Data Synopsis for HLY0902

April 03 – May 12, 2009

Dutch Harbor to Dutch Harbor

Chief Scientist- Carin Ashjian

Co-Chief Scientist- Evelyn Lessard

Healy Captain- Captain Frederick Sommer

Photo by Chris Linder, Woods Hole Oceanographic Institution

Prepared by: Tom Bolmer, David Forcucci, David Hassilev, Steve Roberts, & Dale Chayes

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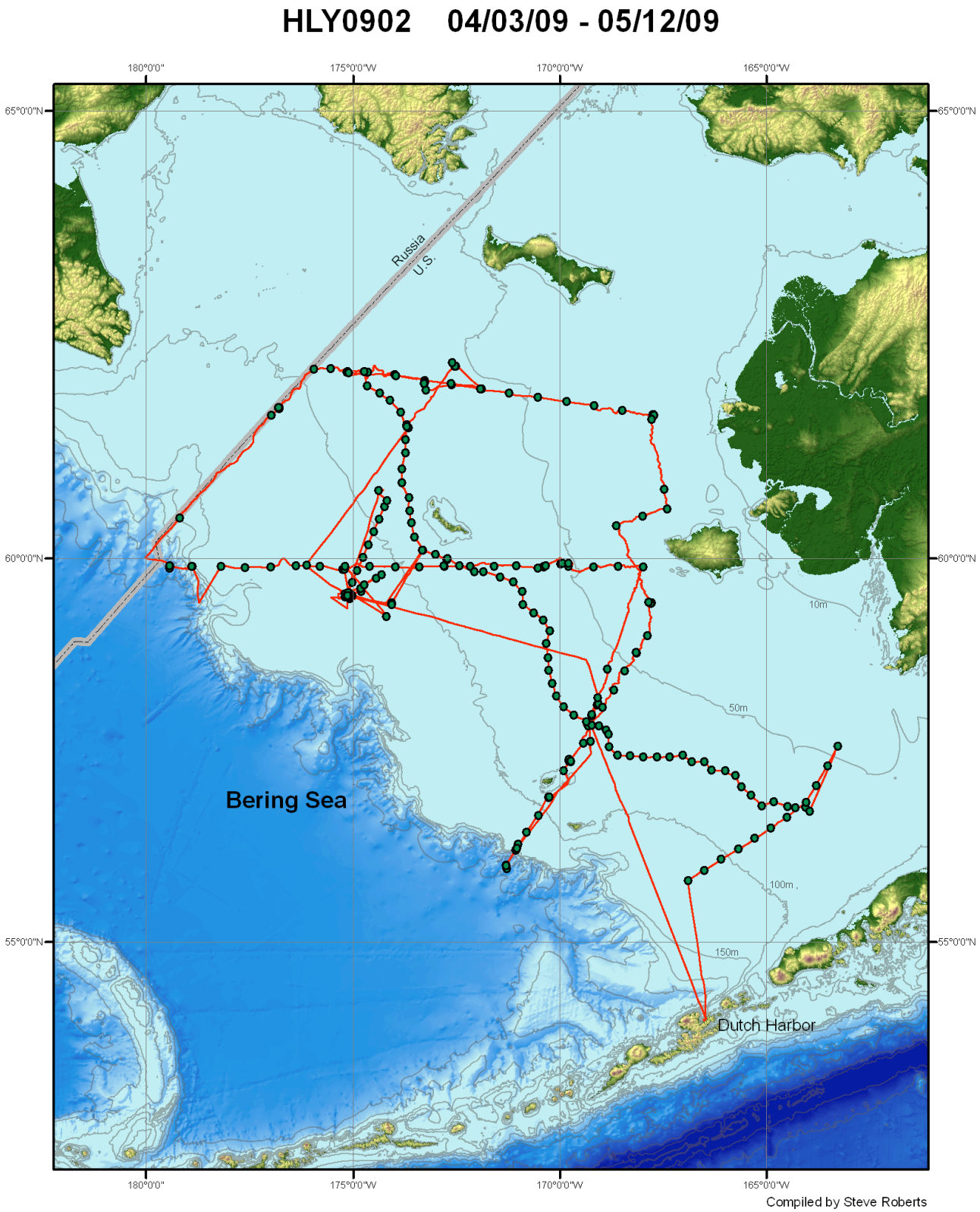
Project Summary

HLY0902 – Bering Ecosystem Study and Bering Sea Integrated Research Program Spring Cruise

The overall objective of this cruise is to describe the lower trophic levels of the Bering Sea ecosystem under varying conditions of ice cover in order to better understand ecosystem response to ongoing changes in climate, ice cover (extent of ice cover and timing of ice formation and retreat), and accompanying oceanographic conditions. Twelve projects are supported on cruise HLY0902 on board the USCGC Healy in the Bering Sea during April 3 – May 12, 2009. Sampling was conducted across three major east-west transects of the shelf, along the 70 m isobath from ~70 miles south of St. Lawrence Island to ~200 m north of Dutch Harbor, AK, and in a region of the middle shelf where an ice-edge bloom was developing. This scheme permitted sampling of different regions of the shelf under varying conditions of ice cover. A range of sampling activities was supported including water column sampling using CTD/Niskens, plankton nets, floating sediment traps, and a Video Plankton Recorder, benthic sampling using Van Veen Grabs and Multicore, and on-ice sampling both directly from the ship via personnel deployment on the ice and from helicopter landings on more remote ice floes. Underway sampling of basic hydrographic, meteorological, and bathymetric parameters also was conducted. An IPY media team was aboard to document the cruise through photographs and text and to facilitate communication with museum groups. A grade school teacher participated in the cruise through the ARCUS Polar Trec program.

Cruise Track



Personnel

HLY0902 Science Party Personnel

Name	Institution	Position	Phone	Email	Date on	Date off	Nationality	PI Group
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Alley, Tysin FS3
Angelo, James YNC
Appleberry, Jason LT
Ayers, Silas LT
Baldwin, Robin FS3
Bartlett, Charles MST1
Beasley, Corey HSCS
Beebe, Brandon FN
Bender, Zachary LTJG
Berringer, Mike ETC
Braddock, Amelia R. SN
Brogan, John MKC
Brown, Betty MK3
Buford, Aimee BM2
Chaidez, Marshal MST3
Coates, Brittney FN
Cooler, Jesse SA
Coombe, Jeffrey MK2
Dabe, Jeffrey IT1
Davis, Jonathon ET2
Dolton, Peter ENS
Dowd, Robert SN
Dull, Steven FS2
Dunning, Lara BM2
Fernandez, Chelsey SN
Ford, Angela SN
Galvez, Oscar R. LT
Glenzer, William BM1
Gray, Deidre SN
Griffin, Bobby SK2
Hamilton, H. Mark FS3
Harbinsky, Mark ET2
Harris, Daniel SK1
Howard, Daniel DC3
Huneycutt, Gaines BM1
Hurtado, Daniell EM1
Imgarten, Christopher DC1
Irwin, Paul EM2
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Kruger, Thomas MST3
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Laisure, Jeremy SK2
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Manangan, Sorjen OSC
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Merten, James BM3
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Murphy, Nicholas MK1
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Myatt, Lisa ENS
Olson, James EM3
O'Sullivan, Brandon MK2
Passalacqua, Joseph ETCM
Podhora, Curtis EMCM
Powell, Gregory ET3
Quichocho, Robert MK1
Redd, Davion DC2
Rieg, Mark MSTC
Rodermund, Michael, SA
Rose, John CWO
Roy, Evan BM3
Rudibaugh, Kenneth MK1
Schendorf, Tara ENS
Shaffer, Hans EM1
Siciak, Anthony MK3
Smith, Corey MK2
Starling, Wendy MK2
Stein, Kelsey FN
Swanson, Shawn ET1
Thomas, Tasha LTJG
Von Kauffmann, Daniel IT1
Whiting, Allan, MK1
Williams, Tony FSCS
Wilson, Thomas BMCM
Yeckley, Andy BM2
Zitting, Arrene FS1

Science Components and their Major Sampling Activities

Projects and Descriptions

BEST: Sea Ice Algae, a Major Food Source for Herbivorous Plankton and Benthos in the Eastern Bering Sea (NSF ARC-0732767)

PIs: Rolf Gradinger, Bodil Bluhm, Katrin Iken (UAF)

Cruise Participants: Katrin Iken, Jared Weems, Heloise Chenelot

Abundance, biomass, community composition and productivity of sea ice algae and phytoplankton. Salinity, temperature, and nutrient concentrations in ice cores and under-ice water, ice thickness, snow cover and light regime. Sedimenting material, stable isotope ratios ($d^{13}C$, $d^{15}N$) and algal community composition. On-ice sampling with ice augers, ice-tethered sub-ice sediment traps, plankton nets, benthic grabs. Occasional small boat.

BEST: Mesozooplankton-microbial food web interactions in a climatically changing sea ice environment (NSF ARC-0732301, -0732362, -0732382)

PIs: Evelyn Sherr and Barry Sherr (OSU), Robert Campbell (URI), Carin Ashjian (WHOI)

Cruise Participants: Carin Ashjian, Celia Gelfman, Celia Ross, Julie Arrington, Donna van Keuren

Mesozooplanton/microzooplankton grazing rates and grazing impacts; high resolution vertical and horizontal distribution of plankton from Video Plankton Recorder. Plankton nets, CTD, Video Plankton Recorder

BEST: A Service Proposal to Examine Impacts of Sea-ice on The Hydrographic Structure and Nutrients Over the Eastern Bering Sea Shelf (NSF ARC-0732430, -0732640)

PIs: Whitledge (UAF), Sonnerup (U. Washington), (Stabeno (NOAA))

Cruise Participants: Calvin Mordy, Jessica Cross, Daniel Naber, Nancy Kachel, David Kachel, Ned Cokelet

Hydrography, nutrients, and chlorophyll. CTD sampling.

BEST: A service proposal to examine impacts of sea-ice on the distribution of chlorophyll-a over the eastern Bering Sea shelf. (NSF ARC-0813985)

PIs: Rolf Sonnerup (UW), T. Whitledge (UAF)

Cruise Participants: Calvin Mordy, Jessica Cross, Daniel Naber, Nancy Kachel, David Kachel, Ned Cokelet

BEST: The Trophic Role of Euphausiids in the eastern Bering Sea: Ecosystem Responses to Changing Sea-ice Conditions (NSF ARC-0732389, -0732667)

PIs: Evelyn Lessard (UW), Rodger Harvey (U Maryland)

Cruise Participants: Evelyn Lessard, Rodger Harvey, Tracy Shaw, Rachel Pleuthner, Megan Bernhardt, Virginia Endel

Age structure and diet history of important euphausids; euphausiid grazing rates and growth and trophic lipid markers. CTD, plankton nets, on ice sampling.

BEST: Nitrogen supply for new production and its relation to climatic conditions on the eastern Bering Sea Shelf. NSF ARC-0612427, -0612198

PIs: Raymond Sambrotto (LDEO-Columbia), Daniel Sigman (Princeton)

Cruise Participants: Didier Burdloff, Kris Swenson

New (nitrate) and regenerated nitrogen production; nitrogen isotope ratios. CTD.

