	01/06/30 01:11:16.00	492575.81	5310520.84	2190.305	3.7	342.981		**Deployment** of 10048P	
49	01/06/22 01:26:09.00	493231.36	5312267.75	2175.614	4.8	315.96	Mav 10049	Picking 10049 out of elevator	
	01/06/22 01:26:22.00	493231.36	5312267.75	2174.88	5	327.346	Mav 10049	Away it goes	VID_GRAB
	01/06/22 01:31:59.00	493231.36	5312267.75	2177.093	2.5	279.765	Mav 10049	Shit. Trapped in elevator by retaining strap!	
	01/06/22 01:36:33.00	493231.36	5312267.75	2177.426	2.2	346.612	Mav 10049	Strap pulled off by great work of Jim and Yogie!	VID_GRAB
	01/06/22 01:37:35.00	493231.36	5312267.75	2177.286	2.4	351.787	Mav 10049	Under elevator	VID_GRAB
	01/06/22 01:43:07.00	493231.36	5312267.75	2174.84	5.5	83.396	Mav 10049	We'll fige it another try	VID_GRAB
	01/06/22 01:49:25.00	493221.14	5312266.63	2175.06	4.2	264.513	Mav 10049	Have mav on hook heading to target in southern Clambed for deployment	
	01/06/22 01:50:08.00	493221.14	5312266.63	2175.06	6.3	233.248	Mav 10049	AST target for deployment is the northern red target on the southern end of the field	
	01/06/22 02:10:25.00	493163.89	5312196.61	2182.495	0.9	240.441	Mav 10049		VID_GRAB
	01/06/22 02:10:31.00	493164.4	5312197.77	2182.679	1.7	236.533	Mav 10049		VID_GRAB
	01/06/22 02:11:25.00	493164.4	5312197.77	2183.307	30	240.082	Mav 10049	Deploying mavs 49	VID_GRAB
	01/06/22 02:12:29.00	493162.41	5312196.77	2183.36	30	240.196	Mav 10049	thermistor chain is not straight	
	01/06/22 02:12:45.00	493162.41	5312196.77	2183.354	30	240.104	Mav 10049	the ctd shows ~0.1 C anomaly	
	01/06/22 02:19:55.00	493159.99	5312199.45	2183.471	30	240.274	Mav 10049	attempted temp measurement, not much of a signal. Shimering appears to be on the far side of the MAVs	VID_GRAB
	01/06/22 02:20:19.00	493157.65	5312196.98	2182.36	1.2	228.932	Mav 10049	Shimmering above bio box in the picture	VID_GRAB
	01/06/22 02:22:05.00	493160.86	5312199.77	2181.25	2.5	80.866	Mav 10049	jason is moving to make temperature measurment in the hot spot. Temperature is still being recorded.	
	01/06/22 02:24:11.00	493158.79	5312197.1	2183.306	0.7	56.073	Mav 10049	mavs has fallen	VID_GRAB
	01/06/22 02:26:03.00	493158.79	5312197.1	2183.306	1.9	54.942	Mav 10049	Probing temperature in a muddy area. Not much of a temperature signal.	VID_GRAB
	01/06/22 02:29:17.00	493158.79	5312197.1	2183.291	30	55.497	Mav 10049	temperature measurement max 2.7 C.	VID_GRAB
	01/06/22 02:34:48.00	493152.12	5312198.66	2182.102	1.6	73.526	Mav 10049	moving mavs to a hotter spot	
	01/06/22 02:35:56.00	493159.93	5312197.11	2181.607	1.5	37.02	Mav 10049	We picked up the Mav and are moving to a different target taken from the AST.	
	01/06/22 02:53:26.00	493160.95	5312219.14	2176.692	5.7	4.911	Mav 10049	Watch change	
	01/06/22 03:00:23.00	493165.11	5312199.82	2181.246	2.3	249.94	Mav 10049	possible new MAV location	VID_GRAB
	01/06/22 03:01:32.00	493167.34	5312197.49	2180.986	3.3	256.392	Mav 10049	MAV location	VID_GRAB
	01/06/22 03:02:53.00	493163.54	5312197.54	2182.757	2.5	321.623	Mav 10049	beautiful basalt	VID_GRAB
	01/06/22 03:05:23.00	493154.17	5312196.95	2183.391	30	328.29	Mav 10049	MAV 49 tipping over, trying to straighten	
	01/06/22 03:08:06.00	493154.17	5312196.95	2182.637	0.8	343.639	Mav 10049	rotating MAV to correct orientation	
	01/06/22 03:11:20.00	493160.62	5312199.27	2183.579	0.7	49.737	Mav 10049	testing	VID_GRAB
	01/06/22 03:12:46.00	493160.62	5312199.27	2183.637	30	50.401	Mav 10049	shimmering at base of MAV location	

MAVs

No.	Date & Time	UMT(X)	UMT(Y)	Depth (m)	Alt. (m)	Heading		Event	
	01/06/22 03:15:28.00	493165.77	5312199.74	2183.609	0.7	50.637	Mav 10049	temperature probe	
	01/06/22 03:17:56.00	493165.77	5312199.74	2183.643	0.7	49.945	Mav 10049	temp 2.9-3.0 C	
	01/06/22 03:18:40.00	493154.26	5312196	2183.654	0.7	50.077	Mav 10049	lots of bacteria/floc	
	01/06/22 03:24:10.00	493156.58	5312198.59	2181.908	1.6	31.146	Mav 10049		VID_GRAB
	01/06/22 03:25:05.00	493156.58	5312198.59	2181.912	1.5	9.668	Mav 10049	orientation 010	VID_GRAB
	01/06/22 03:25:41.00	493151.51	5312194.52	2179.574	3.9	9.933	Mav 10049	MAV 49 **Deployed**!	VID_GRAB
	01/06/22 03:26:05.00	493160.39	5312195.65	2178.354	4.8	7.752	Mav 10049	Preparing to drop nav. target	
	01/06/22 03:26:14.00	493160.39	5312195.65	2178.421	4.7	7.92	Mav 10049	target 15 - MAV 49	
	01/06/22 03:28:28.00	493167.56	5312193.93	2180.266	3.7	128.892	Mav 10049	high temperature area	VID_GRAB
	01/06/22 03:29:31.00	493166.03	5312194.32	2181.784	2.8	131.865	Mav 10049	different tube worms show higher temperature area	
	01/06/22 03:30:21.00	493164.35	5312192.92	2183.192	1.4	155.644	Mav 10049	moving MAV 49 to new found, high temp location	
	01/06/26 04:20:42.00	493171.7	5312199.47	2179.305	5.9	215.643	AST survey Line 3.5	MAV 49 in view - it appears to be a bit leaning	
	01/06/28 11:09:07.00	493161.09	5312199.85	2181.174	2.6	188.264		10049?	VID_GRAB
50	01/06/26 02:03:37.00	493197.57	5312330.78	2178.764	2.7	55.587		Arrival at MAV 50	
	01/06/26 02:06:00.00	493196.8	5312328.13	2177.337	3.9	59.727		MAV 50 in manipulator **Recovered**	
	01/06/28 06:22:16.00	493321.72	5312720.86	2159.952	5.2	56.99	entrainment experiment	MAV50 **deployed**	VID_GRAB
	01/06/28 06:23:45.00	493320.16	5312711.64	2160.119	7.6	41.495	entrainment experiment	orientation 138	VID_GRAB
	01/06/28 06:28:22.00	493335.48	5312716.59	2159.406	3.7	253.725	entrainment experiment	MAV 50	VID_GRAB
	01/07/01 00:13:20.00	493327.79	5312724.65	2164.77	1.9	180.081	entrainment experiment	view of MAVs #50 from station #71.	VID_GRAB
	01/07/01 00:47:57.00	493324.18	5312715.8	2160.64	4.8	87.196	entrainment experiment	mav #?	VID_GRAB
	01/07/01 00:48:04.00	493324.18	5312715.8	2160.634	4.8	87.283	entrainment experiment	mav #?	VID_GRAB
	01/07/01 00:49:20.00	493323.35	5312716.26	2160.649	4.7	87.626	entrainment experiment	last two framegrabs may be combined for psuedo-panarama of mav to smoker locations mav#?	
51	01/06/22 05:56:25.00	493405.35	5312642.37	2163.831	5.4	87.437	mav 51 deploy	mav did not deploy properly - deploy target #17	
&	01/06/22 05:57:29.00	493403.9	5312644.57	2163.835	7.2	107.107		go deploy second mav and come back to fix 51	
56	01/06/22 05:58:04.00	493402.42	5312644.31	2166.196	5.2	138.006		set down second mav here and fix 51 now	
	01/06/22 06:08:56.00	493406.06	5312643.37	2162.939	7.7	140.293	mav 51 deploy	second mav set down and fell over	
	01/06/22 06:12:34.00	493399.19	5312638.55	2166.94	1.3	54.05	mav 51 deploy	trying to fully deploy mav 51	
	01/06/22 06:13:42.00	493395.87	5312638.78	2167.141	1.1	59.205	mav 51 deploy	mav is down **Deployed**	
	01/06/22 06:16:25.00	493395.21	5312638.33	2166.794	30	179.606	mav 51 deploy		VID_GRAB
	01/06/22 06:19:29.00	493365.59	5312632.56	2166.194	1.7	193.705	mav 51 deploy	heading 205	VID_GRAB
	01/06/22 06:22:38.00	493365.59	5312632.56	2168.116	1.3	130.227	mav 51 deploy	picking up mav 56	
	01/06/22 06:24:37.00	493396.22	5312641.6	2166.397	4.3	78.998	mav 51 deploy	dropped mav 56	
	01/06/22 06:25:37.00	493396.22	5312641.6	2166.204	1.7	167.785	mav 51 deploy	get ready to take temp data while sitting to get some ADCP data	
	01/06/22 06:31:58.00	493396.22	5312641.6	2165.976	2	176.232	mav 51 deploy	mav pulled loose while getting temps	
	01/06/22 06:32:32.00	493402.3	5312640.95	2166.475	3.4	127.418	mav 51 deploy	mav stuck on fromt of jason	
	01/06/22 06:33:56.00	493403.74	5312639.83	2165.329	2	129.075	mav 51 deploy	place mav 51 to another site	
	01/06/22 06:36:13.00	493402.86	5312620.09	2165.495	1.9	128.9	mav 51 deploy	mav 51 freed from front of jason	
	01/06/22 06:39:01.00	493398.28	5312642.61	2160.911	6.9	111.54	mav 51 deploy	leaving mav56 - few meters West of 17- go deploy mav51	
	01/06/22 06:45:32.00	493412.9	5312634.93	2161.363	27	102.028	redeploy mav 51	shift change	
	01/06/22 06:52:49.00	493412.9	5312634.93	2163.254	30	230.323	redeploy mav 51	Animal observations	fish
	01/06/22 06:53:21.00	493412.9	5312634.93	2163.256	30	229.677	redeploy mav 51		VID_GRAB
	01/06/28 09:12:48.00	493410.25	5312631.05	2157.736	3.2	298.043		Jason has Mavs 51	
	01/06/28 09:57:37.00	493429.91	5312384.18	2182.31	8.6	109.49		Mav 51 is in the north elevator in slot B	
52	01/06/22 01:08:09.00	493223.87	5312272.29	2180.897	30	292.203	Mav 10052	Picking up Mav 10052 which was placed by elevator earlier, awaiting a tube in the elevator to open up.	
	01/06/22 01:09:56.00	493223.87	5312272.29	2180.892	30	287.812	Mav 10052	attempting to recover 10052 from base of elevator	VID_GRAB
	01/06/22 01:10:21.00	493223.87	5312272.29	2180.873	30	287.694	Mav 10052	10052 had fallen over when Will placed by the elevator	
	01/06/22 01:12:00.00	493223.87	5312272.29	2176.48	5.7	266.891	Mav 10052	One in the hand, one in the bush	VID_GRAB
	01/06/22 01:21:11.00	493231.36	5312267.75	2175.676	4.9	315.915	Mav 10052	10052 secured in elevator	VID_GRAB
53	01/06/22 23:36:22.00	492630.52	5310544.66	2190.813	1.6	287.935	10053 deployment	North of S & M	
	01/06/23 00:17:47.00	492633.41	5310549.59	2192.699	26	206.872	10053 deployment	Moving to pick up 10053 and head on our way	
	01/06/23 00:19:12.00	492633.48	5310547.24	2185.646	7.1	237.435	10053 deployment	a mav in the bush and a mav in the basket	VID_GRAB

