Cruise Instructions

Nauru99

Cruise RB-99-04

June 15, 1999 - July 19, 1999

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Endorsements:

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Project Instructions

Nauru99
Cruise RB-99-04

NOAA Ship RONALD H. BROWN

Area: Tropical Western and Central Pacific

Participating Institutions:

NOAA Environmental Technology Laboratory
NOAA Aeronomy Laboratory
NOAA Pacific Marine Environmental Laboratory
NOAA Atlantic Oceanographic and Meteorological Laboratory
NOAA National Environmental Satellite Data and Information Service
National Center for Atmospheric Research
Pennsylvania State University
Brookhaven National Laboratory
Max Planck Institute (Germany)
Le Vai Moana Marine Center (Samoa)
College of the Desert (California)

1.0 OVERVIEW

1.1 Summary

1.1.1 The Nauru99 Mission will begin in Darwin, Australia, on June 15, 1999. During the 8-day transit to Nauru Island, it will acquire data with a suite of atmospheric and ocean surface sensors, some of which will already be aboard for the preceding JASMINE mission. The Nauru99 suite will include advanced remote sensors for measuring sea surface temperatures, surface fluxes of heat, energy, moisture, and CO_2, and atmospheric profiles of temperature, humidity, aerosols, wind, and clouds, as well as upwelling and downwelling fluxes of shortwave and longwave radiation. In transit we will focus on air-sea interactions across a wide latitude and longitude region of the climatically-important western and central Pacific, and compare results with similar measurements made during the 1996 Combined Sensor Program on NOAA R/V DISCOVERER in the same region. The mission's core objectives will be executed in the vicinity of Nauru Island

over a 24-day period. Inbound to Nauru, R/V RONALD H. BROWN will hold station for seven days at the Tropical Ocean Atmosphere (TAO) buoy at 2S, 165E, about 270 km (145 nm) from the island. Here we will acquire data in coordination with U.S. Department of Energy island-based instrumentation and with the Japanese R/V MIRAI positioned at the 0S, 165 TAO buoy 222 km (120 nm) to the north. Coordinated measurements made in this triangular geometry will permit, for the first time in open water, characterization of large-scale properties of the atmosphere and ocean that affect radiative balance in the overhead column. This will lead to improved understanding of important climate processes over the oceans and improve climate single-column modeling there; it will validate DOE's island-based measurements; and it will help assess how well the island-based measurements represent properties of the atmosphere above the open ocean surrounding the island. Next RONALD H. BROWN will move to within 20 km (11 nm) of Nauru and hold station there for four days. MIRAI will at the same time hold a position 50 km (27 nm) north of RONALD H. BROWN and 47 km (25 nm) from Nauru. This smaller triangular configuration is ideal for coordinated dual-Doppler scans by the ships' powerful scanning weather radars, to be used to study cloud processes in convective storms, including any over Nauru. During this 4-day period, if no significant storms are present RONALD H. BROWN may steam to MIRAI to conduct side-by-side sensor intercalibrations, for a period of approximately one day. At the conclusion of the 4-day small triangle configuration on July 4, MIRAI's participation in Nauru99 will end. RONALD H. BROWN will then proceed to Nauru itself for a 2-3 day period to conduct instrument intercalibrations between the ship and the island. The positioning of RONALD H. BROWN on subsequent days will be determined by consultations between the science team on RONALD H. BROWN and the operations center on Nauru. It is likely the ship will be positioned at various short distances (less than 100 nm) around Nauru. While the ship is in the vicinity of Nauru Island for 24 days, daily HF communications will take place between the ship, the island, and MIRAI, to coordinate data acquistion activities. There will also be frequent research aircraft flights within the large and small triangles. The aircraft, a manned Cessna 404 and a remotely-piloted Aerosonde, will be based on Nauru island. The final two days of the mission, July 17-19, will be spent taking data in transit to Kwajalein Island, where the Nauru99 mission will end. A subset of Nauru99 instrumentation will remain onboard to support the next mission (KWAJEX, a mission to validate NASA's and NASDA's Tropical Rainfall Measurement Mission satellite, TRMM).

1.2 Administrative

1.2.1 Support for ship time on RONALD H. BROWN is provided by NOAA. Scientific support for Nauru99 is provided by Department of Energy (DOE) Atmospheric Radiation Measurement (ARM) program.

1.2.2 Chief Scientist is Madison J. Post who is affiliated with the NOAA Environmental Technology Laboratory (ETL).

1.2.3 Foreign clearances required: Australia, Papua New Guinea, Solomon Islands, Nauru, and Marshall Islands. The cruise plan assumes that clearances to work in the EEZs of these countries

will be obtained. Failure to obtain clearances will limit success of the Nauru99 mission.

1.2.4 The Japanese R/V MIRAI is scheduled to coordinate operations with RONALD H. BROWN in the vicinity of Nauru Island between June 17 and July 5. MIRAI*'s* schedule is not flexible.

1.3 Loading and Setup in Darwin

1.3.1 Loading and setup of scientific equipment for this cruise will take place in Darwin, Australia, between June 8 and June 14, 1999. Heavy lifting (e.g., ISO containers) can take place only at Fort Hill Wharf, an expensive commercial facility. Time at this wharf will be limited, and occur early during RONALD H. BROWN's stay at Darwin. Loading of light loads can continue at the Stokes Hill Wharf, where the ship will be moored prior to its departure. It is unlikely that loading can occur on Sunday, June 13. Loading cannot take place during fueling.

1.3.2 It is desirable for checkout of the stabilization of the HRDL lidar scanner to have the ship depart from the dock and steam at sea (or in the harbor) for a short period (2-3 hours) as soon as possible after HRDL is setup and operating. The ship would then return to port to continue loading equipment and supplies for several more days.

1.3.3 In addition to equipment loaded in Darwin, several other instruments and/or containers from previous 1999 missions will remain onboard, either to participate in Nauru99 or subsequent missions, or to be transported back to the U.S. Copies of equipment lists, including serial numbers and country of origin, must be supplied to the Executive Officer (XO) and Chief Scientist prior to departure from Darwin. It is the responsibility of each group of investigators to arrange for shipping its equipment to and from RONALD H. BROWN, including all customs requirements, documentation, and transfers between the receiving dock and the ship. Any modification to the ship's equipment or special requirements for this cruise should be brought to the attention of the ship's Field Operations Officer (FOO) and the Chief Scientist as soon as possible.

1.4 Science Party Travel Information

1.4.1 Scientists and other Nauru99 participants should check with the Atlantic Marine Center (AMC) in Norfolk, VA (http://www.pmc.noaa.gov/amc.htm, Tel. 757-441-6206) or the ship's homepage (http://www.pmc.noaa.gov/rb/index.htm, for updates on planned arrival and departure times of RONALD H. BROWN at Darwin, Australia, and Kwajalein Island. Travelers should allow for possible flight delays due to weather, holidays, or other considerations.

1.5 Cruise Plan

1.5.1 Waypoints

Way Point	Lat.	Long.	Naut. Miles	Spd. (kts)	Hrs	Depart Date	EEZs	Comments
1	12.5 S	130.8 E	—	—	—	June 15	Aus.	Darwin
2	11.2 S	131.7 E	100	5.0	20.0	June 15	Aus.	
3	10.6 S	141.8 E	605	12.5	48.5	June 17	Aus. N.G.	
4	10.2 S	142.9 E	80	13.3	6.0	June 18	N.G., Aus.	
5	11.3 S	152.1 E	585	12.4	47.0	June 20	N.G.	
6	6.9 S	156.3 E	364	12.6	3.9	June 21	N.G., Sol.	
7	2.0 S	165.0 E	612	12.5	49.0	June 23	Sol.	TAO Buoy
8	0.6 S	166.8 E	137	12.5	10.9	July 1	Nau.	Small Triangle
9	0.5 S	166.9 E	11	12.5	0.9	July 5	Nau.	Nauru Island
10	8.9 N	167.8 E	567	13	43.6	July 19	Nau., Mar.	Kwajalein

Abbreviations:

Aus. = Australia
N.G. = Papua New Guinea
Sol. = Solomon Islands
Nau. = Nauru
Mar. = Marshall Islands

1.5.2 Note: When the ship is within 20 km (11 nm) of Nauru (e.g., waypoint 9 and later), exchanges of scientists between the ship and the island (both directions) will be desirable. The exchanges may be effected by the ship RHIB, the Nauru harbor master, or both. The exchange scientists may be carrying small instruments used as calibration standards, to ensure that larger instruments on the ship and the island are properly inter-calibrated. Similar exchanges of scientists may occur between the island and the R/V MIRAI between June 17 and June 19, and possibly between MIRAI and RONALD H. BROWN between July 1 and July 5. While drifting, the ship may be asked to maintain a heading, or it may not be asked to do so. This requirement will be determined as the mission is being executed, and will depend on the desires of mission scientists. When close to Nauru Island and when radiometer tip calibrations are taking place, the ship will be asked to maintain a heading, to keep parallel island-based and ship-based vertical scan planes (i.e., to sample the same atmospheric volume, as close as possible).