BEST: Denitrification and global change in Bering Sea shelf sediments (NSF ARC-0612436, -0612380)

PIs: Allan Devol (U. Washington), David Shull (Western Washington U.)

Cruise Participants: David Shull, Heather Whitney, Maggie Esch

Profiles and fluxes of oxygen, nitrate, ammonium, phosphate and silicate in the sediment; measurement of ^{222}Rn and ^{210}Pb. Benthic coring with multicore; AUV work under ice.

BEST: The Impact of Changes in Sea Ice Extent on Primary Production, Phytoplankton Community Structure, and Export in the eastern Bering Sea (NSF ARC-0732680, -0732359)

PIs: Brad Moran (URI), Mike Lomas (BBIOS)

Cruise Participants: Mike Lomas, Pat Kelly, Doug Bell

Gross and net primary production using traditional ^{14}C, ^{13}C methods, and triple oxygen isotope technique and dissolved oxygen concentrations. Water column fluxes of particulates along the slope. Sinking rates of particulates. CTD and floating sediment traps.

North Pacific Pelagic Seabird Observer Program (NPRB Project 637)

PIs: Kathy Kuletz, David Irons (USFWS)

Cruise Participants: Liz Labunski, Marty Reedy

Seabird abundance and composition relative to oceanography. Visual observations.

Bering Ecosystem Study Data Management Support (NSF ARC-0808853)

PIs: Jim Moore, Greg Stossmeister, Steve Williams (NCAR/EOL)

Cruise Participants: Janet Scannell

Develop an on-line field catalog including project documentation and data browsing capabilities during the cruise. The catalog is continually updated throughout the cruise and is expected to contain: map plots of ship and station locations, ice observation summaries and photos, periodic chief scientist reports, event log, a station summary table, preliminary analyses by onboard scientists, and access to preliminary bottle and CTD data. After the cruise the field catalog will be moved to a more permanent location on EOL's website and sensitive data will be password protected to limit distribution to BEST-BSIERP PIs only. EOL will also provide archival services for all data collected during this cruise.

Assessment of Mesozooplankton Population and Biomass in the Eastern Bering Sea for Spring and Summer of 2008, 2009 and 2010.

PIs: Ken Coyle and Alexei Pinchuk (UAF).

Cruise Participants: Alexei Pinchuk

Determine the mesozooplankton species composition, abundance, and biomass of the eastern Bering Sea during each of two cruises per year for three BEST field seasons using MOCNESS (in open water only) and CalVET plankton nets.

IPY: Collaborative Research: Live from the Poles; A Multimedia Educational Experience. (NSF DRL-0632219)

PI: Chris Linder

Cruise Participants: Chris Linder and Helen Fields

This project brings together polar researchers, science centers and broadcast media reporters to tell the story of polar research expeditions to the general public, teachers and students. A photographer (Linder) and a science writer (Helen Fields) will participate in the cruise. Information will be disseminated via the web and via several scheduled real-time phone patches to audiences at a range of museums including the Smithsonian Natural History Museum and at other media outlets.

POLAR TREC: Participation of teachers in Arctic science field work.

Cruise Participant: Simone Welch

Table of Projects and Members

Project	PIs	Healy Team	Sampling Activities
Sea Ice Algae, a Major Food Source for Herbivorous Plankton and Benthos in the Eastern Bering Sea	Rolf Gradinger, Katrin Iken, Bodil Bluhm	Katrin Iken, Jared Weems, Heloise Chenelot	On-ice sampling, vertical nets, Van Veen grabs, CTD and water sampling, ice sampling by helicopter
Mesozooplankton-microbial food web interactions in a climatically changing sea ice environment	Evelyn Sherr, Barry Sherr, Carin Ashjian, Robert Campbell	Carin Ashjian, Philip Alatalo, Celia Gelfman, Celia Ross, Julie Arrington, Donna Van Keuren	Plankton nets, water from CTD, Video Plankton Recorder
A Service Proposal to Examine Impacts of Sea-ice on The Hydrographic Structure and Nutrients Over the Eastern Bering Sea Shelf	Terry Whitledge and Rolf Sonnerup	Nancy Kachel, David Kachel, Calvin Mordy, Dan Naber, Ned Cokelet, Jessica Cross	CTD sampling, nutrient and chlorophyll analysis, oxygen analysis, underway sampling, on-ice sampling
The Trophic Role of Euphausiids in the eastern Bering Sea: Ecosystem Responses to Changing Sea-ice Conditions	Evelyn Lessard and Rodger Harvey	Evelyn Lessard, Rodger Harvey, Tracy Shaw, Megan Bernhardt, Rachel Pleuthner, Virginia Engel	Bongo nets, CTD and water sampling, on ice sampling
Nitrogen supply for new production and its relation to climatic conditions on the eastern Bering Sea Shelf	Raymond Sambrotto and Daniel Sigman	Kris Swenson, Didier Burdloff	CTD and water sampling, on ice sampling and incubations, small plankton net, underway water sampling
Denitrification and global change in Bering Sea shelf sediments	Allan Devol and David Shull	David Shull, Heather Whitney, Maggie Esch	Multicore benthic sampling, water sampling from CTD, on ice sampling
The Impact of Changes in Sea Ice Extent on Primary Production, Phytoplankton Community Structure, and Export in the eastern Bering Sea	Brad Moran and Mike Lomas	Mike Lomas, Pat Kelly, Doug Bell	CTD and water sampling, on-ice sampling, floating sediment traps
North Pacific Pelagic Seabird Observer Program	Kathy Kuletz and David Irons	Liz Labunski, Marty Reedy	Seabird and marine mammal observations while underway
Bering Ecosystem Study Data Management Support	Jim Moore, Greg Stossmeister, and Steve Williams	Janet Scannell	Event and data organization, web serving, and archiving

Project	PIs	Healy Team	Sampling Activities
Assessment of mesozooplankton population and biomass in the eastern Bering Sea for spring and summer of 2008, 2009, and 2010	Ken Coyle and Alexei Pinchuk	Alexei Pinchuk	CalVET nets and MOCNESS plankton net sampling system
Live from the Poles; A Multimedia Educational Experience.	Chris Linder	Chris Linder and Helen Fields	Photography, web dissemination of information, teleconferences with museums
Polar Trec	ARCUS	Simone Welch	Teacher Participation in Arctic research. Daily web journals, teleconference with schools.

Distribution Contents

Introduction to Data

The Healy data acquisition systems continuously log data from the instruments used during the cruise. This document describes:

- The structure and organization of the data on the distribution media.
- The format and contents of the data strings.
- Formulas for calculating scaled, calibrated values from logged data.
- Information about the specific instruments in use during the cruise.
- A log of instrumentation issues, adjustments , acquisition problems, and events during the cruise that may affect the data.
- Calibration data for the instruments in use during the cruise.

The data is distributed on a small USB disk drive.

***IMPORTANT**: Read the section, "Acquisition Problems and Events," for important information that may affect the processing of this data.*

There are two logging system on the Healy. The US Coast Guard Seattle Electronic Support Unit (ESU) runs the NOAA/SCS logging system and the LDEO support group runs the Lamont Data System (LDS) logging system. Although this provides some redundancy in logging, LDS is is required to provide precision time-stamping, real-time reformatting, and logging of data that SCS was not designed to support including the sonar systems, web cameras, and gravity meters.

The NOAA-developed Scientific Computer System (SCS) (version 4.2) is a data acquisition, and display system designed for Oceanographic, Atmospheric, and Fisheries research applications and was originally intended to log data from supporting sensors (not the mapping sonar's) on survey launches. It acquires sensor data from shipboard oceanographic, atmospheric, and fisheries sensors and provides this information to scientists in real time via text and graphic displays, while simultaneously logging the data to disk for later analysis. SCS also performs quality checks by monitoring I/O, providing delta/range checks and plotting data after acquisition.

The LDEO Data System (LDS) is derived the logging code originally developed on the R/V Conrad in 1986 and has evolved through use on the Conrad, Ewing, Nathaniel B. Plamer, R/V Gould, six SCICEX submarine cruises and a number of smaller, short field programs since 1987. LDS is the result of significant restructuring of the code base in 2004 and has been data acquisition system on the R/V Langseth since she went into service.

SCS Data Overview

SCS receives all of its data through asynchronous serial (RS-232) connections. In SCS a time tag is added at the beginning of each line of data in the form,

mm/dd/yyyy,hh:mm:ss.sss,[data stream from instrument] where:

Format	Value used
mm	2 digit month of the year
dd	2 digit ay of the year
yyyy	4 digit year
hh	2 digit hour of the day
mm	2 digit minute
ss.sss	seconds

An example string from the Seabeam Centerbeam file is:

04/13/2007,06:49:20.920,$SBCTR,2007,4,13,06:49:09.437,57.158792,-165.664322 ,69.15,60*00

All times are reported in UTC. Each file type has it's own NEMA string name ($SBCTR as an example).

The delimiters that separate fields in the raw data files are commas. Care should be taken when reprocessing the data that the field's separations are clearly understood.

By design, SCS separates different data records from a single serial data stream into different directories. For instance, a GPS receiver may transmit $GPGGA, $GPHDT, and $GPGLL records. In the SCS data architecture, each of these messages will be logged in a different directory.

LDS Data Overview:

LDS receives most of its data through serial ports like SCS and like SCS, prepends a time stamp. Unlike SCS, LDS uses remote nodes to acquire and timestamp data and provide it to the central LDS logger. Data from the two ship's gyrocompasses is handled by a remote node installed on the bridge and data form the two gravity meters is handled by a node in IC/Gyro. Remote nodes are substantively different than terminal servers in that they timestamp the data locally which eliminates the network latency associated with acquiring data through a terminal server and then providing the timestamp later.

An example LDS data record is shown below. The first field is the instrument identifier, the second is a precision time stamp and the remainder is the raw data from the device, in this case, an LDEO iLab BGM-3 gravity meter interface:

```
bgm222  2008:264:00:00:26.9340  04:025508 00
```

Directories:

1_Minute_Averaged_Data: This directory contains one minute averages of many of the the under way data types.

data: This directory contains the data directories below.

SCS_Data*:* This directory contains serial data collected by the SCS version 4.2 data collection system in different directories. Directory names are labeled by the

	instrument name and string type of the data collected. A description of the data contained in this directory is below.
LDS_Data*:*	This directory contains data collected by the Lamont LDS data collection system in different directories. Directory names are labeled by the name of the instrument. A description of the data contained in this directory is below.
Raw:	This directory contains raw data as recorded by individual instruments and put into different directories. Directory names are labeled by the instrument name. A description of the data contained in this directory is below.
Meta_data:	This directory contains documents useful in the post analysis of the data on this DVD media set. The data types are separated into different directories. A description of these directories is below.
Plots:	This directory contain daily and hourly plots of underway data that were generated in LDS.
Ice_observations:	Directories of the Ice Observations taken for the cruise.

