PROJECT INSTRUCTIONS
29 April 2003

NOAA Ship RONALD H. BROWN
Cruise RB-03-04
CO2 and Tracer Study
4 June-11 August 2003

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ENDORSEMENTS

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PROJECT INSTRUCTIONS
NOAA SHIP Ronald H. Brown
RB-03-04 CRUISE
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Note: Updates on the RB-03-04 cruise will be posted at: http://www.pmel.noaa.gov/co2/a16n

II. CRUISE OVERVIEW

A.) Summary of Objectives:

This cruise will be the first in a decadal series of repeat hydrography sections jointly funded by NOAA-OGP and NSF-OCE as part of theCLIVAR/CO2/hydrography/tracer program: http://www.aoml.noaa.gov/ocd/repeathydro/justification.html.
Academic institutions and NOAA research laboratories will participate. The program focuses on the need to monitor inventories of CO_2, heat and freshwater and their transports in the ocean. Earlier programs under WOCE and JGOFS have provided a baseline observational field for these parameters. The new measurements will reveal much about the changing patterns on decadal scales. The program will serve as a backbone to assess changes in the ocean's biogeochemical cycle in response to natural and/or man-induced activity. Global warming-induced changes in the ocean's transport of heat and freshwater, which could affect the circulation by decreasing or shutting down the thermohaline overturning, can be followed through long-term measurements. The Repeat Hydrography Program provides a robust observational framework to monitor these long-term trends. The goal of the effort is to occupy a set of hydrographic transects with full water column measurements over the global ocean to study physical and hydrographic changes over time. These measurements are in support of:

* Model calibration and validation
* Carbon system studies
* Heat and freshwater storage and flux studies
* Deep and shallow water mass and ventilation studies
* Calibration of autonomous sensors

This program will follow the invasion of anthropogenic CO_2, CFCs and other tracers into intermediate and deep water on decadal timescales and determine the variability of the inorganic carbon system, and its relationship to biological and physical processes. More details on the program can be found at:
www.aoml.noaa.gov/ocd/repeathydro.

In addition to the CTD/rosette casts, separate trace metal casts will be made at some stations along the section, nominally at 60 mile spacing. This will be the largest-scale study ever done of the distribution of iron in the ocean. Because of contamination problems in sampling for iron and aluminum, these samples will have to be collected on separate casts, utilize a special trace-metal-clean winch and 1500 meter Kevlar coated cable provided by the trace metal investigators.

Near surface seawater (temperature, salinity, pCO2, ADCP) and atmospheric measurements (CO_2, CFCs, aerosols) will be made along the cruise track. A few ALACE-type profiling floats will be deployed along the section, along with special 'Carbon Explorer' profiling floats designed to measure particulate inorganic carbon (PIC).

B.) Operating Area:
The RB-03-04 cruise will focus on completing a long meridional section through the middle of the North Atlantic, nominally along 20˚W from 60˚N to 5˚S. (see attached map). This section in spring 2003 repeats the A16N section occupied during the World Ocean Circulation Experiment (WOCE) period, hence this cruise is designated A16N2003. This is also a repeat of the NOAA lead cruise in 1993, during which a full suite of inorganic carbon, hydrographic and CFC measurements were performed. The Germans also occupied parts of the A16N line in 1995 and 1998 and performed inorganic carbon measurements. A US led cruise in 1988 (Oceanus-202) completed the entire section 60˚N to 3˚S. No inorganic carbon measurements were performed on this cruise but high quality hydrographic and CFC measurements were performed. Thus the upcoming cruise will yield a first comprehensive snapshot of changes in anthropogenic CO_2 inventories and hydrographic changes in the region over the last decade. Full water column CTD stations will be occupied at 30 nautical mile intervals and include a variety of physical, chemical and biological parameters.
During RB-03-04a (transit from Charleston to Reykjavik) a few brief (~1 hour each) test casts may be performed to check the CTD/rosette and trace metal packages and collect water samples for instrument testing. These tests will involve stopping the ship and lowering the packages into the water. The locations of these tests will be chosen during the transit leg once the analytical gear is running, and in consultation with the ship's Captain.

C.) Participating Institutions:

AOML	NOAA-Atlantic Ocean Marine Laboratory
FSU	Florida State University
Hawaii	University of Hawaii
LDEO	Lamont-Doherty Earth Observatory, Columbia University
LBNL	Lawrence-Berkeley National Laboratory
Miami	University of Miami
PMEL	NOAA-Pacific Marine Environmental Laboratory
SIO	Scripps Institution of Oceanography, University of California, San Diego
TAMU	Texas A&M University
UCLA	University of California, Los Angeles
UW	University of Washington
UCI	University of California, Irvine
WHOI	Woods Hole Oceanographic Institution

D.) Personnel

Preliminary list of personnel on A16N2003 Cruise- (JLB 29 April 2003)
NOAA Ship RONALD H. BROWN

		Inst		Nat.	Leg 0	1	2
Chief Sci	John Bullister	PMEL	M	US		*	*
Co-Chief Sci	Nicolas Gruber	UCLA	M	Swiss		*	*
Data Manager	Robert Williams	SIO	M	US		*	*
Grad Student	Nicole Lovenduski	UCLA	F	US			*
Grad Student	Elena Brambilla	SIO	F	Italy		*	
Grad Student	Regina Cesario	UW	F	US		*	
Grad Student	TBD						
CTD process	Kristene McTaggart	PMEL	F	US		*	*
ET	Doug Anderson	AOML	M	US		*	
ET	David Bitterman	AOML	M	US			*
LADCP	Jules Hummon	Hawaii	F	US		*	*
Salinity	Gregory Johnson	PMEL	M	US		*	
Salinity	David Wisegarver	PMEL	M	US			*
O2	George Berberian	AOML	M	US		*	*
Nutrients	Jia-Zhong Zhang	AOML	M			*	
Nutrients	David Wisegarver	PMEL	M	US		*	
Nutrients	Charles Fischer	AOML	M	US			*
Nutrients	Calvin Mordy	PMEL	M	US			*
CFC	Frederick Menzia	PMEL	M	US		*	*
CFC	Mark Warner	UW	M	US		*	*
CFC	Eric Wisegarver	PMEL	M	US		*	*
Helium/Trit	TBD	LDEO				*	*
HCFC	Shari Yvon-Lewis	AOML	F	US		*	*
Alkalinity	Xiaorong Zhu	Miami	M	China		*	*
Alkalinity	Taylor Graham	Miami	M	US	*	*	
Alkalinity	Mike Trapp	Miami	M	US			*
pH	Vanessa Koehler	Miami	F	US	*	*	*
pH	William Hiscock	Miami	M	US	*	*	
pH	David Sergio Valdes	Miami	M	Mexico			*
pH	Denis Pierrot	Miami	M	France	*		
DIC1	Esa Peltola	AOML	M	US		*	*
DIC2	Robert Castle	AOML	M	US		*	*
pCO2	Dana Greeley	PMEL	M	US		*	*
pCO2	Kevin Sullivan	AOML	M	US	*		
Trace Metal	Chris Measures	Hawaii	M	US		*	*
Trace Metal	Rodrigo Torres	WHOI	M	Chile	*	*	*
Trace Metal	Matt Brown	Hawaii	M	US	*		
Aerosol	William Landing	FSU	M	US	*	*	*
Aerosol	Clifton Buck	FSU	M	US	*	*	*
Aerosol	Erik Kvaleberg	FSU	M	Norway	*		
Aerosol	Anthony Arguez	FSU	M	US	*		
POC/PIC	Todd Wood	LBNL	M	US		*	*
POC/PIC	Jim Bishop	LBNL	M	US		*	*
POC	Alexey Mishonov	TAMU	M	Ukraine		*	
DOC	Stacy Brown	Miami	F	US		*	*
Alkyl Nitrate	TBD	UCI	F				*
CIRIMS-IR-SST	Trina Litchendorf	UW	F	US	*		
TOTALS					12	32	31

E.) Administrative:

Clearances:
Foreign clearances required: Iceland, Portugal (Madeira)
Clearance has been requested (through Brian Lake, NOAA-PMEL) to work in the EEZs of Iceland and Portugal (near Madeira). The cruise plan assumes that clearance to work in the EEZ of Iceland will be obtained. Failure to obtain clearance from Iceland will severely impact the success of the expedition. If Portuguese clearance is not granted, the cruise track will be modified slightly to avoid occupying stations in the EEZ around Madeira.