MAVs

No.	Date & Time	UMT(X)	UMT(Y)	Depth (m)	Alt. (m)	Heading		Event	
	01/06/23 00:36:56.00	492630.07	5310660.59	2180.473	9.4	2.867	10053 deployment	Easter island smoking structure Paul has deemed this the toad stool.	VID_GRAB
	01/06/23 00:37:29.00	492628.51	5310667	2177.444	6	4.304	10053 deployment	A great deal of waterborne smoke is present	
	01/06/23 00:39:54.00	492636.03	5310675.89	2177.897	12.8	29.749	10053 deployment	more smoke in water column.	
	01/06/23 00:41:14.00	492648.82	5310685.8	2179.718	12.5	1.293	10053 deployment	taking JASON down to the seafloor.	
	01/06/23 00:42:17.00	492648.69	5310681.23	2183.712	2.2	214.743	10053 deployment	Matt is back on watch	
	01/06/23 00:44:50.00	492651.85	5310676.4	2183.876	11	312.102	10053 deployment	We are at/near Grotto vent	VID_GRAB
	01/06/23 00:45:34.00	492649.89	5310673.66	2182.571	10.5	279.624	10053 deployment	Looks like Pittsburg	VID_GRAB
	01/06/23 00:49:27.00	492637.7	5310677.08	2183.891	7.7	36.144	10053 deployment	Looks pretty obvious that the AST anomaly caused by black smoker	
	01/06/23 00:54:15.00	492637.44	5310679.65	2187.798	4.3	151.551	10053 deployment	shimmering stuff there	VID_GRAB
	01/06/23 00:55:45.00	492631.8	5310677.75	2185.969	5.1	203.136	10053 deployment		VID_GRAB
	01/06/23 00:56:04.00	492630.8	5310681.3	2185.798	5.2	210.613	10053 deployment	Side smoker	VID_GRAB
	01/06/23 01:01:32.00	492628.43	5310657.31	2188.139	3.1	178.375	10053 deployment	looks like a stegasourus	
	01/06/23 01:32:14.00	492598.76	5310616.67	2189.838	2.3	136.196	10053 deployment	pedal to the metal to E. Hulk	
	01/06/23 01:44:55.00	492680.98	5310658.14	2187.324	8.4	37.257	10053 deployment	big sulfide	
	01/06/23 01:45:35.00	492682.65	5310662.88	2181.886	11.2	41.881	10053 deployment	smoker	VID_GRAB
	01/06/23 01:55:49.00	492757.25	5310731.67	2198.617	2.5	339.619	10053 deployment	shimmering water	
	01/06/23 01:57:32.00	492750.72	5310741.83	2195.025	3.5	347.723	10053 deployment	flat diffuse plain	
	01/06/23 01:58:19.00	492752.1	5310750.49	2195.305	2.9	25.352	10053 deployment	well ok not so flat after all	
	01/06/23 01:58:38.00	492754.14	5310754.03	2195.309	3.3	53.419	10053 deployment	shimmering water	
	01/06/23 01:59:47.00	492753.31	5310756.19	2195.358	2.9	86.911	10053 deployment	lots of diffuse flow on the flanks of Hulk	
	01/06/23 02:11:23.00	492761.35	5310743.68	2196.727	3.3	307.408	10053 deployment	starting to look good	VID_GRAB
	01/06/23 02:12:45.00	492756.76	5310744.26	2195.468	3.5	308.852	10053 deployment	we see some nice cracks	VID_GRAB
	01/06/23 02:15:03.00	492750.4	5310745.83	2195.757	1.8	298.106	10053 deployment	there it is, what a nice deployment site. Let's record one for 10066, the noble MAV who gave it's all	VID_GRAB
	01/06/23 02:18:36.00	492751.83	5310746.53	2197.35	0.7	276.831	10053 deployment	Mav 10053 in crack	VID_GRAB
	01/06/23 02:18:53.00	492751.36	5310746.42	2197.348	0.7	276.799	10053 deployment	Temp measurement	
	01/06/23 02:20:18.00	492751.7	5310745.75	2197.387	0.7	277.182	10053 deployment	3.3 degrees	VID_GRAB
	01/06/23 02:20:26.00	492751.7	5310745.75	2197.426	0.7	277.092	10053 deployment	2.9 degrees	VID_GRAB
	01/06/23 02:20:40.00	492750.87	5310746.43	2197.44	0.7	276.982	10053 deployment	2.6 degrees	VID_GRAB
	01/06/23 02:22:15.00	492752.13	5310746.17	2197.5	0.7	277.442	10053 deployment	2.9degrees	VID_GRAB
	01/06/23 02:25:11.00	492752.58	5310745.79	2197.498	0.7	277.59	10053 deployment	2.4	VID_GRAB
	01/06/23 02:25:27.00	492752.58	5310745.79	2197.538	0.7	277.695	10053 deployment	2.9	VID_GRAB
	01/06/23 02:26:11.00	492751.97	5310745.19	2197.761	0.7	277.936	10053 deployment	stom temperature record high 3.8 low 2.3	
	01/06/23 02:30:00.00	492753.82	5310744.71	2197.847	30	286.846	10053 deployment		VID_GRAB
	01/06/23 02:59:07.00	492752.46	5310743.42	2197.674	30	329.526	10053 deployment	mav is deployed	
	01/06/23 03:00:00.00	492751.12	5310743.64	2197.692	30	330.178	10053 deployment		VID_GRAB
	01/06/23 03:01:44.00	492753.76	5310743.61	2197.932	1.3	312.085	10053 deployment	take temperature measurements	
	01/06/23 03:03:16.00	492753.85	5310743.76	2197.953	30	312.291	10053 deployment	temp.measurements	VID_GRAB
	01/06/23 03:06:37.00	492752.39	5310743.58	2197.778	1.7	321.208	10053 deployment	heading321 orientation 141	VID_GRAB
	01/06/23 03:06:55.00	492752.29	5310744.09	2197.812	30	321.505	10053 deployment	dropping target 35	
	01/06/23 03:08:32.00	492753.37	5310743	2197.756	1.4	321.694	10053 deployment	heading 321, orientation 141	
	01/06/23 03:08:40.00	492753.37	5310743	2197.783	30	321.692	10053 deployment		VID_GRAB
	01/06/23 03:10:03.00	492753.99	5310742.18	2190.64	7.1	34.458	10053 deployment	heading East then up to go to milliQ for HT hobo recovery	VID_GRAB
	01/06/29 07:48:48.00	492754.24	5310737.73	2195.372	2.1	334.797		Mav 53 has been knock over and is covered in tubworms	
	01/06/29 07:49:54.00	492757.1	5310738.28	2197.172	1	282.394		The Mav has become one with its environment	
	01/06/29 07:49:58.00	492757.1	5310738.28	2197.252	0.9	280.096			VID_GRAB
	01/06/29 07:50:32.00	492755.32	5310740.61	2193.447	3.6	297.901			VID_GRAB
	01/06/29 07:51:29.00	492754.23	5310743.8	2194.2	2.8	187.513		Stuff is growing up into the velocity senors	
	01/06/29 07:51:32.00	492754.28	5310743.04	2194.2	2.9	187.679			VID_GRAB
	01/06/29 08:03:35.00	492762.09	5310692.1	2198.15	5	99.882		Elevator is in sight	
	01/06/29 08:08:38.00	492767.85	5310683.82	2201.971	5.4	318.956		MAV 53 IS IN THE ELEVATOR in slot E	
	01/06/29 08:09:04.00	492769.56	5310683.08	2202.373	5	327.971		MAV 53 is bungeed in	

MAVs

No.	Date & Time	UMT(X)	UMT(Y)	Depth (m)	Alt. (m)	Heading		Event	
54	01/06/22 23:39:31.00	492630.94	5310545.07	2190.365	2.2	277.169	10054 deployment		
	01/06/22 23:40:10.00	492630.94	5310545.07	2190.009	2.3	301.681	10054 deployment	We're changing who gets deployed here to 10054	Error
	01/06/22 23:43:37.00	492629.98	5310543.28	2190.826	1.3	315.973	10054 deployment	off mark48	VID_GRAB
	01/06/22 23:45:58.00	492629.68	5310549.69	2192.495	30	237.895	10054 deployment		VID_GRAB
	01/06/22 23:46:11.00	492629.68	5310549.69	2192.475	30	237.858	10054 deployment	Thermistor out the back end	VID_GRAB
	01/06/22 23:46:30.00	492629.68	5310549.69	2192.441	30	239.666	10054 deployment	Right next to alvin dive weights	VID_GRAB
	01/06/22 23:55:30.00	492629.68	5310549.69	2192.495	30	219.136	10054 deployment	Let's give this bast*** a shake	VID_GRAB
	01/06/22 23:57:14.00	492629.68	5310549.69	2192.482	1.5	218.581	10054 deployment	Thermister is actually around the side	VID_GRAB
	01/06/22 23:57:46.00	492629.68	5310549.69	2192.502	30	217.428	10054 deployment	Deploy! Deploy! Deploy!	VID_GRAB
	01/06/23 00:03:12.00	492629.68	5310549.69	2192.504	30	215.234	10054 deployment	working on rotating the Mav	VID_GRAB
	01/06/23 00:08:21.00	492629.68	5310549.69	2192.47	30	214.409	10054 deployment	Deployed	VID_GRAB
	01/06/23 00:12:30.00	492629.68	5310549.69	2192.482	30	215.896	10054 deployment	Good thermister deployment	VID_GRAB
	01/06/23 00:16:00.00	492633.41	5310549.59	2191.251	1.5	207.262	10054 deployment	cooler was open was, but now is closed	VID_GRAB
	01/06/23 00:16:10.00	492633.41	5310549.59	2190.946	1.8	208.132	10054 deployment	good fix on Jason	
	01/06/23 00:19:58.00	492635.37	5310544.43	2184.375	8.4	358.696	10054 deployment	heading orientation for the mav was 060	
	01/06/23 00:21:06.00	492634.26	5310560.94	2184.208	8.7	355.566	10054 deployment	Up, UP and away we go	
	01/06/29 06:31:43.00	492605.43	5310455.53	2184.58	7.8	7.452		go back to target 34 to get MAV 54	
	01/06/29 06:38:47.00	492615	5310484.05	2164.437	14	8.28	MAV 54 recovery	passing through smoke	
	01/06/29 06:48:22.00	492627.13	5310546.25	2179.259	12.4	4.407	MAV 54 recovery	tubeworm catching a ride	VID_GRAB
	01/06/29 06:48:44.00	492630.03	5310546.88	2184.856	6.5	4.076	MAV 54 recovery		VID_GRAB
	01/06/29 06:50:00.00	492637.81	5310546.64	2189.489	1.8	111.184	MAV 54 recovery		VID_GRAB
	01/06/29 06:50:19.00	492642.59	5310543.57	2189.642	2.1	114.181	MAV 54 recovery		VID_GRAB
	01/06/29 06:50:49.00	492642.56	5310540.52	2189.889	1.9	97.896	MAV 54 recovery	Mav 54 is in sight	
	01/06/29 06:50:58.00	492643.32	5310539.1	2189.902	1.7	78.225	MAV 54 recovery		VID_GRAB
	01/06/29 06:51:14.00	492644.96	5310536.51	2190.527	1.2	63.607	MAV 54 recovery		VID_GRAB
	01/06/29 06:52:44.00	492646.03	5310535.21	2190.414	1.2	47.473	MAV 54 recovery		VID_GRAB
	01/06/29 06:52:49.00	492646.03	5310535.21	2190.694	1.1	45.654	MAV 54 recovery		VID_GRAB
	01/06/29 06:53:36.00	492646.21	5310538.69	2187.017	4.7	30.966	MAV 54 recovery	Mav 54 is on Jason hook	
	01/06/29 06:54:32.00	492644.35	5310528.66	2184.041	6.8	202.118	MAV 54 recovery		VID_GRAB
	01/06/29 07:10:29.00	492658.76	5310593.02	2099.268	30	244.75	MAV 54 recovery		VID_GRAB
	01/06/29 07:28:55.00	492758.21	5310694.99	2197.619	6.8	85.922	MAV 54 recovery		VID_GRAB
	01/06/29 07:29:14.00	492760.61	5310693.77	2199.664	6.4	83.12	MAV 54 recovery		
	01/06/29 07:29:17.00	492760.61	5310693.77	2199.578	6.2	82.89	MAV 54 recovery		VID_GRAB
	01/06/29 07:30:23.00	492766.34	5310689.37	2201.264	6	6.996	MAV 54 recovery	We are at the elevator	
	01/06/29 07:31:44.00	492770.11	5310686.27	2200.865	6.6	347.503	MAV 54 recovery	Will gave Mav 54 a love tap that really was wacking in against the elevator	
	01/06/29 07:32:32.00	492767.82	5310690.19	2201.697	5.7	355.464	MAV 54 recovery	Mav 54 is in the elevator	
	01/06/29 07:33:33.00	492768.84	5310686.39	2202.813	4.5	335.393	MAV 54 recovery	Mav 54 is bungeed in	
	01/06/29 07:33:42.00	492768.84	5310686.39	2202.759	4.6	344.617	MAV 54 recovery		VID_GRAB
	01/06/29 07:33:51.00	492769.61	5310686.4	2202.273	5.1	342.395	MAV 54 recovery		VID_GRAB
	01/06/29 07:34:05.00	492769.61	5310686.4	2202.332	5.2	346.768	MAV 54 recovery		VID_GRAB
	01/06/29 07:34:07.00	492769.61	5310686.4	2201.753	5.7	346.892	MAV 54 recovery		VID_GRAB
	01/06/29 07:34:33.00	492771.79	5310686.44	2198.066	5.5	346.178	MAV 54 recovery	Mav 54 is in slot F	
55	01/06/22 03:32:56.00	493158.48	5312190.73	2180.732	4.6	228.3	Mav 10055	error MAV 55 moving	
	01/06/22 03:33:08.00	493158.48	5312190.73	2180.439	4	233.798	Mav 10055		
	01/06/22 03:33:16.00	493158.48	5312190.73	2180.439	4.1	232.676	Mav 10055	MAV 55 on the move	
	01/06/22 03:37:54.00	493167.5	5312189.38	2181.775	3.8	147.614	Mav 10055	new MAV 55 location ahead	VID_GRAB
	01/06/22 03:38:40.00	493173.76	5312187.02	2182.912	2.6	157.318	Mav 10055	tube worms are red-headed - rare	
	01/06/22 03:38:49.00	493173.76	5312187.02	2182.873	2.6	157.774	Mav 10055		VID_GRAB
	01/06/22 03:39:52.00	493188.49	5312163.95	2183.349	2.2	167.559	Mav 10055		VID_GRAB
	01/06/22 03:40:03.00	493188.49	5312163.95	2183.787	1.7	166.604	Mav 10055	look at that!!!	VID_GRAB
	01/06/22 03:40:12.00	493161.78	5312186.3	2184.12	1.4	167.435	Mav 10055		VID_GRAB
	01/06/22 03:40:16.00	493161.78	5312186.3	2184.08	1.4	167.992	Mav 10055		VID_GRAB
	01/06/22 03:41:13.00	493161.78	5312186.3	2183.305	2.1	219.874	Mav 10055	MAV 55	VID_GRAB

