ALPHA HELIX CRUISE HX260
Thursday 20th June 2002- Saturday 29th June 2002
BERING STRAIT CRUISE REPORT

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SCIENTIFIC PURPOSE:

This cruise had two main scientific goals.

The first (and foremost) was the recovery and redeployment of moorings in the Bering Strait. These moorings are part of a multi-year time-series (currently over 10 years long) of measurements of the flow through the Bering Strait. The properties of this flow not only influence the Chukchi and Beaufort Seas, but can also be traced across the Arctic to the Fram Strait and beyond. The long-term monitoring of the inflow into the Arctic Ocean via the Bering Strait is important for understanding climatic change both locally and in the Arctic.

Three moorings (A2 and A4, in the eastern channel of Bering Strait, and A3, c.35nm north of Bering Strait), which were deployed from the Alpha Helix last year, were recovered and redeployed. All the moorings carry conventional instrumentation - current meters (RCM), temperature and salinity sensors (SBE16). In addition, moorings A2 and A3 carry Upward-Looking-Sonars (ULS). The new mooring A4 carries an upward-looking ADCP to study the coastal jet. Mooring A3 also supports a nutrient sampler from UAF, and the replacement mooring carries in addition a transmissometer, a fluorometer and a PAR sensor, all connected to the SBE16. The current meters and ULSes allow the quantification of the movement of ice and water through the strait. The nutrient sampler and the optical sensors should yield the first biophysical time series measurements in the region, greatly advancing our understanding of the biological system in the Bering Strait and Chukchi Sea.

The second aim of the cruise was to conduct a hydrographic and ADCP survey of the Bering Strait and the southern part of the Chukchi Sea, concentrating on sections in the vicinity of the moorings and the region north of the mooring sites. These CTD and nutrient measurements will be used to calibrate the moored instruments and to give a framework for the analysis of the data. The hydrographic lines repeated and extended the surveys from previous years, allowing an interannual comparison.

Our application to work in the Russian EEZ, submitted in December 2001, was turned down in June 2002. Thus, all section and mooring work was confined to the US EEZ or international waters.

In addition to maintaining the time series measurements in Bering Strait, this work will also act as a upstream boundary condition for the NSF SBI (Shelf Basin Interaction) program, which starts its field work sampling this year.

CRUISE OBJECTIVES:

1. To recover moorings A2-01, A3-01 and A4-01 (see Table 1).
2. To deploy moorings A2-02, A3-02 and A4-02. As time/weather permits, to run hydrographic casts (CTD and nutrients) and ADCP sections in the vicinity of the moorings and in the southern region of the Chukchi Sea (see Table 2 and Figure 1).

Due to exceptionally good weather, all the cruise objectives were successfully accomplished. The moorings were recovered and redeployed, and a total of 98 CTD stations, and corresponding ADCP lines were run. Sampling details are provided below.

CRUISE SCHEDULE:

(Times are generally to the nearest half hour, and are in AKDS time, i.e. GMT-8hrs. The map in Figure 1 gives the location of the CTD and ADCP lines.)

20th June 2002	Join Alpha Helix at 9am, sail from Dutch Harbor at 1125
21st June 2002	Transit to Bering Strait
	0705 Primary productivity station at site M2
22nd June 2002	Transit to Bering Strait
23rd June 2002	Arrive Bering Strait at 1410
	1410 Primary Productivity Station at site A2
	1530-2100 CTD section along BS line
	2100-2400 ADCP section along BS line
24th June 2002	0100-0400 ADCP section along MBS line
	0400-0830 CTD section along MBS line
	0900-1100 Recover and redeploy A4
	1200-1330 Recover and redeploy A2
	1730-1930 Recover and redeploy A3
	1930-0230 CTD section along A3L line
25th June 2002	0230-1000 ADCP line along A3L line
	0947 Primary Productivity Station at site A3
	1500-0530 CTD and ADCP along PHL line
26th June 2002	0530-1130 ADCP out to CCL line
	1130-2400 CTD section along CCL line, including
	1656 Primary Productivity Station at CCL15
27th June 2002	0000-1000 ADCP section along CHUK and EEXT lines
	1000-2030 CTD section along EEXT and CHUK lines
	2030-0230 CTD section along CCL line (continued)
28th June 2002	0230-0900 ADCP section along NBS line
	0900-1700 CTD section along NBS line
	1700-1930 CTD section along CCL line (continued)
	1930 Close of science, steam for Nome
29th June 2002	arrive Nome ca.0700 and disembark

SAMPLING:

Due to the exceptionally good weather we encountered, we were able to complete the mooring work and an extended CTD and ADCP plan.