Logistics:
Loading of most of the scientific equipment for this expedition on RONALD H. BROWN will take place in Charleston, SC prior to the departure for Iceland on 4 June 2003. Several ISO compatible laboratory vans will be loaded on the ship in Charleston (see Appendix E).
It is possible that additional loading and replenishment of spares will occur during the port stops in Reykjavik and Funchal, Madeira.

III. OPERATIONS

A. Data to be collected	**Lead PI**:
CTD	Greg Johnson-PMEL
Salinity:	Greg Johnson-PMEL
Chlorofluorocarbons (CFCs):	John Bullister-PMEL; Mark Warner-UW
HCFs	Sheri Yvon-Lewis-AOML
Total CO_2(DIC), pCO_2:	Dick Feely-PMEL; Rik Wanninkhof-AOML
Nutrients:	Calvin Mordy-PMEL; Jia-Zhong Zhang-AOML
Dissolved Oxygen:	Greg Johnson-PMEL
Helium/tritium:	Peter Schlosser-LDEO
Total Alkalinity:	Frank Millero-Miami
pH	Frank Millero-Miami
Trace Metals	Chris Measures-Hawaii, William Landing-FSU
Aerosols	William Landing-FSU
ADCP:	Eric Firing-Hawaii
ALACE Float deployment:	Breck Owens-WHOI, Silvia Garzoli-AOML
PIC/POC	Jim Bishop-LBNL
DOC	Dennis Hansell-Miami
13-C, 14-C	Ann McNichol-WHOI
Alkyl Nitrate	Eric Saltzman-UCI
Bathymetry:	Ship personnel
Underway thermosalinograph:	Ship personnel

B. Staging Plan

Much of the loading and setup of gear will be done in Charleston, tentatively during the week before departure. The scientific party will require assistance from the ship in loading and storing gear, and will need access to the laboratories for setup and testing of instruments. Several laboratory vans are planned to be loaded in Charleston (see Appendix E):

Copies of equipment lists, including serial numbers and country of origin must be supplied to the CO and Chief Scientist prior to the departure of the ship from Charleston. It is the responsibility of each group of investigators to arrange for shipping their equipment to and from the BROWN , including preparing all necessary customs or export/import documentation, and transfers to the ship. Any modifications to the ship's equipment or special requirements for this cruise should be brought to the

attention of the Field Operations Office (FOO) and Chief Scientists as soon as possible.
We anticipate unloading and shipping the scientific vans from Bridgetown, Barbados following the completion of the cruise, or in a US port if possible on a following leg.
Please read the important information concerning hazardous materials (HAZMAT) in Appendix B

C. Cruise Plan:

The A16N2003 expedition is scheduled for 3 legs (RB-03-04a, RB—03-04b, RB-03-04c) on NOAA ship RONALD H. BROWN. The tentative cruise schedule is given in Appendix G:

Leg RB-03-04a: Charleston, SC to Reykjavik
The vessel will depart Charleston and steam toward Reykjavik. During the transit, one or two CTD/rosette and trace metal casts may be made in deep water to test the performance of the winches and rosette system, and to collect water samples for testing the analytical instruments. Underway measurements of atmospheric gases and aerosols will be made, along with measurements of sea surface temperature, salinity, pCO2 and ADCP. Underway testing of the CIRIMS-IR-SST system will take place. The ship will stop for fueling at Keflavik enroute to Reykjavik.

Leg RB-03-04b: Reykjavik to Funchal;
After departing Reykjavik, the vessel will steam to the start of the A16N2003 section and begin a series of full water column stations (see Appendix C). On most casts the CTD/rosette will be lowered to within 10 meters of the bottom. The first station will be at a depth of ~200m. The vessel will move southward, occupying a series of closely spaced stations along the slope into deep water (see Appendix D for nominal station locations). Once deep water is reached (~1800m) CTD stations will be occupied at a nominal spacing of 30 nautical miles. Station spacing will be closer along boundary crossings and areas of steep bathymetry Water samples will be collected with a 36 position, twelve-liter CTD/rosette system. Three backup rosette systems: a 36 position, 10 liter rosette; a 24 position 4.0 liter rosette (for rough weather sampling) and the RB's CTD/rosette package [12 position, 10 liter] will also be available. Special trace metal casts will be occupied at some stations and will usually follow the completion of the CTD/rosette cast. The trace metal package will be deployed immediately after the CTD/rosette is on deck. Careful co-ordination will be required to minimize the time between the return of the CTD and deployment of the trace metal rosette. The number of trace metal casts will depend on the time required for each cast. If the trace metal casts require 1 hour to complete, then approximately 70 casts may be completed on the cruise.
We anticipate ending Leg B at about 32.5N 21.9W to minimize the transit time from the line to Funchal. Some scientific personnel will be exchanged in Funchal and some scientific gear and spares may be loaded.

Leg RB-03-04c: Funchal to Natal

At the completion of the port stop, the ship will steam back to the section and continue the line southward as on the previous leg. If the section to 5^{o}S is completed ahead of schedule, we plan to extend the section southward or sample the Romanche fracture zone in this region. At the completion of the section work, the ship will steam to port in Natal. We anticipate that the vans and some scientific gear will be remain on BROWN until the ship arrives in Bridgetown or at a US port.

D.) Waypoints:

Leg RB-03-04a (transit Charleston to Reykjavik)

Lat	Lon	dist.	#Sta.	Sta	steam*	total

		(nm)		(hrs)	(hrs)	(hrs)
32.9N 80.0W	64.3N 22.0W	2818	2	6	217	223
						9.3d

*assuming average speed on Leg a of 13 kts

Leg RB-03-04b (Reykjavik to Funchal)

Lat	Lon	dist.	#Sta.	Sta	steam**	total
		(nm)		(hrs)	(hrs)	(hrs)
64.3N 22.0W	63.3N 20.0W	120	0	0	10	10
63.3N 20.0W	36.0N 20.0W	1638	55	242	137	379
36.0N 20.0W	32.5N 21.9W	230	8	35	19	54
32.5N 21.9W	32.6N 16.9W	253			21	21
time at dock in Reykjavik (departure day)						12
time at dock in Madeira (arrival day)						12
Trace Metal Casts						36
						524
						21.8d

Leg RB-03-04c (Funchal to Natal)

Lat	Lon	dist.	#Sta.	Sta	steam**	total
		(nm)		(hrs)	(hrs)	(hrs)
32.6N 16.9W	32.4N 22.1W	263			21	21
32.4N 22.1W	20.0N 29.0W	831	28	112	69	181
20.0N 29.0W	11.0N 29.0W	540	18	72	45	117
11.0N 29.0W	1.5N 25.0W	617	21	84	52	136
1.5N 25.0W	5.0S 25.0W	390	13	52	33	85
5.0S 25.0W	5.7S 35.3W	614			51	51
time at dock in Madeira (departure day)						12
time at dock in Natal (arrival day)						12
Trace Metals Casts						36
						651
						27.2d

** assuming average steaming speed of 12 knots
Assuming average station spacing of 30 nm,
Assuming average station time of 4.4 hrs (Leg b) and 4 hours (Leg c)and)

Trace metal casts:
(1000 m cast every 1 degree of latitude along section, done at CTD stations, assuming 1 hour per cast)~ 72 hr

The cruise track is shown in Appendix D and a list of nominal station locations is given in Appendix E.