MAVs

No.	Date & Time	UMT(X)	UMT(Y)	Depth (m)	Alt. (m)	Heading		Event	
	01/06/22 03:41:40.00	493172.99	5312187.31	2183.531	2.6	253.43	Mav 10055		VID_GRAB
	01/06/22 03:42:08.00	493174.45	5312184.99	2183.036	4.7	270.046	Mav 10055	dropping nav target 16	
	01/06/22 03:42:41.00	493162.56	5312183.19	2182.865	4.8	289.854	Mav 10055		VID_GRAB
	01/06/22 03:43:17.00	493170.07	5312181.81	2182.945	5	285.9	Mav 10055	orientation 284 of MAV 55	
	01/06/22 03:46:14.00	493163.51	5312181.06	2185.248	30	309.578	Mav 10055	temp probe 2.2-2.4 water	
	01/06/22 03:55:55.00	493163.51	5312181.06	2185.35	30	309.73	Mav 10055	temp in ground rising upwards of 150 C!	
	01/06/22 03:57:24.00	493163.51	5312181.06	2185.332	30	309.485	Mav 10055	preparing to do temp profile up the MAV every 6 inches	
	01/06/22 03:58:47.00	493163.51	5312181.06	2185.348	30	309.472	Mav 10055	shimmering	VID_GRAB
	01/06/22 04:01:31.00	493163.51	5312181.06	2185.39	0.7	309.373	Mav 10055	up 6 inches	VID_GRAB
	01/06/22 04:03:35.00	493163.51	5312181.06	2185.418	0.7	309.328	Mav 10055	back down the MAV to half-way between the bag	
	01/06/22 04:04:26.00	493163.51	5312181.06	2185.419	30	309.481	Mav 10055	half-way up bag photo	VID_GRAB
	01/06/22 04:05:03.00	493163.51	5312181.06	2185.418	30	309.59	Mav 10055	half-way between the base and the pressure housing for pt.4	
	01/06/22 04:05:11.00	493163.51	5312181.06	2185.439	30	309.454	Mav 10055	point 4	VID_GRAB
	01/06/22 04:07:52.00	493163.51	5312181.06	2185.497	30	309.538	Mav 10055	Pt. 5 level with pressure housing	VID_GRAB
	01/06/22 04:09:26.00	493163.51	5312181.06	2185.513	0.7	309.188	Mav 10055	Point 6- over #55	VID_GRAB
	01/06/22 04:11:40.00	493163.51	5312181.06	2185.534	30	309.509	Mav 10055	Pooint 7 - bottom of syn. foam	VID_GRAB
	01/06/22 04:12:53.00	493163.51	5312181.06	2185.528	0.7	309.286	Mav 10055	Point 8 top of MAV	VID_GRAB
	01/06/22 04:16:21.00	493163.51	5312181.06	2185.582	30	309.359	Mav 10055		VID_GRAB
56	01/06/22 07:25:52.00	493404.27	5312651.03	2169.265	0.9	157.68		Retreved Mav 56	
	01/06/22 07:28:37.00	493397.39	5312644.89	2166.472	4	156.058		Mav 56 on hook	
	01/06/28 03:22:18.00	493312.33	5312684.74	2176.386	2.6	53.64	entrainment experiment	at MAV 56	
	01/06/28 03:39:45.00	493314.68	5312686.54	2174.23	4.1	191.801	entrainment experiment	MAV 56 on Jason	
	01/06/28 03:40:24.00	493312.74	5312685.89	2174.181	4.5	192.494	entrainment experiment	MAV 56 not retracting into tube	
	01/06/28 03:42:11.00	493305.5	5312684.4	2172.02	3.3	192.723	entrainment experiment	heading to the elevator - 400 m transit	
	01/06/28 04:00:57.00	493361.65	5312569.36	2137.659	30	139.192		MAV 56 is still not retracted into his tube on the transit	
	01/06/28 04:47:20.00	493420.77	5312361.64	2191.333	0.9	82.167		trouble getting Mav to retract to get it into the elevator	
	01/06/28 04:50:26.00	493421.06	5312360.32	2189.695	2.5	84.901		MAV 56 retracted!	
	01/06/28 04:52:38.00	493424.45	5312362.28	2185.568	5.7	141.431		MAV 56 in the elevator	
	01/06/28 04:56:27.00	493422.91	5312363.49	2187.115	4.2	123.93		MAV 56 in there!	VID_GRAB
57	01/06/28 06:47:20.00	493315.05	5312732.26	2166.301	2.9	208.598	entrainment experiment	MAV 57 is placed	
	01/06/28 06:50:17.00	493309.61	5312730.94	2168.229	1.9	72.976	entrainment experiment	mav heading 253 for the oreintation	
	01/06/28 06:51:10.00	493312.34	5312731.55	2164.028	5.5	101.82	entrainment experiment	Mav 57 thermistor orientation.	VID_GRAB
	01/06/28 06:52:25.00	493325.39	5312726.51	2163.211	1.9	87.421	entrainment experiment	Mavs deployments are through for now, we are moving onto the ADCP transects for the entrainment experiment.	
	01/07/01 00:47:57.00	493324.18	5312715.8	2160.64	4.8	87.196	entrainment experiment	mav #?	VID_GRAB
	01/07/01 00:48:04.00	493324.18	5312715.8	2160.634	4.8	87.283	entrainment experiment	mav #?	VID_GRAB
	01/07/01 00:49:20.00	493323.35	5312716.26	2160.649	4.7	87.626	entrainment experiment	last two framegrabs may be combined for psuedo-panarama of mav to smoker locations mav#?	
58	01/06/26 01:47:49.00	493206.79	5312345.62	2181.572	2.9	86.101		Arrived at MAV58	
	01/06/26 01:54:04.00	493212.46	5312343.37	2179.423	3.5	272.06		MAV 58 retrieved and in manipulator	
	01/06/29 18:27:52.00	492788.33	5311234.41	2180.09	1.3	311.195		place MAV58 first then pick up MAV60	
	01/06/29 18:29:08.00	492789.95	5311228.29	2179.449	2.2	317.334		MAV 58 is down and deployed- try to straighten	
	01/06/29 18:29:54.00	492790.05	5311229.46	2181.08	1.2	300.499			VID_GRAB
	01/06/29 18:31:08.00	492790.05	5311229.46	2181.417	1.4	302.734		HOBO 35 placed next to MAV 58	VID_GRAB
	01/06/29 18:32:20.00	492788.29	5311236.19	2180.965	1.8	299.925		MAV 58 is straight	
	01/06/29 18:33:36.00	492789.02	5311236.7	2180.031	2.5	337.564		MAV 58 orientation 060	
59	01/06/29 02:55:29.00	492608.66	5310182.74	2191.057	5.2	335.871	SM 2000 Bathy survey	mav 59 in sight	
	01/06/29 02:56:18.00	492604.57	5310187.4	2193.714	3.6	293.557	SM 2000 Bathy survey	MAV 59	VID_GRAB
	01/06/29 02:56:42.00	492603.51	5310188.81	2196.311	1.4	294.607	SM 2000 Bathy survey		VID_GRAB
	01/06/29 02:57:14.00	492604.16	5310189.28	2195.718	1.8	275.239	SM 2000 Bathy survey		VID_GRAB
	01/06/29 02:57:17.00	492604.16	5310189.28	2195.386	2	276.417	SM 2000 Bathy survey		VID_GRAB
	01/06/29 02:57:28.00	492604.16	5310189.28	2193.368	4.1	277.086	SM 2000 Bathy survey	MAV 59 on Jason	
	01/06/29 02:59:24.00	492604.49	5310197.05	2176.415	23.4	132.639	SM 2000 Bathy survey	MAV 59 back to elevator	
	01/06/23 09:18:45.00	492604.76	5310180.7	2198.438	30	235.91		Mav 59 is in place but needs help delying	

MAVs

No.	Date & Time	UMT(X)	UMT(Y)	Depth (m)	Alt. (m)	Heading		Event	
	01/06/23 09:20:03.00	492604.76	5310180.7	2198.622	30	235.398		Mav 59 is delyed	
	01/06/23 09:30:52.00	492604.76	5310180.7	2196.068	1.9	290.2		Orientation of Mav 59 is 210	
60	01/06/29 18:35:23.00	492788.57	5311227.98	2178.302	1.3	343.59		picking up MAV 60	
	01/06/29 18:40:51.00	492786.78	5311231.16	2175.665	4	11.23		MAV 60 has been retrieved	
61	01/06/22 15:57:43.00	493160.23	5310557.73	2108.45	4	52.689	MAV 61	MAV 61	VID_GRAB
	01/06/22 15:58:54.00	493159.69	5310557.48	2105.886	6	17.496	MAV 61	Mav 61 removed from the elevator	
	01/06/22 15:59:09.00	493161.95	5310552.39	2103.245	8.5	17.143	MAV 61		VID_GRAB
	01/06/22 15:59:24.00	493161.95	5310552.39	2103.033	8.7	17.119	MAV 61	beginning transit to Salut - est. time 45 minutes	
	01/06/22 16:23:04.00	493015.34	5310499.55	2074.591	30	67.449	MAV 61	problems with Medea cam - somthing is hanging off	
	01/06/22 16:33:17.00	492887.54	5310457.31	2074.591	30	60.386	MAV 61	Target 24 is dropped at Salut - 23 is the location where Maggie 5 was located	Error
	01/06/22 16:34:13.00	492871.48	5310456.73	2074.616	30	57.582	MAV 61	We are headed toward target 24	
	01/06/22 16:56:13.00	492596.39	5310385.5	2075.073	30	68.35	MAV 61	stopping CTD aquisition	
	01/06/22 16:56:48.00	492591.33	5310384.18	2075.126	30	70.617	MAV 61	started CTD 308007	
	01/06/22 17:05:33.00	492566.71	5310374.18	2182.408	10.5	262.448	MAV 61	nearing Salut looking for diffuse flow near base	
	01/06/22 17:08:00.00	492566.74	5310387.75	2183.147	8	250.775	MAV 61	wait to reposition medea to the NE of Salut	
	01/06/22 17:13:24.00	492565.02	5310393.01	2182.263	8.7	237.094	MAV 61	jason coming down to work area	
	01/06/22 17:25:15.00	492570.44	5310380.8	2190.074	2.6	200.007	MAV 61	placing mav NE of target 24	
	01/06/22 17:25:38.00	492569.49	5310380.43	2190.159	2.5	202.948	MAV 61		VID_GRAB
	01/06/22 17:26:33.00	492569.71	5310381.79	2189.527	2.4	197.794	MAV 61	area may be too steep- try moving down slope	
	01/06/22 17:34:06.00	492575.89	5310378.5	2192.808	1.7	165.639	MAV 61	mav is down -try to deploy	
	01/06/22 17:38:06.00	492576.28	5310378.41	2194.899	0.9	135.25	MAV 61	mav is deployed	
	01/06/22 17:39:44.00	492574.68	5310377.93	2194.912	0.9	134.843	MAV 61	taking temp measurements	
	01/06/22 17:41:10.00	492575.72	5310378.46	2194.93	0.9	134.143	MAV 61	base temp 2.4	
	01/06/22 17:41:31.00	492576.06	5310378.16	2194.925	0.9	133.948	MAV 61	base temp location	VID_GRAB
	01/06/22 17:43:23.00	492576.6	5310377.61	2194.988	30	134.311	MAV 61	drop nav target 25 at mav 61	
	01/06/22 17:45:05.00	492576.95	5310380.95	2193.862	1	166.292	MAV 61	orientation heading 165	VID_GRAB
	01/06/22 17:46:18.00	492576.4	5310387.14	2180.752	11.9	172.356	MAV 61	heading to pick up thermal blanket at Grotto	
	01/06/29 04:03:45.00	492765.84	5310691.09	2204.15	5.4	310.444		going to pick up MAV 61, the thermal blanket, and hobos	
	01/06/29 04:33:42.00	492765.53	5310699.52	2204.346	4.4	156.931		taking MAVS 61 off elevator	
	01/06/29 04:35:53.00	492765.02	5310696.78	2201.748	7.1	181.959		MAVS 61 out of elevator	
	01/06/29 05:17:59.00	492637.34	5310545.07	2191.409	1.1	82.073	MAV61 placement	MAV is down	
	01/06/29 05:18:29.00	492638.25	5310544.51	2190.977	1.6	114.172	MAV61 placement		VID_GRAB
	01/06/29 05:19:03.00	492638.25	5310544.51	2192.281	0.9	158.936	MAV61 placement		VID_GRAB
	01/06/29 05:21:03.00	492638.25	5310544.51	2192.509	30	229.697	MAV61 placement	HOBO 34 being placed next to MAV 61	
	01/06/29 05:22:09.00	492638.25	5310544.51	2192.097	0.7	267.555	MAV61 placement		VID_GRAB
	01/06/29 05:24:46.00	492637.49	5310547.33	2191.24	1.4	58.253	MAV61 placement		VID_GRAB
	01/06/29 05:29:39.00	492633.96	5310550.08	2192.649	30	33.92	MAV61 placement	trying to upright MAV 61	
	01/06/29 05:30:47.00	492638.02	5310544.46	2192.624	0.8	33.672	MAV61 placement	MAV has deployed	
	01/06/29 05:33:52.00	492637.38	5310543.02	2189.685	2.7	296.496	MAV61 placement		VID_GRAB
	01/06/29 05:33:59.00	492637.38	5310543.02	2190.318	2.1	285.953	MAV61 placement		VID_GRAB
	01/06/29 05:38:29.00	492637.38	5310543.02	2192.013	30	283.552	MAV61 placement	61 is on the right	VID_GRAB
	01/06/29 05:42:22.00	492637.51	5310548.15	2192.417	30	225.695	MAV61 placement		VID_GRAB
	01/06/29 05:44:10.00	492642.66	5310541.97	2190.655	1.9	283.246	MAV61 placement		VID_GRAB
	01/06/29 05:44:15.00	492642.66	5310541.97	2190.499	2	284.791	MAV61 placement		VID_GRAB
	01/06/29 05:44:21.00	492642.66	5310541.97	2190.24	2.2	316.327	MAV61 placement		VID_GRAB
	01/06/29 05:44:29.00	492642.66	5310541.97	2190.033	2.4	314.017	MAV61 placement		VID_GRAB
	01/06/29 05:44:42.00	492642.66	5310541.97	2189.907	2.5	313.385	MAV61 placement	orientation 135	
63	01/06/22 00:53:44.00	493223.87	5312272.29	2175.779	4.1	267.705	Mav 10063	Planning on removing 63 and placing near elevator.	
	01/06/22 00:54:16.00	493223.87	5312272.29	2175.766	4	266.531	Mav 10063	Restraining bungee removed	VID_GRAB
	01/06/22 00:58:28.00	493223.87	5312272.29	2175.738	4.1	264.891	Mav 10063	A Mav in the claw is worth three in the bush	VID_GRAB
	01/06/22 01:05:00.00	493223.87	5312272.29	2177.627	2.9	356.451	Mav 10063	10063 deployed	VID_GRAB
	01/07/01 07:01:26.00	493212.83	5312259.23	2178.996	2.5	97.396	MAVS 10063		VID_GRAB
	01/07/01 07:01:55.00	493212.83	5312259.23	2179.594	2.4	86.277	MAVS 10063		VID_GRAB

