LOST CITY EXPEDITION 2005
CRUISE INSTRUCTIONS
NOAA Ship Ronald H. Brown
RB-05-03
July 17 – August 4, 2005

Cruise Itinerary: July 17, 2005 – Depart Woods Hole, MA
August 4, 2005 – Arrive Punta Delgado, Azores
19 Days at Sea

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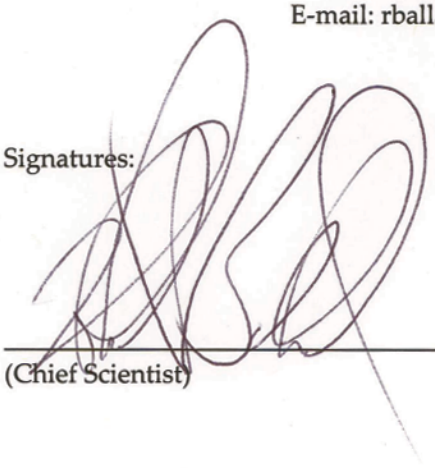

(Chief Scientist)

(NOAA Marine Operations Center Director)

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I. Cruise Overview

A. Summary of objectives

The Institute for Exploration (IFE), in collaboration with the University of Rhode Island, the University of Washington, the NOAA Office of Ocean Exploration, the Immersion Institute, the Jason Foundation for Education and others will conduct a remotely operated vehicle (ROV) survey of the Lost City Hydrothermal Field (LCHF) near the axis of the Mid Atlantic Ridge at 30°N (Figure 1). This multidisciplinary research and exploratory survey will be the key component to a large educational outreach effort using satellite telecommunications and video broadcasting to deliver real time professional productions to a variety of outreach sites throughout the US. In addition to the outreach effort, this expedition will test a new paradigm for oceanographic research, to have a large and critical component of the science party at a shore-based control center, led by Dr. Deborah Kelley at the University of Washington in Seattle. The exploration program will focus on mapping new areas within and surrounding LCHF, and collecting new samples from hydrothermal vent sites, all utilizing new technologies in deep sea research. As during the Titanic expedition and Mountains in the Sea expedition in 2004, the primary IFE vehicle systems that we will employ during this cruise are *Argus* and *Hercules*. New for this expedition will be the use of "elevator" systems to carry geological and biological samples up from the seafloor.