1.6 Logistics

1.6.1 Contact Information

Ship Operations: AMC Operations
CDR Jon E. Rix

439 W. York St.
Norfolk, VA 23510-1114
757/441-6844
-6495 (fax)
jon.e.rix@noaa.gov

RONALD H. BROWN

At Norfolk, VA: 757/441-6206 (AMC Operations Office)

CO:	CAPT Roger Parsons
FOO (Field Ops Off):	LT Alan Hilton
XO:	LCDR Fred Rossmann
Sen. Survey Tech:	Jon Shannahoff
Navigator:	LT Mark Boland
Medical/Environ. Compliance Off:	LCDR Dan Aronson

1.6.2 Agents

In U.S.:

Ms. Mae Chu
Interconex, Inc.
17120 Valley View Avenue
La Mirada, CA 90638
Tel. 562-483-7141 (desk)
562-921-0939 (office)
Fax: 562-926-0918
E-mail: mae.chu@interconex.com

In Darwin, Australia:

Beauford Shipping Agency Company
Mr. David A. K. Roger, Director
Level 18
201 Kent Street
Sydney 2000
Australia
Tel. 61-2-9364-8960
Fax 61-2-9364-8999

At Kwajalein Island:

Military Sealift Command
Denise Roberts
Tel. 805-355-3798 (or -2182)
Fax 805-355-1814
E-mail droberts@kls.usaka.smdc.army.mil

1.6.3 Shipping Details

Shipping details should be cc'ed to the ship's CO and FOO at RL_Parsons%Brown@ccmail.rdc.noaa.gov and Alan_Hilton%Brown@ccmail.rdc.noaa.gov, respectively.

Note: Contractual arrangements exist between the port agents and the CO for services provided to NOAA Ship RONALD H. BROWN. The costs 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. Reimbursement for all such services will be the responsibility of the program.

1.7 Scientific Goals

- Deployment and operation of a suite of *in-situ* and remote sensors for climate research and parameterization of cloud-aerosol-radiative interactions in the tropical maritime environment, including surface fluxes of heat, momentum, and moisture.

- Evaluation of cloud effects on the surface energy budget in the Tropical Western Pacific (TWP) and Tropical Central Pacific (TCP).

- Determination of cloud cover and cloud layering statistics in the TWP and TCP.

- Evaluation of marine boundary layer height and internal characterization in the TWP and TCP.

- Characterization of TWP and TCP stratus and cumulus clouds, in terms of radiative effects, ice and water contents, and effective radii.

- Validation and calibration of aerosol and radiance products for U.S. polar orbiting satellites.

- Cross-calibration of measurements with similar DOE/CART instrumentation on Nauru Island.

- Coordinated data acquisition with similar instrumentation onboard the Japanese R/V MIRAI and Nauru Island, to calculate large-area atmospheric fluxes across the boundaries

of the triangle formed by the 3 sites. The measurements will establish boundary conditions for Single-Column Models (SCMs) and provide for their validation.

C Evaluation of the effects of island topography on measurements of aerosols, clouds, and radiative balance in the vicinity of Nauru Island.

C Characterization of the effects of the marine boundary layer, cloud dynamics, and moisture on the concentration and growth of aerosols in the lower and middle troposphere.

1.8 Scientific Measurements and Instruments

Instrument	Comments	Org./Person
Surface Meteorology	T, P, ?, V, 0.01 to 10 min average, Multiple Locations	ETL/Hare Ship/ Tech[1]
Ceilometer	Vaisala, 7.6 km max altitude, Not Stabilized, Stares Up	ETL/Hare
Radiosondes	2-8 daily, 20 mbar max altitude	ETL/Hare Ship/Tech[1]
Radar Wind Profiler	0-3, 0-16 km modes, Stabilized	ETL/Hare
Surface Flux Sensors	Heat, Momentum, Moisture	ETL/Hare
Sea Surface Temperature	Skin, 10 cm, 5 m	ETL/Hare & Zorn Ship/Tech[1]
K_a-Band Cloud Radar	35 GHz (8.6 mm), 20 km max alt., Doppler, Not Stabilized, Stares Up	ETL/Hazen
C-Band Precipitation Radar	6 GHz (5 cm), Scanning, Doppler, Stabilized	PSU/Verlinde Ship/ET[2]
S-Band Precipitation Radar	3 GHz (10 cm), 16 km max alt., Not Stabilized, Stares Up	ETL/Hare
Total Sky Imager	Not Stabilized, Day and Night	PSU/Pavloski
FTIR	500-2000 cm^{-1}, Not Stabilized, Stares Up	ETL/Zorn & Hazen
2-Ch Microwave Radiometer	Column water, liquid and vapor, Not Stabilized, Stares Up, Tip Cals	ETL/Hazen
Scanning Microwave Radiometer	60 GHz, Temp Profiles in MBL, Air-Sea Temp Difference	ETL/Zorn

Infrared Radiometer PRT-5	11 µm, Sky Brightness & Cloud Base Temperatures	ETL/Hazen
Scanning Infrared Radiometer	14 µm, Temp Profiles in MBL, Air-Sea Temp Difference	ETL/Zorn
DABUL Lidar	0.523 µm, Aerosols Profiles, Not Stabilized, Stares Up	ETL/Sandberg & Newsom
Scanning Doppler Lidar	2.1 µm, Aerosols and Wind, Stabilized	NCAR/Wulfmeyer & Weickmann
DIAL Lidar	0.73 µm, Water Vapor Profiles, Not Stabilized, Stares Up	MPI/Lehmann
Aerosol Samplers	In Situ, 0.05 - 5.0 µm, Chemistry	PMEL/Coffman
Satellite Receiver	GOES, NPOES, SeaWiFs, METEOSAT, WEFAX	ETL/Post Ship/Boland[3]
Satellite Processor	Combined Sensor Products, Validations	ETL/Stankov NESDIS/Reale
Sun Photometer	Stabilized, 7 Ch, 0.4 -1.0 µm	PSU/Pavloski
Radiative Fluxes	Visible, IR, Direct, Diffuse, Upwelling and Downwelling, IMET	ETL/Hare BNL/Smith Ship/Tech[1]
Rain Gauges	Ship's Instruments, Optical & Gravity	Ship/Tech[1]
pCO_2 Sensor	AOML/Wanninkhof	LVMMC/Aicher
Chlorophyll Sensor	Ocean Sampler	LVMMC/Aicher
Navigation, Ocean Sensors	Ship's Instruments, SCS	Ship/Tech[1]

1.8.1 Most instruments are designed to take data unattended and continuously. No operator role is anticipated for ship's personnel for any instrument being brought by Nauru99 investigators. Ship's personnel are listed only in reference to those ship's instruments or systems that are particularly important to the success of Nauru99.

1.8.2 [1]Ship's personnel will not be requested to support the mission in any way other than those duties already in undertaken to mentor the indicated ship's instrumentation. However, the science party may want to consult with the ship's personnel to better understand data management of ship's data and calibration of ship's sensors. In some cases (e.g. balloon launches) the science party may be able to assist the ship's personnel in their duties by sharing duties, altering schedules, etc.

1.8.3 [2]Ship's personnel will not be asked to operate or monitor the radar, but may need to help in initial training, trouble shooting, repairs, and data management.

1.8.4 [3]Ship's personnel will not need to operate or monitor the satellite receiver for the mission's scientific needs, but may be asked to help in initial training, trouble shooting, repairs, and data management.

1.8.5 For more information see the following Appendices: A for physical descriptions and power requirements for the scientific instruments; B for van and other system placements; C for equipment placement considerations; and G for a listing of the science party.

2.0 OPERATIONS SUMMARY

2.1 Background

2.1.1 Instruments on the Nauru99 mission typically will be acquiring data continuously, both while the ship is underway en route to Nauru and when it is holding station. Rawindsonde observations are one notable exception. Considerable coordination with both the Nauru99 Operations Center on Nauru (run by DOE) and the Japanese R/V MIRAI is required. Appendix E depicts the time line for joint operations between RONALD H. BROWN and MIRAI. Appendix F shows the large and small triangle configurations in which RONALD H. BROWN will participate.

2.2 Rawindsonde Operations

2.2.1 From the time the ship leaves Darwin (June 15) until it reaches the TAO buoy at 2S, 165E (June 23), 2 radiosonde launches per day will be made. For the next 11 days 8 radiosonde launches per day will be attempted , while the ship is in the large and small triangle configurations -- see sections 2.4 and 2.5 below. An average of 4 launches per day will be attempted thereafter, with no launches needed for mission purposes the final 2 days between Nauru and Kwajalein. All radiosonde data will be collected in standard form and, if possible, higher resolution or "research mode," as well. Minor adjustments to standard launch times may be made to better coordinate with satellite overpasses. Personnel for balloon operations will be provided by both the participants and the ship's crew, on a mutually acceptable basis. To avoid interference between several balloons that may be in the air simultaneously, sondes launched from the NOAA and Japanese ships will offset frequencies to near the high and low ends of the band, respectively, with sondes from Nauru remaining on band center. Sondes launched from RONALD H. BROWN will operate at a nominal frequency of 405 MHz; those from MIRAI and Nauru will be operated at 401 and 403 MHz, respectively. If balloons are launched within 12 nm of land, the nearest airport will be contacted by the Chief Scientist and notified of date/time of launches, expected rate of ascent, maximum expected height, and whether the balloon is lighted or unlighted.

2.3 Operations Near Nauru Island

2.3.1 During the 24-day period when the ship is in the vicinity of Nauru Island, investigators

onboard will be conferring daily via e-mail, HF radio, or other means with other investigators on land and/or on the Japanese R/V MIRAI to decide how to best achieve the scientific goals of the mission, including the ship's station-holding position(s) and modes of data acquisition. The ship is requested to contact Nauru officials by radio both when it enters the 200-mile EEZ zone and territorial waters (12-mile limit). Both a Cessna 404 and a small fleet of unmanned Aerosonde aircraft based on Nauru will fly tracks in the vicinity of the ships, in coordination with data-taking activities of the of the ships and DOE facility on Nauru. DOE's Operations Center on Nauru will coordinate operations of all mission resources, including RONALD H. BROWN, during the time BROWN is in the vicinity of Nauru (June 23 - July 17).