Mooring Work:
All three moorings (see Table 1) were successfully and smoothly recovered and redeployed. Releases functioned well. All instrumentation was recovered in good condition. Unlike in previous years (when mooring recoveries took place in the autumn), the moorings were not badly fouled and the rotors and salinity cells were reasonably clear of biological growth.
Of the three RCMs, two gave good data. The third (A2) developed a battery short before deployment and recorded no data. The three SBEs appear to have run well. The ULSes were still working on recovery and binary data was successfully downloaded. Although both records were complete, one ULS (A2) did not record any echo returns after January. The nutrient analyzer ran for ca. 1 month before a mechanical plunger jammed. (The unused chemicals from the analyzer were still in good condition after a year in the water.)

CTD and ADCP section work:
See Figure 1 and Table 2 for the CTD and ADCP sections ran. A total of 98 CTD casts were taken. (Three profiles were recast since the CTD acquisition software crashed part-way through the up-cast.) Preliminary section plots are given in an Appendix. Bottles were fired at standard depths (bottom, bottom-2m, 50m, 40m, 30m, 20m, 10m, 5m, surface) and samples were taken for nutrients, DMS, chlorophyll, O18 isotopes, nitrogen isotopes and salinity. With the exception of the PHL and CCL lines, ADCP sections were run as dedicated sections at a speed of 7 knots.

Nutrient Analysis work (Whitledge, Thornton, Lee):
A total of 536 nutrient samples were taken and analyzed on board for silicate, phosphate, nitrate, nitrite and ammonia by Whitledge, Thornton and Lee. Preliminary section plots are included as an appendix. In addition, at many stations samples were taken at surface, mid water column and bottom for chlorophyll, and at some stations samples were taken for size-fractionated chlorophyll, fractionated on 20um, 5um and GF/F filters. At the four sites M2, A2, A3 and CCL15, primary productivity stations (stable isotope nutrient enrichment primary productivity experiments with 15N-labeled nitrate and ammonia and 13C-labeled carbon) were also run.

DMS Analysis work (Deal):
DMS sea water profiles were taken at 18 stations, namely
June 23: A2-P
June 24: A4, A2, A3
June 25: PHL1, PHL6, PHL11
June 26: CCL12
June 27: EEXT3, CHUK10, CHUK7, CHUK2, CCL08
June 28: A3, NBS11, NBS7, NBS2, NBS1.
These samples were analyzed on board by Deal.

Oxygen isotope sampling (Woodgate for Cooper, Tennessee):
A total of 379 water samples were taken for O18 sampling. Samples were taken at all stations except some of the productivity stations (see bottle list in an appendix). These samples were sealed with parafilm and shipped to Lee Cooper at the University of Tennessee for later analysis. To ensure the integrity of the bottle samples, when possible salinity samples (ca. 200) were taken from the bottles used for O18 samples.

Nitrogen Isotope sampling (by Deal for Tanaka, IARC/UAF)
Nine water samples (3 each at sites A2, A3 and A4) were taken for nitrogen isotope analysis. These samples will be analysed post cruise by Dr Tomoyuki Tanaka, IARC/UAF.

Underway sampling:
Seachest data showed evidence of some remarkable fronts during transit and in the work area. For example, passing St Lawrence Island in the early evening, we encountered a few remaining small pieces of ice and a remarkably strong front in surface temperature and salinity.
The flow through Bering Strait was generally towards the south, reflecting the southward winds. For the first few days in Bering Strait, the coastal jet was not easily identifiable (though a more comprehensive check of the ADCP data is required to confirm this). For the latter part of the cruise, although the general flow was still southward, there did appear to be some evidence of the boundary current.