E. Station Operations

The preliminary personnel task assignments are indicated with each operation. Final responsibilities will be determined by the Chief Scientist and the Commanding Officer.

-- Full water column CTD/rosette casts (Ship's and scientific personnel)
-- Sampling the rosette bottles for salinity, oxygen, nutrients, CFCs, helium, tritium, carbon dioxide, alkalinity, DIC, carbon isotopes, chlorophyll (Ship and scientific personnel)
-- Release of ALACE floats (Ship and scientific personnel)
-- Trace Metal Casts (Ship's and scientific personnel)

a.) Full water column CTD/Rosette Casts (Ship's and scientific personnel)
It is of utmost importance to the success of the expedition that the ship be able to hold position at all times during the CTD casts, and that the CTD winch, meter wheel, hydraulic frame, conducting cable and backups function properly during this expedition. Both primary and secondary winches must contain full lengths of CTD conducting cable in good condition. Skilled ship personnel and adequate spare parts must be available on all legs to assure that this equipment is maintained in good working order. The personnel must be skilled in CTD wire re-terminations, and adequate supplies of materials for CTD wire re-terminations must be available. Since typical steaming time between stations is less than 3 hours, re-terminations of the conducting cable (when required) must be completed within 2-3 hours.
The CTD/rosette system will be deployed off the starboard side. During recovery, the CTD/rosette package will be lowered onto a pallet with a rubber pad to reduce the jolt as the package lands. A 36-position rosette system with 12 liter bottles will be used for CTD/rosette casts. This type of rosette package has been used successfully on a number of research vessels. In addition to this primary system, a 36-position rosette with 10 liter water bottles will be available. As a backup for sampling during rough sea conditions, a small instrument package (consisting of a CTD mounted on 24-position rosette with 4 liter bottles) will also be available. The smaller package must be secured in a readily accessible area, and will be switched with the larger packages when required. A means of safely and quickly moving the rosettes into position for deployments and sampling during bad weather will be required. A pinger and altimeter will be mounted on the rosette systems and used during casts to monitor distance from the bottom. We anticipate that during most casts, the CTD/rosette will be lowered within about 10 meters of the bottom. The ship's PDR must be working properly for this purpose

The winch, wire and meter wheel must be capable of routinely making 6000 meter casts with these rosette systems. PMEL is sending CTD watch leaders on Legs b & c to perform CTD data collection, processing and quality control. CTD watch leaders will assign science party members to monitor CTD casts. During the casts, if needed and available, ship's personnel will assist the CTD operators monitoring of the bathymetric recorder and pinger signal and to properly assess the distance of the rosette package
off the bottom. The ship's electronics technician will share responsibility with the scientific party for maintaining good electrical and mechanical connections between the CTD/rosette system, the conducting cable and winch slip-rings, and to the deck unit for the CTD/rosette system.

The ship's personnel will be responsible for the deployment and recovery of the CTD/rosette and trace metal rosettes. A number of members of the scientific party have experience with CTD deployments and will be available to assist with these operations. Members of the scientific party will be responsible for collecting the water samples from the rosette. Members of the scientific party will also be primarily responsible to collect oxygen, nutrient and salinity samples and recording sample ID's. Ship's personnel, if needed and available, may assist on a case-by-case. Particular care must be taken in the collection and analysis of water samples to assure that all properties are measured with the greatest accuracy possible. Many of the chemical measurements are sensitive to contamination from soot, oils, solvents, spray cleaners, lubricants, paints, hydraulic fluid, and other substances. The Chief Scientist must be notified prior to the use of these substances. Care must be taken to avoid contamination of the rosette system with these substances. Smoking is prohibited in

the area around the rosettes during sampling and at all times in the laboratories.

Discharges from holding tanks must be secured 20 minutes before arriving on station. The tanks may be pumped when the cast is at depth (>200 meters). Discharges must again be secured 20 minutes before the CTD/rosette returns to the surface layer. The bridge must inform the ship's engineers in advance when discharges are to be secured.

b.) Sampling the rosette bottles (Ship's and scientific personnel):
The usual order for drawing seawater samples on deck will be: CFCs, helium/tritium, oxygen, DIC, alkalinity, nutrients, salinity. Samples will be collected for salinity, oxygen and nutrient analysis from each sample bottle.
Salinity samples will be analyzed by scientific personnel. Two salinity samples will be drawn from the deepest bottle at each station to monitor the precision of the sampling/analysis procedures. Salinity samples will be run using the RB's Guild line 8600B Autosal instrument, complete with computer interface and laptop computer. A backup salinometer must be provided by the ship. The salinometers must be checked for accuracy and precision during the import before the start of the expedition. Salinity samples will be analyzed in the salinity lab off the main oceanographic laboratory, and variations in laboratory temperature must not exceed 1°C during a 24 hour period. The salinity samples will also be stored in this temperature controlled area for at least 8 hours to allow them to come to ambient temperature. The Autosal will be standardized at least once each run with new vials of standard seawater. Standard seawater will be provided by the scientific personnel for use on this cruise, and one vial will be analyzed per day. To maintain the required accuracy, it is advisable to have one person run all salinity samples. We anticipate ~140-160 samples/day. An accuracy of 0.003 PSS-78 or better is required, and will be monitored by scientific personnel by comparison with CTD and historical data. To assure timely detection of any problems with the CTD system or Autosal, salinity analyses should be completed within 36 hours of sampling and submitted to the CTD operators. Any problems with the Autosal should be reported immediately to the Chief Scientist.

Oxygen and nutrient sampling and analysis (Scientific personnel):
Samples will be collected for oxygen and nutrient analysis from each sample bottle at all stations. Nutrients will be run on board ship by members of the scientific party. Refrigerator space will be required in the main lab for nutrient sample storage prior to analysis. Nutrient measurements will be made using a AlpKem RFA system. Dissolved oxygen samples will be run in the main lab by members of the scientific party.

CFC ('Freon') and helium samples (Scientific personnel)
Water samples will be drawn for CFC analysis at most stations. CFC samples must be drawn first, ahead of the helium and oxygen samples. The measurements are sensitive to the high CFC levels on board ship. The chief scientist should be notified prior to any service or maintenance of the air-conditioning system and of any discharge or leakage of CFCs or solvents on the ship.

Helium samples will be drawn at selected stations and will be stored. (Scientific Personnel) Due to the danger of contamination, no luminous dial watches may be used on board the ship during this expedition. Dr. Peter Schlosser (LDEO) or his representative must be notified of any proposed use of helium gas on board ship during this expedition.