2.3.2 Personnel exchanges between the ship and land via the ship's RHIB and/or the harbor master's launch may be requested when the ship is within 20 km of Nauru. These exchanges will be limited to small numbers of people (6 or less), and may involve press as well as scientists. Exchanges from the 20 km position will occur only during daylight hours and only when conditions are safe. No overnight visits on either the ship or the island by visitors are anticipated, but may be requested.

2.4 Large Triangle Configuration

2.4.1 Beginning June 23 RONALD H. BROWN will hold station for seven days near the TAO buoy at 2S, 165E, approximately 270 km from Nauru. During this time MIRAI will be holding a position at another TAO buoy directly to the north at 0S, 165E. The DOE/ARM facility on Nauru Island forms the third apex of a large triangle. In this configuration both ships will be asked to hold a heading facing into the wind with the TAO buoy to the starboard side of the ship and no more than 1 km distant. Neither ship nor buoy will experience disrupted flow in this orientation, and proximity is sufficient to allow meaningful comparisons between ship and buoy sensors.

2.5 Small Triangle Configuration

2.5.1 On June 30 RONALD H. BROWN will move to a new station 20 km southwest of Nauru Island for a period of 4 days. Simultaneously MIRAI will move to a new position approximately 50 km to the north of BROWN and 47 km from Nauru. During this time the primary goal will be to operate the two ships' C-band radars in coordinated dual-Doppler scans of nearby precipitating cloud systems. The ship will be asked to maintain its position within 1 km of the exact coordinates, facing into the prevailing wind. At the end of this 4-day period (July 4) to MIRAI will leave the area and no longer be part of the scientific operations for Nauru99.

2.5.2 If no precipitation of interest is forecast to occur for one day or longer during this period, RONALD H. BROWN will be asked to steam to a position next to MIRAI for intense simultaneous data-taking to compare similar measurements and cross-calibrate instruments. Such a ship-to-ship intercomparison is likely to last about 24 hours. Nearly-identical scientific instruments on the two ships (e.g. radar wind profilers, S-band radars, C-Band radars) may cause mutual interference, necessitating that one of the pair be turned off when the ships are in near proximity.

2.6 Operations at Nauru Island

2.6.1 On July 4 RONALD H. BROWN will be asked to steam to a position on the west side of Nauru Island as close as possible to the DOE facility, and hold station, moor, or tie up there for several days (length of time TBD). During this time intense data-taking will occur with emphasis on comparisons between ship and island sensors. At times the ship may be asked to hold a heading that orients the ship's radiometer scans in a plane parallel to that of similar radiometer scan planes on the island. At other times a heading facing into the wind may be requested. Numerous ship to island and island to ship personnel transfers are anticipated at this time, most likely involving use of the RHIB and perhaps a Nauru-based boat of similar size. Arrangements for positioning RONALD H. BROWN at Nauru may be affected by commercial ore-loading operations, and can be finalized only a few days ahead of time. The Operations Center on Nauru will serve as the ship's point of contact in making arrangements for mooring and/or station-holding near the island.

2.7 Operations of ETL Flux System and WHOI CO_2 System

2.7.1 These systems all take measurements continuously; they will be monitored round-the-clock by 1 person watches. The major operational aspects of these systems are moving blocks of data for archiving, preliminary processing for data quality assessment, routine calibration checks, and cleaning of optical surfaces on the fast humidity and CO2 sensors. The WHOI calibration will be checked roughly once a day using a procedure worked out by J. Ware. ETL scientists will take hourly readings of ambient T/RH from the bridge or 02 deck using an Assman psychrometer and a Vaisala hand-held calibration reference. The Ophir hygrometer and the Oak Ridge IRGA have exposed optical surfaces that accumulate salt particles generated by oceanic whitecaps. This causes contamination of both water vapor and CO2 signals. The contamination can be reduced by washing with tap water. A water hose will be run up the jackstaff to a set of sprayers on the instruments. Thus, the washing can be done by turning on the tap without climbing jackstaff.

2.8 ETL Remote Sensor Operations

2.8.1 These systems are engineered to operate continuously and unattended except for data storage media exchanges. The microwave radiometer will be calibrated during in cloud-free conditions by performing 'tip curves' where the spinning reflector is tilted to receive radiation from several different zenith angles. The aft deck must be cleared, port to starboard, in the radiometer's narrow scan plane for this procedure. The cloud radar, S-band radar, wind profiler, and ceilometer will produce screen images of recent measurements. 12-hr cloud radar images will be made available via ftp to the other investigators.

2.9 C-band Doppler Radar Operations

2.9.1 The C-band radar on board the RHB will be operated nearly continuously during Nauru99. Raw radar data will be archived onto the DAT tape drive in the pilot house. Raw radar data will also be copied from the disk in the HP in the pilot house to a PI-provided Sun workstation

(located in the main lab or computer lab) over the network between the two machines. From the Sun workstation, the data will be redundantly archived and also analyzed using Zebra analysis software. The scan strategy will involve both low level, long range surveillance scans and 3D volume scans of radar reflectivity and radial velocity. A regular schedule of calibrations involving both pieces of the radar system (i.e. pulse width measurement, receiver calibration, noise level stability, and antenna pointing stability) and end-to-end calibration using a balloon-borne sphere will be undertaken by the mission's radar scientist, Hans Verlinde, during the cruise, most likely at times the ship is holding station. Procedures developed for calibration of the radar during JASMINE will be adapted for Nauru99.

3.0 FACILITIES

3.1 Equipment and Services Provided by Ship

3.1.1 Communications

3.1.1.1 An INMARSAT link for data and written messages, and e-mail with maximum 1-day delay. In the vicinity of Nauru Island, ship-to-shore and ship-to-ship voice communications via HF and/or VHF radio will also be needed. Proposed frequencies are:

VHF Aircraft:	122.925 MHz	
HF Monitor:	2182 kHz	
HF Primary:	6203 kHz	(Nauru Operations)
HF Alternate (Hi):	8225 kHz	
HF Alternate (Lo):	4083 kHz	

3.1.1.2 Daily radio conferences at 1800 local time are anticipated when the ship is in the vicinity of Nauru, June 23 - July 17.

3.1.2 Navigational Systems

3.1.2.1 Navigation information will be recorded in the format replacing the Marine Operations Abstract (MOA - OSC Worksheet 001). All events, such as when the ship changes course or speed, will be recorded as they occur, or at least every 4 hours. In the event of a Ship's Computer System (SCS) failure, the bridge will record hourly GPS positions. GPS position and time base will be made available in real-time to scientific work stations on the ship via the ship's computer network, as detailed in section 3.1.6, at the same frequency as other data from ship's sensors.

3.1.3 Thermosalinograph Records

3.1.3.1 Thermasalinograph records for the entire cruise are required, calibrated to within 0.1°C and 0.01 ppt. The ship's autosal will be used for underway calibrations as per procedures developed by Greg Thomas (AOML). Ship's personnel will train La Vai Moana Marine Center

scientists in the method, after which time the science party can assist in calibrations.

3.1.4 Science Party Laboratory Work Space Requirements

3.1.4.1 Work space in the main lab, hydro lab, bio lab, and computer room, primarily for instrument data systems whose sensors are positioned outside, is required. One unit of computer space is defined as counter-top space 2 feet wide, 30 inches deep, and 3 feet high.

3.1.4.2 Needed are:

Sensor	Sensor Location	Best Lab	Units Needed
Wind Profiler	Main Deck Aft, Port	(As setup during previous missions)	
Ceilometer	Main Deck Aft, Port	(As setup during previous missions)	
DABUL	02 Mid-ship, Port	Bio	2
Cld-Rad	Main Deck Aft, Port	(As setup during previous missions)	
HRDL	02 Forward, Starboard	Main	2
DIAL	02 Forward, Starboard	Main	2
Flux System	Jack Mast	(As setup during previous missions)	
Aerosols	(Various)	(As setup during previous missions)	
$pC0_2$	Hydro Lab	(As setup during previous missions)	
Port. Radiation	Bow Tower	(As setup during previous missions)	
S-Band Radar	03 Forward, Port	(As setup during previous missions)	
Satellite Processor	(Various)	Computer	2

3.1.4.3 Cable runs from lidars to labs:

System	Cable	Diam.(in)	Connector, Diam.(in)	Comments
DIAL	RG58 Coax	0.25	BNC, 0.5	
HRDL	Phone line	(from ship)	(from ship)	
DABUL	RG58 Coax	0.25	BNC, 0.5	
	Cond. Power	0.7	Std Jack	3 ea 10 ga.
	Uncond. Power	0.7	Std Jack	3 ea 10 ga.

Note: Connectors will be attached after the cables are stuffed through raceways or conduits.

3.1.5 Compressed Air

3.1.5.1 Dry compressed air (100 psi, 2 CFM) must be provided to vans, as needed, including DIAL.

3.1.6 Power to Vans

3.1.6.1 Power to all other vans is needed, as indicated in Appendix A. Only the following power outputs are available from the ship, all at 60 Hz: 1) 450 VAC, 3 phase, 2) 220 VAC, 1 or 2 phase, and 3) 120 VAC, 1 or 3 phase. Three-phase power is configured as "delta" (no ground), not as "Y" (with central ground). Transformers or motor-generators for other power requirements will not be provided by the ship and must be provided by the participants. Only U.S. standard power plugs and jacks will be provided by the ship.

3.1.7 SCS Data Streams

3.1.7.1 Access to ship's high-speed data (0.5 Hz) is required , including ring gyro; relative wind speed and direction; barometric pressure; air temperature; solar irradiance; salinity; rainrate (both optical gauges); sea temperature (2-5 m depth); and GPS Pcode longitude, latitude, ship speed, ground speed, ship direction, ship heading. At regular intervals not to exceed 5 days, ship's personnel will archive ship's data to tape (medium TBD) for delivery to the Chief Scientist at the end of the mission. All ship's sensors are to be calibrated routinely and calibration data provided together with sensor data.