FIGURE 1: Overview Map of the Work Area

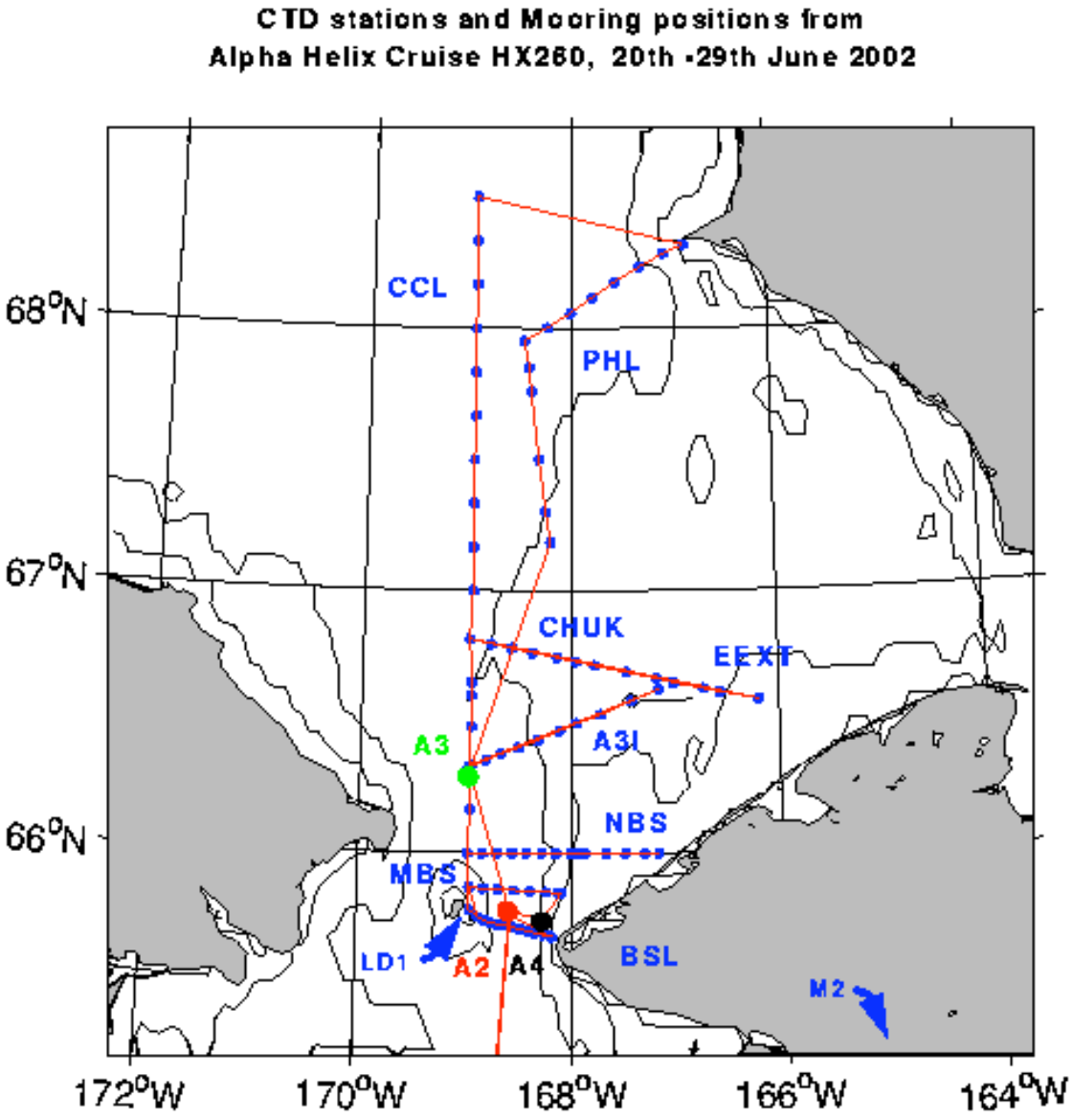

TABLE 1: Mooring Positions and Instrumentation

ID	LATITUDE (N)	LONGITUDE (W)	WATER DEPTH /m	INST.
Recovered				
A2-01	65° 46.76'	168° 34.52'	56	ULS RCM7 SBE16
A3-01	66° 19.58'	168° 58.03'	57	ULS RCM9 SBE16 NAS-2E
A4-01	65° 44.73'	168° 15.83'	48	RCM7 SBE16
Deployed				
A2-02	65° 46.77'	168° 34.53'	56	ULS RCM7 SBE16
A3-02	66° 19.56'	168° 58.03'	57	ULS RCM11 SBE+TF NAS-2E
A4-02	65° 44.70'	168° 15.78'	49	ADCP SBE16