MAVs

No.	Date & Time	UMT(X)	UMT(Y)	Depth (m)	Alt. (m)	Heading		Event	
	01/07/01 07:03:37.00	493212.83	5312259.23	2182.376	1	137.146	MAVS 10063		VID_GRAB
	01/07/01 07:03:45.00	493212.83	5312259.23	2182.642	0.8	140.986	MAVS 10063		VID_GRAB
	01/07/01 07:04:07.00	493212.83	5312259.23	2181.757	1.7	138.79	MAVS 10063	Who was drinking beer down here?	
	01/07/01 07:05:44.00	493212.83	5312259.23	2179.747	2.3	344.599	MAVS 10063	Can see Mav 63	
	01/07/01 07:05:59.00	493212.83	5312259.23	2179.282	2.7	359.738	MAVS 10063		VID_GRAB
	01/07/01 07:06:13.00	493212.83	5312259.23	2179.049	2.6	20.986	MAVS 10063		VID_GRAB
	01/07/01 07:06:30.00	493212.83	5312259.23	2179.088	1.8	79.293	MAVS 10063		VID_GRAB
	01/07/01 07:06:36.00	493212.83	5312259.23	2179.141	1.8	124.868	MAVS 10063		VID_GRAB
	01/07/01 07:06:43.00	493212.83	5312259.23	2179.302	1.6	127.264	MAVS 10063		VID_GRAB
	01/07/01 07:07:10.00	493212.83	5312259.23	2178.722	2.2	131.708	MAVS 10063		VID_GRAB
	01/07/01 07:07:40.00	493212.83	5312259.23	2180.373	1.3	162.118	MAVS 10063		VID_GRAB
	01/07/01 07:08:16.00	493212.83	5312259.23	2178.517	2.8	165.216	MAVS 10063	Mav 63 is on the hook	
	01/07/01 07:46:58.00	493421.88	5312345.05	2049.845	30	248.759	MAVS 10063	smoke	
	01/07/01 13:21:30.00	492703.65	5310481.12	2201.948	7	136.04		MAV 63 recovered, no sign of crab.	
64	01/06/23 05:46:25.00	492634.91	5310501.56	2189.276	2.7	149.565	MAV 64		VID_GRAB
	01/06/23 05:46:32.00	492638.36	5310499.57	2189.91	2.2	152.334	MAV 64		VID_GRAB
	01/06/23 05:47:13.00	492637.72	5310498.24	2188.789	3.4	157.661	MAV 64	MAV 64 orientation 160	
	01/06/23 05:47:50.00	492639.02	5310498.2	2188.738	3.3	205.164	MAV 64		VID_GRAB
	01/06/23 05:48:16.00	492639.02	5310498.2	2188.731	3.4	233.914	MAV 64		VID_GRAB
	01/06/23 05:48:52.00	492644.3	5310493.75	2189.874	2.2	246.02	MAV 64		VID_GRAB
	01/06/23 05:49:12.00	492642.42	5310495.14	2190.668	1.2	238.754	MAV 64	in S&M	
	01/06/23 05:49:30.00	492639.55	5310493.19	2191.945	30	239.556	MAV 64		VID_GRAB
	01/06/23 05:49:38.00	492639.55	5310493.19	2192.071	30	231.425	MAV 64		VID_GRAB
	01/06/23 05:54:09.00	492638.09	5310494.18	2191.598	0.7	223.087	MAV 64	temperature probe at MAV 64 location high - 7.1	
	01/06/23 05:54:23.00	492638.09	5310494.18	2191.945	1.7	217.049	MAV 64		VID_GRAB
	01/06/23 05:56:18.00	492635.76	5310493.63	2192.016	1.1	214.107	MAV 64		VID_GRAB
	01/06/23 05:56:37.00	492637.4	5310494.39	2192.042	1.8	214.072	MAV 64	high at front of MAV 5.5 C	
	01/06/23 06:01:36.00	492636.38	5310498.66	2179.645	12.2	215.89	MAV 64	MAV 64 hooked onto JASON - on our way to the elevator	
65	01/06/23 13:29:20.00	492781.37	5311220.83	2181.769	2.7	308.737	10065 & 10060		VID_GRAB
&	01/06/23 13:29:33.00	492781.37	5311220.83	2181.266	3.2	308.849	10065 & 10060	LT hobo 35	VID_GRAB
60	01/06/23 13:43:26.00	492773.88	5311233	2183.555	0.8	330.324	10065 & 10060	lunch	VID_GRAB
	01/06/23 13:44:10.00	492773.88	5311233	2183.788	1.8	332.431	10065 & 10060		VID_GRAB
	01/06/23 13:52:05.00	492773.88	5311233	2183.382	1.2	331.917	10065 & 10060	35 is a double hobo	VID_GRAB
	01/06/23 13:56:50.00	492773.88	5311233	2184.021	1.5	320.376	10065 & 10060	Not a whole lot of growth compared to the others we've recovered	VID_GRAB
	01/06/23 13:58:33.00	492773.88	5311233	2183.947	30	320.7	10065 & 10060	this design sucks	VID_GRAB
	01/06/23 13:59:06.00	492773.88	5311233	2183.936	30	320.756	10065 & 10060	can't we make a simpler design	VID_GRAB
	01/06/23 13:59:37.00	492773.88	5311233	2183.984	30	320.682	10065 & 10060	You know the SeaFloor Magnetometers deploy in about 3 seconds not 3 hours	VID_GRAB
	01/06/23 14:00:03.00	492773.88	5311233	2183.913	30	320.626	10065 & 10060	Tripod, maybe in the future of these current meters	VID_GRAB
	01/06/23 14:00:13.00	492773.88	5311233	2183.898	30	320.617	10065 & 10060	change is good	VID_GRAB
	01/06/23 14:00:24.00	492773.88	5311233	2183.951	30	320.606	10065 & 10060	improvements are good	VID_GRAB
	01/06/23 14:00:46.00	492773.88	5311233	2184.02	30	320.453	10065 & 10060	Should we release version 2.0 for the 2002 field season	VID_GRAB
	01/06/23 14:02:27.00	492773.88	5311233	2184.097	30	320.038	10065 & 10060	come on grad the probe	VID_GRAB
	01/06/23 14:04:37.00	492773.88	5311233	2184.118	30	320.171	10065 & 10060	this is alot of work	VID_GRAB
	01/06/23 14:05:57.00	492773.88	5311233	2184.039	30	320.169	10065 & 10060	poking the t-string	VID_GRAB
	01/06/23 14:07:37.00	492773.88	5311233	2183.971	30	320	10065 & 10060	this is painful.	VID_GRAB
	01/06/23 14:10:18.00	492773.88	5311233	2183.906	30	319.864	10065 & 10060	the t-string is out, but alas the poor boy still doesn't want to deploy. Perhaps we should apply some collision engineering.	VID_GRAB
	01/06/23 14:11:29.00	492773.88	5311233	2183.919	30	320.001	10065 & 10060		VID_GRAB
	01/06/23 14:20:58.00	494308.41	5314106.05	2183.575	10	319.903	10065 & 10060	LT35 recovered	VID_GRAB
	01/06/23 14:26:38.00	492784.7	5311213.19	2180.057	2.2	186.841	10065 & 10060		VID_GRAB

MAVs

No.	Date & Time	UMT(X)	UMT(Y)	Depth (m)	Alt. (m)	Heading		Event	
	01/06/23 14:27:10.00	492777.5	5311224.11	2175.268	7.7	180.659	10065 & 10060	10060 in hand rising vertical to get improved fix on location of 10065	
	01/06/23 14:32:48.00	492775.38	5311231.94	2176.886	3	269.745	10065 & 10060		VID_GRAB
	01/06/23 14:40:35.00	492772.51	5311244.41	2178.577	1.1	300.435	10065 & 10060	Afraid to come out and play	VID_GRAB
	01/06/23 15:13:17.00	492776.63	5311240.02	2177.54	2.3	339.847	10065 & 10060		VID_GRAB
	01/06/23 15:13:20.00	492776.63	5311240.02	2177.884	1.9	341.423	10065 & 10060		VID_GRAB
	01/06/23 15:13:22.00	492776.63	5311240.02	2177.959	2	343.57	10065 & 10060		VID_GRAB
	01/06/23 15:13:24.00	492776.63	5311240.02	2177.95	1.9	0.044	10065 & 10060		VID_GRAB
	01/06/23 15:13:26.00	492776.63	5311240.02	2177.946	2	12.692	10065 & 10060		VID_GRAB
	01/06/23 15:13:39.00	492779.33	5311231.11	2178.997	0.9	5.007	10065 & 10060	several pictures of the orientation	
	01/06/23 15:15:22.00	492779.06	5311233.64	2179.374	1.3	349.228	10065 & 10060	watch change	
	01/06/23 15:30:41.00	492779.16	5311231.37	2178.521	1.5	351.083	10065 & 10060	problem with the CTD	
	01/06/23 15:32:12.00	492779.16	5311231.37	2178.682	1.4	350.939	10065 & 10060	rebooting computer containing CTD data	
	01/06/29 21:59:57.00	492792.21	5311217.17	2179.411	4	222.215		Mav 65 in on Jason	
	01/06/29 22:23:55.00	492784.44	5311087.16	2093.857	30	2.311		Mav 65 and 60 are the Mav on Jason	
	01/06/29 23:27:25.00	492762.98	5310686.99	2200.813	7	350.9		10065 in elevator	
66	01/06/22 21:49:15.00	493155.24	5310555.49	2110.848	4.3	4.756		Droped Mav 66	
	01/06/22 21:50:01.00	493155.24	5310555.49	2110.264	4.2	9.188		The Mav fell a huge distance and in a huge creavis	
	01/06/22 21:50:25.00	493155.24	5310555.49	2110.021	2.8	5.994		The Mav 66 seems to be lost forever	
	01/06/22 21:51:00.00	493155.24	5310555.49	2109.862	6.2	49.877		The hole it fell into seems to be a cavern	
	01/06/22 21:51:36.00	493155.24	5310555.49	2111.865	3.7	350.925		The Mav 66 fell out of the claw it was not dropped, the claw was not openned	
	01/06/22 21:51:46.00	493155.24	5310555.49	2113.372	2.5	352.08			VID_GRAB
	01/06/22 21:54:15.00	493155.24	5310555.49	2110.579	4.6	23.798		It was agreed that Mav 66 was lost forever	
	01/06/22 21:55:59.00	493155.24	5310555.49	2110.979	3.9	46.862		Went back to elevator	
	01/06/22 21:56:56.00	493155.24	5310555.49	2111.111	3.6	349.145		Rest in Peace Mav 66, we had a moment of silence for the Mav lost	

----------1st EMAIL TRANSMISSION----------

Hello,

I'm Janet Voight, Associate Curator of Zoology at The Field Museum, aboard the R/V THOMAS G. THOMPSON steaming away from Seattle, WA to a study site 250 nautical miles west of the North American continent. I'm out here with geophysicists, oceanographers, geologists and a microbiologist for a 17-day research cruise to study hydrothermal vents on Juan de Fuca Ridge. Our diverse group of 15 scientists on the THOMPSON will use the Remotely Operated Vehicle (ROV) Jason to study these singular sea floor habitats from which emerge super-heated vent fluids chemically altered by their passage through the Earth's crust. The fluids carry a chemical soup, rich in elements that are rare in most other habitats, but NO oxygen. Despite the lack of what we recognize as the one element essential to animal life, animals that are supported entirely by bacteria in the absence of sunlight are abundant at vents. Deposited at The Field Museum are collections I have made during eight other submersible-assisted cruises to hydrothermal vents in the North Pacific over the last 5 years. During this cruise, I hope to collect additional samples from different vents to improve our knowledge of species ranges and variation in diversity among sites.

These hot water vents lie amid jagged rocks that emerge as molten lava from beneath the crust during the frequent volcanic events at Mid-Ocean Ridges. The terrain and their great depth mean that the vents and their animals can't be sampled by ordinary means such as trawls. We have with us on the THOMPSON the ROV Jason, an unmanned submersible. Jason is lowered from the ship to the seafloor; it is linked to us on the surface through a 5 km long fiber optic cable. Jason sends continuous video of the bottom and data from its instruments to the ship through this cable and receives commands from the highly skilled pilots who operate it. (For images & facts about Jason see http://www.marine.whoi.edu/ships/rovs/jason_med.html)

Because the scientists know what needs to be done and the ROV pilots know how to get things done with Jason, we have to work together as a team to accomplish our goals. Using both the surface ship and the ROV, we would seem to be poised to do the research to improve our knowledge of these unique sea floor habitats. Although we sailed promptly at 0900 hours yesterday morning from the University of Washington dock, we will not reach the study site until 1300 hours today. It is only 250 nautical miles between the two sites, and the THOMPSON is one of the biggest and fastest of the UNOLS fleet (the group of Navy-owned ships operated by universities that are dedicated to science), we travel only at about 12 knots, or 12 nautical miles per hour. This, however frustrating at times, at least gives us time to adjust to being on board and at sea, where the floor is constantly in motion. Under less favorable weather conditions, anything lying on a counter would likely wind up on the floor as the ship pitches and rolls. To avoid loss, everything that could move is secured, tied down to counters that are bolted to the floor. When I went to sleep last night, we were sailing through the strait between Canada and the Olympic Penninsula of Washington State

surrounded by white caps. This morning at dawn, no land can be sighted and only 3-4 foot swells rock the boat as we steam west.

No one else in the sciences party is up and about yet. This may be the only time for the next 16 days that I have the main lab and the 12 PC's the science party carried on to the ship in preparation for the cruise to myself. Most of the PC's will be in near constant use in the coming weeks as we settle into 3 watches that allow us to use Jason and the ship for 24
hours a day. We'll be standing watches of four hours on and eight off for the duration.

To help us most efficiently use the ship and ROV, which are both very expensive to operate, the 19 men and women of the THOMPSON's crew and the 9 members of the Jason group share these watches, the former to keep the boat running and the scientists safe, and the latter to operate and maintain Jason as we ask it to place instruments, and take measurements
and samples. We're well compensated for our effort, the THOMPSON serves 3 great meals a day (for a virtual tour of the ship see
http://www.cev.washington.edu/learning_center/vt_qtvrs.html) and we are moving into waters with more beautiful colors than anything seen closer to land. Our research team will be in place to make new discoveries about things as simple as discovering new vents to how these vents release the earth's heat that drives plate tectonic motions.

Tomorrow I hope to write about the beginning of our first dive.
Janet

----------2nd EMAIL TRANSMISSION----------

Working at sea invariably brings unique challenges. Today we arrived on site promptly at 1300 hours, after a fire and boat drill.
The US Coast Guard requires that all people on board understand and practice procedures that would be required if there is an emergency at sea. Evacuating the ship is not one of the things we anticipate, especially with water temperatures of 10 C, but knowing where your survival suit is brings a bit of piece of mind, if you have read The Perfect Storm.
After the drill, we did a CTD, a remote means to determine the Conductivity, Temperature and Depth of the sea water at different depths beneath us. Because the temperature of the water determines in large part the speed at which sound travels through it, this, as you will come to appreciate, matters. Think about how you would get a sample of water from a depth of 2000 m, without mixing it with water from any other depth as quickly as possible. How about a circle of 23 self-closing bottles rigged to a computer and a winch that can open & close individual bottles at whatever depth you specify? That was the first thing we did on site. The water will offer information on the "normal" seawater in the area and thus a reference point to determine how different water with vent plumes is.

Once we got the CTD hauled back onto the deck, we started to deploy transponders. The ship uses satellite technology to determine its precise position on the ocean surface, but we will be working deep under the sea and the satellite signals do not penetrate water. To determine where Jason is within meters, which is critical to determining where it collects

samples and leaves instruments, we use sound or acoustic signals from acoustic transponders. An individual transponder emits a sound of a very specific frequency. The ship has sensors that distinguish each sound. To find out where Jason is is a long process. After locating itself using
satellite positioning the ship drops a transponder into the ocean and makes sure it knows where that transponder is. More transponders are dropped to develop a network. When Jason is put in the water, the ship hears its unique acoustic signal and the signals of the transponders. Calculations based on the speed on sound in the ocean, as affected by the temperature of the water and the position of the transponders allow us to determine Jason's position within a few feet. The Jason Navigator uses these transponders, information on terrain, and sometimes the speed of the ship and Jason itself to figure out the best course to take going from here to there and how to get back to (or in some cases, to find) where we want to be.