Dissolved inorganic carbon (DIC), Total Alkalinity (TALK), pH, pCO2 (Scientific personnel):
The chemistry groups from AOML, PMEL, and Miami will make the DIC, pH, pCO_2,and TALK measurements at the hydrocast stations. DIC and TALK samples will be collected from the 12-L Niskin bottles into 500 ml glass-stoppered bottles containing 0.025 mL of a saturated solution of HgCl2 to retard bacterial oxidation of organic matter prior to analysis. DIC samples will be measured by the coulometric titration method and will be done in a temperature controlled van. Discrete pCO_2 samples will be collected from the Niskins into 500 ml flasks for analyses by IR. TALK samples will be measured by the potentiometric methods

Profiling ADCP (Ship and Scientific personnel):

The lowered ADCP (LADCP) will be used on the 36 position rosette casts. The instrument is a broadband, self-contained, 150 kHz ADCP, which is to be mounted to the 36-position rosette system. Because of the instrument size, 2-4 of the water sample bottles cannot be used when the ADCP is mounted to the rosette. The instrument can be used to a depth of 6000 m. The instrument is turned on about 15 minutes prior to the launch of the CTD/rosette package using a removable cable connection to a deck box and PC computer. The deck box should be in a dry area within 10 m of the rosette. After the CTD station, about 30 minutes are required to transfer the data from the instrument and to turn it off. The LADCP may have to be removed from the rosette for repair and possible battery changes.

ALACE and CARBON EXPLORER Float deployment (Ship and scientific personnel):
About 6 ALACE and 2 Carbon Explorer floats will be released during this expedition. The Chief Scientist will co-ordinate this program. These floats require about an hour of preparation prior to deployment. Preparations will be completed while the CTD is in the water. Floats will be deployed at stations immediately following recovery of the CTD and trace metal casts and before the ship gets underway. Deployment involves lowering he ~30 kg float by hand into the water from the stern of the ship. One or two persons from the ship and scientific party will be required for preparation and deployment.

Navigation (Ship's personnel):
Navigation shall be based on the best available information including GPS, radar and visual. When GPS control is available, it is the preferred navigation method. It is important that accurate speed and course information be used in satellite position computation. At least one GPS P-code receiver and one Seapath 3DF GPS unit must be functional and integrated with the ship's SCS system for ADCP and LADCP measurements.

The station locations listed in Appendix D are nominal positions and some drift during CTD/rosette casts is acceptable to maintain wire angle. In most cases, starting station positions along the section should be within 1-2 nautical miles of the listed position. Navigation information will be recorded on the MOA form. In addition to satellite fixes and other events as they occur, MOA entries shall be made at least once every four hours, and at the time of each course and speed change when the ship is enroute between stations (including slowdowns on arrival at the station and speedups on departure).

The numerical MOA entries will suffice for scientific purposes; a cruise plot is not required in the cruise data package. Since copies of the MOA forms will be made and used by various cruise participants, it is important that the entries be checked and made clearly and dark enough for reproduction.

F. Underway Operations:
Underway measurements will be made along the entire cruise track, including the transit (Leg RB-03-04a) from Charleston to Reykjavik:

-Underway measurement of sea surface temperature and salinity (Ship's personnel)
-Underway sea surface measurements of carbon dioxide, chlorophyll, and atmospheric measurements of CFCs and aerosols (Scientific personnel)
-Underway air measurements of carbon dioxide (Scientific and ship's personnel)
-ADCP (Scientific and ship's personnel)
-Routine weather observations (Ship's personnel).
-Center-beam Sea Beam data logging (Ship's personnel).
-CIRIMS-IR-SST (TBD)

Sea surface temperature and salinity (Ship's personnel):
Sea surface temperature and salinity will be recorded continuously with a system accurate to within 0.1°C and 0.1 PSS-78. A copy of the calibration data will be provided to the Chief Scientist. The

Survey Department will translate the data from thermosalinograph to ASCII and plot the data on a daily basis. The thermosalinograph should be calibrated no more than 3 months before the start of the cruise.

Underway sea surface measurements and sampling (Ship's and scientific personnel):
Continuous water sampling will be made from the ship's bow intake system. Ship's personnel will maintain this pump and provide adequate spare parts. This system must be capable of delivering 120 liters/minute of seawater. Seawater will be drawn off this line to three sea/air equilibrators. Care must be taken to prevent contamination from smoke, solvent fumes, cleaning solutions, etc. Continuous underway measurements of pCO_2 will be made from one of the headspace equilibrators utilizing a LICOR NDIR Analyzer. Continuous measurements of chlorophyll will also be made.

Underway air measurements (Scientific personnel):
Atmospheric and aerosol sampling will be conducted while underway and on station only when the wind is forward of the beam. It is essential that the bridge notify the Chief Scientist if the ship's course will result in winds abaft the beam.
Air inlet cups will be mounted on the foredeck as high off the deck as possible for collecting uncontaminated marine air. Air sampling lines will run from these inlets into the laboratory and laboratory vans.

Aerosol sampling and tower:
Ship and scientific personnel must constantly be aware of potential sample contamination. Work activities forward of the main stack must be secured during sampling operations. This includes the bow, boat deck forward of the stack, bridge deck and flying bridge. The scientists on watch must be notified of any change in ship course or speed that will move the relative wind abaft the ship's beam or if anyone needs access to the bow. The appropriate personnel on watch should also be notified when a ship enters a rain squall and when the rain subsides.

At a number of locations along the cruise track, a compressor will be used for filling air cylinders. The samples will be collected in aluminum cylinders secured next to the pump near the bow of the ship. Filling of the cylinders will be done during good weather. Filling each cylinder will require approximately 2 hours. The compressor requires 15 amps of 240 volt power.
Small low pressure flasks will be filled at some stations and analyzed for methyl halides by R. Gammon (UW)

ADCP underway operations (Ship's and scientific personnel):
Data from the ADCP system will be logged continuously while underway.

Weather observations (Ship's personnel):
Observations must be done at each station, and at regular intervals while underway.

Seabeam and PDR (Ship's personnel):
While underway, in place of annotation of the bathymetric (PDR) chart record, Sea Beam (center beam) will be operated to obtain a continuous record of time, position and bottom depth. During CTD stations, the PDR will be required for bottom detection.

The Turbulent Flux System is currently deployed on the Ron Brown (on the jackstaff and in the Main Lab forward). This system makes measurement of the small-scale fluxes of sensible and latent heat, momentum, and CO_2 through fast-response turbulent instrumentation and unique ship-motion correction algorithms.

G) Applicable restrictions:

H.) Small Boat Operations: none anticipated

I.) De-staging plan

Because of difficulties in shipping scientific equipment from Brazil, we anticipate shipping the CFC, CO_2, and trace metal and aerosol vans from Bridgetown or at a US port following the cruise, along with miscellaneous scientific gear. All documentation and shipping arrangements will be prepared by the scientific party prior to arrival. Arrangements will be for a scientist on the RB-03-05 and RB-03-06 legs to supervise any hazardous materials left on the ship.

The CIRIMS-IR-SST equipment will remain on the RB until return to Charleston at the end of the season.