ULS = APL Upward Looking Sonar
RCM7 = Aanderaa Mechanical Recording Current Meter
RCM9 = Aanderaa Acoustic Recording Current Meter
SBE16 = Seabird CTD recorder
SBE+TF = Seabird CTD recorder with transmissometer, fluorometer and PAR sensor
NAS-2 = Nutrient Analyzer
ADCP = RDI Acoustic Doppler Current Profiler

TABLE 2: CTD Positions

Name	#	Time (GMT)	Stat	Lat(N)	Long(W)	D	P-	P+
hx2600001	1	Jun 21 2002 15:05	m2	57 5.83	165 5.22	72	3.1	69.8
hx2600002	2	Jun 23 2002 22:13	a2p	65 45.80	168 34.09	57	2.2	52.2
hx2600003	3	Jun 23 2002 23:42	bsl6	65 40.93	168 10.89	26	1.6	28.3
hx2600004	4	Jun 24 2002 00:17	bsl5	65 41.37	168 15.22	42	2.0	45.1
hx2600005	5	Jun 24 2002 00:46	bsl5	65 41.78	168 19.52	51	2.5	53.7
hx2600006	6	Jun 24 2002 01:23	bsl4.5	65 42.15	168 24.01	54	1.1	51.3
hx2600007	7	Jun 24 2002 01:49	bsl4	65 42.62	168 28.20	51	2.2	52.5
hx2600008	8	Jun 24 2002 02:18	bsl3.5	65 43.05	168 32.38	54	1.9	54.8
hx2600009	9	Jun 24 2002 02:46	bsl3	65 43.50	168 36.98	54	1.4	51.0
hx2600010	10	Jun 24 2002 03:22	bsl2.5	65 43.72	168 40.86	50	1.7	51.4
hx2600011	11	Jun 24 2002 03:46	bsl2	65 44.12	168 45.04	50	2.2	52.8
hx2600012	12	Jun 24 2002 04:19	bsl1.5	65 44.75	168 48.65	50	1.9	52.6
hx2600013	13	Jun 24 2002 04:45	bsl1	65 45.49	168 52.12	40	2.2	42.6
hx2600014	14	Jun 24 2002 12:03	mbs1	65 52.09	168 57.04	43	2.0	41.8
hx2600015	15	Jun 24 2002 12:40	mbs2	65 51.88	168 49.05	50	2.1	50.3
hx2600016	16	Jun 24 2002 13:14	mbs3	65 51.69	168 40.94	51	2.1	51.4
hx2600017	17	Jun 24 2002 13:48	mbs4	65 51.55	168 31.92	55	1.9	51.8
hx2600019	19	Jun 24 2002 14:37	mbs5	65 51.37	168 23.01	50	2.2	51.3
hx2600020	20	Jun 24 2002 15:13	mbs6	65 51.13	168 13.92	50	2.3	46.7
hx2600021	21	Jun 24 2002 15:45	mbs7	65 50.96	168 6.93	40	2.3	38.5
hx2600022	22	Jun 24 2002 16:05	mbs8	65 50.93	168 5.04	32	2.6	30.7