It may seem like not a big deal, but when you are a machine dangling at 2000 m depth in the North Pacific the end of a 5 km long cable of glass, trying to find landmarks with lights that only penetrate for a distance of about 20 feet, capable of a maximum speed of about 1 knot, knowing whether there is a 250C hydrothermal vent behind you (the TV cameras on Jason all point one direction) or to your right can save hours of time.

Because Jason can only carry a limited amount of stuff, not all essential science gear can ride to the bottom on the vehicle. Because transiting the water column, either going from the surface to the bottom or from the bottom to the surface takes Jason bout 2 hours at 20 m/minute, having it make many trips is not an option. We have to send instruments down in packages called elevators. We aren't talking about elevators like at the Hancock Building here. Jason elevators have weights, glass floats a transponder all attached to a metal frame with a platform on which we secure stuff, water samplers, current meters, markers, etc. The weights are attached to the platform by a burn wire. An acoustic signal can tell the burn wire to let go and the glass floats will make the elevator rise to the surface. We drop the elevator from the ship, it sinks, Jason finds it on the bottom and removes stuff as it is needed. Elegantly simple in theory, in practice sometimes it is a bit more complex. Jason elevators don't sink or rise in a shaft, they move with the currents. Sometimes finding them on the bottom is a challenge so it is critical that the Jason navigator knows where to look, based on the transponder's signal.

Last night we were hoping to begin our first dive, Jason Dive 306, at about 10 PM, but we had to send down 2 elevators first. After having located the transponder array, something happened to navigation. We couldn't hear signals from any transponder. Fortunately, on this cruise is Tom Crook, a member of the Jason group who is among the best navigators in the business. When Tom didn't know what the problem was, we all felt a pang of fear. These elevators, now out of contact, could be drifting toward Japan, or toward Mexico, carrying irreplaceable instruments that are vital to the success of our cruise.

When my watch ended at midnight, with the situation still unresolved, I did what any sane sea-going researcher would do. I went to bed so I could be rested to work my 8-12

watch this morning. I just checked. Jason got in the water at about 1AM, the problem if not fixed is ameliorated enough so we can work. Jason found at least one elevator and was removing an instrument so that it could start taking data. That's the great thing about being on board with experts, I know that the problems will be solved and we will move ahead. It may not happen as fast as I would like, but it will happen. There's no place here for worrying about the worst case scenario because usually it is hard enough to deal with reality.

----------3rd EMAIL TRANSMISSION----------

Some days go well and you don't get any specimens, and getting specimens is the reason I am here. Some days go poorly and you get unexpected bonuses, like yesterday.

My day started with our first watch during a Jason dive, right after I sent you my email. Our watches are made up of four scientists, a watch leader (me), a data logger, one person each to monitor videotapes and the computers that receive data from Jason. We team up with 3 members of the Jason group, a pilot who operates the vehicle, an engineer who assists the pilot and a navigator who determines where Jason is on the seafloor and where we go to get to where we want to be. As watch leader, I oversee all sea floor operations, maintain a science log, ensure that key data are recorded, communicate the needs of the science party to the Jason group and decide given the immediate problems, needs and overall situation, what to do next.

When you're working on the sea floor the immediate situation can change from moment to moment and the variables that have to be considered are many. Yesterday was a case in point. Our watch took over at 0745 (use of military time is very helpful because of the 24 hour a day operations), after Jason had found the first elevator we dropped from the ship last night. Our navigation had never gotten a lot better, but the elevator was exactly where it was supposed to be. We took a current meter, called a MAVS for Modular Acoustic Velocity Sensor off the elevator to place on the sea floor at a good place near active hydrothermal vents. We then picked
up a MAVS that we had left by a vent during our cruise last fall & took it to the elevator for future recovery. Without much navigation, this wasn't easy, but we were lucky & found a good place, and positioned the new MAVS. We also found the old MAVS fairly quickly, which was covered with bio-film, called slime with an un-matched level of disgust by the geophysicists. This film is made of bacteria that probably live on chemicals in the vent fluids that surrounded the instrument. We picked up the slimy MAVS & took it back to the elevator.

Unfortunately, during these operations, Jason's manipulator, functionally its hand, developed idiosyncrasies. Idiosyncrasies in a
mechanical object are rarely good, these caused the arm to function unpredictably but it still kind of worked. Then we had problems with one of the thrusters, or motors, that drive Jason. With navigation problems, finding things were taking a lot longer than it should have. With the manipulator problems, handling things was taking a lot longer than it should have. With navigation problems, finding things was taking a lot longer than it should have. So we got together & decided to recover Jason so its problems could be fixed before they got worse. Problems mean that the pilots, engineers and navigators turn

into repairmen and show off their skills in mechanical and electrical engineering. It also means that they will switch from our standard 4 hours on and 8 off watches to working until the problems are fixed. Meanwhile the science party will be doing CTD's to make the most of being here on this ship.

After Jason was recovered, we decided to recover one of the elevators we sent down last night. The Nav. problems had gotten bad when it went in the water, removing it we figured might make them better. When the elevator rose to 700 m from the 2400 m deep sea floor, Nav. problems disappeared. We (I mean the ship's crew who recovers all the big stuff for the science party) got the 1500 lb. elevator on board safely with all the equipment it carried.

Our current status is: Jason on deck undergoing repairs; only 1 of 10 MAVS from the sea floor recovered (with invaluable data composed of 2 minutes of temperatures and flow rates from that spot taken every hour for the last nine months); only 1 of 12 MAVS to be deployed actually deployed; and a fix being undertaken for our Nav. problem. Not the best end to the first dive or start to Day 4, but one thing makes it wonderful. On the vent bacteria-made slime that covered the MAVS we brought up from the ocean floor, I found some gastropods. I've been collecting and identifying snails from hydrothermal vents along this ridge for 5 years. It will take microscopic study back at the Museum to confirm this, but to the best of my knowledge, this species of snail has never
been found at these vents during the 15 or so years in which this fauna has been studied. Even with our current problems, to which I could add increasing swells, collection of this new snail has made this cruise a success for me. We have 9 more MAVS to recover from the bottom. I can't wait to see what they are carrying.

----------4th EMAIL TRANSMISSION----------

Well, it has been a quiet day on board the R/V THOMPSON. Jason spent most of the day on deck undergoing repairs. Members of the Jason group have been working diligently, but the rather grim expression on their faces when they emerged from their work area made it clear that asking questions would be inappropriate. In the meantime, the science party has been using the CTD apparatus to survey the water between the ship and the ocean floor across the mid-ocean ridge for evidence of hydrothermal activity. Water samples have been collected at various depths for chemical analyses and bacterial sampling.

While the ship's technician was fixing problems that developed with the CTD apparatus, we put the elevator back in the water. The changes we had made to the elevator's transponder seemed to have fixed our navigation problem, meaning that Jason's next dive should have excellent navigation. It's great to have another 10 hours of CTD casts done and to know that Nav. will probably work, but the high point of the day was the birthday cake that we asked Dan, the Chief Steward to make as a surprise for Lisa Gilbert, a Ph.D. Candidate in Oceanography at the University of Washington and watch leader for the 12-4 watch.

Days like these are hard to take at times, we've traveled hundreds of miles away from home to access these hydrothermal vents that are only 2200 m away, but without Jason the closest we come to sampling is collecting water with the guidance of the computer that links us to the CTD. As valuable as the CTD data are, monitoring a computer screen for hours on end is mind-numbing (especially late at night). We are all anxious to get Jason back in the water and cram ourselves into the Jason control van where we see real time TV of one of the most exotic habitats on earth.

Hydrothermal vents are very special areas of the earth's crust. They are cracks in the sea floor where heat from deep beneath the
crust escapes. As the heat escapes, it pulls water out from under the crust. This chemically distinct water released at vents supports unique life forms. The existence of vents in the deep oceans was hypothesized by geophysicists, a hypothesis that lead to the discovery of vents. Prior to the first actual sighting of a hydrothermal vent, no one imagined that life would flourish at vents. The geophysics cruise that discovered the habitats did not even have a biologist on board. Since then scientists have learned to be more inter-disciplinary.

Although among the major goals of this cruise is to deploy instruments that will attempt to estimate the amount of heat that vents release, it will also serve my interest in what animals occur at vents. Animals in these habitats live with half of their bodies bathed in normal, cold oxygen-rich waters and the other half in warm vent fluids that are rich in toxic chemicals such as hydrogen sulfide. The sulfide is fuel for bacteria that chemically modify it and harvest energy by doing so. Snails that eat this bacteria can be very abundant at vents and where snails are abundant, so are their predators. These aren't the predators that we may think of as being
typical. Among the most common are polynoid polychaete worms, or scale worms (the blood-red scales form a armor over the worm's body). Thinking about them, I imagine scenes of an ecosystem being ravaged by packs of scale worms, sucking in prey through their protruding proboscises with pincer-like jaws at the tip (I won't go into details as I don't want to give you bad dreams).

The diversity of animals at hydrothermal vents is low compared to, for instance, that in tropical rainforests, but considering the toxins at vents, the temperature fluctuations and that at least some vents can appear and disappear within a year's time, the fact that some animals not only occur in the habitat but flourish there is a tribute to the adaptability and resilience of life. The finite number of animal species known from vents contrasts sharply with the diverse bacterial life at vents. Microbiologists are making new discoveries with virtually every sample. Not only are the bacteria new to science, their physiology, the basic way they gather energy, had been previously unknown. Vents may mimic conditions that existed on Earth present before life arose, their bacterial inhabitants may be basal to the tremendous radiation of life around us.

Although I spent yesterday hoping to get other biological samples, it didn't happen. Jason got in the water about 1850 hours last night to begin a dive we hoped would last for days. However, as we approached the bottom at 1962 m depth, it became apparent that the

thruster problems were back. We brought Jason back on deck for more repairs at midnight. I was glad that I wasn't the one who had to wake up the sleeping two-thirds of the Jason group with the news. They'll fix it as soon as they can, meanwhile the science party is back to using the CTD apparatus as our link to the vents.

----------5th EMAIL TRANSMISSION----------

Good news on the THOMPSON yesterday, Jason went in the water about 0940 hours and all systems continue to work now as of 0630 (yes, I over slept, hope this is legible as I need to get it out before my 0800 watch). We found the elevator we had dropped the day before yesterday and promptly started unloading and deploying the MAVS it had carried so we had space on
the elevator for the MAVS that have spent 9 months on the sea floor - these, with luck, will carry to the THOMPSON the animals that have lived on them since their deployment. Spirits on board are high, as all members of the science party have stood watches devoted exclusively to events on the bottom. As this offers for some of us our first contact with hydrothermal vents in real time, the first good dive is a memorable experience.

This is my eighth cruise with either an ROV or ALVIN, the submersible that carries people to the sea floor. On each of my cruises, my first view of massive rock structures belching so much super-heated chemical-saturated water that they appear to be smoking is always spectacular, as is the first approach to the vents. Usually the vehicle comes down a safe distance from any known vents to allow us time to get oriented and do a systems check. As we move toward the on-vent target, we seem to spend forever passing over barren basalt outcrops on which even isolated sponges are rare. As the lights of the vehicle catch something white ahead, the contrast between the seemingly abiotic non-vent habitat and the on-vent habitat in which bacteria and animals grow so densely that the bottom is covered with 6" of animals is dazzling. I've seen snails with their shells coated with bacteria piled four deep on tube worms. Apparently in some habitats, regardless of how many snails feed on the bacteria, it grows so fast that there's always more. Vent animals often only have the color provided by their blood. All life at vents depends on bacteria, not plants. Most pigments that give animals color come from plants, so vent animals tend to be colorless. Unfortunately, time to appreciate the habitat on an aesthetic level is limited. The costs of operating the THOMPSON and Jason are very high, so we try to use the ship and vehicle as efficiently as possible. This means no (OK, not very much) gawking at the scenery.

Last night we did sneak in a few minutes of sight-seeing. We were at High Rise vent field and Jason maneuvered up the smoker called Ventnor. This black smoker is nearly 30 m or over 3 stories tall, and absolutely immense. Its top is crowned with spires from which billow black smoke. There was no way anyone in the control van at 2300 hrs was going to not see where the top was and what was on it. The bad part of this is that Jason is linked to an intermediate, Medea, and the ship by a tether, its fiber optic cable. As Jason drives around a 30 m high structure, there is a risk that the tether will snag, or be burnt by the hot water. Fortunately, the
skills of our Jason watch standers avoided any major problems.

We make the most of our time on the sea floor with Jason by building instruments or other deployments so that they can be easily
picked up by Jason's one manipulator claw that opens and closes. Learning how to do this is one of the hardest parts for me of doing
submersible-based science. Members of the Jason group help, their knowledge of the vehicle and how it works is vital to finding out that your design has to be changed, a lesson much better learned on shore, or at least on deck, than on the sea floor.

One fact of Jason life is that nearly everything has to have a loop of polypropeline line attached. Because polypro floats, Jason's manipulator, or one of its four fingers, can grab this loop fairly easily. The catch is that polypro is really hard to work with because knots slip. To minimize problems, we splice two lengths of polypro line together to form a circle. It isn't easy, and I've never needed to know how to do it before, but I'm picking up this skill on this cruise to help make it go well and to use in the future. We recovered a light weight deployment I had made last fall yesterday. It wasn't very pretty because the loop was secured by cable ties and duct tape, but it held. I'm anxious to see how the deployment survived and find out if it did what I expected. But that has to wait
because the deployment will remain on Jason until the end of the dive, which may not come for several days, if things continue to go well.

Time to stand watch, and let's all hope that those splices I made earlier this week hold. Let's hope too that the storm front in the area that is forecast to come our way, doesn't.

----------6th EMAIL TRANSMISSION----------
6/23/01
Things continue to go well on board the R/V THOMPSON. The ROV Jason is still working hard on the sea floor, completing tasks identified for our first dive which is actually Dive 308 in Jason's history. The science party is settling into a routine that we hope will continue for the duration of the cruise, 4 hours of work devoted to Jason dive activities, 8 hours off, with the pattern repeated every 12 hours. The action is primarily restricted to the Jason control van where watch standers gather around video & computer monitors that receive feed from Jason's three cameras over 2000 m below. The pilot has the biggest chair, as he is actually the one making Jason work. The chairs for the Jason engineer and navigator and the science party's watch leader have arm rests (definitely a mark of status) and other members of the watch have padded, but armless chairs. Non-watch standers perch on stools or stand in the limited space available, or watch the action on a monitor in the main !
lab.