IV FACILITIES

A. Equipment and capabilities to be provided by ship:

The following systems and their associated support services are essential to the cruise. Sufficient consumables, back-up units, and on-site spare parts and technical support must be in place to assure that operational interruptions are minimal. All measurement instruments are expected to have current calibrations and all pertinent calibration information shall be included in the data package.

(a) Navigational systems including a GPS P-code receiver and SeaPath 3DF GPS units.
(b) Primary and back-up oceanographic winch, meter wheel, and 7500 meter CTD conducting cable systems capable of lowering and raising the CTD to 6000 meters with 36 or 24 bottle rosette sampler packages, conducting wire termination kits, backups and spare parts. PMEL's two 36, and one 24 bottle rosettes and 2 Sea-Bird CTDs will be the primary systems used. The ship's Sea-Bird CTD shall be calibrated before the cruise, and afterward, if used as a backup
The CTD cable will be lubricated with Pre-lube 18 or Super-Lube during installation and at regular intervals according to manufacturers specifications. Care must be taken to minimize the amount of excess lubricant applied to the cable. To reduce the risk of sample contamination, the last 50 meters of cable between the rosette and drum will not be lubricated. The Chief Scientist must be notified prior to re-lubrication of the CTD conducting cable.
(c) Surface seawater thermosalinograph system calibrated to within 0.1°C and 0.1 PSS-78.
(d) Bow continuous water sampling system with minimum flow of 120 L/min, with backup pump.
(e) Autosal salinometer. The Autosal, along with a backup, is required to meet WOCE precision and accuracy guidelines.
(f) Seabeam and PDR Depth sounder/pinger tracking capability in lab for underway bathymetry and CTD operations.
(g) Compressed air line (100 psi) in oceanographic laboratory
(h) Laboratory and storage space for 18000 pounds of equipment (see Section 3.3)
(i) Rosette sampling area cover

B.) Equipment, capabilities and supplies provided by scientific party:

Several container vans will be loaded aboard RB for this cruise. These containers will act as laboratory vans, and must be accessible at all times throughout the expedition. Compressed gas (non-flammable) cylinders will be used in ship's laboratories and laboratory vans.

(a) Two 36 position rosette sampling with 12 (or 10) liter water sampling bottles and spare parts. One 24 position, 4 liter rosette system.
(b) Complete CTD recording and processing system including 2 Sea-Bird CTDs, 2 deck units, connectors, spare parts and consumables.
(c) Chemical analysis instrumentation including gas chromatographs, equilibrators, oxygen titration system, autoanalyzer, coulometer, alkalinity titrator, salinity bottles.
(d) Chemical reagents, compressed gases (approximately 30 cylinders). A listing of chemicals is given in Appendix D and will be updated prior to departure for Leg 1.
(e) Two Benthos pingers with spare batteries, and altimeter.

(f) Winch, Kevlar cable, meter wheel for trace metal casts
rosette, CTD and data acquisition system for trace metal casts
(g) Strain gage
(h) Milli-Q system, and replacement parts

3.3 Equipment weight and location: TBD

V. DISPOSITION OF DATA AND REPORT

A.) Data responsibilities

The Chief Scientist is responsible for the disposition, feedback on data quality, and archiving of data and specimens collected on board the ship for the primary project. The Chief Scientist is also responsible for the dissemination of copies of these data to participants on the cruise and to any other requesters. The ship will assist in copying data and reports insofar as facilities allow. The ship will provide the Chief Scientist copies of the following data:

Sightings log (position, speed, course, distance upwind) of other vessels
Navigational log sheets (MOAs)
Weather observation sheets
Thermosalinograph and CTD calibration reports
Digitized Bathymetric Data (TIME, LAT, LON, DEPTH)
SCS data CDs
ADCP and associated navigational data

The Chief Scientist will receive all original data gathered by the ship for the primary and piggy-back projects, and this data transfer will be documented on NOAA form 61-29 "Letter Transmitting Data". The Chief Scientist in turn will furnish the ship a complete inventory listing of all data gathered by the scientific party, detailing types and quantities of data.

The Commanding Officer is responsible for all data collected for ancillary projects until those data have been transferred to the projects' principal investigators or their designees. Data transfers will be documented on NOAA Form 61-29. Copies of ancillary project data will be provided to the Chief Scientist when requested. Reporting and sending copies of ancillary data to NESDIS (ROSCOP) is the responsibility of the program office sponsoring those projects.

Foreign research clearance reports

A request for research clearance in foreign waters (Iceland, Portugal) has been submitted. Copies of clearances received will be provided to the ship before departure. The Chief Scientist is responsible for satisfying the post-cruise obligations associated with diplomatic clearances to conduct research operations in foreign waters. These obligations consist of (1) submitting a "Preliminary Cruise Report" immediately following the completion of the cruise involving the research in foreign waters (due within 30 days); and (2) ultimately meeting the commitments to submit data copies of the primary project to the host foreign countries.

B) Pre & post-cruise meetings

A pre-cruise meeting between the Commanding Officer and the Chief Scientist will be conducted either the day before or the day of departure, with the express purpose of identifying day-to-day project requirements, in order to best use shipboard resources and identify overtime needs.

A post-cruise debriefing will be held between the Chief Scientist and the Commanding Officer.

C.) Ship operation evaluation form

A Ship Operations Evaluation Form will be completed by the Chief Scientist and given to the Director of PMEL for review and then forwarded to NMAO.

VI. ADDITIONAL PROJECTS

A.) Supplemental ("Piggyback) projects

Any ancillary work done during this project will be accomplished with the concurrence of the Chief Scientist and on a not-to-interfere basis with the programs described in these instructions and in accordance with the NOAA Fleet Standing Ancillary Instructions.
Personnel assigned to ancillary projects and participating in the cruise may be assigned additional scientific duties in support of the project by the Chief Scientist.
Any additional work will be subordinate to the primary project and will be accomplished only with the concurrence of the Chief Scientist and Commanding Officer on a not-to-interfere basis.

B.) NOAA Fleet Ancillary Projects

The following projects will be conducted by ship's personnel in accordance with general instructions contained in the MOA OPORDER:

(a) SEAS Data Collection and Transmission (MOA OPORDER 1.2.1)
(b) Marine Mammal Reporting (MOA OPORDER 1.2.2)
(c) Nautical Charting (MOA OPORDER 1.2.6)
(d) Bathymetric Trackline (MOA OPORDER 1.2.5)
(e) Central Pacific Weather Reporting (MOA OPORDER 1.2.7)
(f) Sea Turtle Observation Program (SP-MOA-2-94)

No other ancillary projects are assigned.

VII HAZARDOUS MATERIALS

All NOAA ships will operate in full compliance with all NOAA hazardous materials (HAZMAT) requirements. All hazardous materials and substances needed to carry out the objectives of the embarked science mission, including ancillary tasks, are the direct responsibility of the embarked designated Chief Scientist, whether or not that Chief Scientist is using them directly. The ship's Environmental Compliance Officer will work with the Chief Scientist to ensure that this management policy is properly executed.

Material Safety Data Sheet: All hazardous materials require a Material Safety Data Sheet (MSDS). Copies of all MSDSs shall be forwarded to the ship at least two weeks prior to sailing. The Chief Scientist shall have copies of each MSDS available when the hazardous materials are loaded aboard. HAZMAT for which the MSDS is not provided will not be loaded aboard.

The Chief Scientist will provide the Commanding Officer with an inventory indicating the amount of each hazardous material brought onboard, and for which the Chief Scientist is responsible. This inventory shall be updated at departure, accounting for the amount of material being removed, as well as the amount consumed in science operations and the amount being removed in the form of waste.