hx2600023	23	Jun 24 2002 17:44	a4-01	65 44.68	168 15.94	45	2.1	46.5
hx2600024	24	Jun 24 2002 20:49	a4	65 46.74	168 34.36	54	2.1	53.8
hx2600025	25	Jun 25 2002 02:18	a3	66 19.58	168 58.18	54	2.5	53.4
hx2600026	26	Jun 25 2002 04:14	A3L2	66 21.26	168 48.38	57	2.5	53.6
hx2600027	27	Jun 25 2002 04:49	A3L3	66 22.75	168 39.81	59	2.4	55.5
hx2600028	28	Jun 25 2002 05:31	A3l4	66 24.13	168 30.22	55	2.0	52.1
hx2600029	29	Jun 25 2002 06:35	A3L5	66 25.89	168 18.67	50	2.4	47.1
hx2600030	30	Jun 25 2002 07:16	A3L6	66 28.09	168 6.35	30	2.4	27.7
hx2600031	31	Jun 25 2002 07:51	A3L7	66 29.71	167 56.77	25	2.7	22.5
hx2600032	32	Jun 25 2002 08:32	A3L8	66 31.71	167 42.82	27	2.6	25.0
hx2600033	33	Jun 25 2002 09:25	A3L9	66 34.75	167 25.32	32	2.2	29.7
hx2600034	34	Jun 25 2002 10:13	A3L10	66 37.41	167 9.23	35	2.6	30.5
hx2600035	35	Jun 25 2002 17:51	a3lp	66 20.17	168 56.15	54	2.2	53.8
hx2600036	36	Jun 25 2002 23:19	phl1	67 11.04	168 11.90	36	2.1	36.7
hx2600037	37	Jun 26 2002 00:14	phl2	67 18.07	168 14.93	45	2.1	42.2
hx2600038	38	Jun 26 2002 01:34	phl3	67 30.08	168 18.93	50	2.2	45.9
hx2600039	39	Jun 26 2002 03:21	PHL4	67 45.60	168 23.69	53	2.4	47.6
hx2600040	40	Jun 26 2002 04:18	PHL5	67 51.02	168 24.95	54	2.5	50.8
hx2600041	41	Jun 26 2002 05:30	phl6	67 57.13	168 28.16	60	2.2	56.6
hx2600042	42	Jun 26 2002 06:38	phl7	68 0.15	168 14.05	60	2.3	56.5
hx2600043	43	Jun 26 2002 07:42	PHL8	68 3.55	168 0.05	58	2.6	53.9
hx2600044	44	Jun 26 2002 08:51	phl9	68 7.05	167 47.04	55	2.3	51.8
hx2600045	45	Jun 26 2002 09:55	PHL10	68 10.48	167 33.54	51	2.2	48.0
hx2600046	46	Jun 26 2002 11:05	PHL11	68 14.02	167 17.98	48	2.3	44.7
hx2600047	47	Jun 26 2002 12:10	PHL12	68 17.06	167 3.11	41	2.3	37.0
hx2600048	48	Jun 26 2002 13:07	PHL13	68 19.03	166 50.69	31	2.5	27.6
hx2600049	49	Jun 26 2002 19:33	ccl19	68 29.98	168 56.98	55	2.1	51.5