For watch standers on the 8-12 watch, the daily routine is to start the shift by 0745, finish the shift, eat, take a nap, get up for
dinner, have an hour or 2 off, work the evening shift, go to bed, get up, eat and start the cycle over. Eating is a big part of the day at sea, as you may have noticed. The food is very good, varied and served 3 times a day buffet style during 45 minute periods. Although food is always available in the mess, meals are our primary chance to socialize,

especially with people on other shifts, get non-rushed updates on what is going on with Jason, what has been seen on the seafloor and what to expect in the short-term. Some days, well, meals are the only part of the day that we can honestly look forward to. Dan, the Chief Steward, lives up to
our high expectations with his cuisine. I probably eat twice as much at sea as I do at home, but I always come back a few pounds lighter. I suspect it has to do with the amount of energy I spend trying to stabilize myself as the THOMPSON (a really pretty stable ship) rolls or pitches. So far it hasn't been doing both at once, although that may change in another 24 hours. Other inherent exercise factors are the large number of heavy water-tight doors we must pass through to get from part of the ship to another, and moving among the ship's six decks.

The days of 3 people in the science party, Paul Johnson, Susan Hautala (both professors in Oceanography at the University of
Washington) and Chris Jones of the Applied Physics Lab aren't as structured as they are for most of us. These are the people who came up with the plan for the cruise, wrote the grant proposal to NSF, got it funded and are now responsible for its success. They have been spending most of their time in the control van, and are probably shorter on sleep than anyone on the boat. None of you should worry about them, or any of us, as we all try to take care of each other. They all went to bed during my watch last night, which I see as a vote of confidence.

As this first phase of instrument deployment begins to come to an end they too will settle in to a routine. They know that the worst thing to do out here is to get exhausted, which is easily done by skipping a much-needed (and well-deserved) nap to watch one recovery that gets delayed just one hour. Exhaustion leads to mental errors that can slow things down. With only a finite amount of time to do everything we possibly can to learn more about vents and the planet we live on, we can't afford mental errors. Weather is another thing that slows things down. The clouds are thicker today but the swells aren't a lot higher. The weather faxes we
receive twice a day show that winds (and the waves they create) will increase within Jason's tolerance limits in the next 24 hrs. Hopefully, they will also remain within the tolerance limits of all members of the science party. Weather can impair the ship's satellite link, if you don't hear from me we may be under a cloud with email queued, waiting for a break.

6/24/01
It has been a very good day on board the R/V THOMPSON. We finished the first major part of Dive 1, deploying and recovering MAVS. The MAVS that have been on the seafloor since fall are all secure in place on the elevators. At the end of this dive, after Jason is safely on deck, they will be issued an acoustic command to rise to the surface and so they can be recovered by the THOMPSON's crew.

I'm afraid I haven't told you much about these instruments. MAVS (Modular Acoustic Velocity Sensors) are long cylindrical instruments that are secured by swivels inside 4 foot long polyethylene tubes with cut-outs in the front and back. They have

weighted bottoms, floats at the top and the ever-present loop of polypro line to let Jason carry them. The instrument itself is pulled vertically into the housing when the polypro line is taut, when the tension of the loop is relaxed, the MAVS is supposed to swing into a horizontal position. Theoretically, and on deck, this works good. On the seafloor, at 2C when Jason puts the MAVS down one of two things happen. The MAVS falls over (which is totally unacceptable) or the instrument doesn't swivel, but stays upright inside the housing. Jason then has to manipulate the housing, or the very expensive instrument itself until it conforms to expectations. Jason does this, under command of the pilot with its one manipulator working only with the view offered by one video camera.

Imagine you are on top of the John Hancock Building, using a manipulator arm to work on a MAVS in the plaza below and able to watch what you are doing on a TV screen. The Hancock building is about 105 stories tall, I think, or roughly 420 m tall, if every story is 4 m high. Jason is working five times farther away from us than that. The terrain in which we are working isn't a flat plaza. In some areas, there are 15 m high rocks that are releasing water heated to over 200C (the water at these depths doesn't boil, due to the high hydrostatic pressure of over 200 atmospheres). We successfully placed 12 MAVS as specified, upright and with the sensors fully deployed in the last 48 hours over an area of 3 km, and recovered 10 and a few other various pieces of equipment. Even when I am sitting next to the pilot doing the work, this really is pretty amazing to me.

This success means that we are on the second primary goal of this dive, an acoustic survey of the axial valley with Jason 5 m or so above the bottom. We're slowly moving along each of four 1500 m long lines, stopping Jason every 20 meters to collect data for 35 seconds. The acoustic signals we send bounce in an odd way when they are reflected by shimmering, that is to say, heated, water. The resultant acoustic returns give us a precise map of areas that are warmer, even by just a few degrees, than the surrounding 2C water. We have to do this survey for hours on end, in fact this morning we have completed over 20 hours of survey, and this is not the only such survey we hope to finish during this cruise. I am convinced that the survey is much more interesting to read about than it actually is to watch, but it is the best way to get the data that will provide new insight into heat flow from all areas of the ridge and its central valley.

Even though surveys aren't the best part of working with Jason, other factors made yesterday a good day. The weather front that had been forecast was weaker than we feared, and this morning the sea surface has an almost glassy look to it. We've had a group of young seals near the boat for the last few days. Watching them as they dive deep into the clear surface waters is great entertainment. Before dinner yesterday we had a brief visit by a small group of Dall's Porpoise, a species that normally doesn't have much to do with boats, unlike many species of dolphins and porpoises. But the unquestioned highlight was seeing two of what I am pretty sure were finback whales who spent most of the day a mile or so off our port side. Although the seals and the porpoises were a lot closer, nothing compares to seeing the white massive column of a whale blow tower over the endless blue water that surrounds us.

6/25/01

It's been another good day on board the R/V THOMPSON, partly because for the first time all cruise, the sun has been out all day and the seas are calm with gentle rolling swells. We haven't had bad weather on this cruise (which would be high seas) but we have had heavy clouds, fog, drizzle and rain. The latter has come most often when there has been a need for people to be on deck, whether to recover or deploy material over the side or to repair Jason.

The first acoustic survey was completed after our watch yesterday afternoon, allowing the12-4 watch to get back to the sea floor and
reposition instruments to focus data collection on a small, poorly-studied vent field. After 45 minutes of working on the sea floor, Jason was back up in the water column, running surveys. We're all looking forward to having an entire watch free of acoustic surveys, but well, it isn't going to happen for a while yet.

It may seem odd that a Field Museum curator is writing about geophysical research, and even more odd that I am spending so much of my time collecting geophysical data for other scientists, notably geophysicists. Geophysicists seem to be primarily oriented to data collection and analysis, their best-case scenario would be to sail into port at the end of the cruise with their instruments and computers so crammed full of data that they can't open a program. Their research is aimed at understanding the processes that affect the Earth, and they do this by documenting heat flow, gravity anomalies and magnetic profiles, all physically invisible features of the planet that can only be detected with (very expensive) instruments.

My research interests require access to specimens. There is no instrument in the world that can tell me the diversity of species at one vent and compare it to another vent, or that can record changes over time. No instrument or computer program can tell me that the video is showing a member of an unknown species, vent animals are often quite small and occur in incredibly densities. Identifying and describing new species require specimens be examined under a microscope. To address the questions I have about vent diversity and changes with time, I need to examine samples of the animals living at different vents, and repeated samples taken from the same vent at different times.

The Field Museum benefits because my work is providing us with the best collection of vent animals in the country, and probably
among the 3 best collections of vent animals in the world. These collections are available to other scientists who aren't able to come to sea, but need access to specimens to further our knowledge of the diversity and evolution of life in these extreme environments. Being at sea with people interested in collecting data, but not samples means that Jason's limited payload (the weight and volume of
material that we can bring back from the sea floor to the ship) can be devoted to biological collections that I tell the Jason pilot to
make. This interaction is beneficial to both geophysics and biology. I help them by doing my best as a watch leader to get their data collected, in turn, they give me a few minutes of Jason time to collect samples. Frankly, I think I come out a bit ahead in this arrangement. I not only get samples, the more I work with Jason, the better I understand

the vehicle and its capabilities. In addition, when I'm lucky, Jason's camera sees a deep-sea octopus, a group with which I am expert (please pardon my apparent lack of modesty).

While at sea with geophysicists, I've been the first octopod specialist to actually see these animals alive in their natural habitat and to document behaviors such as egg care by females. You might think I should just get my own cruise to accomplish these goals, and I have secured NSF funding to make biological collections using ALVIN at a little-known ridge off California next summer, but cruise time, especially with a submersible is precious. We estimate that one day of R/V THOMPSON time and one day of the ROV Jason time costs the NSF, the sponsor of this cruise and the primary source of funding for the fleet of scientific research vessels in the US and our two undersea vehicles devoted to research (the ROV Jason and the submersible ALVIN), near $30,000. That's over $1200 per hour, starting when we leave the dock. This cost, and the intense competition among scientists for use of
the limited number of ships and submersibles, necessitates that scientists try to forge mutually beneficial relationships, like the one I have with the geophysicists. (But even after writing all that, I do wish we were done with these acoustic surveys.)

----------7th EMAIL TRANSMISSION----------

We're another day into Dive 1 with Jason and things continue to go well. By lengthening the dive, we accomplish more than we could with repeated dives separated by a 2 hour one-way transit between the sea floor and the surface, what is inevitably at least 6 hours of vehicle maintenance, and the 2 hour transit back to the sea floor. We anticipate ending this dive this morning after 115 hours of bottom time, which might just be a new record for Jason. I'm writing this after getting off my midnight watch. At 0630 today instead of sending email, I hope to be opening my deployment that we recovered on the first day of this dive.

During our morning watch yesterday, we deviated a bit from the standard duties of moving instruments and running surveys. A magnetic survey conducted last fall using Jason revealed 2 sites in the eastern axial valley in this 3.5 km long survey area that had a reduced magnetic signal. Because hot water (at least 100C) passing through rock reduces the magnetic signature, Paul Johnson, our chief scientist, hypothesized that these unexplored areas were extinct vent fields, which showed a reduced magnetic signal due to historic events. The alternative hypothesis was that these are active vent fields, with fluids currently moving through them. The latter hypothesis would mean that our ideas of how hydrothermal vents are distributed relative to geological faults on this segment of the mid-ocean ridge are wrong.

Yesterday morning, we had the immense pleasure of testing these contrasting hypotheses. After recovering more instruments, we transited to the southern area of low magnetism. No one that we knew of had ever been to this site before, meaning that we were doing exploration in the true sense, choosing our destination as X and Y coordinates in the blank space on the map rather than based on the need to deploy instruments at a known site. When we got there, a forest of extinct smokers that reached heights of over 10 m

greeted us. The bulk of a smoker remains as a sulfide structure after hydrothermal venting stops. They are formed when
super-heated mineral and sulfide-laden fluids emerge from a vent and contact cold seawater. The chemicals precipitate as the fluids cool. The precipitate piles up throughout the life of the vent, sometimes as we have seen reaching huge sizes. When the fluid flow stops, the precipitate and the bodies of the vent animals that had lived on the smoker, remain as silent remnants of vigorous hydrothermal venting.

Watching the live video feed from Jason as we carefully moved through these cold, slowly dissolving structures, I was reminded of the
villages of the original peoples of the Northwest coast of America. Their totem poles were meant to be reminders of the past, tributes to people and events that had molded the village's present. They built to stand in place until they weathered away. These sulfide structures on these seafloor are also remnants of the past, weathering as time passes. The modern Northwest coast cultures and current sites of hydrothermal venting are building new tributes to the present. As is true with cultural artifacts, the sulfide edifices we saw today give us a better understanding of their history and that of our planet.

----------8th EMAIL TRANSMISSION----------

Jason Dive 308, our dive #1, ended at 0653 hrs. yesterday morning as Jason was hoisted on deck after 117 hours and 6 minutes under water, a new record dive duration for Jason. Everything we had on board was recovered with the vehicle, although one instrument dangled precariously over the side held only by Jason's manipulator arm. Secure on board Jason was my
deployment, sitting inside a closed box that was bolted to the vehicle. My deployment consisted of 3 foot-long lengths of wood bound inside a nylon mesh bag with a polypro loop on top. Wood has fallen to the seafloor as long as trees have grown and washed into the sea, yet we don't often find wood sunken on the sea floor. Bacteria break down the wood fibers, allowing it to rot. Just as on the vents, unique species of animals recruit onto sunken wood and eat bacteria that flourish there.

Among questions that interest me about the distribution of deep-sea animals is whether species known only from vents are in fact restricted to vents. A considerable amount of deep-sea biology has focused on the vent fauna, but with very little comparable research done in other habitats. Can we really say that these species are unique to vents? I deployed the wood to see if vent animals would live on it, eating wood-degrading bacteria rather than chemosynthetic bacteria. I'd never left anything on the seafloor for months before. Last winter in Chicago I found myself wondering how it was doing. I held my breath as I cut into the bag, not knowing whether animals would come tumbling out or if the wood would appear to be unchanged. I found that the latter was closer to the truth. Although disappointing, this result is very important as it tells me that I need to modify my plans for future deployments.

My deployment seems to have been the only disappointment after this recovery. With Jason secure, we released the 2 elevators from the seafloor in sequence with specific acoustic signals. The crew got them on board with all instruments intact. The data loggers

of all instruments, except one that is being fussy, are now down-loading their contents into the PC's that clutter the Main Lab. The geophysicists would be immensely happy with the present situation if it were not for the weather.

I've mentioned weather only briefly before, figuring that if you're suffering in heat and humidity I didn't want to tell you about highs in the 60's and cool sea breezes. Unfortunately, we are encountering more than breezes tonight, as the winds may pick up to over 40 knots, which would quality as gale-force, from their current 25. White caps had dotted the blue waters around us all day; if the winds
build, we'll see more white and less of the peaceful blue we've been enjoying for the last week.

To avoid problems associated with the wind and the waves they create, and to give the Jason group more time to devote to the thrusters which were only working intermittently during the last stages of the dive, we won't put Jason back in until after breakfast. In the meanwhile, those of us in the science party who aren't down-loading data and preparing instruments to go back to the seafloor will be monitoring CTD casts. This is comparable in terms of our level of emotional involvement to running acoustic surveys so we are all anxiously looking forward to a beautiful, calm day spent in the dark control van watching the sea floor through Jason's cameras.

----------9th EMAIL TRANSMISSION----------

Yesterday was an all too quiet day on the R/V THOMPSON but the gale force winds that had been in the worst-case scenario forecast didn't arrive, at least while I was awake, and by mid-morning the barometer was clearly rising. We did a CTD survey for about 18 hours and as that instrument was being brought on board, the elevators were being prepared for their sequential descent to the seafloor. Jason followed in mid-afternoon, as the white caps diminished and the seas began to flatten.