All HAZMAT, except small amounts for ready use, must be stored in the HAZMAT Locker. If science party requirements exceed ship's storage capacity, excess HAZMAT must be stored in dedicated lockers meeting OSHA/NFPA standards to be provided by the science party.

The scientific party, under supervision of the Chief Scientist, shall be prepared to respond fully to emergencies involving spills of any mission HAZMAT. This includes providing properly trained personnel for response, as well as the necessary neutralizing chemicals and clean-up materials. Ship's personnel are not first responders and will act in a support role in the event of a spill. The Chief Scientist shall provide a list of science party members that are properly trained to respond in the event of hazmat spills. These include Dana Greeley from PMEL

The Chief Scientist is directly responsible for the handling, both administrative and physical, of all scientific party hazardous wastes. No liquid wastes shall be introduced into the ship's drainage system. No solid waste material shall be placed in the ship's garbage.

The embarking Chief Scientist will work with the departing Chief Scientist and the ship's Environmental Compliance Officer to ensure proper tracking of inherited hazardous materials.

B.) Inventory [will be provided later]

C.) Material Safety Data Sheets (MSDS) [will be provided later]

VIII RADIOACTIVE ISOTOPES

Each scientist working with these materials will be required to wear a lab coat and disposable booties to reduce the likelihood of tracking the substance out of the specified working area.

It will be the responsibility of the investigator to conduct pre-cruise (for background) and post-cruise wipe tests (regardless of whether a spill occurred or not). Wipe tests should also be conducted in the event of a spill, as well as periodically while underway.

A detailed procedural methodology describing the use of these materials should be provided to the Environmental Compliance Officer (ECO) for review at least one month prior to bringing them aboard. A spill contingency plan should also be provided at the same time. Please note that ship's personnel are not first responders in the event of a spill.

A log detailing the type and amount of materials brought aboard and removed from of the ship shall be maintained, along with a record of any spills that occurred.

All radioisotope work will be conducted by NRC or State licensed investigators only, and copies of these licenses shall be provided to the ECO at least one month prior to bringing any materials on board.

[Note: the only radioisotope on the RB-03-04 cruise will Nickel-63, present in the Electron Capture detectors used in gas chromatographs. These are low-activity sealed sources used routinely in the laboratory and on research vessels. Further information will be supplied on these]

B.) Inventory

C.) License and name of person holding license

IX MISCELLANEOUS

A.) Scientific berthing

The Chief Scientist is responsible for assigning berthing for the scientific party within the spaces approved as dedicated scientific berthing. The ship will send stateroom diagrams to the Chief Scientist showing authorized berthing spaces. The Chief Scientist is responsible for returning the scientific berthing spaces back over to the ship in clean and ready-to-use condition for the next scientific party, for stripping bedding and for linen return; and for the return of any room keys which were issued.

The Chief Scientist is also responsible for the cleanliness of the laboratory and storage areas used by the science party, both during the cruise and at its conclusion prior to departing the ship.

Implied consent

All persons boarding NOAA vessels give implied consent to comply with all safety and security policies and regulations which are administered by the Commanding Officer. All spaces and equipment on the vessel are subject to inspection or search at any time. All personnel must comply with NMAO's Drug and Alcohol Policy dated May 7, 1999 which forbids the possession and/or use of illegal drugs and alcohol aboard NOAA Vessels.

B.) Medical Forms and emergency contacts:

The NOAA Health Services Questionnaire must be completed in advance by each participating scientist. It should reach the ship no later than 4 weeks prior to the cruise. This will allow time to medically clear the individual and to request more information if needed. All personnel should bring any prescription medication they may need and any over-the-counter medicine that is taken routinely (e.g. an aspirin per day, etc.). The ship maintains a stock of medications aboard, but supplies are limited and chances to restock are few.

Emergency contacts

Prior to departure, the Chief Scientist will provide a listing of emergency contacts to the Executive Officer for all members of the scientific party, with the following information: name, address, relationship to member, and telephone number.

C.) Shipboard Safety

A discussion of shipboard safety policies is in the "Science User's Guide" which is available on *RONALD H. BROWN* and is the responsibility of the scientific party to read. This information is also available on the ship's web page: www.moc.noaa.gov/rb/science/welcome.htm A meeting with the Operations Officer will be held for the scientific party at the beginning of the cruise which will include a safety briefing. All members of the scientific party are expected to be aware of shipboard safety regulations and to comply with them.

Wearing open-toed footwear or shoes that do not completely enclose the foot (such as sandals or clogs) outside of private berthing areas is not permitted. Steel-toed shoes are required to participate in any work dealing with suspended loads, including CTD deployments and recovery. The ship does not provide steel-toed boots. Hard hats are also required when working with suspended loads. Work vests are required when working near open railings and during small boat launch and recovery operations. Hard hats and work vests will be provided by the ship when required.

D.) Communications

Data (email) transfers will take place three times per day at approximately 0700, 1200 and 1730 LT.

The Chief Scientist or designated representative will have access to ship's telecommunications systems. Direct payment (e.g. by credit card) to the communications provider (e.g. the telephone company) shall be used as opposed to after-the-fact reimbursement. Specific information on how to contact Ronald H. Brown and all other fleet vessels can be found at http://www.moc.noaa.gov/phone.htm.

Ship's systems include:

- INMARSAT-B

INMARSAT-B provides high quality voice and fax communications (9600 baud) and high speed data transmission, including FTP; it is the primary means of transferring email. Cost is $2.60/min for voice and fax; $7.25/min for high speed. INMARSAT-B calls may be made collect or charged to credit card; cost is approximately $2.60/min **.

- INMARSAT-M

INMARSAT-M (or Mini-M) provides medium quality voice communications. Cost is $2.15/min. INMARSAT-M may be charged to credit card or collect.

- INMARSAT-A

INMARSAT-A provides high quality voice communications as a backup system. It can also provide fax communications (9600 baud) and high speed data transmission, including FTP. Cost varies from $2.65/min to $5.60/min for voice and fax depending on vendor and peak vs off-peak rates. High speed costs $10.80 - $15.60/min. INMARSAT-A may be charged to credit card or collect.

**Note: All rates listed are 2001 rates based on direct-dialed business calls to the US. Collect, or calls charged to credit calls are charged higher rates, subject to additional fees, and may have minimum charges.

E-MAIL

An e-mail account for each embarked scientist will be established by the ship's LET. The account name will use the person's first and last name as listed in Personnel Section. The e- mail address for

scientists will use the format:

Each member of the ship's complement (crew and scientists) will be authorized to send/receive up to 15 KB (approximately 3 pages of text) of data per day ($1.50/day or $45/month) at no cost. E-mail costs accrued in excess of this amount must be reimbursed by the individual. At or near the end of each leg, the Commanding Officer will provide the Chief Scientist with a detailed billing statement for all personnel in his party. Prior to their departure, the chief scientist will be responsible for obtaining reimbursement from any member of the party whose e-mail costs have exceeded the complimentary amount. Each scientist should bring a blank check to cover these costs before departure, or provide a valid NOAA project number.

E.) Port Agent Services/Billing

Contractual agreements exist between the port agents and the Commanding Officer for services provided to NOAA SHIP *RONALD H. BROWN*. The costs or required reimbursements for any services arranged through the ship's agents by the scientific program, which are considered to be outside the scope of the agent/ship support agreement, will be the responsibility of that program. Where possible, it is requested that direct payment be arranged between the science party and port agent, as opposed to after-the-fact reimbursement to the ship.