3.1.7.2 Network connections are by ethernet 10-base-T; IP addresses will be assigned by the ship's ET.

3.1.7.3 We request that the ship continue to record the same navigation data for wind profiler support as was done for INDOEX. This file contains the date, time, Pcode SOG and COG, Lat., Lon., and laser ring gyro heading at 15 s intervals.

3.1.8 C-band Doppler Radar

3.1.8.1 Hans Verlinde will be the responsible scientist for operating the 5-cm Doppler weather radar during Nauru99. He may need assistance from the ship's personnel early in the Nauru99 mission to become familiar with the installation and operation of the radar. During the 25-day period June 23 - July 17 that RONALD H. BROWN is in the vicinity of Nauru, up to 10 radar calibration spheres (6-inch diameter) will be flown beneath balloons normally used for radiosonde flights. These spheres will be tracked automatically by the radar system using Sigmet software and provide end-to-end calibration of the radar for the first time. The balloons will need to be launched from the ship's RHIB in order to acquire a signal from the calibration sphere when it is outside the radar's minimum range (about 1 km). Most likely, a balloon will be inflated in the RHIB while it drifts 1-2 km from the ship, and a calibration sphere will be raised via the balloon as it is tethered to the RHIB. When the radar acquires the calibration sphere unambiguously, personnel on the RHIB will be instructed by radio to release the balloon and return to the ship.

Procedures for successful field calibration of the radar developed during JASMINE will be used for Nauru99, even if they differ significantly from the above description.

3.1.9 Satellite Receiver

3.1.9.1 Reception of environmental satellite data will be required. Chlorophyl and aerosol products from SeaWiFs data will be needed within a few hours of data reception, for routine comparison with investigators' onboard measurements. Assistance from ship's personnel may be required to setup the system's scripts to acquire, process, and record such scientific data routinely. However, once such procedures are established, the science party will take responsibility for daily operation of the satellite receiver for scientific data acquisition and processing. Data from the ship's satellite receiver will be used in near real-time by the satellite processor, an additional workstation used to generate better satellite products from combinations of satellite and ship-based data, and to compare satellite products with ship's measurements.

3.1.10 ASAP Van

3.1.10.1 The ASAP van will be used to track, and possibly to launch, rawindsondes as often as once every 3 hours. Help from the ship's crew will be needed to move helium cylinders to support these operations. Scientists will be responsible for all radiosonde launches not normally part of the ship's normal operations. However, ASAP operations may be altered on a mutually acceptable basis. Data will be acquired in "research mode" for all launches during Nauru99.

3.1.11 IMET System

3.1.11.1 The ship's IMET system will be operated and calibrated throughout the Nauru99 mission, and its data made available to scientists via the SCS network.

3.1.12 Small Craft Operations

3.1.12.1 Transportation of people to and from Nauru Island via the ship's Rigid Hull Inflatable Boat (RHIB) when the ship is holding station within a 20 km of Nauru may be required. Similar exchanges of personnel may be requested when RONALD H. BROWN is nearby MIRAI, during the period of the small triangle configuration (see section 2.2.2). Operations of this type will take place at the discretion of the CO, with emphasis on safety. Such operations will occur only during daylight hours when the ship is in open waters.

3.1.12.2 As mentioned in section 3.1.8, it will also be necessary to use the RHIB to assist in launches of calibration spheres for the C-band radar.

3.1.13 Brookhaven Radiation Package

3.1.13.1 The Brookhaven Radiation Package, currently mounted on the bow tower, may be interchanged with a similar package on Nauru Island when the ship is near Nauru, July 4-7. This would require logistic support from the ship, both for dismounting equipment from the bow tower

and in transportation via RHIB to and from the island.

3.1.14 Miscellaneous

3.1.14.1 A phone line to the cloud radar van is requested.

3.1.14.2 Midnight rations are requested for approximately 5 members of the science party.

3.1.14.3 It is mandatory that the ship arrive at Kwajalein atoll late July 18 or early July 19 (before 9 a.m.), in order for many Nauru99 scientists to make airline connections to Honolulu on the afternoon of July 19. Scientific operations near Nauru Island will be terminated whenever necessary to guarantee on-time arrival at Kwajalein.

3.1.14.4 During the 2-day transit from Nauru to Kwajalein July 17-19 it is likely that scientists will need help from deck hands from time to time, to assist in packing and to stage equipment for off-loading.

3.1.14.5 The science party will ask the ship to store several wooden crates, perhaps broken down, in which equipment arrives. These same crates will be used to ship gear home from Kwajalein or to transport gear to the U.S. in the ship's hold. An estimate of number of crates to be stored and total storage volume will be provided to the ship by the chief scientist at least 2 weeks prior to the beginning of the mission.

3.2 Equipment Provided and Operated by Participants

Science party responsibilities can be divided into the following groups:

3.2.1 ETL Systems

3.2.1.1 These systems include the flux system (bulk meteorology and CO_2, radiation), S-band radar (clouds and precipitation), radar wind profiler (wind , cloud, and precipitation profiles), ceilometer (cloud base), cloud radar (cloud layering and microphysics), 2-channel microwave radiometer (column water liquid and vapor), aerosol lidar (aerosol and cloud profiling), Doppler lidar (aerosol and wind fields), FTIR (gas species and temperature measurements), satellite processor, and other microwave and infrared radiometers (SST, temperature profiles).

3.2.1.2 The flux system, S-band radar, radar wind profiler, ceilometer, cloud radar, and 2-channel microwave radiometer will already be onboard, having been deployed for JASMINE.

3.2.1.3 To be loaded in Darwin for Nauru99 is ETL's Radiometer van, mentored by Heather Zorn during the mission; the HRDL van, ETL's infrared (eyesafe) scanning Doppler lidar, mentored by Scott Sandberg and Rob Newsom of ETL and Volker Wulfmeyer of NCAR; and the DABUL lidar, mentored by Scott Sandberg and Rob Newsom. Numerous other ETL staff will be present in Darwin to install and setup these instruments that are joining the ship for the first time.

During Nauru99 Jeff Hare will mentor the flux system, the wind profiler, the S-band radar, and the ceilometer. He will also coordinate support for all rawindsonde launches, duties shared by both ship crew and scientists. He will also deploy a small tethered float off the side of the ship when it is holding station, for measurement of sea surface temperature a few cm below the surface.

3.2.1.4 Duane Hazen will join the ship in Darwin for Nauru 99 and will mentor the cloud radar, the 2-channel microwave radiometer, and the FTIR. As often as possible when skies are cloud-free, Duane will perform tip calibrations on the microwave radiometer system, scanning its beam(s) in a vertical plane from horizon to horizon. He and/or Heather Zorn will also be filling the FTIR detector with liquid nitrogen several times per day.

3.2.1.5 The Radiometer and HRDL vans will have people working on top them daily, to supply liquid nitrogen to detectors, work with scanners, etc.. Any activity on top of vans will be coordinated with the bridge, and will require use safety harnesses, tethers, and jacklines. The Radiometer van will have a 20-foot boom extending from the inboard side of the van to 12 feet port of the port side of the van, on which sensors will be positioned to view nearly undisturbed water off the port bow.

3.2.1.6 Boba Stankov (ETL) and Tony Reale (NESDIS) will operate the satellite processor workstation.

3.2.2 PMEL Systems

3.2.2.1 Much of the same in situ aerosol instrumentation operated during BROWN's first two missions in 1999 (Atlantic and Indian Oceans) will be turned back on and operated during Nauru99. PMEL staff rejoining the ship in Darwin for this purpose are Drew Hamilton and Derek Coffman. Many of the constraints for operating these samplers will pertain during Nauru99 as for earlier work (e.g., clean air off the bow, no work on the forward main deck); these constraints should be familiar to the ship.

3.2.3 Max Planck Institute System

3.2.3.1 The H_2O DIfferential Absorption Lidar (DIAL) system will be loaded in Darwin and operated by three Germans, Friedhelm Jansen, Klaus Ertel, and Volker Matthias. This system is to be supplied with 50-Hz, 380 VAC 3-phase power from the Machinery van, already onboard as part of INDOEX. This system is not eyesafe, but its laser beam will be directed only vertically and it will not be operated during any time that hydrometeors or sea spray might cause scattering to occur within view of people on the ship.

3.2.4 Brookhaven National Laboratory Radiation Package

3.2.4.1 This system was installed to participate in all BROWN's earlier missions. Originally Mike Reynolds set it up and operated it, but for Nauru99 his colleague Scott Smith will be the instrument mentor. It is installed on the bow tower and requires regular cleaning and calibration.

Similar instrumentation will be on both Nauru Island and MIRAI. While BROWN is near Nauru July 4-7, it is likely that the BNL radiation packages on Nauru and BROWN will be interchanged, requiring logistical assistance from the ship.

3.2.5 Woods Hole Oceanographic Institute System

3.2.5.1 The WHOI Li-Cor 6262 fast CO_2 sensor mounted on the bow tower in Singapore for JASMINE will be mentored during Nauru99 by Jeff Hare of ETL. The system must be calibrated daily by injecting zero CO2 air and by comparing the mean value obtained for ambient air with that obtained by the AOML seagoing CO_2 value. Jeff Hare will monitor data from IMET. Occasional cleaning of detector domes may be required.