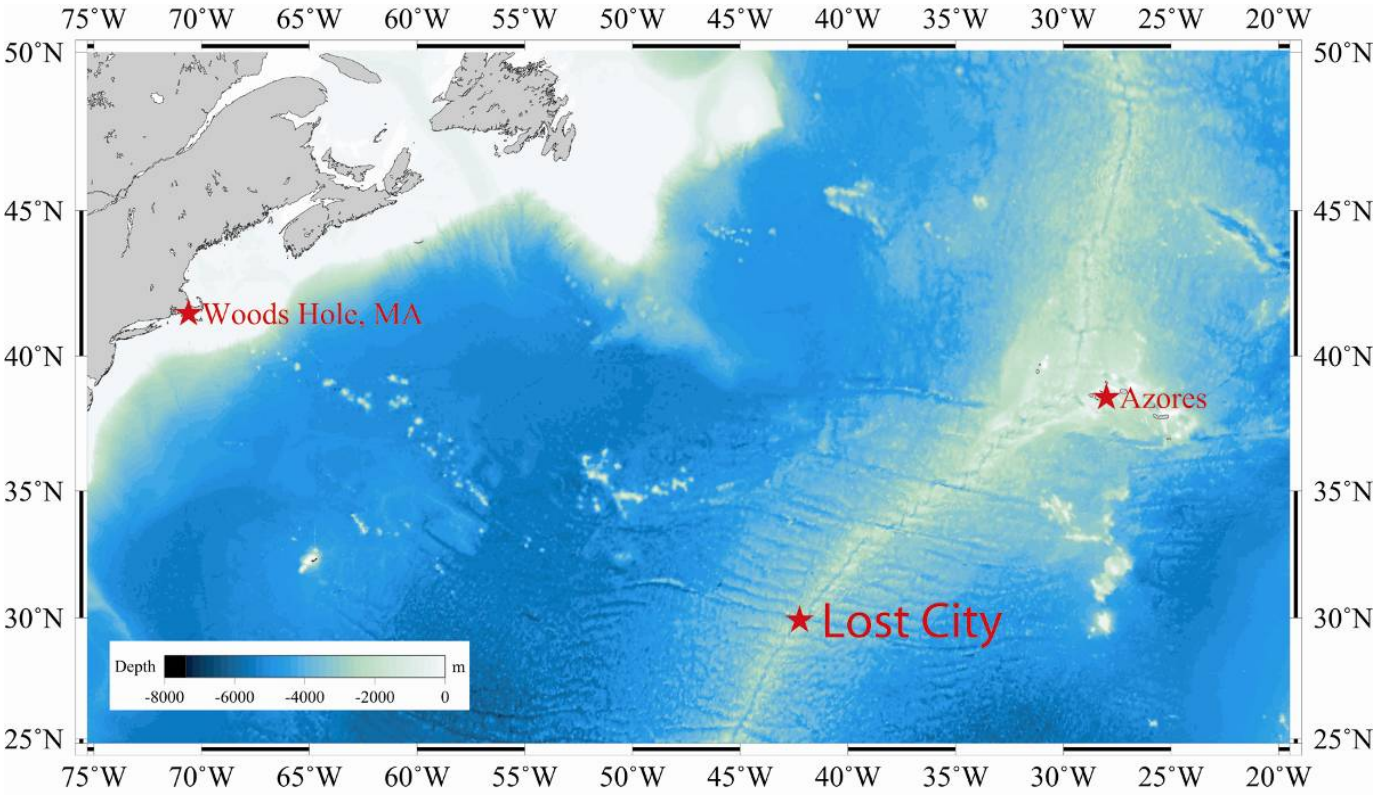

Figure 1. Region of the North Atlantic Ocean to be transited to and from the Lost City Hydrothermal Field. The research cruise will originate in Woods Hole, MA, transit to the Lost City region, then end in the Azores.

B. Operating Area

The operating area for this expedition is in the North Atlantic Ocean, southwest of the Azores (Figure 1), along the Mid Atlantic Ridge, near the intersection of the ridge axis with the Atlantis fracture zone (Figure 2). The primary, large-scale survey region for this expedition is between 40° W and 41° W longitude and between 30° N and 31° N latitude. During most of the expedition, the NOAA Ship RONALD H. BROWN (RHB) and ROVs will be working inside two smaller dive areas (Figure 2). When the ROVs are not in the water, the RHB will conduct Seabeam surveys in regions to be determined, but primarily in the vicinity of this large-scale region.