1_Minute_Averaged_Data:

HLY0902_distance.csv.gz	Distance along track from port.
HLY0902_Averaged.csv.gz	All the Under way data averaged for 1 minute.
Shapefile	All of the 1 minute under way data averaged at 1 minute spacing in shp, shx and dbf GIS files.

data

SCS_Data:

/aft_a_frame	Wire tension, wire out, and wire speed for the Aft A frame winches.
/air_temp_f	Temperature data from the ship temperature snsor on the bridge in Fahrenheit. Data is derived from data from files in the rmyoung_air directory.
/air_temp3a_f	Temperature data from the MET3A sensor on top of the HCO shack in Fahrenheit. Data is derived from data from files in the met3a_sen directory.
/air_temp_bow	Temperature data from the temperature sensor on the Jackstaff in Fahrenheit.
/ashtech_attitude	Attitude in NMEA format from the Ashtech ADU5 GPS receiver.
/ashtech_gga	Position data in NMEA GGA format from the Ashtech ADU5 GPS receiver.
/ashtech_gll	Position data in NMEA GLL format from the Ashtech ADU5 GPS receiver.
/ashtech_hdt	Heading data in NMEA HDT format from the Ashtech ADU5 GPS receiver.
/flomet	Flow meter data just upstream of the TSG and Fluorometer.
/flomet_b	Flow meter data just upstream of the B TSG and Fluorometer. (if this second sensor is installed)
/fluro	Flurometer for the TSG sensor.
/fluro_b	Flurometer for B TSG sensor. (if this second sensor is installed)
/glonass_gga	Position data in NMEA GGA format from the GLONASS GPS receiver.

/glonass_gll	Position data in NMEA GLL format from the GLONASS GPS receiver.
/gyro_mk27	Heading data in NMEA HDT format from the Sperry MK27 gyro compass.
/gyro_mk39	Heading data in NMEA HDT format from the Sperry MK39 gyro compass.
/ibs_waypoints	Waypoints from the Healy's Integrated Bridge Syste.m
/isus	ISUS Nitrate Sensor small file.
/isus3v	ISUS Nitrate Sensor 3V full file.
/knudsen	Depth data in a proprietary PKEL format received from Knudsen 320 B/R serial output.
/met3a_sen	Meterology data from the top of the Jackstaff.
/oxygen	Oxygen values from the TSG.
/oxygen_b	Oxygen values from B TSG. (if this second sensor is installed)
/pcode_aft_gga	Position data in NMEA GGA format from the Trimble Centurion receiver located in the Computer lab.<
/pcode_aft_gll	Position data in NMEA GLL format from the Trimble Centurion receiver located in the Computer lab.
/pcode_aft_vtg	Course and speed over ground in NMEA VTG format from the Trimble Centurion receiver located in the Computer lab.
/pcode_aft_zda	Time and date data in the NMEA ZDA format. Data retrieved from the Trimble Centurion receiver located in the Computer lab.
/pcode_bridge_gga	Position data in NMEA GGA format from the Trimble GPS receiver located on the bridge.
/pcode_bridge_gll	Position data in NMEA GLL format from the Trimble GPS receiver located on the bridge.
/pcode_bridge_vtg	Course and speed over ground data in NMEA VTG format from the Trimble GPS receiver located on the bridge.
/posmv_gga	Position data in NMEA GGA format from the POS/MV
/posmv_gst	Pseudorange error statistics in NMEA GST format from the POS/MV
/posmv_hdt	Heading data in NMEA HDT format from the POS/MV
/posmv_pashr	Roll, pitch and heave from POS MV inertial navigation system.
/posmv_vtg	Course and speed over ground in NMEA VTG format from the POS/MV
/posmv_zda	Time and date data in NMEA ZDA format from the POS/MV
/pressure_sen	Pressure sensor in the Uncontaminated Seawater System before the Bio Chem Lab which measures header pressure in PSI.
/rmyoung_air	Temperature, humidity, air pressure data in NMEA XDR format from the ship RM Young meteorological system near the bridge.
/rmyportwind	Wind speed and direction data in NMEA WMV format from the ship RM Young weather vane on the port side of the Healy Mast Yard.<
/rmystbdwind	Wind speed and direction data in NMEA WMV format from the ship RM Young weather vane on the starboard side of the Healy Mast Yard.
/samos_data	Meterology data for SAMOS.
/seabeam_center	Center depth data from the Seabeam 2112
/solar_radiometers	Solar Radiometer data for SW and IW.
/sperry_speedlog	Ground/water speed data from the Sperry Speed Log.
/stbd_a_frame	Wire tension, wire out, and wire speed for the starboard A frame winches.

/surface_par	Photosynthetic Active Radiation volts and Microeinstens/m2 se from the surface par sensor.
/sv2000	Sound Velocity data from the SV2000 sound velocimeter located in the ADCP BB150 sonar well.
/temp_incubat	Temperatures from the Incubators.
/true_wind_port	True wind speed data derived from gyro data and rmyportwind.
/true_wind_stbd	True wind speed data derived from gyro data and rmystbdwind.
/tsg	Thermosalinograph and fluorometer data from the TSG instruments in the Bio/Chem Lab.
/tsg_b	Thermosalinograph and fluorometer data from the B TSG instruments in the Bio/Chem Lab. (if this second sensor is installed)
/wind_aft	Wind data from the UltraSonic wind sensor on top of the HCO Shack.
/wind_bow	Wind data from the UltraSonic wind sensor on top of the Jack Staff.
/wind_mid	Wind data from the UltraSonic wind sensor on the Yard.

Extra files in the directory SCS_Data:

ACQLOG.LOG	Contains the data as to what occurred with SCS data. It shows when data collection was started and stopped. Includes startup and shutdown events.
Incidents_YYYYMMDD-TTTTTT.DTM	Contains any incident data, which were triggered in SCS. Refer to the SCS documentation for the definition of "incidents."
sensor_YYYYMMDD-TTTTTT.scf	Contains the configuration file for data collection as configured by SCS.

LDS_Data:

/AloftConCam	Contains picture files separated by folders named by Year and Day of the Year (YYYYJJJ). The picture files are in 5 minute JPEG format.
/FantailCam	Contains picture files separated by folders named by Year andDay of the Year (YYYYJJJ). The picture files are in 5 minute JPEG format.
/adcp_nav	Contains the navigation data sent to the ADCPs.
/adu5	Contains the data from the ADU5 GPS.
/aggps	Contains the data from the AG GPS.
/ais	Contains Automatic Identification System (AIS) messages as encapsulated VDM sentences.
/bgm221	Contains the data from the BGM221 Gravimeter.
/bgm222	Contains the data from the BGM222 Gravimeter.
/events	Contains the logs of event for different systems.
/hdgextract	Contains the extracted Heading data from the POSMV.
/mk27	Contains the data from the MK27 Gyro.
/mk30	Contains the data from the MK30 Gyro.

/posatt	Contains the attitude data from the POSMV GPS.
/posnav	Contains the navigation data from the POSMV GPS.
/posreform2sb	Contains the navigation data from the POSMV GPS reformatted for the SeaBeam.
/sbctr	Contains the center beam data from the SeaBeam.
/sbsv	Contains the surface sound velocity data for the SeaBeam.
/seabeam	Contains the data from the SeaBeam.
/tsg_met	Contains the all data from SIO TSG and Met sensors.
/SwapPingHLY	Contains ping results for Healy/Louis wireless network(swap) connection. Not currently active.
/SwapRoute	Contains routing table stats for Healy/Louis wireless network(swap) connection. Not currently active.
/SwapStatsHLY	Contains Healy wireless stats for Healy/Louis wireless network(swap) connection. Not currently active.
/SwapStatsLSL	Contains Louis wireless stats for Healy/Louis wireless network(swap) connection. Not currently active.
/winch_aft	Wire tension, wire out, and wire speed for the Aft A frame winches.
/winch_stbd	Wire tension, wire out, and wire speed for the Starboard A frame winches.

Raw:

/adcp150	150 Khz ADCP data.
/adcp75	75 KHz ADCP data.
/ctd	CTD data in directories by Cast number.
/ctd/TSG DATA	AUTOSAL Salinometer TSG comparison data
environmental_sensors	Temperature and Humidity Sensor data for the Climate control chambers
/knudsenraw	Knudsen 320B/R data.
/tsg_met	All the TSG and MET data.
/xbt	Expendable Bathythermograph data.

Images:

Contains satellite imagery in jpeg format

Satellite_Images

/dmsp	Data from the Defense Meteorology Satellite Program passes logged by the Healy's Terascan . Directories are identified by Year, Month, Day
/hrpt	Data from the NOAA weather satellite passes logged by the Healy's Terascan . Directories are identified by Year, Month, Day

Meta_Data:

/elog	Contains the technical support staff narrative of important events, which occurred both to the network and to individual sensors.
/Bridge_Logs	
DDMMMYY.doc	The "smooth log" containing events recorded by the bridge watch.
DDMMMYYWX.xls	Weather log recorded by the watch.
DDMMMYYNAV.xls	Navigation logs recorded by the watch.
/Sensor_Formats	Contains html and PDF files documenting the formats of all the files collected under way during the cruise.
./Systems_Calibrations	All of the calibrations sheets for the underway instruments are here.
./WHOisWHO	The directory has information about contacts for the Science personnel on this cruise.

SVP:

Sound speed profiles used for the Seabeam(Not provided for HLY0902)

Plots:

./knudsen_hourly_plots:	Directories of the SIOSEIS plots of the Knudsen 3.5 kHz data are in directories named by year, month, and day. These images are in the png format. There are two plots for each window in time. One is a large sized plot and one is a smaller plot. The files start 10 minutes before the file name and 10 minutes after the hour the file is named for. The vertical axes use Two-Way Travel Time. The Speed of Sound used is 1500 m/sec. To get the depth in meters from these plots multiply the time depth by 750.
./surface_daily_plots	Directories containing daily plots of under way data.

Ice_observations:

Directories of the Ice Observations taken for the cruise.

Sea_ice_movie:

Quicktime movie of selected satellite images. Also includes the individual images used to generate the movie.

Contents by directory:

SCS_Data:
CallSign
NOAA_Data
aft_a_frame
air_temp3a_f
air_temp_f
airtemp_bow
ashtech_attitude
ashtech_gga
ashtech_gll
ashtech_hdt
flomet
flomet_b
fluro
glonass_gga
glonass_gll
gyro_mk27
gyro_mk39
ibs_waypoints
knudsen
met3a_sen
oxygen
pcode_aft_gga
pcode_aft_gll
pcode_aft_vtg
pcode_aft_zda
pcode_bridge_gga
pcode_bridge_gll
pcode_bridge_vtg
posmv_gga
posmv_gst
posmv_hdt
posmv_pashr
posmv_vtg
posmv_zda
pressure_sen
rmyoung_air
rmyportwind
rmystbdwind
samos_data
seabeam_center
sensor_2009*.scf
sensor_2009*.xml
solar_radiometers
sperry_speedlog
stbd_a_frame
surface_par
surface_temp
sv2000
temp_incubat
true_wind_port
true_wind_stbd
tsg
wind_aft
wind_bow
wind_mid

Raw:
adcp150
adcp75
ctd
ctd/TSG DATA
environmental_sensors
knudsenraw
tsg
xbt

Images:

***Satellite*_Images:**
dmsp
hrpt

LDS_Data:
AloftConnCam
FantailCam
adcp_nav
adu5
aggps
ais
bgm221
bgm222
events
hdgextract
ibs_waypoints
mk27
mk39
posatt
posnav
posnavreform
posreform2sb
sbctr
sbsv
seabeam
tsg_met
winch_aft
winch_stbd
SwapPingHLY
SwapRoute
SwapStatsHLY
SwapStatsLSL

Meta_Data:
Bridge_Logs
Systems_Calibration_Data
Elog
WHOisWHO

Sensor_Formats

Plots:

Knudsen_hourly_plots

Surface_daily_plots

SVP:

1_Minute_Averaged_Data:

Ice_observations:

Merged Data

LDEO Averaged One Minute Data File

The data are summarized into an averaged one (1) minute data file by the LDEO technician. This file takes the average value centered on the minute, (30 seconds either side of the whole minute). The averages are calculated from the raw values as they are logged. There has been no quality control done on these files prior to the averaging. Those wishing more accurate and quality controlled values should process the data in the directories described below in the document. See the below NOTE.