3.2.6 Pennsylvania State University Systems

3.2.6.1 These include a multi-channel, stabilized sun photometer to be mounted in the vicinity of the 02-level vans, perhaps on the 03-level railing or on top of the PMEL Pump Van. Chuck Pavloski of PSU will mentor this instrument; he will cover it at night and whenever it may get wet. Chuck will also install and mentor the Total Sky Imager.

3.2.7 AOML System

3.2.7.1 The AOML partial pressure CO_2 system in the Hydro Lab will be operated and calibrated by Jennifer Aicher and Tepora Tolinius of La Vai Moana Marine Center in Samoa. Jennifer knows Rik Wanninkhof and used to be a technician on the NOAA R/V DISCOVERER.

3.2.8 Miscellaneous

3.2.8.1 The Nauru99 science party is responsible for supplying all meteorological balloons, sondes, and helium for the balloons (including those used for launching radar calibration spheres). It is also responsible for supplying all needed liquid nitrogen, a VHF aircraft radio and antenna (118-136 MHz), and the 380 VAC, 3-Phase, 50-Hz power for H_2O DIAL van.

3.2.8.2 After departure from the vicinity of Nauru, the science party will work to break down and pack all instruments for off-loading that will not be staying onboard to participate in the next mission, KWAJEX. During the 2-day cruise from Nauru to Kwajalein it is likely that scientists will need help from the deck hands from time to time to assist in packing and to stage equipment for off-loading. Systems staying onboard to participate in KWAJEX are the radar wind profiler, the S-band radar, and the Radiometer van. PMEL may request to have vans remain onboard for transportation back to Seattle.

4.0 DISPOSITION OF DATA AND REPORTS

4.1 Data Responsibilities

4.1.1 The Chief Scientist, working with the CO of RONALD H. BROWN, is responsible for providing adequate opportunity for participants to acquire relevant datasets with their instruments. However, each participant is responsible for quality control, archiving, and data accessibility of data to other participants. The Chief Scientists will request that the following ship's data be provided to him:

Calibration information for ship's instruments
Marine Operations Abstract (MOA)
Deck log/weather observation sheets
Sea surface temperature and salinity logs
Thermosalinograph data
ADCP digital recordings
Rawinsonde data
C-band radar data
Satellite receiver data
IMET data
Optical rain gauge data
Data from ship's meteorological sensors

4.1.2 The Chief Scientist is responsible for dissemination of data to nations in whose EEZ data are acquired and requested. The Chief Scientist will furnish the ship a complete listing of all data gathered by the primary scientific party, detailing types and quantities of data. The Chief Scientist will receive all original data gathered by the ship for the primary mission, and this data transfer will be documented on NOAA form 61-29.

4.2 Ancillary Projects

4.2.1 The CO 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, Letter Transmitting Data. Copies of ancillary project data will be provided to the Chief Scientist on request. The following ancillary projects will be carried out by ship's personnel in accordance with general instructions contained in PMC OPORDERs: a) SEAS Data Collections and Transmission (PMC OPORDER 1.2.1); b) Marine Mammal Reporting (PMC OPORDER 1.2.2); c) Sea Turtle Observations (SP-PMC-2-89); d) others to be specified, with concurrence of Chief Scientist and CO, on a not-to-interfere basis.

4.3 Ship Operation Evaluation Report

4.3.1 The Chief Scientist will complete the Shipboard Operations Evaluation Form and forward it to Director, Office of NOAA Corps Operations within 20 days of the completion of the cruise.

4.4 Foreign Research Clearance Reports

4.4.1 Requests for research clearance in foreign waters (Australia, Indonesia, Papua New Guinea,

Solomon Islands, Nauru island, and Marshall Islands) have been submitted by ONCO to the U.S. Department of State on behalf of the Chief Scientist for the Nauru99 mission. Copies of clearances received will be provided to the FOO 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 research in foreign waters, due at ONCO within 30 days, and (2) ultimately meeting the commitments to submit data copies of the primary project to the host foreign countries.

5.0 HAZARDOUS MATERIALS

5.1 RONALD H. BROWN will operate in full compliance with all environmental compliance requirements imposed by NOAA. 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. RONALD H. BROWN Environmental Compliance Officer will work with the Chief Scientist to ensure that this management policy is properly executed, and that any problems are brought promptly to the attention of the Commanding Officer.

5.2 All hazardous materials require a Material Safety Data Sheet (MSDS). Copies of all MSDFSs 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. Hazardous material for which the MSDS is not provided will not be loaded aboard.

5.3 The Chief Scientist will complete a local inventory form, provided by the Commanding Officer, 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 in science operations and the amount being removed in the form of waste.

5.4 The ship's dedicated HAZMAT Locker contains two 45-gallon capacity flam cabinets and one 22-gallon capacity flam cabinet, plus some available storage on deck. Unless there are dedicated storage lockers (meeting OSH/NFPA standards) in each van, all HAZMAT, except small amounts for ready use, must be stored in the HAZMAT Locker.

5.5 The scientific party, under supervision of the Chief Scientist, shall be prepared to respond fully to emergencies involving spills of any mission's 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 only in the event of a spill. The Chief Scientist will provide to the ship's Environmental Compliance Officer a list of scientific personnel who are qualified responders in the event of a hazardous material spill.

5.6 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.

6.0 MISCELLANEOUS

6.1 Small boat operations are weather-dependent and at the discretion of the Commanding Officer.

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

6.3 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 scientific berthing spaces to the ship in the condition in which they were received, for stripping the bedding and returning the linen, and for return of any issued room keys.

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

6.5 In accordance with NC Instruction 5255.0, Controlled Substances Aboard NOAA Vessels, dated 06 August 1985, all persons boarding NOAA vessels give implied consent to conform 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. Wearing open-toed footwear (such as sandals) on the weather decks is unsafe and is not permitted.

6.6 Thirty days prior to departure, the Chief Scientist must provide to the Executive Officer a list of emergency contacts for all members of the science party, including name, address, relationship to member, and telephone number. These can be combined with the NOAA Health Service Questionnaire.

6.7 The Chief Scientist shall be cognizant of the reduced capability of RONALD H. BROWN's operating crew to support 24-hour mission activities. 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 day, 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 non-work 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 such a dayworker being unavailable to support science operations until the rest period has ended. All wage marine employees are supervised and assigned work only by the Commanding Officer or his designee. The Chief Scientist and the Commanding Officer shall consult regularly to ensure the shipboard resources available to support the science mission are utilized safely, efficiently, and in accordance with the above policies.

7.0 COMMUNICATIONS

7.1 The Chief Scientist or designated representative will have access to INMARSAT - A and INMARSAT - M, electronic mail, and other available ship-to-shore and ship-to-ship communication. To use INMARSAT - A or INMARSAT - M for Fax or voice communications , participants must bring a valid credit card. Rates are approximately $7 - $15 and $3 per minute, respectively. The more expensive INMARSAT - A has high-quality voice and supports high-speed data transmission; INMARSAT - M has lower quality voice and data rates only as high as 2400 baud. To reach the ship by INMARSAT (voice) use 011-872-154-2643 for A, and 011-872-761-266-581 for M. Fax is available via INMARSAT - A only at 011-872-154-2644.

7.2 E-mail charges for all personnel will be borne by the ship, provided size and quantity restrictions are not exceeded. Unless otherwise arranged, e-mail exchanges via INMARSAT will take place only once per day. Embarking scientists will be issued addresses of the form Firstname_Lastname%Brown@ccmail.rdc.noaa.gov. Due to the escalating volume of e-mail and its associated transmission costs, each member of the ship's complement, whether crew and scientist, will be authorized to send/receive up to 15 KB 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 his party whose e-mail costs have exceeded the complimentary entitlement**.**

8.0 GENERAL PROVISIONS

8.1 Radio Frequency Interference

Radio transmission can interfere with several of the continuous data streams as well as with salinity and nutrient instrumentation. If there is radio interference, the CO and Chief Scientist will work out a transmission schedule to minimize the deleterious effects of the transmissions.

8.2 Deviations from Cruise Plan

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

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

8.3 Medical and Emergency Data Forms

Ship health questionnaires and emergency data forms for all participants must be completed and mailed to the ship (attention medical officer and/or XO) at least 30 days prior to the beginning of the mission. All such forms should be routed through the Chief Scientist.

8.4 Onboard Storage of Science Party Effects

Research groups (see section 3.2) within the Nauru99 science party will require storage space for various shipping crates and boxes. Most crates and boxes will be empty and can be stored for the duration of the cruise. Some small number of each group's crates and boxes will contain supplies, spares, etc., which must be stored for easy accessability; these will be marked and separated for accessibility by the science party prior to departure from Darwin.

9.0 APPENDICES

Appendix A

Equipment List

1) **DABUL Lidar** (NOAA/ETL)
   WT: 700 lbs
   SIZE: 2.5'L x 3.5'W x 7'H
   PWR: Two separate 120 VAC Lines, 15 amps each, One line "clean" pwr 3.6 KVA Total
   SITE: 02 Portside Landing

2) **Portable Radiation Package** (DOE/BNL)
   WT: 50 lbs
   SIZE: 1'L x 2'W x 1'H
   PWR: 12 VDC
   SITE: Bow Tower

3) **Wind Profiler** (NOAA/ETL)
   WT: 900 lbs
   SIZE: 10'L x 10' W x 7' H
   PWR: 120 VAC single phase 12 amps
   SITE: Main Deck Aft, Port

4) **S-Band Radar** (NOAA/AL)
   WT: 600 lbs
   SIZE: 7' Diam. X 5' H
   PWR: 120 VAC single phase 12 amps
   SITE: 03 Forward, Port

5) **Ceilometer** (NOAA/ETL)
   WT: 100 lbs
   SIZE: 18"L x 18"W x 4' H
   PWR: 120 VAC single phase 6 amps
   SITE: Main Deck Aft, Port

6) **Flux System** (NOAA/ETL)
   WT: 100 lbs
   SIZE: 2'L x 1'W x 2'H
   PWR: 120 VAC single phase 8 amps
   SITE: Various, incl. Jackmast & Bow Tow.