F.) Wage marine dayworker working hours and rest periods

Chief Scientists shall be cognizant of the reduced capability of *RONALD H BROWN*'s operating crew to support 24-hour mission activities with a high tempo of deck operations at all hours. Wage marine employees are subject to negotiated work rules contained in the applicable collective bargaining agreement. Dayworkers' hours of duty are a continuous eight-hour period, beginning no earlier than 0600 and ending no later than 1800. It is not permissible to separate such an employee's workday into several short work periods with interspersed nonwork periods. Dayworkers called out to work between the hours of 0000 and 0600 are entitled to a rest period of one hour for each such hour worked. Such rest periods begin at 0800 and will result in no dayworkers being available to support science operations until the rest period has been observed. All wage marine employees are supervised and assigned work only by the Commanding Officer or designee. The Chief Scientist and the Commanding Officer shall consult regularly to ensure that the shipboard resources available to support the embarked mission are utilized safely, efficiently and with due economy.

Radio interference

Radio transmission can interfere with several of the continuous data streams. If this becomes a problem, the Commanding Officer and Chief Scientist will work out a transmission schedule to minimize data interferences to the extent that vessel communication needs allow. Nothing will preclude or interfere with the use of VHF radio for communications related to the safe navigation of the vessel.

The Chief Scientist is authorized to alter the scientific portion of this cruise plan with the concurrence of the Commanding Officer, provided that the proposed changes will not:

(1) jeopardize the safety of the personnel or the ship;
(2) exceed the allotted time for the cruise;
(3) result in undue additional expense; or
(4) change the general intent of the cruise.

X. APPENDICES

Appendix A. Equipment Inventory
Appendix B. Hazmat inventory
Appendix C. Cruise Track- A16N2003
Appendix D. Proposed Station Locations
Appendix E. Van dimensions and Locations and Requirements
Appendix F. Contact Information
Appendix G. Ship Schedule

Appendix A.: Equipment Inventory:
will be provided prior to the departure of the ship in Charleston

Appendix B.: Hazmat Inventory
(This is a preliminary list; an updated list will be provided prior to the departure of the ship in Charleston
Compressed Gases
- argon/methane (95/5%)
- nitrogen
- carbon dioxide
- compressed air
- helium

Chemicals

Appendix D.: Preliminary Station Locations

STATION	Latitude	Longitude	BOTTOM DEPTH (M)
1	63 20.0 N	020 00.0 W	204
2	63 12.9 N	020 00.0 W	604
3	63 07.5 N	020 00.0 W	1011
4	62 45.0 N	020 00.0 W	1406
5	62 20.0 N	020 00.0 W	1786
6	61 50.0 N	020 00.0 W	1709
7	61 36.8 N	020 00.0 W	2112
8	61 20.0 N	020 00.0 W	2473
9	61 00.0 N	020 00.0 W	2435
10	60 30.0 N	020 00.0 W	2650
11	60 00.0 N	020 00.0 W	2726
12	59 30.0 N	020 00.0 W	2770
13	59 00.0 N	020 00.0 W	2829
14	58 30.0 N	020 00.0 W	2631
15	58 00.0 N	020 00.0 W	1646
16	57 30.0 N	020 00.0 W	1171
17	57 00.0 N	020 00.0 W	994
18	56 30.0 N	020 00.0 W	1384
19	56 00.0 N	020 00.0 W	1462
20	55 30.0 N	020 00.0 W	1140
21	55 00.0 N	020 00.0 W	1631
22	54 30.0 N	020 00.0 W	1405
23	54 00.0 N	020 00.0 W	1424
24	53 30.0 N	020 00.0 W	2311
25	53 00.0 N	020 00.0 W	2683
26	52 30.0 N	020 00.0 W	2806
27	52 00.0 N	020 00.0 W	3777
28	51 30.0 N	020 00.0 W	3594
29	51 00.0 N	020 00.0 W	3654
30	50 30.0 N	020 00.0 W	3936
31	50 00.0 N	020 00.0 W	4385
32	49 30.0 N	020 00.0 W	3908
33	49 00.0 N	020 00.0 W	4412
34	48 30.0 N	020 00.0 W	4014
35	48 00.0 N	020 00.0 W	4363
36	47 30.0 N	020 00.0 W	4559
37	47 00.0 N	020 00.0 W	4542
38	46 30.0 N	020 00.0 W	4853
39	46 00.0 N	020 00.0 W	4667
40	45 30.0 N	020 00.0 W	4534
41	45 00.0 N	020 00.0 W	4336
42	44 30.0 N	020 00.0 W	4192
43	44 00.0 N	020 00.0 W	3985
44	43 30.0 N	020 00.0 W	4005
45	43 00.0 N	020 00.0 W	5130
46	42 30.0 N	020 00.0 W	4570
47	42 00.0 N	020 00.0 W	2387
48	41 30.0 N	020 00.0 W	2757
49	41 00.0 N	020 00.0 W	4601
50	40 30.0 N	020 00.0 W	4981
51	40 00.0 N	020 00.0 W	4665
52	39 30.0 N	020 00.0 W	4773

53	39 00.0 N	020 00.0 W	4734
54	38 30.0 N	020 00.0 W	4419
55	38 00.0 N	020 00.0 W	5102
56	37 30.0 N	020 00.0 W	4852
57	37 00.0 N	020 00.0 W	3818
58	36 30.0 N	020 00.0 W	5164
59	36 00.0 N	020 00.0 W	5326
60	35 30.0 N	020 16.9 W	5269
61	35 00.0 N	020 33.8 W	5068
62	34 30.0 N	020 50.6 W	5179
63	34 00.0 N	021 07.5 W	5221
64	33 30.0 N	021 24.4 W	5324
65	33 00.0 N	021 41.2 W	5224
66	32 30.0 N	021 58.1 W	5217
67	32 30.0 N	021 58.1 W	5217
68	32 00.0 N	022 15.0 W	5152
69	31 30.0 N	022 31.9 W	5250
70	31 00.0 N	022 48.8 W	5230
71	30 30.0 N	023 05.6 W	5256
72	30 00.0 N	023 22.5 W	5247
73	29 30.0 N	023 39.4 W	5216
74	29 00.0 N	023 56.2 W	5223
75	28 30.0 N	024 13.1 W	5197
76	28 00.0 N	024 30.0 W	5217
77	27 30.0 N	024 46.9 W	5205
78	27 00.0 N	025 03.8 W	5223
79	26 30.0 N	025 20.6 W	5193
80	26 00.0 N	025 37.5 W	4790
81	25 30.0 N	025 54.4 W	5353
82	25 00.0 N	026 11.2 W	5360
83	24 30.0 N	026 28.1 W	5416
84	24 00.0 N	026 45.0 W	5407
85	23 30.0 N	027 01.9 W	5499
86	23 00.0 N	027 18.8 W	5519
87	22 30.0 N	027 35.6 W	5435
88	22 00.0 N	027 52.5 W	5399
89	21 30.0 N	028 09.4 W	5310
90	21 00.0 N	028 26.2 W	5050
91	20 30.0 N	028 43.1 W	5135
92	20 00.0 N	029 00.0 W	4581
93	19 30.0 N	029 00.0 W	4884
94	19 00.0 N	029 00.0 W	4764
95	18 30.0 N	029 00.0 W	4810
96	18 00.0 N	029 00.0 W	4691
97	17 30.0 N	029 00.0 W	4795
98	17 00.0 N	029 00.0 W	4651
99	16 30.0 N	029 00.0 W	4953
100	16 00.0 N	029 00.0 W	4447
101	15 30.0 N	029 00.0 W	5211
102	15 00.0 N	029 00.0 W	5368
103	14 30.0 N	029 00.0 W	5375
104	14 00.0 N	029 00.0 W	5519
105	13 30.0 N	029 00.0 W	5551
106	13 00.0 N	029 00.0 W	5640
107	12 30.0 N	029 00.0 W	5526