HLY0902_Average.csv

6489,2009/04/06 10:45,58.7901313,-168.7344088,12.6,6.9,15.4,52.5,-1.686,11.760,0.1640,0.105,0.090,0.009,0.00,1.22,325.99,273.48,273.42,1.66,0.13,99.71,999.75,116.25,4.32,160.66,6.68,117.60,3.82,164.25,6.31,5.809,2.148,11.814,2,-76,-6,0,1,-60,1,0,13.25,162.1,7.58,1.77

6490,2009/04/06 10:46,58.7919917,-168.7336473,11.2,6.9,13.6,51.5,-1.686,11.866,0.1676,0.107,0.090,0.009,0.00,1.22,326.29,273.46,273.42,1.66,0.13,99.71,999.75,121.08,3.99,162.73,6.60,121.34,4.33,161.99,6.93,5.797,2.148,11.918,2,-76,-6,0,1,-60,1,0,13.62,163.3,7.56,1.76

6491,2009/04/06 10:47,58.7938830,-168.7329548,10.5,6.9,12.6,52.2,-1.686,11.970,0.1717,0.110,0.090,0.009,0.00,1.22,325.92,273.46,273.42,1.66,0.14,99.71,999.75,121.64,3.62,162.85,6.29,125.20,3.81,164.85,6.63,5.785,2.149,12.021,2,-77,-6,0,1,-60,1,0,12.93,163.7,7.54,1.76

Field	Data	Example	Units
01	ID	6489	sample count
02	date 2009/04/06	10:45	date & time UTC (year/month/day hour:minute)
03	lat	58.7901313	$INGGA, POSMV Latitude (decimal degrees)
04	lon	-168.7344088	$INGGA, POSMV Longitude (decimal degrees)
05	cog	12.6	$INVTG, POSMV Course Over Ground (angular distance from 0 (North) clockwise through 360, 1 minute average)
06	sog	6.9	$INVTG, POSMV Speed Over Ground (Knots, 1 minute average
07	heading	15.4	$PASHR, POSMV ship heading(angular distance from 0 (North) clockwise through 360, 1 minute average)
08	depth	52.5	$SBCTR, Seabeam centerbeam depth(meters, 1 minute average)
09	SST	-1.686	$PSSTA, SBE3s RemoteTemperature, Sea Chest intake (Celsius, 1 minute average)
10	TSG_InTemp	11.760	$PSTSA, SBE45 Water Temperature (Celsius, 1 minute average)
11	TSG_Cond	0.1640	$PSTSA, SBE45 Water Conductivity (millisiemens/centimeter, 1 minute average)
12	TSG_Sal	0.105	$PSTSA, SBE45 Water Salinity (PSU, 1 minute average)
13	SCF-FL	0.090	$PSFLA, Seapoint Fluorometer (Ug/l, 1 minute average)
14	SCF-FL-V	0.009	$PSFLA, Seapoint Fluorometer (Volts, 1 minute average)

Field	Data	Example	Units
15	tsg_flow_A	0.00	$PSFMA, Flowmeter in-line with PSTSGA, PSOXA, PSFLA (LitersPerMinute, minimum value in 1 minute interval)
16	SWR	1.22	$PSSRA, Short Wave Radiation (W/M^2, 1 minute average)
17	LWR	325.99	$PSSRA, Long Wave Radiation (W/M^2, 1 minute average)
18	LWR_Dome_T	273.48	$PSSRA, LWD Dome Temperature (Deg K, 1 minute average)
19	LWR_Body_T	273.42	$PSSRA, LWD Body Temperature (Deg K, 1 minute average)
20	PAR	1.66	$PSSPA, Surface PAR (uE/Sec/M^2, 1 minute average)
21	JS_Air_Temp	0.13	$PSATC, Bow Jackstaff Air Temperature (Deg C, 1 minute average)
22	Bridge_RH	99.71	$PSMEB, Bridge RM Young Relative Humidity (%, 1 minute average)
23	Bridge_Baro	999.75	$PSMEB, Bridge RM Young Barometric Pressure (millibars, 1 minute average)
24	JS_WndDirR	116.25	$PSWDC, Jackstaff Relative wind direction (deg, 1 minute average)
25	JS_WndSpdR	4.32	$PSWDC, Jackstaff Relative wind speed (m/s, 1 minute average)
26	JS_WndDirT	160.66	$PSWDC, Jackstaff True wind direction (deg, 1 minute average)
27	JS_WndSpdT	6.68	$PSWDC, Jackstaff True wind speed (m/s, 1 minute average)
28	MM_WndDirR	117.60	$PSWDB, Main Mast Relative wind direction (deg, 1 minute average)
29	MM_WndSpdR	3.82	$PSWDB, Main Mast Relative wind speed (m/s, 1 minute average)
30	MM_WndDirT	164.25	$PSWDB, Main Mast True wind direction (deg, 1 minute average)
31	MM_WndSpdT	6.31	$PSWDB, Main Mast True wind speed (m/s, 1 minute average)
32	SBE_Oxy	5.809	$PSOXA, SBE-43 Oxygen(ml/l, 1 minute average)
33	SBE_Oxy_Raw	2.148	$PSOXA, SBE-43 Oxygen(Volts, 1 minute average)
34	SBE_Oxy_T	11.814	$PSOXA, SBE-43 Oxygen Temperature(Deg C, 1 minute average)
35	WinchAft	2	Aft A-Frame Winch number
36	TensionAft	-76	Aft A-Frame Winch Wire tension(Pounds, 1 minute average)
37	WireOutAft	-6	Aft A-Frame Winch Wire out (Meters, 1 minute average)
38	SpeedAft	0	Aft A-Frame Winch Wire speed(Meters/minute, 1 minute average)
39	WinchSbd	1	Starboard A-Frame Winch number
40	TensionSbd	-60	Starboard A-Frame Winch Wire tension(Pounds, 1 minute average)

Field	Data	Example	Units
41	WireOutSbd	1	Starboard A-Frame Winch Wire out (Meters, 1 minute average)
42	SpeedSbd	0	Starboard A-Frame Winch Wire speed(Meters/minute, 1 minute average)
43	StbdWndSpdT	13.25	RMYoung True Wind Speed, starboard(Knots, 1 minute average)
44	StbdWndDirT	162.1	RMYoung True Wind Direction, starboard(angular distance from 0 (North) clockwise through 360, 1 minute average)
45	OxySat	7.58	Dissolved oxygen (DO) saturation as a funciton of T and S (Weiss)(ml/L, 1 minute average)

Notes

It was determined that the TSG was malfunctioning and outputting incorrect values from the beginning of the cruise until it was replaced with a new unit on 04/12/2009 05:15 UTC. TSG parameters (TSG_InTemp,TSG_Cond,TSG_Sal) and those parameters dependent on the TSG (OxySat,AOU) should not be used for this time period.

The Ship's Bridge Barometeric Pressure(Bridge_Baro) and Humidity Sensors (Bridge_RH) were incorrectly adjusted with the wrong sequence of calibration values for the start of the cruise. On 04/28/09 near the end of the day this error was noticed and corrected. The data up to this point from these instruments are not correctly adjusted and are to be treated as suspect. There is a separate report in the associated documentation about this sequence of events.

The Science Seawater System experienced numerous outages for certain sections of the cruise due to ice blockage. This was due to the fact that incubators were drawing more water from the system than it could handle. Affected parameters are TSG_InTemp, TSG_Cond,TSG_Sal, SCF-FL,SCF-FL-V, tsg_flow_A, SBE_Oxy,SBE_Oxy_Raw, SBE_Oxy_T, OxySat and AOU. ***Use these with caution.***

File Formats of Data Collected Underway

The formats of the Under way data files that were collected on this cruise are in a separate document named HLY0902_Sensors. This is now a separate document due to its large size. The file HLY0902_Sensors.htm is found in the Meta_Data directory. A PDF version of this file should also be here. To use this html file you will need to have the directory HLY0902_Sensors_files in the same directory as the html file.

Also in the Meta_Data directory there may be some PDF files for data that was collected but not part of the normal science routine.

APPENDIX:

Acquisition Problems and Events

A electronic logbook (elog) is utilized on the ship for logging of science related problems and events as they happen. A dump of the logbook is done at the end of the cruise and saved in the Meta_Data directory under the "elog" subdirectory. Two logbooks are kept: one by the technical support personnel and one of entries by the science party watchstanders. Several dump formats are made available such as html, csv, xml and raw. These logs should be consulted to help identify instrument and system anomalies affecting data quality. Times are reported in GMT (UTC, Z).

Below here is a summary of technical logbook. For exact details you should check the files in elog. The science watchstanders log is not summarized here.

This summary will NOT attempt to summarize all of the various Science Sea Water System adjustments made during HLY0902. The user should look for the table that attempts to document all of the various settings used during HLY0902. The user should also look in the Elog files distributed on the USB Disk drive.