7) **HRDL** (NOAA/ETL)
   WT: 15,000 lbs
   SIZE: 20'L x 8'W x 8'H
   PWR: 220 VAC single phase 60 amps
   SITE: 02 Forward, Starboard Outboard

8) **Cloud-Rad-FTIR Van** (NOAA/ETL)
   WT: 15,000 lbs
   SIZE: 20'L x 8' W x 8'H
   PWR: 480 VAC, 3 phase 30 amps
   SITE: Main Deck Aft, Port Inboard

9) **Sun Photometer** (Penn State U.)
   WT: 100 lbs
   SIZE: 30"L x 30"W x 36"H
   PWR: 120 VAC single phase 6 amps
   SITE: TBD in Darwin (02 van top ?)

10) **Total Sky Imager** (Penn St. U.)
   WT: 50 lbs.
   SIZE: 20'L x 14'W x 35"H
   PWR: 120 VAC single phase 6 amps
   SITE: TBD in Darwin (02 van top?)

11) **Radiometer Van** (NOAA/ETL)
- WT: 13,000 lbs
- SIZE: 20'L x 8'W x 8'H
- PWR: 208 VAC 3 phase
  40 amps
- SITE: 02 Forward, Port
  Outboard

12) **H_2O DIAL Van** (MPI)
- WT: 20,000 lbs
- SIZE: 20'L x 8'W x 8'H
- PWR: By Motor-Generator Set
  480 VAC 3 phase input
  30 KVA, 25 amps
- SITE: 02 Forward, Starboard, Inboard

13) **Machinery Van**
- WT: (TBD) lbs
- SIZE: 20'L x 8'W x 8'H
- PWR: 480 VAC 3-phase
  30 amps
- SITE: Stack on top of inboard
  van (#22), 01 portside

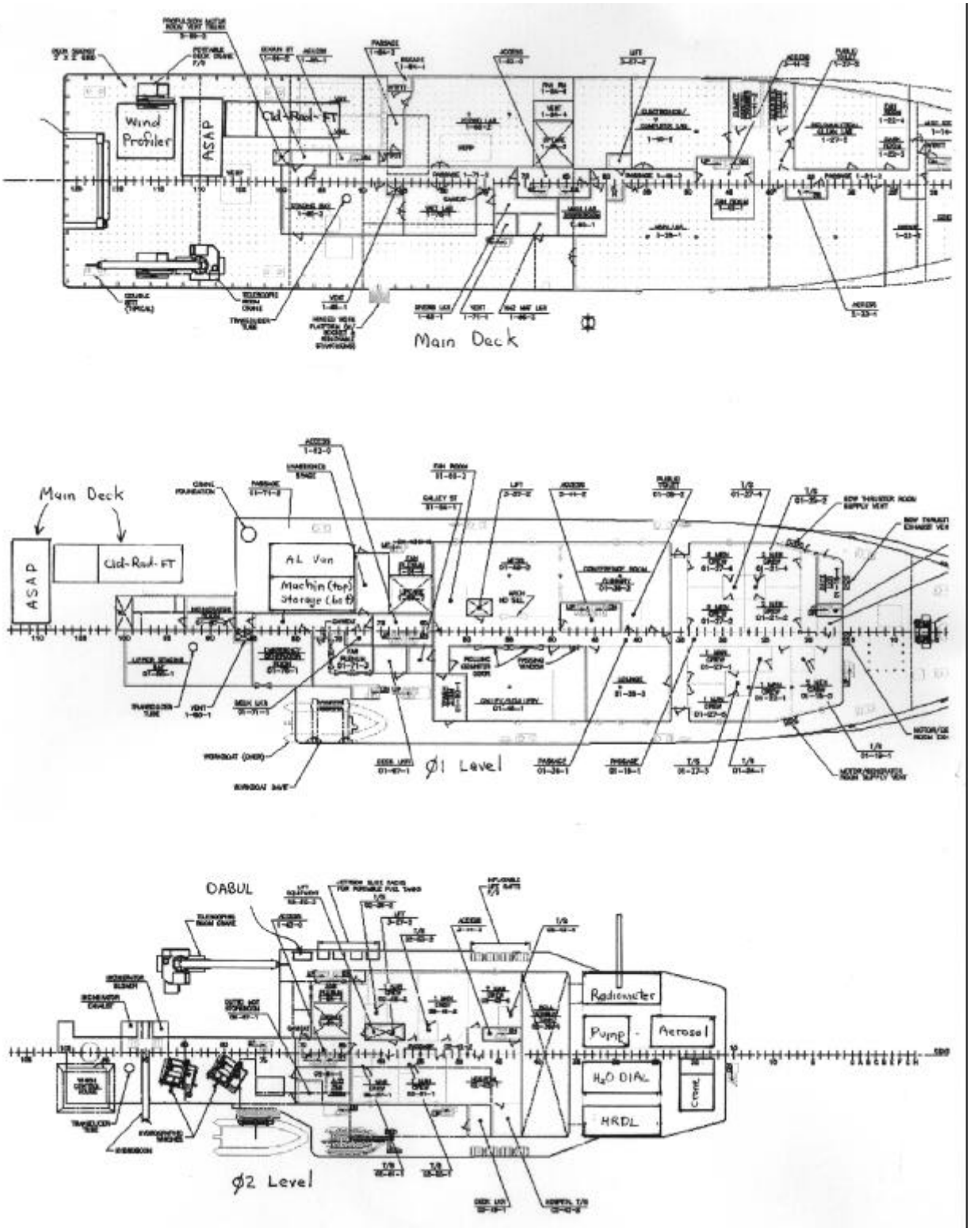
18) **Aerosol Van** (NOAA/PMEL)
- WT: 1200 lbs
- SIZE: 18'L x 8'W x 8'H
- PWR: 440 VAC 3-phase
  50 amps
- SITE: 02 Forward, Port,
  Inboard (forward #19)

19) **Pump Van** (NOAA/PMEL)
- WT: 4000 lbs
- SIZE: 12'L x 7'W x 8'H
- PWR: (from Aerosol Van #18)
- SITE: 02 Forward, Port
  Inboard (aft of #18)

20) **Chemistry (AL) Van** (NOAA/PMEL)
- WT: 10,000 lbs
- SIZE: 20'L x 8'W x 8'H
- PWR: 440 VAC 3-phase
  30 amps
- SITE: 01 Aft, Port, Outboard

21) **Storage Van** (NOAA/PMEL)
- WT: 12,000 lbs
- SIZE: 20'L x 8'W x 8'H
- PWR: (not in use)
- SITE: 01 Aft, Port, Inboard

Appendix B
Van and Instrument Positioning



Appendix C
Considerations for Placement of Vans and other Mission Instruments

(a) H_2O DIAL van (#12), and HRDL van (#7) should be physically close to one another for purposes of intercomparisons and for synergistic data analysis. HRDL needs to be able to scan through an unobstructed vertically-oriented cone of 60 degrees full width (30 degrees off zenith). It also needs to scan through a wide azimuthal range in a horizontal plane. Therefore, we propose siting HRDL starboard side forward on the O2 level, and to provide rails with new ISO fittings to permit it to be mounted very close to the starboard rail. Power for it will be provided by a transformer mounted on the starboard 02 railing forward of HRDL; the transformer will be connected to ship's 480 volt power from the 02 van bulkhead by a project-provided power cord.

(b) The H_2O DIAL will be inboard, next to HRDL. It requires that a freestanding cooling unit (radiator/fan) to be mounted near it, connected to the van via hoses, as well as a separate air recirculating structure (cowling/fan). The latter attaches to the van end doors via 15" diameter flexible tubing. This van may need to be moved forward toward the existing crane to make room for the air recirculator and to provide better access to existing entry doors. The H_2O DIAL system will get power from a motor-generator set that converts 480 V 3-phase ship power at 60 Hz to 380 V 3-phase power at 50 Hz. This set will be housed in the Machinery van (#13), stacked on top of the PMEL Storage van (#22) in the 01 aft (inboard) van slot, with 50 Hz power brought forward to the DIAL van via a 40 m power cord.

(c) The Radiometer van (#11) needs to be positioned forward and outboard. Like HRDL, rails with new ISO fittings may be used to reposition it laterally further outboard, next to the port railing on the 02 level (forward). It will have a horizontal 20' boom running perpendicular to the length of the van (and ship) from the center of the van. It's purpose is to enable scanning radiometers to view a portion of the ocean's surface that is undisturbed by the ship's wake, and to do so as close to nadir as possible. We must ensure that this boom does not introduce a safety hazard and can be stowed in a forward-pointing direction in a short period of time to clear the ship's profile, if needed. The boom will be supported from its mid-point (or farther) via 3 spars that will attach to the port side railing (bottom 2 rails). The temporary duct work in this same area used to divert ship's exhaust from the forward 02 vents must not prevent attachment of these spars to the rails. Metal plates attached to the lower rails via U-bolts will secure the lower ends of the spars.

(d) These van placements, and the needs of the Cld-Rad-FTIR van (below), necessitate relocating the ASAP van to the aft main deck (starboard). As ASAP was positioned when the ship left Norfolk in January, 1999, it was not far enough aft to allow the Cld-Rad-FTIR van (#11) unobstructed side-to-side scanning in a vertical plane. Therefore for Nauru99, it will have to be moved aft 10-12 ft., and its power and signal cables extended.