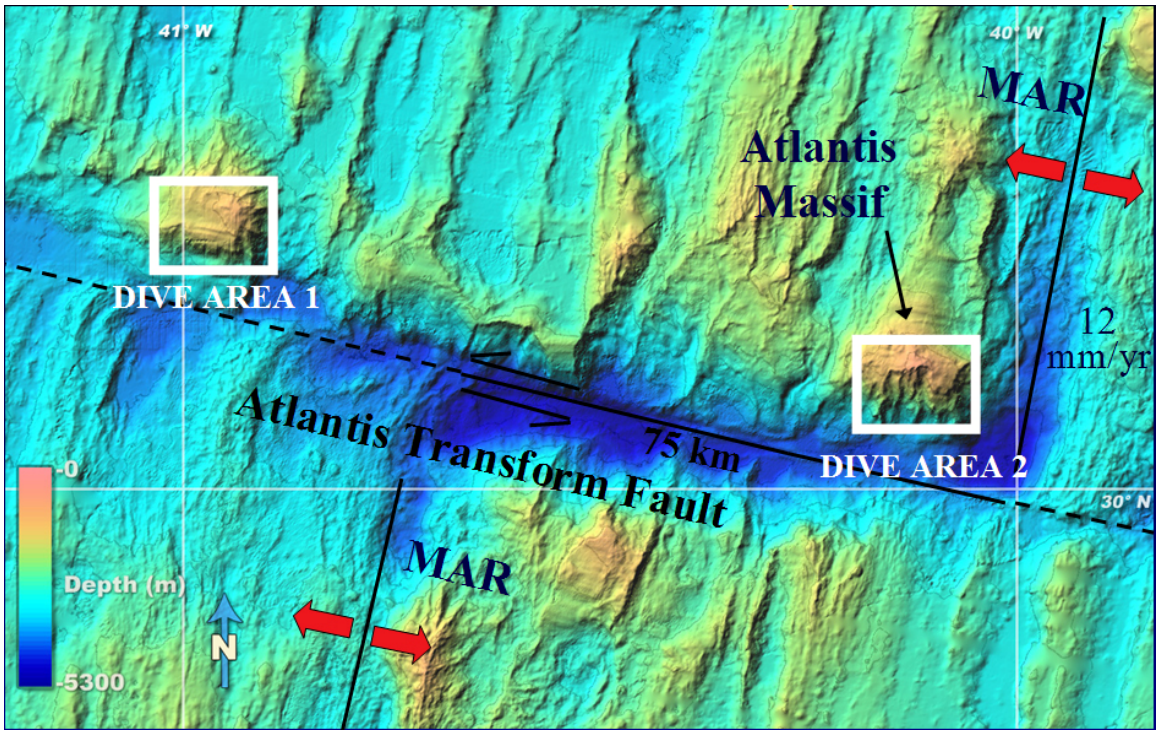

Figure 2. Location map for two dive areas along the Atlantis Transform Fault and Fracture Zone, near the axis of the Mid Atlantic Ridge (MAR). This map also depicts bathymetric relief, topographic features, and present-day tectonic setting. LCHF is located within Dive Area 2, along the southern flanks of the Atlantis Massif.

C. Participating Institutions

Institute for Exploration (IFE)
University of Rhode Island (URI)
University of Washington (UW)
Woods Hole Oceanographic Institution (WHOI)
University of New Hampshire (UNH)
Jason Foundation for Education (JFE)
Media Arts (MA)
Immersion Presents (IP)
Hellenic Center for Marine Research (HCMR)
NOAA Office of Ocean Exploration (NOAA-OE)

D. Personnel

	Name	Position	Affiliation	Gender	Nationality
1.	Ballard, Robert	Chief Scientist	IFE/URI	M	USA
2.	Coleman, Dwight	Scientist	IFE/URI	M	USA
3.	Roe, Kevin	Scientist	NOAA-PMEL	M	USA
4.	Brazelton, Billy	Scientist	UW	M	USA
5.	Proskurowski, Giora	Scientist	WHOI/UW	M	
6.	Buckman, Kate	Scientist	WHOI	F	USA
7.	Newman, Jim	Chief Engineer	IFE	M	USA
8.	Howland, Jonathan	Software Eng.	WHOI	M	USA
9.	Gregory, Todd	Chief Herc Pilot	IFE	M	USA
10.	Orvosh, Tom	Herc Pilot 2	URI	M	USA
11.	Lovalvo, Dave	Herc Pilot 3	IFE	M	USA
12.	DeRoche, Mark	Argus Pilot 1	IFE	M	USA
13.	Wright, Dave	Argus Pilot 2	IFE	M	USA
14.	Phillips, Brennan	Argus Pilot 3	IFE	M	USA
15.	Roman, Chris	Navigator 1	WHOI	M	USA
16.	Naiman, Matt	Navigator 2	WHOI	M	USA
17.	Moore, Jimmy	Navigator 3	URI	M	USA
18.	Raynes, David	Video 1	IFE	M	USA
19.	Bachmann, Bill	Video 2	IFE	M	USA
20.	Kulliver, Jeff	Video 3	IFE	M	USA
21.	Martinez, Catalina	Data 1	NOAA-OE	F	USA
22.	Caporaso, Alicia	Data 2	URI	F	USA
23.	Pinner, Webb	Data 3	NOAA-OE	M	USA
24.	Stamps, Scott	Satellite	IFE	M	USA
25.	Pontecorvo, Joe	Production	MA	M	USA
26.	Charles, Scot	Production	MA	M	USA
27.	St Amant, Kurt	Production	MA	M	
28.	Viola, Todd	Educator	II	M	USA
29.	Shea, Patrick	Educator	JFE	M	USA
30.	John Wasserman	Data manager	NOAA-OE	M	USA
31.	Nichols, Mary	Video	IFE	F	USA
32.	TBD				