Date	*Time (UTC)*	*Comment*
04/02/09	21:23	HCO MET-3A replaced. Precipitation still does not work
04/03/09	17:18	HCO MET-3A powered down
04/03/09	17:51	Start SCS ACQ logging for HLY0902
04/04/09	00:18	Set up new PPS box form POSMV for Seabeam
04/04/09	04:06	Start Seabeam for HLY0902
04/04/09	04:11	Start Knudsen for HLY0902
04/04/09	04:25	Seabeam Sea Survey not workng SBDISK not operational
04/04/09	04:53	Start ADCP 150 for HLY0902
04/04/09	04:57	Start ADCP 75 for HLY0902
04/04/09	04:59	Start Science Sea Water for HLY0902
04/04/09	18:04	SeaBeam SVP changed using hly0901XBT.sv
04/04/09	18:27	SeaBeam SVP changed using hly0901_001.sv
04/04/09	00:52	LDS entries using SWAP data removed
04/05/09	10:03	SeaBeam Sea Survey SBDISK replaced and Sea Survey working
04/06/09	10:12	TSG water flow stopped, monitoring it
04/06/09	04:54	Gravimeters are both working again
04/06/09	15:15	ADU5 lost heading and attitude
04/06/09	22:48	Speed Log off while in the ice
04/07/09	01:10	ECC secure Science Sea Water since it is clogged
04/07/09	04:22	Science Sea Water back on after back flushing
04/07/09	17:42	ADU5 reset and all working again
04/08/09	06:12	Note TSG weird values Apr 05 03:55 and Apr 06 02:05 UTC
04/08/09	23:12	Gravimeter BGM 222 started failing at 20:43 UTC
04/09/09	21:02	New SeaBeam SVP using CTD HLY0902_016025 and AGO R4900799_073
04/09/09	23:25	New SeaBeam SVP using CTD HLY0902_016026 and AGO R4900799_073
04/10/09	05:37	New SeaBeam SVP using CTD HLY0902_018027 and AGO R4900799_073
04/10/09	22:27	SCS stopped
04/10/09	22:29	SCS restarted

Date	*Time (UTC)*	*Comment*
04/11/09	00:38	New SeaBeam SVP using CTD HLY0902_020034 and AGO R4900799_073
04/11/09	03:56	New SeaBeam SVP using CTD HLY0902_020035 and AGO R4900799_073
04/11/09	06:11	LDS winch loggers stopped and restarted
04/11/09	19:00	New SeaBeam SVP using CTD HLY0902_024038 and AGO R4900799_073
04/12/09	17:19	New TSG (serial #0228) installed
04/12/09	20:13	New SeaBeam SVP 025039.sv
04/13/09	00:37	New SeaBeam SVP using CTD HLY0902_026043
04/13/09	02:47	Knudsen to Pinger mode for multicore
04/13/09	04:38	Knudsen to Subbottom mode
04/13/09	05:48	Knudsen to Pinger mode for multicore
04/13/09	06:42	Knudsen to Subbottom mode
04/14/09	08:01	reload SeaBeam SVP using CTD HLY0902_016025
04/14/09	20:44	New SeaBeam SVP using CTD HLY0902_029050
04/15/09	21:39	New SeaBeam SVP using CTD HLY0902_032054
04/16/09	01:17	Aloft Con Webcam stopped re-plugged back in and running
04/17/09	08:50	ADU5 no heading and attitude coming in. Reset and working again
04/18/09	20:45	VMS rebooting
04/18/09	21:30	VMS rebooted
04/20/09	06:21	Reuse SeaBeam SVP using CTD HLY0902_003004 and ARGO R4900855_019 rebooted
04/23/09	00:15	New SeaBeam SVP using XBT HLY0902 T7_00004 and ARGO R4900855_019
04/23/09	03:13	New SeaBeam SVP using ARGO R4900855_019
04/23/09	04:45	New SeaBeam SVP using CTD HLY0902_060093 and ARGO R4900855_019
04/23/09	08:53	New SeaBeam SVP using CTD HLY0902_061094
04/23/09	12:54	Knudsen to Pinger mode
04/23/09	14:36	Knudsen to SubBottom mode
04/23/09	16:25	Knudsen to Pinger mode
04/23/09	17:36	Knudsen to SubBottom mode
04/23/09	20:11	New SeaBeam SVP using CTD HLY0902_060093 and CTD 061094 for deep
04/24/09	03:13	New SeaBeam SVP using CTD HLY0902_064099
04/24/09	06:23	New SeaBeam SVP using CTD HLY0902_065100
04/24/09	10:38	New SeaBeam SVP HLY0902_066101.sv
04/24/09	18:12	SCS stopped logging
04/24/09	18:45	Reload SeaBeam SVP HLY0902_003004.sv
04/24/09	23:48	SCS restarted
04/25/09	01:11	Note Knudsen input correction not working well. Still on Unit 2
04/26/09	05:55	Reload SeaBeam SVP HLY0902_018027.sv
04/26/09	18:13	New SeaBeam SVP HLY0902_069107.sv
04/26/09	22:42	Gyro MK 39 Reset due to no heading output
04/27/09	01:35	start reboot of IBS CID computer
04/27/09	01:40	reboot of IBS CID computer finished
04/27/09	06:39	New SeaBeam SVP using CTD HLY0902_072111 and CTD 026043 for deep
04/27/09	09:02	New SeaBeam SVP HLY0902_070109.sv
04/27/09	14:53	Note ADCP 150 short and long term averages had date of April 18 on them

Date	*Time (UTC)*	*Comment*
04/27/09	16:08	ADCP 150 restarted
04/28/09	01:10	New SeaBeam SVP using CTD HLY0902_075117 and CTD 026043 for deep
04/28/09	03:48	New SeaBeam SVP using CTD HLY0902_077119 and CTD 026043 for deep
04/28/09	05:18	New SeaBeam SVP using CTD HLY0902_078120 and CTD 026043 for deep
04/28/09	06:46	New SeaBeam SVP using CTD HLY0902_079121 and CTD 026043 for deep
04/28/09	20:42	New SeaBeam SVP using CTD HLY0902_080122
04/28/09	22:20	Noted that Ship's Air Press, Air Temp and Humid sensors had wrong calibrations applied from the start of the cruise
04/29/09	00:58	Reload SeaBeam SVP HLY0902_079121.sv
04/29/09	01:44	Reload SeaBeam SVP HLY0902_078120.sv
04/29/09	04:05	Reload SeaBeam SVP HLY0902_075117.sv
04/29/09	05:23	New SeaBeam SVP using CTD HLY0902_073114
04/29/09	16:30	ADCP 75 restarted with new software 1.46
04/29/09	16:31	ADCP 150 restarted with new software 1.46
04/29/09	19:45	ADCP 150 changed parameters
04/29/09	19:47	New SeaBeam SVP using CTD HLY0902_085131 and CTD 026043 for deep
04/29/09	21:34	New SeaBeam SVP using CTD HLY0902_086132
04/29/09	00:23	New SeaBeam SVP using CTD HLY0902_088134
04/29/09	01:09	New SeaBeam SVP using CTD HLY0902_089135
04/30/09	01:29	Reload SeaBeam SVP using CTD HLY0902_088134
04/30/09	02:27	Reload SeaBeam SVP using CTD HLY0902_086132
04/30/09	03:20	Reload SeaBeam SVP using CTD HLY0902_085131
05/01/09	00:07	New SeaBeam SVP using CTD HLY0902_091141
05/01/09	03:14	Reload SeaBeam SVP using CTD HLY0902_079121
05/03/09	08:10	ADCP 75 has added NEMA data coming in after an added com port
05/04/09	23:02	Environmenatgl temp loggers stopped logging
05/03/09	08:17	ADCP 150 has added NEMA data coming in after an added com port
05/06/09	07:43	Reload SeaBeam SVP using CTD HLY0902_089135
05/06/09	09:17	New SeaBeam SVP using CTD HLY0902_072111
05/06/09	14:18	Edit SeaBeam SVP to be like CTD HLY0902_115172
05/06/09	16:00	New SeaBeam SVP using CTD HLY0902_115174
05/06/09	21:49	Reload SeaBeam SVP using CTD HLY0902_116175
05/06/09	23:58	Aft P-Code stopped outputting lat/long
05/07/09	01:20	Reload SeaBeam SVP using CTD HLY0902_115174 modified
05/07/09	06:19	Aft P-code noticed stopped output of lat/long at 5/6/9 23:58
05/07/09	06:48	Reload SeaBeam SVP using CTD HLY0902_089135
05/07/09	08:25	New SeaBeam SVP using CTD HLY0902_114171
05/07/09	13:23	Reload SeaBeam SVP using CTD HLY0902_080122
05/07/09	19:01	Knudsen SubBottom SVP from 1500 to 1437
05/07/09	19:11	Knudsen SubBottom SVP back to 1500
05/07/09	20:21	ADU5 stopped outputting Attitude
05/07/09	20:49	ADU5 reset, working properly
05/07/09	22:37	New SeaBeam SVP using CTD HLY0902_123184

Date	*Time (UTC)*	*Comment*
05/08/09	00:24	New SeaBeam SVP using CTD HLY0902_124185
05/08/09	02:03	New SeaBeam SVP using CTD HLY0902_125186
05/08/09	06:48	New SeaBeam SVP using CTD HLY0902_128189
05/08/09	07:58	Note Aft P-code GPS not working since before 00:00, reset
05/08/09	17:14	ADCP 150 stopped LTA and STA plots, stop and restart Acquisition
05/08/09	18:04	New SeaBeam SVP editing CTD HLY0902_134195
05/08/09	18:25	New SeaBeam SVP using CTD HLY0902_135196
05/08/09	18:58	New SeaBeam SVP using CTD HLY0902_137198
05/08/09	23:42	New SeaBeam SVP using CTD HLY0902_138199
05/09/09	01:04	New SeaBeam SVP using CTD HLY0902_139200
05/09/09	06:04	New SeaBeam SVP using CTD HLY0902_142203
05/09/09	13:09	New SeaBeam SVP editing CTD HLY0902_146207
05/09/09	14:52	New SeaBeam SVP using CTD HLY0902_147208
05/09/09	16:18	New SeaBeam SVP using CTD HLY0902_148209
05/09/09	19:05	New SeaBeam SVP editing CTD HLY0902_150211
05/09/09	20:01	New SeaBeam SVP editing CTD HLY0902_151212
05/10/09	04:40	New SeaBeam SVP using CTD HLY0902_156217
05/10/09	08:23	New SeaBeam SVP editing CTD HLY0902_158219
05/10/09	11:36	New SeaBeam SVP editing CTD HLY0902_160221
05/10/09	15:54	New SeaBeam SVP editing CTD HLY0902_161222
05/10/09	17:14	ADCP 150 stopped LTA and STA plots, stop and restart Acquisition?
05/10/09	19:00	New SeaBeam SVP editing CTD HLY0902_162223?
05/10/09	20:02	stop and restart ADCP 150 Acquisition
05/10/09	20:03	stop and restart ADCP 75???? Acquisition
05/11/09	00:11	New SeaBeam SVP using CTD HLY0902_165226
05/11/09	00:46	New SeaBeam SVP using CTD HLY0902_159220
05/11/09	02:10	New SeaBeam SVP using CTD HLY0902_166227
05/11/09	04:01	New SeaBeam SVP using CTD HLY0902_167228
05/11/09	06:24	New SeaBeam SVP using CTD HLY0902_168229
05/11/09	08:18	New SeaBeam SVP using CTD HLY0902_169230 and ARGO R4900855_022 for deep
05/11/09	10:36	New SeaBeam SVP editing CTD HLY0902_170231
05/11/09	12:58	New SeaBeam SVP using CTD HLY0902_171232
05/11/09	14:44	New SeaBeam SVP editing CTD HLY0902_172233
05/11/09	18:05	New SeaBeam SVP using ARGO R4900855_022
05/12/09	00:38	Science Sea Water secured for end of HLY0902
05/12/09	01:44	SCS logging ended for end of HLY0902
05/12/09	01:47	ADCP 150 secured for end of HLY0902
05/12/09	01:49	ADCP 75 secured for end of HLY0902
05/12/09	01:52	SeaBeam to IDLE for end of HLY0902
05/12/09	01:52	Knudsen stopped Pinging for end of HLY0902
05/12/09	02:03	LDS stopped for end of HLY0902

Comments that might help when using the data

1. The TSG Salinometer was replaced early in the cruise. It was determined that it was malfunctioning and outputting incorrect values from the beginning of the cruise until it was replaced with a new unit on 04/12/2009 05:15 UTC. This data should not be used prior to this replacement.