(e) The Cloud-Rad-FTIR van (#8) needs a clear vertical plane through which it can scan from

horizon to horizon through the zenith. No cables (signal or power) can interrupt the side-to-side vertical scanning -- they should be run along the deck. Its scanning disc system extends from about 6" to 6' from the aft end of the 20' van. Main deck aft is the only location suitable for this van and scanner, but because of the need to position it well aft of the normal van position, and because of the power connector protrusions from the ship's bulkhead, it must move laterally toward the port railing and therefore occupy both van slots. It also needs 3' clearance on its port side, to open a door and to mount the FTIR. While these required clearances preclude another van from occupying the outboard van slot on the main deck, there may be room forward of the Cld-Rad-FTIR van to store a half-van (#21 or #23). The large 4' diam pulley facing aft and mounted 12' above the main deck on the bulkhead forward of the ASAP van is a problem -- it protrudes into the vertical scanning plane of the radiometers. It needs to be rotated as much as possible out of this plane. The Cld-Rad-FTIR van will be loaded in Singapore prior to Nauru99, to participate in JASMINE. The same siting requirements will pertain for JASMINE (occupying both van slots, movement aft of ASAP, longer ASAP power and signal cables, pulley rotation, etc.). It may stay onboard after Nauru99 to participate in KWAJEX, or it may be taken off the ship and sent back to the U.S.

(f) The 915-MHz radar wind profiler (# 3) will be deployed on the main deck aft, as far from tall superstructure as possible. Next to the port side aft crane is preferred. It will be operated as a ship's instrument throughout most of the 1999 cruise season, including KWAJEX. However, it will need to be torn down prior to mooring work after KWAJEX, to clear space on the fantail. Therefore, wooden crates for it will be loaded onto the ship in Darwin and ETL staff will disassemble it in Kwajalein, either before or after KWAJEX. After Kwajalein the profiler will be stored in pieces on the ship in a dry and safe location, until it can be off-loaded in Seattle. The antenna crate is approximately 7' x 7' x 1', the pedestal crate is about 3' cube, and the clutter screen and radome pieces will be contained in several smaller crates. The S-band radar (#4) can go almost anywhere with a clear upward view – level 3 forward of the Chief Scientist stateroom (port side) is suggested. It will continue to operate throughout the 1999 cruise season. It may or may not be removed after KWAJEX.

(g) Ship's staff will need to peruse the operation of the wind profiler and S-band radar daily and archive data weekly, when ETL and AL staff are not onboard (i.e, for ACE and INDOEX)

(h) The Total Sky Imager and the Sun Photometer will be deployed somewhere in the vicinity of the 02 vans, perhaps on top of one or more of them or on the 03 railing above and behind the 02 vans. Their position should be chosen to minimize interference with HRDL lidar scans. The Sun Photometer needs as clear a view of the sun as possible. The Total Sky Imager needs maximum exposure to the sky, horizon to zenith. The siting of these instruments may have to be determined in Darwin. Both have associated computers that need to be in a van or lab.

(i) The BNL Radiation Package is planned to be deployed on the bow tower boom, and is to be supplied with 12 VDC power by the ship.

DABUL (# 1) needs to have a clear view overhead and be sheltered as much as possible from sea

spray. It is also important that stack and incinerator exhaust not flow above it and intersect the vertically-propagating laser beam for long periods of time. The port side 02 landing amidships, between gas can trays and the port side (aft) crane storage dock, is the target location for this instrument. It will be secured by attaching it to plates clamped to the railing with U-bolts. Signal cables will run forward to the new feed-throughs between the 02 walkway and the BIO lab.

(j) Any instrument or container emitting light, whether laser light or room light, that is visible from the bridge needs to provide shielding of it, to help personnel on the bridge maintain good night vision. This may require that openings in the tops or sides of vans (e.g., ports, windows, scanners) be protected with internal curtains or external baffles.

(k) The Ceilometer (#5) was loaded in Norfolk but it will not be set up until the beginning of JASMINE. It is a small instrument that stares vertically; it can be mounted easily within a 2' deck bolt pattern. The ideal position for it will be between the wind profiler and the ASAP van, aft main deck, port side. It, like the profiler, will be packed and stowed after Kwajalein for delivery by RONALD H. BROWN to Seattle.

(l) The WHOI LI-COR 6262 CO_2 sensor will be placed on the second bow tower. The a calibration computer, zero air bottles, and a pump for this system will be set up in Aero/Pump/or NH3 vans on the 02 deck. Data will be logged through the ETL fast Campbell-2. Two 0.25" air lines will be run to connect the zero air and the pump to the sensor. One RS-232 line will be run to connect the sensor to the calibration computer in the Main lab. Four cylinders of zero-air compressed gas for calibration of the sensor will be loaded in Singapore and placed in the Aero/Pump/or NH3 van.

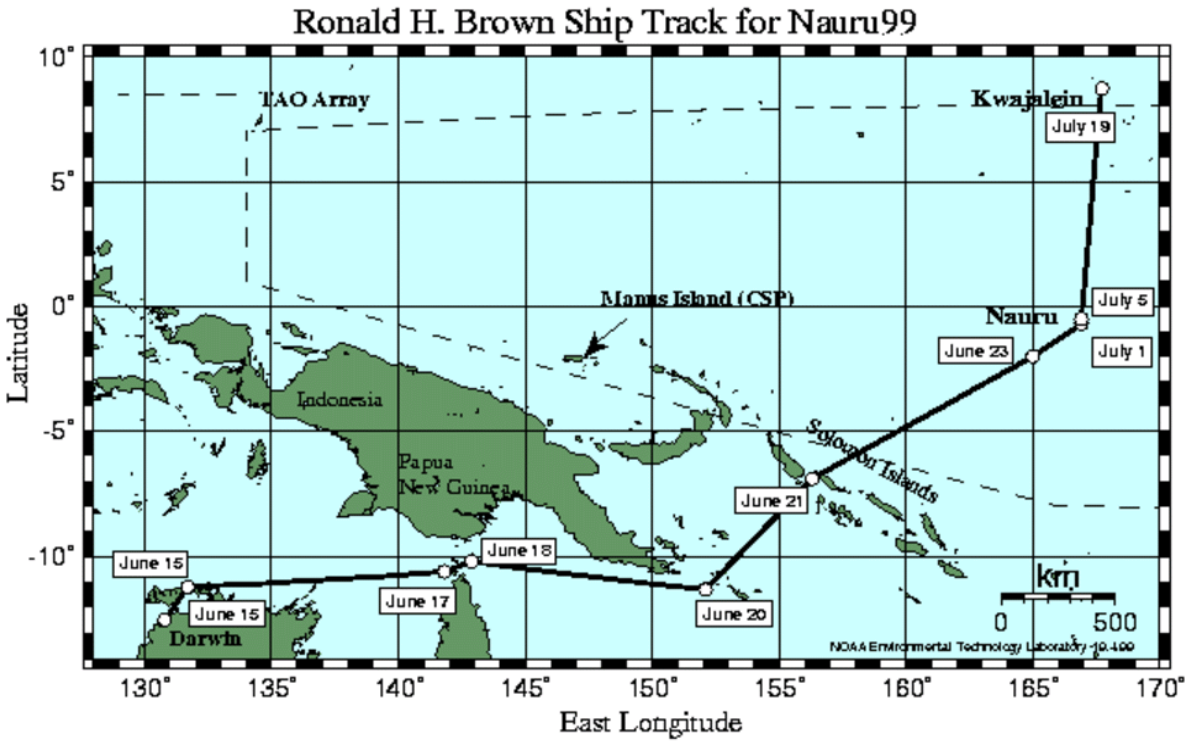
(m) The ETL flux system will consist of seven components. (1) A fast turbulence system with ship motion corrections will be mounted on the jackstaff using the same method as the GASEX-98 cruise. The sensors will be: Sonic anemometer, IR-hygrometer, Oak Ridge IR-CO2/hygrometer, motion-pak. (2) Solar and IR radiometers (Eppley pyranometer/pyrgeometer) will be mounted on the top of the bow tower. (3) A near surface sea surface temperature measurement will be made with a floating thermistor deployed off the port side with an outrigger. (4) An aspirated Vaisala T/RH unit mounted on the bow tower (5) A backup GPS unit, to be mounted at some convenient location, (6) a backup gyrocompass with RS-232 output to be mounted in the main lab, (7) an STI optical rain gauge mounted on the bow tower. The motion-pak signals will be digitized and transmitted via RS-232 using a Campbell data logger mounted on the bow tower. The Oak-Ridge and WHOI fast CO2 signals with be digitized and transmitted via RS-232 using a second Campbell data logger mounted on the bow tower. All slow analog systems will be digitized and transmitted via RS-232 using a third Campbell data logger; location of this unit will be decided in Singapore. All RS-232 data streams will be logged on an HP workstation located in the Main Lab.

(n) Work on top of vans, the bow tower, or the jackstaff while the ship is underway or station-keeping will require personnel to wear safety harnesses and be properly tethered. Personnel doing such work should notify the bridge to obtain permission and to indicate when work has been

safely completed.