108	12 00.0 N	029 00.0 W	5510
109	11 30.0 N	029 00.0 W	5906
110	11 00.0 N	029 00.0 W	5888
111	10 30.0 N	028 45.0 W	5317
112	10 00.0 N	028 30.0 W	5400
113	09 30.0 N	028 15.0 W	5332
114	09 00.0 N	028 00.0 W	5155
115	08 30.0 N	027 45.0 W	5218
116	08 00.0 N	027 30.0 W	5055
117	07 30.0 N	027 15.0 W	4655
118	07 00.0 N	027 00.0 W	4420
119	06 30.0 N	026 45.0 W	4442
120	06 00.0 N	026 30.0 W	4345
121	05 30.0 N	026 15.0 W	4210
122	05 00.0 N	026 00.0 W	4324
123	04 30.0 N	025 45.0 W	4125
124	04 00.0 N	025 30.0 W	4205
125	03 30.0 N	025 15.0 W	4227
126	03 00.0 N	025 00.0 W	4338
127	02 40.0 N	025 00.0 W	4030
128	02 20.0 N	025 00.0 W	3762
129	02 00.0 N	025 00.0 W	3792
130	01 40.0 N	025 00.0 W	3701
131	01 20.0 N	025 00.0 W	3528
132	01 00.0 N	025 00.0 W	3189
133	00 40.0 N	025 00.0 W	4378
134	00 20.0 N	025 00.0 W	3486
135	00 00.0 N	025 00.0 W	3036
136	00 20.0 S	025 00.0 W	3183
137	00 40.0 S	025 00.0 W	3001
138	01 00.0 S	025 00.0 W	3163
139	01 20.0 S	025 00.0 W	4575
140	01 40.0 S	025 00.0 W	4853
141	02 00.0 S	025 00.0 W	4956
142	02 20.0 S	025 00.0 W	5167
143	02 40.0 S	025 00.0 W	5228
144	03 00.0 S	025 00.0 W	5370
145	03 30.0 S	025 00.0 W	5532
146	04 00.0 S	025 00.0 W	5434
147	04 30.0 S	025 00.0 W	5506
148	05 00.0 S	025 00.0 W	5714

Appendix E.: Van dimensions, Locations and Requirements

1) CFC van

wt	12000 lbs
size	8' x 8' x 20'
power input	440V, 3 phase
location	main deck, aft
Door:	Left side of van near double doors
	Needs phone (and Ethernet).

Contract Person: Dave Wisegarver

2) CO_2 van

wt	12000 lbs
size	8' x 8' x 20'
power input	30 amps, 3 phase, 440v.
location	01 deck aft
Door:	center, right side of van
	Needs fresh water available, phone and ethernet.

Contact Person: Esa Peltola

3) Trace metal van

wt	10,500
size	8’ x 8’ x 20’
power	TBD
location	main deck aft

Contact Person: Chris Measures

The ship will need to have accurate van weights as well for stability calculations, usually gotten by the trucking companies enroute after pickup at origin. Container vans must be ISO fitting compatible. Investigators will have to arrange the shipping so that the vans will be delivered for loading on a proscribed date. Co-ordination of a rental crane (if needed) for loading the vans on the BROWN may save costs. The contact for crane scheduling is Esa Peltola (AOML). After loading, adequate electric power will be needed in the vans during the import for testing of the analytical instruments.

Installation of the trace-metal winch will also take place in Charleston. The contact person for this is Chris Measures, PI for the tracer metal program.

Appendix F: Contacts: (to be supplied as a separate file prior to departure of the ship
Name Telephone Internet

Important phone numbers, fax numbers and e-mail addresses: (Up-to-date phone numbers can be found on the MOC web site at www.moc.noaa.gov/phone.htm#RB)

RONALD H. BROWN (to call from US)

- INMARSAT-B VOICE: 011-OAC-336-899-620 (approx $2.60/min)
- INMARSAT-B FAX: 011-OAC-336-899-621
- INMARSAT "M" VOICE: 011-OAC-761-831-360 (approx $2.99/min)
- INMARSAT-A VOICE: 011-OAC-154-2643 (approx $5.60/min)
- CELLULAR: 757-635-0678
- OOD CELLULAR: 206-910-3584

NOTE: For RB-02-05 cruise, the ship will be operating in range of the Atlantic Ocean Satellite (West) with Ocean Area Code (OAC) = 874.

E-mail addresses:

[The scientific party should expect to be charged for e-mailing costs that exceed the monthly $45 per person limit. MOC is currently pursuing options that will make accounting and billing possible.]

Contact Information:

RONALD H> BROWN (in port): - 206-553-7680
All ship inquiries and requests can be directed to FOO (Lt. Mike Hoshlyk)
Captain
Chief Survey Tech
Field Op. Officer
Electronics Tech

RONALD H. BROWN (while underway):
INMARSAT - 011 872 151 7320
Fax - 011 872 151 7321
Telex - 1517320 WTEA
Internet -

Shipping Information:

Charleston:

NOAA Ship RONALD H. BROWN
RB-04-03 : Specify person
USCG Vessel Support Facility
1050 Register St
Charleston, SC 29405

Agents and Contacts:
Reykjavik: To be provided later
Madeira: To be provided later?
Natal: To be provided later

MOA Operations:
LCDR James Meigs
NOAA/MOA
439 West York St.
Norfolk, VA 23510-1114
(757)441-6495
Jim.Meigs@noaa.gov

Scientific Operations Contacts:

Dr. John Bullister
NOAA-PMEL
Building #3
7600 Sand Point Way, NE
Seattle, WA 98115
Telephone : 206-526-6741
Internet bullister@pmel.noaa.gov
Fax : 206-526-6744

Appendix G: Cruise Schedule

ARR:	03/28/03	Charleston, SC	Transit			
DEP:	06/04/03	Charleston, SC	RB-03-04a	10	OAR	105
ARR:	06/13/03	Reykjavik, Iceland	Transit			
DEP:	06/19/03	Reykjavik, Iceland	RB-03-04b	22	OAR	127
ARR:	07/10/03	Madeira	CO2 and Tracer Study			
DEP:	07/15/03	Madeira	RB-03-04c	28	OAR	155
ARR:	08/11/03	Natal, Brazil	CO2 and Tracer Study			
DEP:	08/15/03	Natal, Brazil	Transit	6	OAR	161
ARR:	08/20/03	Bridgetown, Barbados	De-stage OAR/Stage OE			
DEP:	08/25/03	Bridgetown	RB-03-05	18	OE	179
ARR:	09/11/03	TBD 1	TBD			
DEP:	09/15/03	TBD 1	RB-03-06	16	OE	195
	09/30/03	Underway	TBD			