I have to tell you about a few minutes we stole while making deployments near an active black smoker on our night watch. (We didn't really steal them, we had to wait for the ship to change position before we could advance.) This smoker had a flange, basically a structure comparable to an awning that extends laterally. Flanges on Endeavour Segment of Juan de Fuca Ridge are famous, they trap hot water rising from below and allow only a bit to escape at a time. The contrast between the temperature of the trapped water at about 200C and the ambient water at 2C creates an upside down pool that acts like a 2185 m deep mirror. That was the highlight of the day that we mostly spent waiting out the weather.

I admit to likely not being as wary of forecast storms as I should be. Severe weather makes life on board miserable, anything that is not properly secured is on the floor in no time, including water glasses. We try to be constantly aware of the potential for bad weather
and keep things secure, but the biggest danger if the seas pick up is the increased risk of injury. At 250 nautical miles out, we are on our own if emergencies of any kind arise. The only other ships we have seen are container ships passing on the horizon once a day

or so. We of course have a satellite phone and radio that we could use to call for help if it were needed, but the reality is that to get help, be it medical, technical or material, as if say we needed another case of that item critical to cruise success, coffee, we would have to go into port or get the needed resources from another ship.

You may be thinking that a marine helicopter could fly out and make an exchange, airlifting out any one who was seriously hurt or
delivering the coffee, but marine helicopters only travel about 100 miles out to sea, as their fuel tanks hold enough fuel for a 200 mile
trip. Thinking about being entirely reliant on our ship mates for weeks on a boat where tons of equipment such as elevators, Jason and CTD instruments are being hoisted overhead makes us appreciate the professional competence of the ship's crew and how much we need them, not only to help us get things done but to help us keep out of harm's way.

The ship never seems to run out of anything important (although the lettuce in the salad bar may lose its appeal in week 3) and the Jason group has a series of replacement parts that seem inexhaustible. The ship itself runs on diesel fuel, which is also burned to generate electricity, make an ample supply of fresh water and to treat it after use in EPA-approved primary and secondary sewage treatment facilities. The ship in essence functions more independently than a small city. Our autonomy is re-enforced by the fact that we don't get TV, cell phones don't work and at times the weather or the ship's position makes receiving email from the outside world impossible. In fact, for the duration of this cruise, we will see only the 34 people with whom we left Seattle. No strangers will be encountered, no passer-bys will appear and no one unknown will phone with a wrong number. The cruise and the roles we assume for its duration, be it watch leader or instrument technician or senior scientist are heightened by this autonomy. The cruise objectives, the next dive, the task the pilot must make Jason complete before the next one can be begun come into sharp focus with so few distractions.

After having written that, it may seem to you that being here would offer only a bleak existence. There are times when that is true,
when just one email from someone on shore makes a hard day a lot easier, but mostly it seems that we have it all, including evening radio broadcasts of the Seattle Mariners' baseball games. As they are in first place, people from Seattle like to turn them up loud, but I just smile and nod. Then I ask those people from Seattle, "Who's going to move into the
Boeing Company's headquarters when they move to Chicago?"

----------10th EMAIL TRANSMISSION----------

It has not been a quiet day on board the R/V THOMPSON. Jason has been in the water, collecting data during acoustic surveys since the start of our 0800 watch. Normally, acoustic surveys would qualify it as a quiet day, but I am using this term literally. There is an old saying at sea, "Rust never sleeps" and neither, it seems do scientists who are trying to nap while the deck crew is attacking the advancing front of rust. Attacking rust is a good thing, it has to be done, but yesterday afternoon was the one day in this cruise

I've been seriously short on sleep, and it was when the deck crew started using needle guns to attack the rust on the outer walls of my cabin.

During the previous night, we had had to pass on an opportunity to collect vent fauna because it would have put an instrument on Jason at risk of damage. I opted to sample at my second chosen site, where Jason would be in a few hours. When you're using an ROV, sometimes a few hours become several hours, not due to anyone's fault it's just that things happen that make progress slower. So because we had planned to collect as early as 0230, I stayed awake after getting off watch at midnight. By the time we took the sample at 0430 and stowed it on Jason at 0445, my bunk was calling. I got up for the 0800-1200 watch, and lunch, and was sound
asleep when the needle guns started chewing on the walls of my cabin.

I'm not sure how thick those walls were when they started, but I am certain that they are thinner now than they were when I laid down. The deck crew has been doing maintenance on the THOMPSON throughout the cruise whenever weather has allowed. This isn't unique to this cruise, attacking rust on a sea-going ship is a year-in and year-out duty. The THOMPON will have its 10th anniversary sometime on this cruise and 10 years at sea is a long time for its steel decks, bulkheads and deck cranes. In the end, a little sleep disturbance won't matter a lot, keeping the THOMPSON in shape for another decade of service to marine research is worth the price.

I shouldn't complain at all because I in fact have a choice cabin just one deck below the bridge. Most of the science party is housed in cabins below the water line. These cabins are more stable, but also more noisy. The THOMPSON has bow thrusters, special engines that allow it to remain within a meter of the same position on the sea surface regardless despite weather & high seas. These powerful engines are very near (or I suspect actually INSIDE) some of the lowers cabins that house the science party. While Jason is diving, or while we are doing CTD's, these engines are on all the time. Most people get used to the noise, but not me, so I pleaded with Chief Scientist Paul Johnson to assign me to my present cabin. Despite the needle guns, I'm glad I'm there.

The biological sample we took is from an area of diffuse venting, with temperatures of 3.7C about a foot above the bottom. I won't have a good idea of what's in the sample box until it gets on deck at the end of this dive, which may be only shortly before we head in to port early Monday morning. The Jason pilot did all that he could, but the sampling was difficult and even if the box is crammed full, getting the box through the water-air interface always risks its loss, or loss of its contents. I have seen samples and instruments catastrophically lost after having passed safely through thousands of meters of water. A wave at the wrong time while they are being lifted out of the water can sweep them back into the deep blue ocean. No sadder sight do I ever wish to see, but it's taught me that you cannot say you have a sample until it is on deck. I'll let you know how it went Monday. Because this will be my only biological
sample this dive (space is limited to accommodate a large water sampler), I'm hoping for the best and fearing the worst, confident that it will be somewhere in between.

----------11th EMAIL TRANSMISSION----------

Saturday, June 30

It has been a quiet but productive day on board the R/V THOMPSON. As I write this morning, Jason continues its dive, completing surveys and recovering and deploying instruments. Alternate weather forecasts predict deteriorating conditions, but yesterday was about as good as it gets here, in terms of sunshine and no winds. The weather will do as it pleases any way, our primary concern at this point in the cruise is to use the remaining time to get as much science done on the bottom as we possibly can. An accident with the vehicle last night brought home to us the risks that we face as we push to get the planned work done.

Jason, as I have written before, is linked to the ship by a fiber optic cable that carries commands from the pilot on board the ship to the vehicle and that carries the electricity that powers the vehicle. There is an intermediary, Medea, about 30 m away from Jason which converts the electricity into a form that Jason can use and which serves as a weight to dampen the effects of the ship's motion on Jason. Medea is towed by the ship and in turn can tow Jason when it isn't driving under its own power. Medea is heavy; Jason is positively buoyant. It floats because if the tether were to be cut, we want to increase the chances that it could be recovered. This is not hypothetical; ROV's are on occasion lost at sea. ROPOS, the first ROV I worked with, was lost during a recovery in high seas in 1996. As ROV's don't carry people inside, they are fully replaceable, as ROPOS was, but it is something you would rather not have
to do. Risks to tethers include being cut by the ship's propellers, being yanked out of their connections to the vehicle and, in hydrothermally active areas such as Juan de Fuca Ridge where we are now, being melted by contact with super-heated fluids.

Yesterday, the ship was towing Medea with Jason driving to a site at which an instrument was to be recovered. They were moving over a high temperature vent field with a very tall, very thin black smoker, aptly named "The Needle." Jason went on one side of the structure and Medea went on the other. The tether hit the smoker and lodged under a flange. With most of us on the ship unaware of what was going on, the Jason navigator (who during dives has control of the ship) quickly changed the ship speed and heading, setting off bridge alarms as he did so. The quick-thinking Jason engineer lowered Medea to lessen the stress on the tether and minimize damage. The expert Jason pilot maxed out the thrusters to pull the tether away from the smoker's grasp. All of this occurred as Jason's live video feed was showing the orifice of the black smoker inches from Jason's camera, with bits of the smoker falling all around. What could have been the loss of the vehicle was successfully averted.

We recovered Jason immediately afterward to check for damage. After 2 hours it was on deck and close inspection found no deep damage to either Jason or its tether. The tether was scorched in places and superficially abraded, but all things considered, it survived its close encounter with the black smoker fairly well. Within 30 minutes of being recovered, Jason was back in the water.

During my evening watch, the Jason guys started to talk about what could have happened and how lucky we were that we only lost about 5 hours of bottom time, leaving unsaid what we could have lost. I believe we were all thinking how lucky we were that it didn't happen on our watch. During Jason's time on deck, I got to remove the biological sample from the vehicle, making the collection box available for another potential sample. I'll keep my fingers crossed and hope that the opportunity arises, but in light of what could have been the end of Jason's career, I am happy to have what I have.

Sunday, July 1
Yesterday was a beautiful and productive day on board the R/V THOMPSON. The seas have been nearly flat and the breezes light for the last 3 days. The clouds started rolling in the afternoon and we can see rain showers on the horizon. These minor harbingers of a weak low pressure front shouldn't severely impact our operations. We are at an awkward moment in the cruise, having to set priorities among the tasks that are yet to be accomplished. Jason bottom time and ship time are precious commodities and for the last 2 weeks or so we have used them as well as possible. There remains, inevitably, more to do than we can reasonably accomplish as the end of our time at sea approaches.

Sometimes it seems that we have been here forever, other times it seems that we are just adjusting to our routine. Part of the difficulty in adjusting to the routine of Jason dives is that they aren't routine. Yesterday for instance, our entire morning watch was devoted to a bathymetric survey conducted at 18-22 m altitude at a constant speed of 0.5 knots. This differs from the acoustic surveys we've done with stops to collect data every 10 m, or other acoustic surveys with longer stops every 5 m. During surveys, as watch leader, I am watching the monitors and sonar displays to make sure we do not encounter any "navigational hazards," making sure we maintain the proper altitude and specified path and as we fly by them, keeping a close eye on the live video feed to try to glimpse identifiable individuals among the galaxy of very poorly known animals that live in the water column over the ridge.

Pelagic animals that spend their entire lives swimming in the cold dark waters of the world's oceans are among the least known on the planet. Most are gelatinous, containing fluid-filled tissues that help them achieve neutral buoyancy so that they don't waste a lot of energy maintaining their place in the water column. Sampling these animals is almost always done with trawls, which are not delicate devices; a transparent animal that has evolved to spend its life suspended in the water column is not seen to its best advantage after having been forced and sometimes sieved against a trawl for hours. Seeing the abundance of these animals, even the small ones that cannot be distinguished at 0.5 knots, in their natural habitat reveals a new dimension of life on the planet. If the oceans cover about 69% of the planet's surface and have an average depth of 4500 m, think how many animals live between the surface and the bottom.

Our evening Jason watch was spent stowing instruments on an elevator. I know I've mentioned instruments before in a vague way, and I've probably given the impression that they are all the same. Last night's package, an 11 foot tall tower of stainless steel angle iron studded with temperature probes that have been sending data to a logger on its

pyramid-shaped titanium base with the requisite wires and electronic connectors, was unique. The challenge was to secure it to the elevator so that it could be definitely recovered on deck, meaning getting part of the frame into a snap hook on the elevator. Jason elevators do not rest on the sea floor, they are suspended 20 m above, swinging on a line that rises from the weights that hold it down. When Jason touches or pushes into the elevator, it swings about this line, as it appeared to do in response to the very approach of Jason carrying the Tower. I will not detail the agony of watching as the pilot carried the Tower in Jason's one arm and tried to hook it to the rapidly receding elevator. It took him 90 minutes of heroic effort and during every one of those 90 minutes, we all watched tensely, wanting to help, but being powerless to do so.

Today is the last day of bottom time for our cruise. Jason will be off the bottom at midnight for the final time. We will try to cram the day as full as possible, but I figure that will mean surveys rather than heroics. I suspect that they plan it that way so we will be happy when the cruise is over.

Monday, July 2
Remember that in yesterday's email I mentioned a weak low pressure system that wouldn't impact our sea floor operations here on the R/V THOMPSON? Funny thing about weather forecasts, sometimes they are wrong. This low pressure system turned out to be more focused than we expected, sea conditions worsened overnight and all morning. Before lunch, the ship's captain came into the control van as we were between survey lines, announcing that wind gusts had reached 28 knots and were intensifying. The captain and Chief Scientist Paul Johnson had a long talk in an adjoining lab. After we had begun our next second survey line, Paul returned to announce that Jason would have to leave the bottom. Winds build waves and waves increase ship motion and can complicate work
on deck so much that it becomes dangerous to everyone involved. Our watch, however, having only 20 minutes of survey to go (it was a mercifully short line for once), argued that we should be allowed to complete the line and pick up the only instrument not all ready stowed on an elevator. As this instrument is a favorite of Paul's, he relented and we rushed through these tasks, leaving the 12-4 watch to bring Jason to the surface.

I took a nap after watch (and lunch) to be awake & alert when my biological collection came on deck in the box on Jason. As I laid down, my mind envisioned Jason coming up through waves that reached the main deck, 10 feet above the sea surface. Images of the lid of the box opening to spill its contents among white caps as food for the albatross that have been trailing us for days danced in my head. My nap was so troubled by strange dreams that I was pleased to wake up, even though I anticipated a hair-raising recovery. It was immediately apparent, however, that the ship was more stable than it had been when I laid down. I peeked out of
one of my portholes (I do have a very nice cabin) and saw only a few white caps. The seas had begun to settle. Jason was on its way up, and wasn't going to turn around, so we decided to use the time it was on deck to recover the 2 elevators that were now fully loaded with instruments containing the data we came here to get. Given that the success of the cruise rested on the contents of the elevators, the prospect of recovering the

elevators in what could be rapidly deteriorating weather if the system swung back at us was unnerving.

We got Jason on deck without problem. The bio-sample, taken about 5 feet from a 350 C black smoker, was intact and safe from the albatross. We then sent an acoustic signal to one of the two elevators on the seafloor. I don't quite fully understand how, but a specific acoustic signal separates the elevator from its weights, letting it rise to the surface due to the lift of glass floats in its frame. Usually our navigation system allows us to see the elevator begin to rise within minutes of the signal having been sent. With this elevator we saw nothing. For 1 hour & 35 minutes, we saw nothing. We told the other fully loaded elevator to rise. Again nothing happened. I prepared my sample and got to dinner a bit late, but I was just in time to hear that the first elevator had begun to rise. We all felt better; this was good news until shortly after when we heard that the second elevator was also rising, just a little faster. Instead of no elevators at the surface, we now faced the prospect of two elevators on the surface at the same time 3
km apart. One would have to ride the waves, and potentially the currents that could carry it away from us, for at least an hour while we recovered the other.