2. The SCS system has to be stopped when fixing some kinds of issues. If this is the case, you should consult the elog entries for possible explanations and look for the corresponding data in the LDS_Data directories. The data may have been recorded there.

3. The Knudsen data written into SCS_Data/Knudsen has an inconsistent time in the data. The time that the SCS writes to the start of the KEA file should be used. The Knudsen internal clock adds about 22.8 seconds to the internal clock each day near 00:00. But this is reset when the recording program is started up and when watchstanders manually synchronize the time. Use only the SCS time stamp for time in this data and it should be fine. The accuracy of the time in the SEG-Y files and KEB files should be inspected and compared to the time-stamped KEA records.

4. The SeaBeam data is raw and unedited. This data may need significant editing and care depending on the intended use. The SeaBeam 2112 has significant issues with the near-nadir beams: the bathymetry tends to be less repeatable in the near-nadir region compared to the middle of the swath. The outer beams are noisier in the icebreaker 2112 installations than those installed on non-icebreakers.. The acoustic noise plus bubble-sweep down and masking by ice under the hull all contribute to degrading the data quality while operating in ice.

5. The Knudsen subbottom data is not an accurate source of water depth for a number of reasons, including the fact that it is always recorded using a sound speed of 1500 meters/second, because the beam pattern is large (3- to 60 degrees), because of it's bottom detection algorithm and because it penetrates the seafloor.

6. Both Gravimeters had short periods of problems. BGM #221 was fixed early on and the meter was restarted. BGM #222 Gravimeter also had a short period when the data were not good. Care should be taken when using this data until calibrations have been completed.

7. During the cruise at various times many various parties were changing the water flow in the Science Sea Water system to adjust the system's response to various flow rates in response to icing up and filling up the tank in the bow for the Incubators. This changes the amount of water going through the TSG and has discernable impact on the measurements taken. You should closely follow the Elog entries for the TSG and Science Sea Water in the Elog section in the Meta_Data directory on the USB Disk drive to see when water flow rates were adjusted. These events were not always accurately entered into Elog. No attempt was made to summarize these events in the Elog summary in this document. These flow rate changes should affect all of the TSG data and care should be taken when using the TSG data.

8. The POSMV navigation system reports location at the master reference point and not at the antenna locations above the Helicopter Control Shack (HCO). The Location of the Master Reference Point (MRP) can be seen in the diagram at the end of this document showing instrument locations on the ship.

9. During HLY0902 the recording software for both the 75 and 150 ADCPs were updated. The user should be careful to be sure that the data have not changed characteristics from this software update.

10. The Ship's Bridge Barometeric Pressure, Air Temperature and Humidity Sensors were incorrectly adjusted with the wrong sequence of calibration values for the start of the cruise. On 04/28/09 near the end of the day this error was noticed and corrected. The data up to this point from these 3 instruments are not correctly adjusted and are to be treated as suspect. There is a separate report in this document about this sequence of events. See the below Table.

11. Over the past few days I have worked with Mike Lomas, Evelyn Lessard and Megan Bernhardt to "calibrate" or scale the CTD chlorophyll a fluorometer output. I use the word "calibrate" loosely because there is not, nor must there be, a constant relationship between fluorescence and chlorophyll a concentration. I am told that depends upon the phytoplankton species, their condition, their exposure to light, etc, as well as if the instrument is working correctly.

However one can establish a general relationship between Fl and chl_a concentration, and we have done that using Mike and Evelyn's chl_a determinations during this cruise. The attached graph shows the results and a linear least-squares fit to them. The abscissa contains the discrete chl_a concentrations as determined by the Lomas and Lessard groups, and the ordinate is the CTD chl_a concentration based upon the Chelsea Instruments Mk III Aquatracka's factory calibration on 6 March 2007. (Chelsea warns users that their factory calibration may not be appropriate for the species or area being studied and recommends that users do their own field calibration, as we have done.) Dave Kachel got the fluorometer's voltage and chl_a concentration from the Sea Bird bottle files, a line of which is generated each time the CTD rosette trips a bottle. Lomas' s points are in black, Lessard's in purple, a line of slope 1 is black dashed, and the linear least squares fit line is in solid green. From the diagram, you can see that the Chelsea "calibration" underestimates the chlorophyll_a concentration by about a factor of 10. The equation of the fit and the inverse equation are shown on the diagram. So to use this new "calibration" we would multiply the present Chlesea chl_a concentration by 9.9685 and subtract 1.3912 ug/l. The rms error of the fit is 0.18086. Scaling this by the inverse formula implies an rms error in the newly scaled chl_a concentrations of about 1.8 ug/l.

Mike Lomas says that his results from last year imply a scaling factor of about 5 then, so the fluorometer may be losing sensitivity with age. Scott Hiller and I have discussed this. Scott will send the fluorometer back to Chelsea at the end of the field season and ask them to do a calibration before they take it apart and another after they refurbish it. That will give us some idea if the fluorometer has degraded.

Scott Hiller and I have discussed what to do with these results. We feel that it is best to institute this new scaling now, so future CTD casts will show the chlorophyll concentration based upon our new "calibration." For those used to looking at the shape of the chl_a profiles in ug/l units, that will not change because the scaling is linear; only the numbers along the bottom axis of the CTD plots will change. For those used to looking at the fluorescence in voltage, that will not change because voltage is the basic output from the fluorometer and that is unchanged. I would point out that the relationship between fluorometer volts and chlorophyll concentration is exponential, i.e. of the form

chl_a = a*10**V + b

Scott will also re-run the Sea Bird software on all the past CTD casts, and scale ALL the CTD chlorophyll concentrations to the new values from our preliminary "calibration" on this cruise.

We plan to do a similar "calibration" for the full cruise and the 2008 BEST cruises based upon the 6 total chlorophyll values that the Hydro Team measures on each CTD cast. Those results will be available when that work is done, probably a few months from now.

Edward D. (Ned) Cokelet, PhD

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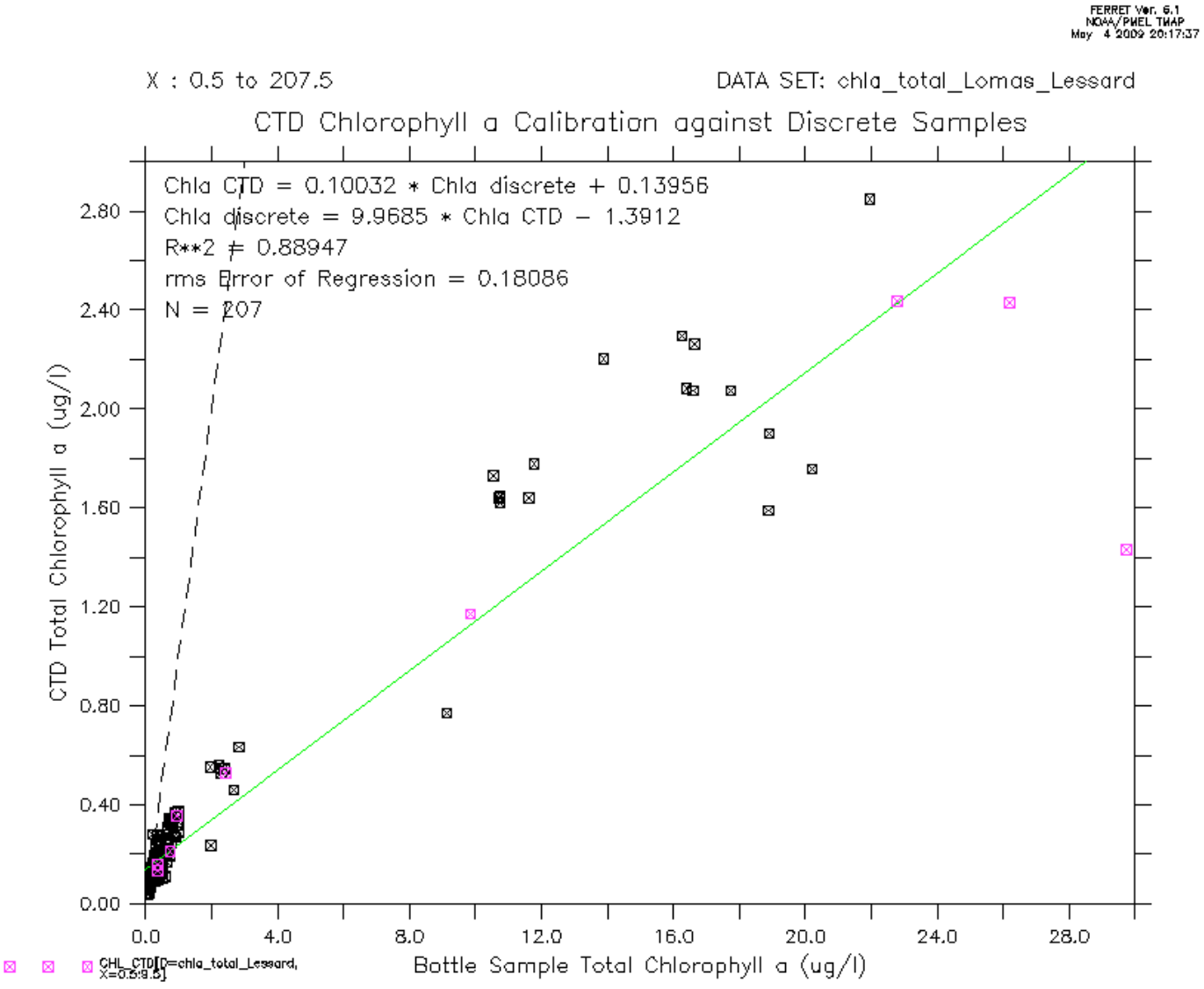
Aboard USCGC Healy in the Bering Sea



Ship Temperature, Pressure and Humidity Sensor Corrections Applied in 2008 and 2009

5/12/09 13:05

Bridge Pressure Sensor

Date	Translator Box		SIO-MET Program		Unused values	
	Multiplier A1	Offset B1	Multiplier A2	Offset B2	Multiplier A2	Offset B2
02/01/08	0.06	805.5			59.853	802.635000
01/15/09	0.06	805.5	0.0599743	803.05400		
04/28/09	1.00	0.0	0.0599743	803.05400		

Bridge Air Temprature Sensor

Date	Translator Box		SIO-MET Program		Unused values	
	Multiplier A1	Offset B1	Multiplier A2	Offset B2	Multiplier A2	Offset B2
02/01/08	0.01	-49.0			101.413	-50.764200
01/15/09	0.01	-49.0	101.9810000	-50.87410		
04/28/09	1.00	0.0	101.9810000	-50.87410		

Bridge Humidity Sensor

Date	Translator Box		SIO-MET Program		Unused values	
	Multiplier A1	Offset B1	Multiplier A2	Offset B2	Multiplier A2	Offset B2
02/01/08	0.01	-0.1			104.836	-0.679727
01/15/09	0.01	-0.1	101.5780000	1.17977		
04/28/09	1.00	0.0	101.5780000	1.17977		