hx2600050	50	Jun 26 2002 20:49	ccl18	68	19.99	168	56.95	55	1.7	53.3
hx2600051	51	Jun 26 2002 22:05	ccl17	68	10.05	168	56.88	58	2.8	56.4
hx2600052	52	Jun 26 2002 23:20	ccl16	67	59.97	168	56.97	62	3.0	57.0
hx2600053	53	Jun 27 2002 00:34	ccl15	67	49.98	168	56.78	53	2.3	50.1
hx2600054	54	Jun 27 2002 00:56	ccl15P	67	50.06	168	57.16	53	2.3	42.4
hx2600055	55	Jun 27 2002 02:08	ccl14	67	40.03	168	56.75	53	2.3	48.5
hx2600056	56	Jun 27 2002 03:17	ccl13	67	29.99	168	57.10	52	2.7	48.1
hx2600057	57	Jun 27 2002 04:24	CCL12	67	19.99	168	57.17	51	2.4	47.4
hx2600058	58	Jun 27 2002 05:34	CCL11	67	9.96	168	57.07	50	2.3	46.7
hx2600059	59	Jun 27 2002 06:46	CCL10	66	60.00	168	56.98	50	2.4	45.9
hx2600060	60	Jun 27 2002 08:04	CHUK1	66	48.93	168	58.30	44	2.0	42.7
hx2600061	61	Jun 27 2002 18:08	EEXT3	66	34.97	166	11.91	15	1.9	13.2
hx2600062	62	Jun 27 2002 19:14	EEXT2	66	36.64	166	33.82	26	2.4	20.7
hx2600063	63	Jun 27 2002 19:51	EEXT1	66	37.52	166	43.74	30	1.4	29.0
hx2600064	64	Jun 27 2002 20:52	chuk10	66	38.89	167	0.95	35	1.6	31.0
hx2600066	66	Jun 27 2002 21:52	chuk9	66	39.94	167	10.55	32	1.9	31.9
hx2600067	67	Jun 27 2002 22:52	chuk8	66	41.41	167	27.99	30	1.7	30.3
hx2600068	68	Jun 27 2002 23:53	chuk7	66	42.88	167	46.00	27	2.0	28.7
hx2600069	69	Jun 28 2002 00:37	chuk6	66	43.81	167	57.05	28	1.5	28.6
hx2600070	70	Jun 28 2002 01:17	chuk5	66	44.82	168	8.01	31	1.9	29.2
hx2600071	71	Jun 28 2002 02:04	chuk4	66	45.86	168	22.01	34	1.6	30.7
hx2600072	72	Jun 28 2002 02:45	chuk3	66	46.86	168	34.11	34	2.5	30.6
hx2600073	73	Jun 28 2002 03:27	chuk2	66	47.87	168	46.00	44	2.1	39.3
hx2600074	74	Jun 28 2002 04:16	chuk1	66	48.86	168	58.19	48	3.0	44.5
hx2600075	75	Jun 28 2002 05:25	CCL08	66	39.00	168	57.10	46	2.5	41.4
hx2600076	76	Jun 28 2002 05:53	CCL07	66	36.03	168	57.21	48	2.1	44.1
hx2600077	77	Jun 28 2002 06:46	CCL06	66	28.95	168	57.15	58	2.0	55.7
hx2600078	78	Jun 28 2002 07:54	A3	66	19.40	168	58.22	58	2.7	55.4
hx2600079	79	Jun 28 2002 09:03	CCL4	66	10.04	168	57.16	58	1.8	54.4
hx2600080	80	Jun 28 2002 10:16	NBS1	65	59.96	168	58.15	55	2.6	51.6
hx2600081	81	Jun 28 2002 16:55	nbs14	65	59.97	167	10.16	10	0.9	7.4
hx2600082	82	Jun 28 2002 17:24	nbs13	65	59.93	167	18.13	13	2.5	10.9
hx2600083	83	Jun 28 2002 17:58	nbs12	65	59.94	167	29.10	18	2.4	15.1
hx2600084	84	Jun 28 2002 18:34	nbs11	65	59.92	167	40.12	15	2.1	15.0
hx2600085	84	Jun 28 2002 19:24	nbs10	66	0.03	167	51.99	12	1.0	9.4
hx2600086	86	Jun 28 2002 19:40	nbs9	65	59.98	167	55.11	20	1.9	19.3
hx2600087	87	Jun 28 2002 20:02	nbs8	65	60.00	167	59.94	34	2.2	32.6
hx2600088	88	Jun 28 2002 20:35	nbs7	65	59.97	168	8.36	45	3.1	47.8
hx2600090	90	Jun 28 2002 21:28	nbs6	65	59.99	168	16.43	50	2.2	53.5
hx2600091	91	Jun 28 2002 22:08	nbs5	65	59.98	168	25.03	55	2.0	56.9
hx2600092	92	Jun 28 2002 22:51	nbs4	66	0.02	168	33.16	52	2.3	54.7
hx2600093	93	Jun 28 2002 23:33	nbs3	65	59.96	168	41.57	52	2.8	52.5
hx2600094	94	Jun 29 2002 00:10	nbs2	65	59.97	168	49.88	52	2.6	52.9
hx2600095	95	Jun 29 2002 00:47	nbs1	65	59.97	168	58.13	51	1.7	51.8
hx2600096	96	Jun 29 2002 01:49	mbs1	65	52.17	168	57.18	42	2.2	43.9
hx2600097	97	Jun 29 2002 02:33	LD-1	65	47.03	168	57.06	36	1.9	32.5
hx2600098	98	Jun 29 2002 03:11	BSL1	65	45.54	168	52.30	46	2.2	41.4

(D = approximate water depth in m)
(P-, P+ = min/max pressure of CTD in dbar)