Elevators do not boldly announce themselves to the world. The top of the elevator is about 4 feet square, and although bright yellow, it does not extend over the water surface. Our acoustic navigation system is relatively ineffective in locating the elevator near the sea surface. If an elevator were caught in an unpredicted current, our chances of finding it in the North Pacific Ocean would be very low. With these problems in mind, we first recovered the elevator carrying the tower without problem. As we were removing the tower from the elevator, the ship swung at high speed to the other elevator site. Before we were through stabilizing the first elevator, the second was spotted, bobbing intermittently near the water surface. Seeing that elevator so quickly was among the luckiest things that have happened on this cruise. The second elevator was secured within an hour of the first and all the instruments it carried are now safe, downloading data to computers in the Main Lab.

Jason went back into the water at 2200 hours; it reached the bottom at midnight, the end of our last watch. Our sailing orders limit bottom time on this last dive of the cruise to 3.5 hours. Our CTD surveys indicate that there are active hydrothermal vents on the east side of the ridge. We are using this dive to see if they are really there. Tomorrow sometime (it will be a late night), I'll write and tell you if we discovered a new active vent field in an unexpected place.

----------12th EMAIL TRANSMISSION----------
Tuesday, July 3 -- Early Morning
It has been a beautiful day on board the R/V THOMPSON. I can hardly bring myself to come inside to write as the mountains on either side of the entrance to Puget Sound are breathtaking and sea birds are abundant. At sea, albatross were the only birds routinely seen, although a storm petrel would be spied occasionally flitting among the waves. Here bird diversity is high and includes the first sea gulls we have seen in days. Probably doesn't sound like a big deal, but for the first time in weeks, I looked up in the sky rather

than down onto the water's surface to see a bird. The water has lost the glorious indescribable character that it has at sea, the clarity and depth with crystalline colors, here it has a more greenish, opaque quality. I noticed the change as soon as I got up at 1000 hours. This is an absurdly late time to hit the deck, but I didn't get to my bunk until 0600 this morning, so I am not embarrassed to admit it. The dive last night successfully collected another sample of vent fauna but it was not successful in every regard.

We had chosen to dive in a spot in the middle of one of the big, blank sections of our map of the sea floor because a CTD instrument on Jason had shown it was unusual. CTD measures the Conductivity, Temperature and Depth of the water electronically as the instrument moves through the water column. CTD readily detect the hot, particle-rich fluids with unusual chemistry that hydrothermal vents, particularly smokers, send high into the water column; it was these in which we were interested. As vent fluids mix with seawater and are cooled, evidence of hydrothermal activity is erased at altitudes of 20 to 180 m above the bottom with bigger, more
vigorous vents creating bigger signatures. Because CTD usually finds vent plumes only very near active vents, they are thought to be good indicators of vents. Our CTD's found 3 areas on the east side of the ridge's axial valley that had clear evidence of hydrothermal activity. Because all known vents on this ridge are on the west side, hypothesized to be due to the large geological faults there, discovery of active vents in the eastern valley would significantly impact how we think of the "plumbing" of these hot fluid channels.

Just about midnight last night, Jason was on a sea floor composed of sheet flows of basalt, without any evidence of hydrothermal activity. Chief Scientist Paul Johnson had announced that Jason would spend only 1 hour looking for these hypothetical vents. If no sight of them was seen in that time, Jason would return to known areas to collect remaining data and specimens. It seemed that the entire science party was in the control van that first hour, watching and hoping for the discovery of new vents. The crowd began to thin out by 0100 hours, and after 2 hours of searching, when Paul issued the order to stop the search, only the 12-4 watch remained. I was up as I had hoped to direct the first collection of the vent fauna from the eastern part of the ridge. As Jason headed toward one of our instrument sites to collect biology, a water sample and to do just a few more survey stations, I stayed up to direct the collection, which came at 0300 hours. Jason and our samples were on deck at 0515 hours and the samples prepared shortly afterward.

I was sad as Jason rose through the water column for the last time on this cruise. It's been a good cruise with an excellent group of people, great technical expertise and an exquisite habitat. As Puget Sound wraps around us, the wake of the R/V THOMAS G. THOMPSON is creating the biggest waves around, just as we have been doing since we left station at 0530 this morning. Equipment that has been in constant use through the cruise is being broken down and packed for transport back to whereever home is. Many of our scientific objectives have been fully achieved and three dedicated biological samples of vent fauna are safe and secure, waiting
deposition at The Field Museum.

Tuesday, July 3 -- Late Afternoon

We are scheduled to tie up at the University of Washington dock at about 1000 this morning, for the first time in 17 days, stepping on solid ground, seeing strangers and being overwhelmed by the color green. I never miss seeing green at sea, there's lettuce in the salad bar, and sometimes someone will wear a green shirt, but after having spent 2 weeks looking at the blue sea and Jason video feed, reaching land and seeing ALL those green plants is phenomenal. The feeling that your eyes are having a feast lasts only a few hours but it brings home the fact that our experience has been intense in unexpected ways.

In preparation for our arrival, we're packing and looking for our wallets and keys, and all the other essential things that we haven't used in weeks. We're promising to keep in contact with new friends. I wish I had the time and space to write about each member of the science party and how each has contributed to making this cruise not only successful, but enjoyable. With limited time, I thank them as a group, which in a way is appropriate as this has been a group effort. From the University of Washington members of the science party were: Tor Bjorklund, Sheryl Bolton, Bill Fredericks, Irene Garcia-Berdeal, Lisa Gilbert, Chris Jones, Matt Pruis and Leif Thomas; from the University of Rhode Island, Kelly O'Connell; from Seattle, Jamie Turner currently on sabbatical from her undergraduate career; from Mar Tech, Chad Findley and from the Geological Survey of Japan, Ko-ichi Nakamura. The Jason Team from Woods Hole Oceanographic Institution was well led by Martin Bowen. Our pilots were Will Sellers, Mark Bokenfohr and Jim Varnum, with expert assistance in engineering and navigation by Peter Collins, Tom Crook, Bob Elder, Jon Howland and Fran Taylor. Captain Gray Drewry and the entire crew of the R/V THOMAS G. THOMPSON have made it all possible with excellent support operations that included late night recoveries and deployments in the rain.

Two individuals merit special thanks. Chief Scientist Paul Johnson has provided expert leadership, general good humor and a willingness to at least listen to opposing opinions. Paul is a professor in Oceanography at the University of Washington and the senior (and most distinguished) scientist on board. Chief Scientist acts as a liaison within the science party, between us and the Jason Team and between all of us and the ship's captain and crew. Paul fulfills this multi-faceted role so well that we don't even notice that he's doing it. Paul's greatest talent as Chief Scientist, however, may be his ability to modify plans in the face of changing conditions, a skill that makes each of his cruises predictably successful in the very unpredictable environment of the North
Pacific Ocean. We were all delighted to be on board with him during this cruise. I personally thank him for having invited me on this cruise and for having made time available for biological sampling.

Susan Hautala served as the other principal investigator on our cruise. Susan was essential to our success. She stood watch, organized the CTD's, MAVS and 2 of the 3 types of surveys we did with Jason. Despite the inevitable problems associated with these commitments, she remained the most pleasant, energetic and cheerful person on the boat. Susan is a great role model. She's the Co Principle Investigator on the grant that funded this cruise (including ship and vehicle time) and an assistant professor in

oceanography who teaches, does scientific research using very analytical approaches to physical oceanography and advises graduate students as they advance toward their PhD. We know she dearly missed her husband and 3 year old son who saw us off as we sailed 2 weeks ago Sunday. She and Paul have been my primary editors for these emails, helping me to understand more about their fields of expertise so I can better communicate the full breadth of the research. I thank them for their help and thank all the members of the science party, the Jason Team and the ship's crew for their assistance and support over the last 17 days at sea.

Analyses of biological samples will occur as I sort and identify the material collected over the coming weeks at The Field Museum. Patterns of diversity in these extreme habitats are not easily understood, having completed a successful cruise and coming home with specimens is only the first step in that direction.

VHS Tape Log Sheet

Dive #	Tape #	Jullian Day	Ship Day	Tape Start	Tape End	Comments
306	1	170	19-Jun	11:15	12:17	ADCP Celibration
306	2	170	19-Jun	12:17	14:00	
306	3	170	19-Jun	14:00	15:53	
306	4	170	19-Jun	15:53	17:44	
306	5	170	19-Jun	17:44	18:29	306 End
306	6	170	19-Jun	19:23		Resumed Filming at bottom after descent
					19:56	Stop Tape
307		We never hit bottom so there is no video for this dive				
308	7	172	21-Jun	19:01	21:00	Began filming at bottom
308	8	172	21-Jun	21:05	23:05	Dropped off Mav 62 and 52 @ elevator
308	9	172	21-Jun	23:05	1:14	
308	10	173	22-Jun	1:14	3:04	
308	11	173	22-Jun	3:04	4:57	Deploy MAV 49 @ start of tape
308	12A	173	22-Jun	4:57	6:47	This and the next were both labeled 12
308	12B	173	22-Jun	6:47	8:47	This and the last were both labeled 12
308	13	173	22-Jun	8:47	9:18	Transit the tape was stopped
308	14	173	22-Jun	10:34	12:20	Get Mag. MEF
308	15	173	22-Jun	12:20	14:22	SFM #5
308	16	173	22-Jun	14:22	15:58	
308	17	173	22-Jun	15:58	17:47	
308	18	173	22-Jun	17:47	19:39	
308	19	173	22-Jun	19:39	21:36	Start with 300M transit
308	20	173	22-Jun	21:36	23:21	Start @ S. elevator
308	21	173	22-Jun	23:21	1:06	MAV 54
308	22	174	23-Jun	1:08	2:43	
308	23	174	23-Jun	2:42	4:43	

Dive #	Tape #	Julian Day	Ship Day	Tape Start	Tape End	Comments	
308	24	174	23-Jun	4:43	6:27		
308	25	174	23-Jun	6:27	8:23		
308	26	174	23-Jun	8:24	10:13	Video Tape is blank, nothing was taped	no video
308	27	174	23-Jun	10:13	12:03		no video
308	28	174	23-Jun	12:05	13:40		no video
308	29	174	23-Jun	13:40	15:32		no video
308	30	174	23-Jun	15:32	17:27	Start of AST Survey	no video
308	31	174	23-Jun	17:27	19:13	AST Survey	no video
308	32	174	23-Jun	19:13	21:06	AST Survey	no video
308	33	174	23-Jun	21:06	22:52	AST Survey	no video
308	34	174	23-Jun	22:52	0:27	AST Survey	no video
308	35	174	23-Jun	0:27	2:12	AST line 2S	no video
308	36	175	24-Jun	2:12	4:02	AST line 2S	no video
308	37	175	24-Jun	4:02	5:53	AST line 2S	no video
308	38	175	24-Jun	5:53	7:38	AST line 2S	no video
308	39	175	24-Jun	7:39	9:29	Probaly Blue Screen recorded Tape stopped	no video
308	40	175	24-Jun	9:31	11:16		
308	41	175	24-Jun	11:16	13:00	AST line 2N	
308	42	175	24-Jun	13:00	14:32	AST line 2N	
308	43	175	24-Jun	14:33	16:28	AST line 2N	
308	44	175	24-Jun	16:28	18:19	AST line 3N	
308	45	175	24-Jun	18:19	20:10	AST line 3N	
308	46	175	24-Jun	20:10	22:01	AST line 4N	
308	47	175	24-Jun	22:01	23:57	Transit to Clam Bed	
308	48	175	24-Jun	23:57	1:43	Clam Bed	
308	49	176	25-Jun	1:43	3:45	Clam Bed	
308	50	176	25-Jun	3:45	5:41	Clam Bed	
308	51	176	25-Jun	5:41	6:50	Clam Bed	
			25-Jun	13:30	14:11	Stopped for 30M transit, Thermal Blanket	
308	52	176	25-Jun	14:11	16:15	SFM 4 and exploration	
308	53	176	25-Jun	16:15	18:18	Exploration	

Dive #	Tape #	Julian Day	Ship Day	Tape Start	Tape End	Comments	
308	54	176	25-Jun	18:18		Stopped because of transit	
				19:43	21:18	Started again for Sheryl's sampling	
308	55	176	25-Jun	21:18	0:30	Sheryl's Sampling, Temp Probe, White Smoker	
308	56	177	26-Jun	0:30	2:02	Magn. Low	
308	60	177	26-Jun	8:13	9:57	AST line and end of dive	
308	61	177	26-Jun	11:01	11:34		
309	61 Cont.	178	27-Jun	23:21		At seafloor	
309	62	179	28-Jun	1:13	3:14	Tower deployment	
309	63	179	28-Jun	3:14	4:16		
309	64	179	28-Jun	4:16	7:21	Entrainment exp.	
309	65	179	28-Jun	7:21	9:26	Entrainment exp. and recovery of MAV 57	
309	66	179	28-Jun	9:26	11:31	Entrainment exp.	
309	67	179	28-Jun	11:31	13:34	Biology Grab	
309	68	179	28-Jun	13:34	14:32	Still have 1 hour left	
				2:49	3:14	@ Beach let for transit	
		180	29-Jun	3:49	4:31		
309	69	180	29-Jun	4:31	6:32	MAV and thermal blanket mvmt.	
309	70	180	29-Jun	6:32	8:37		
309	71	180	29-Jun	8:37	10:44	Moving maggies	
309	72	180	29-Jun	16:25	16:57	off to transit	
				17:22	17:35		
				18:18	19:36	at new field	
309	73	180	29-Jun	19:37	21:46		
309	74	180	29-Jun	23:46	1:43		
309	75	180	29-Jun	6:34	8:17	End of Dive	
310	76	181	30-Jun	6:34	8:17	Going to start of Line 14	
310	77	181	30-Jun	22:22	0:22		

Dive #	Tape #	Julian Day	Ship Day	Tape Start	Tape End	Comments	
310	78	182	01-Jul	0:22	2:13	Entrainment	
310	79	182	01-Jul	2:27	4:30		
310	80	182	01-Jul	4:30	6:34		
310	81	182	01-Jul	6:34	6:50	Recorded over?? Stopped 15min into it	
Note: Explanation of Screw-up: 81 recorded over last 16 minutes of 78;							
ok, only transit from entire site to entrainment site w/ MAV 50 and 57							
310	82	182	01-Jul	6:50			
				11:49	12:31		
310	83	182	01-Jul	12:31	14:37		
310	84	182	01-Jul	14:37	15:50		
				16:01	16:45	New vents in SE	
310	85	182	01-Jul	20:23	20:56	Thermal Blanket	
311	85 Cont.	183	02-Jul	6:40	8:05	Exploration	
311	86	183	02-Jul	8:05	10:10	Exploration	
311	87	183	02-Jul	10:10		Exploration	