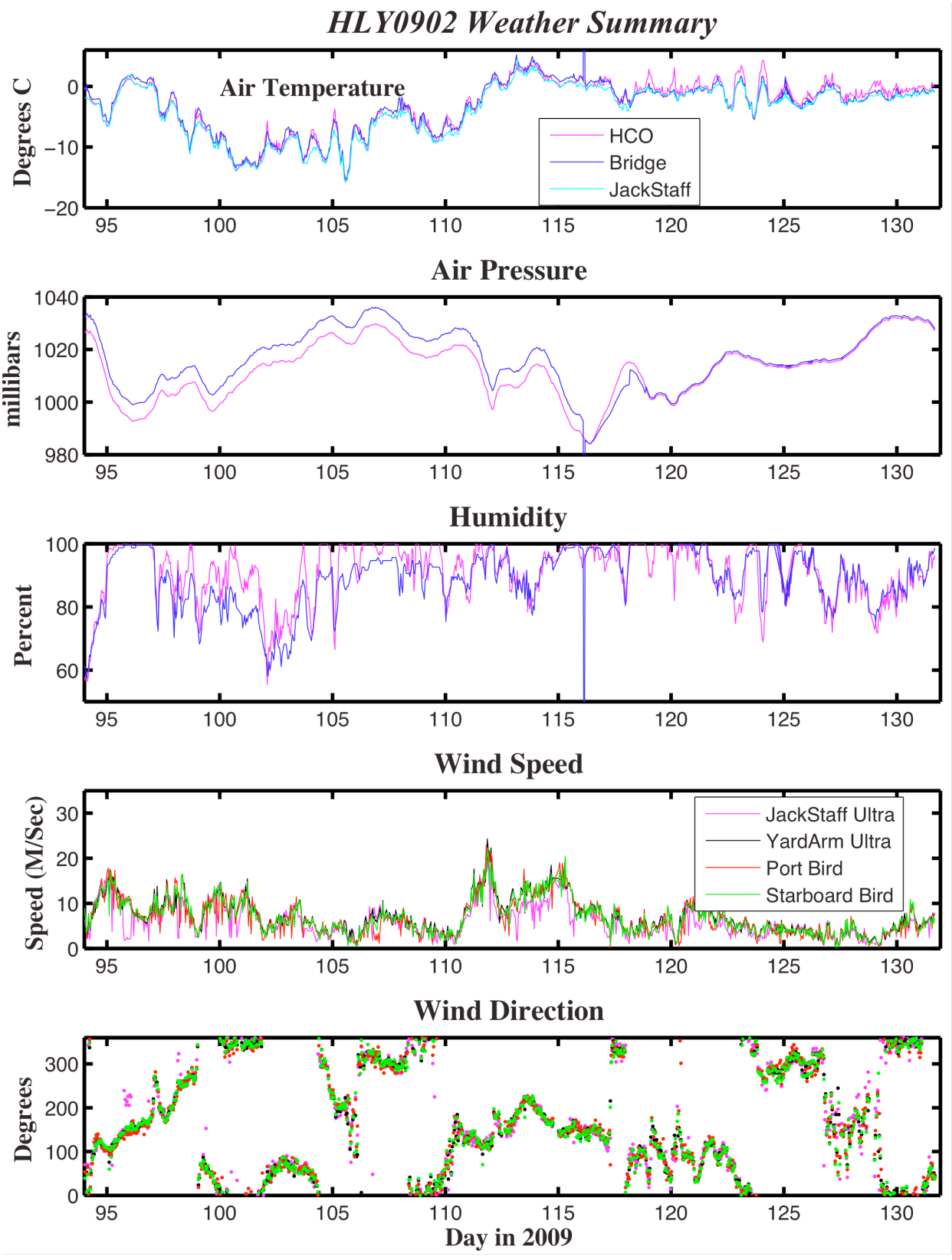
((((Raw * A1)+B1)*A2)+B2)

But it should have been:
((Raw *A2)+B2)

For all of 2008, the Calibration and Offsets found at SIO were not applied, but rather the old previous values were used in the Ship's Translator Box.

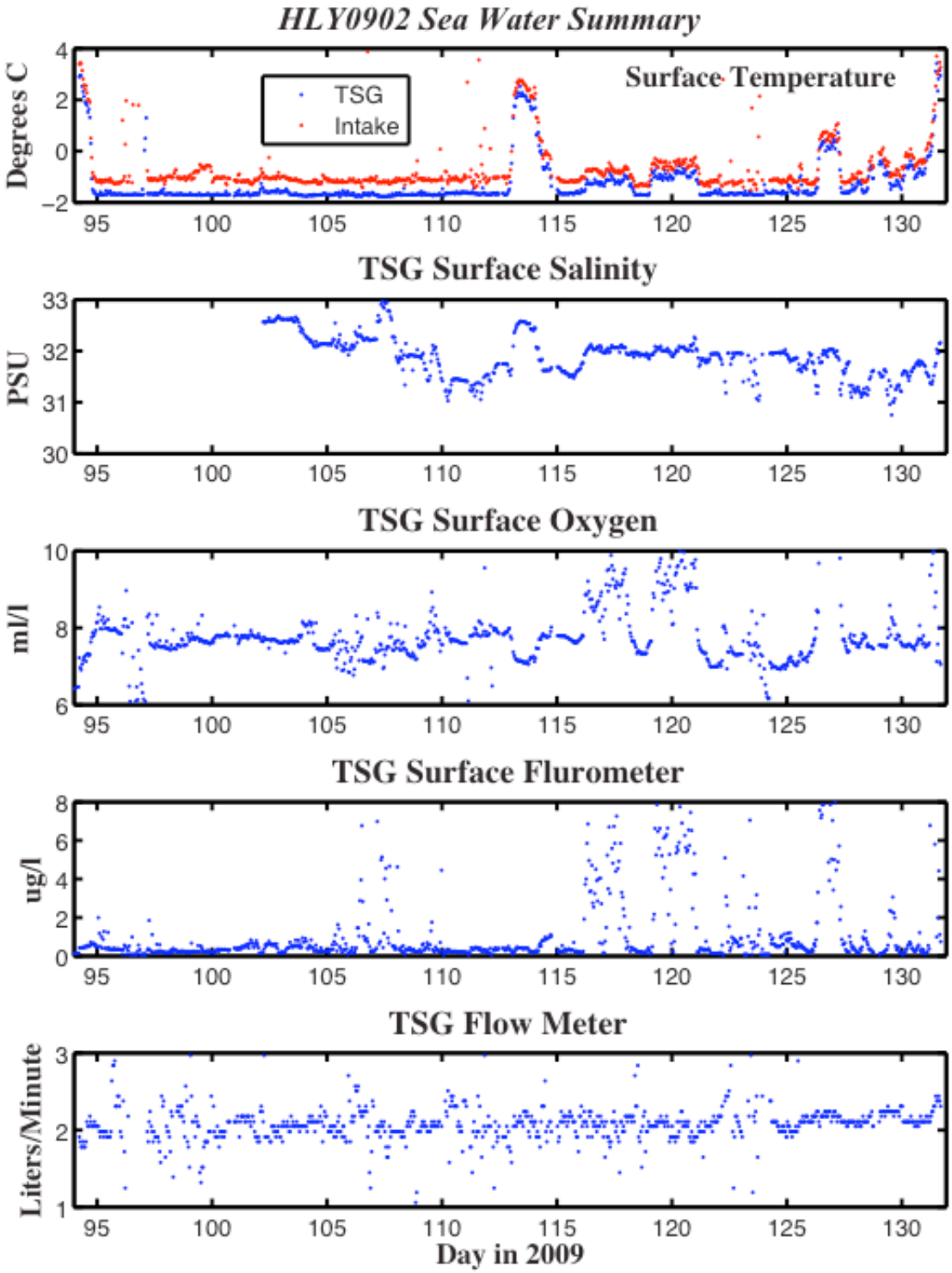
Cruise Weather Summary

Preliminary summary plot of weather conditions during HLY0902. Data from several sensors still require ground-truthing and calibration. The general trends should remain the same in the final data.



Cruise TSG Summary

Preliminary summary plot of the surface sea water conditions during HLY0902. Data from several sensors still require ground-truthing and calibration. The general trends should remain the same in the final data.



Underway Sensors and Calibrations

Sensors and Calibrations

To see the individual Sensor Calibration Sheets go to the Meta_Data directory on the USB Disk drive. You should use the Sensor's Serial number to be sure you have found the proper sheet.

HLY0902 Shipboard Sensors

Sensor	Description	Serial #	Last Calibration Date	Status
Meteorology & Radiometers				
Port Yard Arm Anemometer	RM Young 09101	L001	12/01/08	Collected
Stbd Yard Arm Anemometer	RM Young 09101	L003	03/07/07	Collected
Barometer	RM Young 612011	BP01643	02/22/08	Collected
Air Temp/Rel. Hum.	RM Young 41382V	13352	02/22/08	Collected
Helo shack PAR	BSI QSR-2200	20270	01/09/07	Collected
Shortwave Radiation	Eppley labs - PSP	35032F3	11/11/08	Collected
Longwave Radiation	Eppley labs - PIR	34955F3	11/13/08	Collected
Helo shack MET3A Barometer, Relative Humidity, Temperature	Paroscientific MET3A	101757	06/27/07	Collected
HCO Precipitation	RM Young 50202	1567	1/19/09	Collected
Jack Staff Temperature	41342LC	15166	12/17/08	Collected
Jack Staff Ultrasonic Anemometer	RM Young 85004	00894	09/20/07	Collected
Yard Arm Stbd Ultrasonic Anemometer	RM Young 85004	00704	09/20/07	Collected
Helo shack Ultrasonic Anemometer	RM Young 85004	00703	09/20/07	Collected
Underway Ocean				
TSG	SeaBird SBE45	0215	01/09/09	Collected to 04/12/9
TSG	SeaBird SBE45	0228	01/09/09	Collected starting 04/12/09
Remote Sea Temp	SeaBird SBE3S	4063	12/13/08	Collected
Fluorometer	Seapoint SCF	SCF2957	12/15/07	Collected

Sensor	Description	Serial #	Last Calibration Date	Status
Oxygen Sensor	SeaBird SBE-43	1333	01/20/09	Collected
Wet lab Flowmeter	Flocat C-ES45-B003	09061005	01/07/08	Collected
Wet lab Pressure	Hiller1	001P	12/15/07	Collected
Bow Flowmeter	Signet P51530-PO	60012089621	01/07/08	NOT Collected
Ultraviolet Spectrophotometer	Satlantic MBARI-ISUS V3	0141	01/15/09	Collected
Sonars				
Knudsen- subbottom	320 B/R	K2K-00-0013	N/A	Collected
ADCP 150 kHz	Broad Band (BB150)	80	N/A	Collected
ADCP 75 kHz	Ocean Surveyor	172	N/A	Collected
Multibeam	Seabeam 2112	?	N/A	Collected
Speed log	Sperry SRD500	?	N/A	Collected
Navigation				
P-Code GPS (aft)	Trimble Centurion	0220035469	N/A	Collected
Attitude GPS	Ashtech ADU5	AD520033513	N/A	Collected
DGPS	Trimble AGGPS-AG132	0224016199	N/A	Collected
POSMV	Model- MV V4	2306	N/A	Collected
P-Code GPS (fwd)	Rockwell Collins	?	N/A	Collected
Glonass GPS	?	?	N/A	Collected
GYRO 1	Sperry MK39 Mod 3A PN 03956-1982416-2	340	?	Collected
GYRO 2	Sperry MK27A 4800880-1	025	N/A	Collected