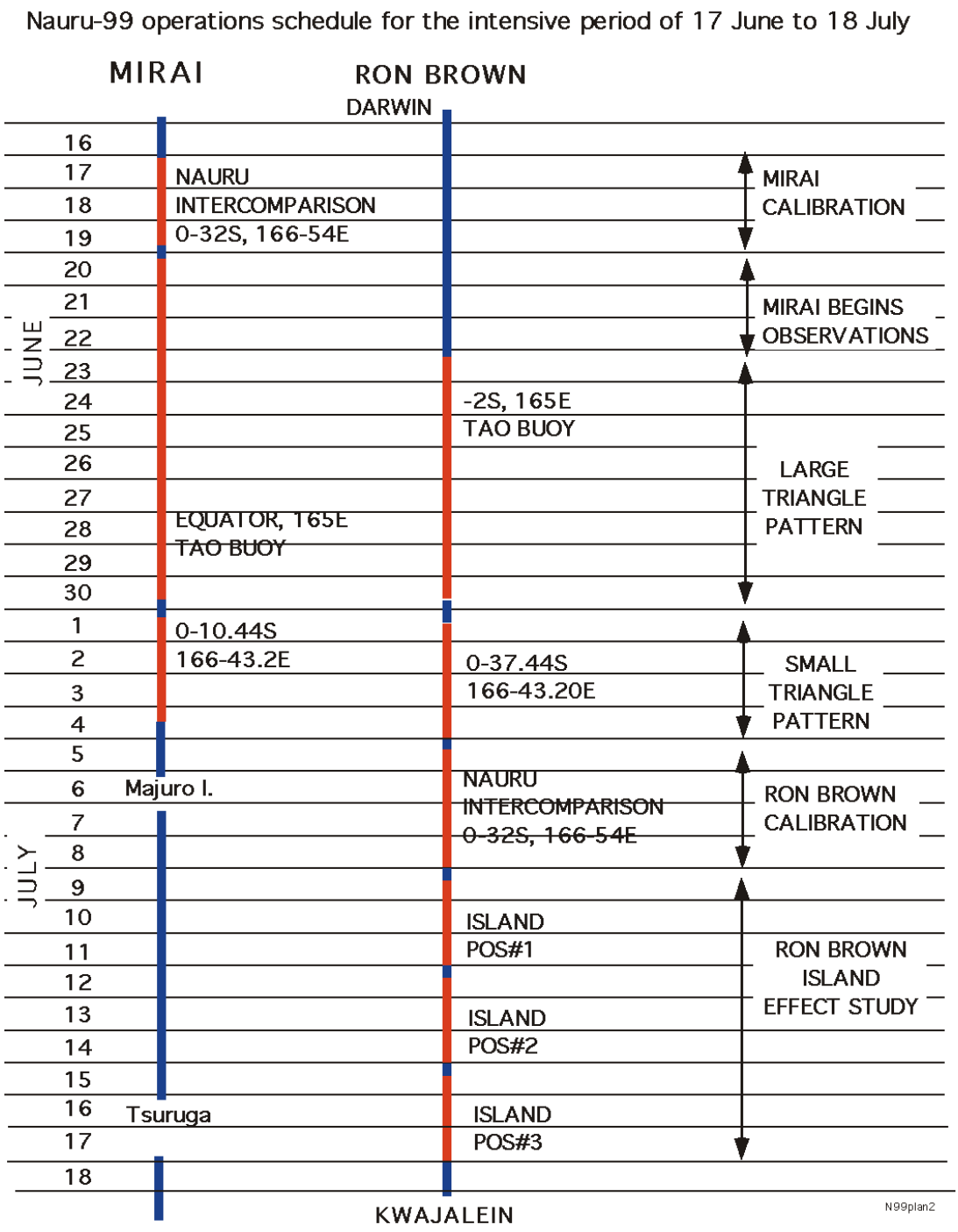
(o) 80 cylinders of helium (five 16-pack pallets) have been marked in Norfolk with a band of red electrical tape on the caps. These cylinders are reserved for JASMINE and Nauru99, and should not be used by other projects. The same 80 bottles have had the cap screws coated with teflon-based grease to help prevent rusting.

Appendix D
Proposed Ship Track



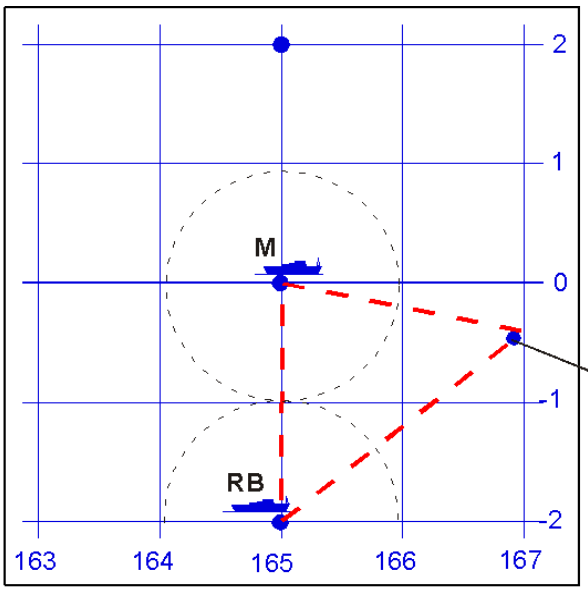
Appendix E

Time Line for Joint Operations
with R/V MIRAI

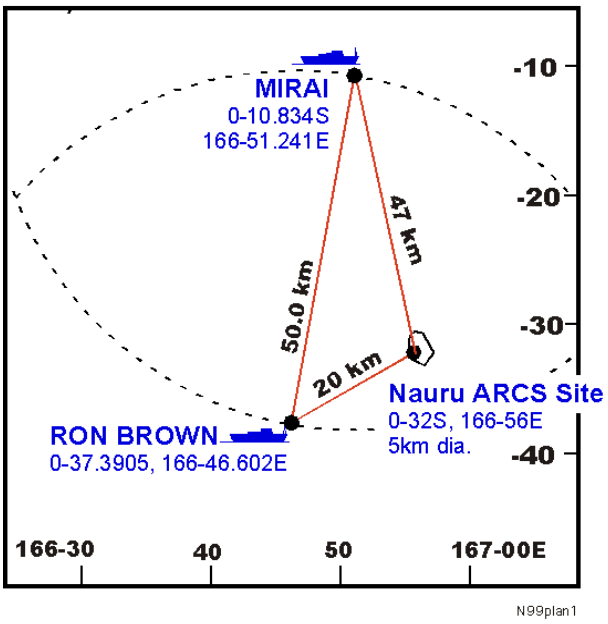


Appendix F

Triangular Configurations for Joint Operations with R/V MIRAI and Nauru Island



TRIANGLE PATTERN: This pattern supports a single-column model study and provides an intercomparison calibration of two fo the **TAO** radiation buoys. The **RON BROWN** holds position at the 2°S TAO buoy and the **MIRAI** holds position at the equator buoy. The approximate length of each leg is 200 km. Station time approximately 7 days.



SPATIAL PATTERN: **MIRAI** moves to latitude -0.180559 and longitude 166.853563, approximately 47 km and at an azimuth of 340 deg from the ARCS site. **RON BROWN** moves to -0.623161 latitude and 166.776693 longitude, 20 km and at an azimuth of 240 deg from the ARCS site. Radar ranges of 50 km are shown by the dashed lines. Station time is approximately 4 days.

Appendix G
Onboard Participants

Name	Affiliation	Nationality	Gender
Heather Zorn	**NOAA/ETL**	**USA**	**F**
Jeff Hare	**NOAA/ETL**	**USA**	**M**
Duane Hazen	**NOAA/ETL**	**USA**	**M**
Brad Orr	**NOAA/ETL**	**USA**	**M**
Madison Post	**NOAA/ETL**	**USA**	**M**
Scott Sandberg*/Rob Newsome**	**NOAA/ETL**	**USA**	**M**
Ed Westwater**	**NOAA/ETL**	**USA**	**M**
Andrey Grachev	**NOAA/ETL**	**Russia**	**M**
Jeff Otten**	**NOAA/ETL**	**USA**	**M**
Ann Weickmann*, ***	**NOAA/ETL**	**USA**	**F**
Boba Stankov	**NOAA/ETL**	**USA**	**F**
Derek Coffman	**NOAA/PMEL**	**USA**	**M**
Drew Hamilton	**NOAA/PMEL**	**USA**	**M**
Tom Gillman	**College of Desert**	**USA**	**M**
Tony Reale**	**NOAA/NESDIS**	**USA**	**M**
Volker Matthias	**Max Planck Inst.**	**Germany**	**M**
Klaus Ertel	**Max Planck Inst.**	**Germany**	**M**
Friedhelm Jansen	**Max Planck Inst.**	**Germany**	**M**
Volker Wulfmeyer	**NCAR**	**Germany**	**M**
Scott Smith	**DOE/BNL**	**USA**	**M**
Chuck Pavloski	**Penn. State Univ.**	**USA**	**M**
Hans Verlinde	**Penn. State Univ.**	**USA**	**M**
Jennifer Aicher	**LVMMC**	**USA**	**F**
Tepora Toliniu	**LVMMC**	**USA**	**F**

* Leaves at Nauru **Joins at Nauru ***Provisional (if needed after Darwin setup)

TOTALS: Darwin to Nauru: 20 or 21, Nauru - Kwajalein: 23

Appendix H

Hazardous Materials List

Acetone
Ethanol
Isopropol Alcohol
Liquid Nitrogen
Gear Oil

Quantities and locations of newly-arriving hazardous materials will be documented in Darwin. The Nauru99 Chief Scientist will work with the departing JASMINE Chief Scientist and the ship's HazMat Officer to ensure proper tracking of inherited hazardous materials.

May 21, 1999

MEMORANDUM TO: Rear Admiral Nicholas Prahl, NOAA
Director, Atlantic Marine Center

FROM: Steven F. Clifford
Director, Environmental Technology Laboratory

SUBJECT: Final Cruise Instructions: RB-99-04
NOAA Ship RONALD H. BROWN
Nauru99 Cruise
June 8, 1999 to July 17, 1999

Final project instructions for NOAA Ship RONALD H. BROWN, cruise RB-99-04, are attached for your endorsement and distribution.