HLY0902- CTD Sensors

Sensor	Comments	Serial #	Last service/ Calibration Date	Status
CTD sensor	SBE 911plus	639	01/14/09	
Pressure Sensor #1	Digiquartz with TC	83012	01/14/09	Collected
Temperature #1	SBE3- Primary	2841	12/18/08	Collected
Temperature #2	SBE3- Secondary	2824	12/18/08	Collected
Conductivity #1	SBE4C- Primary	2575	01/08/09	Collected
Conductivity #2	SBE4C- Secondary	2619	12/18/08	Collected
Pump	SBE5 Primary	3115	01/08	NA
Pump	SBE5 Secondary	3112	01/08	NA
Deck Unit	SBE 11-Plus V2	0417	12/07	NA
Altimeter	PSA916	843	01/08	Collected
Oxygen	SBE43	458	12/17/08	Collected
Fluorometer	Chelsea-Aquatrack3	088234	03/06/07	Collected
Transmisometer	Wetlabs	CST-390DR	02/27/07	Collected
PAR	Bioshperical QSP2300	70115	12/01/08	Collected
Carousel	SBE32- 12 place	347	01/08	NA

Software Versions of some Recording programs

System	Program	Version number
CTD	Seabird SeaSave	7.18c
XBT	Turo XBT software	3.03.01
XBT	Sippican (Old system)	2.1.2
ADCP 75	VMDAS	1.45 operated until 04/29/09
ADCP 75	VMDAS	1.46 installed 04/29/09
ADCP 150	VMDAS	1.45 operated until 04/29/09
ADCP 150	VMDAS	1.45 installed 04/29/09

HLY0902 Sensor Calculations

The coefficients for temperature, conductivity, fluorometer and turbidity sensors can be found in the calibrations sheets found in the Meta_Data directory.

Calculating Temperature – ITS-90

T = decimal equivalent of bytes 1-4
Temperature Frequency: f = T/19 +2100
Temperature = $1/\{g + h[ln(f_0/f)] + i[ln^2(f_0/f)] + j[ln^3(f_0/f)]\} - 273.15$ (°C)

Calculating Conductivity – ITS-90

C = decimal equivalent of bytes 5-8
Conductivity Frequency f = sqrt(C*2100+6250000)
Conductivity = $(g + hf^2 + if^3 + jf^4)/[10(1 + \delta t + \varepsilon p)]$ (siemens/meter)
t = temperature (°C); p = pressure (decibars); δ = Ctcor; ε = CPcor

Calculating Fluorometry Voltage

f = decimal equivalent of bytes 15-17
Fluorometry Voltage = f/819

Calculating Transmittance

V_{dark} = 0.058 V
V_{ref} = 4.765 V
t = decimal equivalent of bytes 18 – 20
Transmissometer Voltage (V_{signal}) = t/819
% Transmittance = $(V_{signal} - V_{dark}) / (V_{ref} - V_{dark})$

Calculating PAR for surface PAR

raw data = mV
calibration scale = 6.08 V/(μEinstiens/cm ^{2}sec)
offset (V_{dark}) = 0.3 mV
(*raw* mV - V_{dark})/scale x 10^4 cm^2/m^2 x 10^{-3} V/mV= μEinstiens/m^2sec
or
(*data* mV – 0.3 mV) x 1.65 (μEinstiens/m^2sec)/mV = μEinstiens/m^2sec

Calculating Pyrgeometer Values

V = Eppley PIR Thermopile voltage

S = Sensitivity (Calibration factor from Eppley Cal sheet)

S = 3.32

J = Stefan-Boltzmann Constant

J = 5.6697e-8

B = [absorption constant (for Eppley Black paint formula) 0.985 / dome glass IR transmission 0.5]

B= 3.5 for Stock Eppley PIR

Tb = Eppley Body Temperature in degrees Kelvin

Td = Eppley Dome Temperature in degrees Kelvin

Tb and Td calculated as follows:

T = 1/ (a + ln(Vo/Irt)*(b + c*(ln(Vo/Irt)**2)));

Irt = (Vref-Vin)/R1

On Healy R1 = 82500 Vref = 5.0

a= 0.0010295 b= 0.0002391 c = 1.568e-7

$W/M2 = V/S + (J * Tb^4) + (B*J*(Tb^4 - Td^4))$

Instrument Locations on the Healy

Layout plot of instrument locations

This layout is not to be used for exact measurements. It is included here for getting a general understanding of instrument locations on the ship. It has not been updated since 2007.

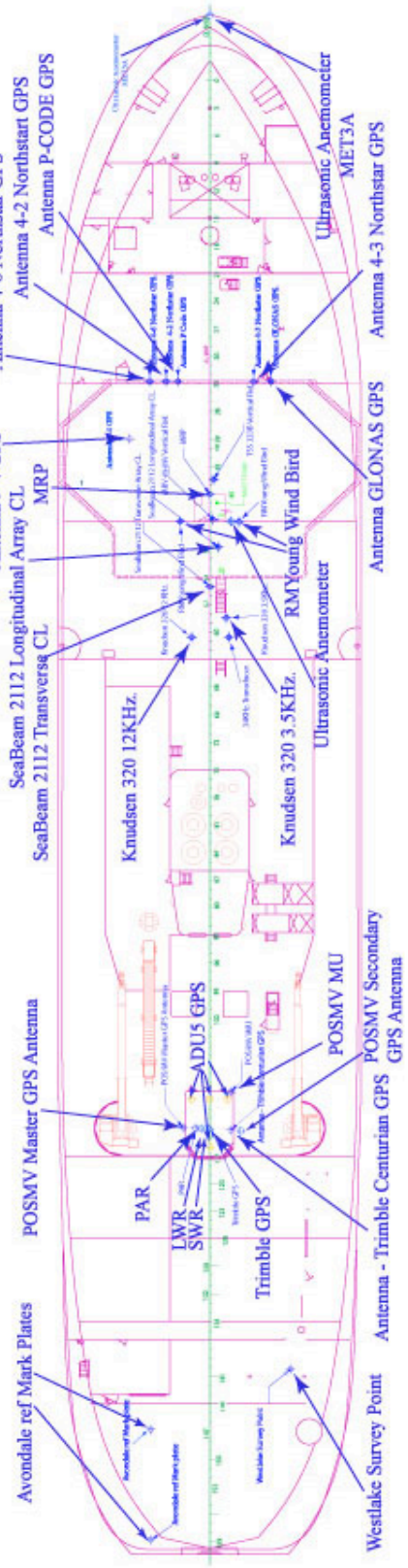

Antenna 4-6 Northstar GPS
Antenna 4-2 Northstart GPS
Antenna P-CODE GPS
Ultrasonic Anemometer
MET3A
Antenna 4-3 Northstar GPS
Antenna 9-4 GPS
Antenna 2112 Longitudinal Array CL
SeaBeam 2112 Transverse CL
MRP
RMYoung Wind Bird
Ultrasonic Anemometer
Antenna GLONAS GPS
Knudsen 320 12KHz.
Knudsen 320 3.5KHz.
POSMV Master GPS Antenna
ADU5 GPS
POSMV MU
POSMV Secondary GPS Antenna
PAR
LWR
SWR
Trimble GPS
Antenna - Trimble Centurian GPS
Avondale ref Mark Plates
Westlake Survey Point

Table of Survey measurements

Consolidated Survey Data						
	Elements of:					
		Avondale Survey				
		Westlake Survey				
		Lamont Survey				
	All Measurements in *Meters* relative to MRP unless otherwise stated					
	X = fore & aft with + foreward					
	Y = port & starboard with + to starboard					
	Z= vertical with + upwards					
				X	Y	Z
Item	***Survey***	***Description***		***North***	***East***	***Elevation***
1	Avondale	**MRP**	See discussion Westlake Final Report	34.30	0.00	9.15
2	Westlake	**MRP**	by Definition	0.00	0.00	0.00
3	Westlake	**Seabeam 2112**				
		Transverse Array	Centerline	-7.679	0.030	9.242
		Longitudinal Array	Centerline	-4.386	0.711	9.238
4	Westlake	**Transducers**				
		Starboard - Forward to Aft				
		Transducer -	Bathy 2000 3.5 kHz	-10.252	1.362	9.243
		Transducer -	Bathy 1500 34 kHz *	-11.866	1.559	9.245
		Transducer -	Doppler Speed Log	-12.168	0.414	9.245
		Transducer -	Spare Transducer Well	-13.081	1.449	9.237
5	Westlake	**Port - Forward to Aft**				
		Transducer -	VM 150	-9.726	-1.395	9.230

		Transducer -	Ocean Surveyor 75 kHz	-10.819	-1.290	9.230
		Transducer -	Bathy 2000 12 kHz	-11.859	-1.492	9.234
		Transducer -	Spare Transducer Well	-13.078	-1.394	9.235
6	Westlake	Gyros				
		Starboard Gyro	Centerline	4.741	0.207	-19.604
		Port Gyro	Centerline	4.746	-0.207	-19.609
7	Westlake	**Antennas**				
		REF DWG TBD	Antenna 9-4 * - GPS Antenna (4.1.5)	4.587	-6.622	-24.000
			Antenna 4-6 * - Northstar GPS (4.1.1)	9.374	-4.970	-23.406
			Antenna 4-2 * - Northstar (4.1.2)	9.362	-3.617	-23.451
			P CODE GPS Antenna *	9.368	-2.645	-23.609
			Antenna 4-3 * - Northstar (4.1.4)	9.355	3.638	-23.363
			GLONAS GPS Antenna *	9.379	5.066	-23.515
			Antenna base (4A)	-53.872	-0.011	-22.025
			Antenna base (4B)	-49.758	0.038	-22.010
			Antenna base (4C)	-49.785	1.629	-22.020
			Antenna base (4D)	-49.771	-1.546	-22.008
			Trimble Centurion**	-52.726	-1.717	-21.113
			Time Server **	-52.671	1.838	-21.115
8	Westlake	**Vertical Ref**				
			MRV-M-MV -			
			Measured at Top of mounting bracket			
			Center (mid-point) - calculated	-2.100	0.291	-0.775

			TSS 333B - Marine Motion Sensor -			
			scribe atop mounting plate			
			Center of TSS 333B	1.210	0.329	-0.013
9	LDEO	**POS/MV**				
		From	**TO**	**X**	**Y**	**Z**
		IMU	Port Antenna (Master)	-2.9719	-3.9140	-5.5310
		MRP	IMU	-49.5710	1.7110	-16.7990
		MRP	Transmit array	-4.3860	0.7110	9.2380
		MRP	Port Antenna (Master)	-52.5429	-2.2030	-22.3300
10	Westlake Raw	**Fan Tail**				
			Aft/Port	-86.737	-4.906	-3.617
			Forward/Port	-77.600	-4.881	-3.589
			Forward/Starboard	-72.590	6.676	-3.653