E. Administrative

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II. Operations

A. Data Collections

This expedition to LCHF will be the first of its kind, delivering data and images in real time to Dr. Kelley and her shore-based team. This team will participate in the live expedition through telepresence technology, which will permit transmissions of audio, video, and data feeds from the ROV control van on the ship to the remote console at UW. The primary data to be collected include digital video and still photographic imagery from the camera systems on the ROVs, and rock, animal, and vent fluid samples. Other data streams from the ROVs, such as vehicle attitude, acoustic data, and sonar imagery are recorded by networked computers in the control van. Navigational data for both the ship and ROV systems will also be recorded. While in transit to and from the site, and during times when the ROV is not deployed, Seabeam multibeam bathymetric data will be collected, with the assistance of RHB's survey technician, and sent to another shore-based control center at the University of New Hampshire, where it will be processed Dr. Larry Mayer's staff. Much of the video and data streaming over the satellite will be recorded at the primary shore-based facility at the University of Rhode Island's Inner Space Center. Adjacent to this facility is the production team that is utilizing the raw scientific feeds to produce educational programming. The NOAA OE Data Manager will be responsible for collecting and organizing metadata for all activities conducted during the expedition, and entering the data into the OE Expedition Information System (EIS). Oceanographic samples will be collected during the expedition using the ROV, including fluid and gas samples from the hydrothermal vents, and seafloor geological and biological samples. These latter samples will be collected by the ROV and also by traps set on the seafloor by the ROV. Elevators will be used to retrieve the samples (see below).

B. Staging plan

Most of the equipment for this expedition (listed below) will be loaded and installed onboard the NOAA Ship RONALD H. BROWN at the Woods Hole Oceanographic Institution during July 15-16, 2005.

Exceptions are the winch, winch power unit, and winch deck plates, which were installed at the shipyard, and the satellite van, satellite antenna and new shipping van, which will be installed on July 6 in Charleston.

Equipment list:

Description	Wt. (lbs)	Destination	Power	Notes
Imaging Van (20′ ISO)	12000	Main deck, port inboard, big doors aft	P448-3	
Control Van (20′ ISO)	15000	Main deck, port outboard, big doors aft	P448-4	
Tool Van (20′ ISO)	16500	Main deck, stbd, big doors forward	P448-1	Doors open FWD
Satellite Van (20′ ISO)	13000	02 deck, new starboard van location	P448-6	
New Shipping Van	3500	Forward 02 deck, doors aft	none	
Satellite Antenna (20′ flat)	5300	Top of New Shipping Van, forward 02 deck	none	No fork pockets; antenna at FWD end
Blue Shipping Van (20′ ISO)	11000	01 deck, port outboard	none	
Winch and cable	27000	Main deck, centerline	none	
Winch power unit	5000	Main deck, centerline	P608-2	
Winch deck plates (2)	2400	Main deck, centerline	none	
ROV Power unit	400	In Tool Van	P422	In Tool Van
ROV HERCULES	5200	Main deck near HIAB	none	
ROV ARGUS	4000	Main deck A-frame	none	
ROV Little HERCULES	600	Staging Bay	none	in Tool van
Sheave	1000	A-frame	none	Arriving in shipping van
HERCULES stand	400	Main deck near HIAB	none	
HERC Aux HPU	500	Staging Bay	P448-2	Arriving in shipping van
USBL Mounting mast	300	Moonpool	none	To be assembled in Staging Bay
Elevators (3)	1500	Main deck starboard	none	To be assembled during transit
ALVIN drop weights	3000	Main deck starboard	none	For elevators

The assistance of the bosun and deck personnel is required during the mobilization. In addition to the equipment listed in the above table, additional assistance from the bosun and deck personnel may be needed to crane on ~3000-4000 lbs of science gear housed in small shipping containers. This gear includes items such as titanium water bottles, the components of a gas extraction line, gas cylinders, and analytical instruments for water and biological analyses. Also, the assistance of both the survey technician and electrical technician is requested to facilitate the integration of our control vans with the ship. The navigation computer inside the control van needs serial data provided by the ship's SCS, namely P-Code DGPS position information in NMEA format. The ship's heading from the gyro and water depths from the ship's echo sounder are also needed as separate serial data streams. We also request the assistance of the electrical technician to help provide connections between the control van and the bridge and between the control van and the main lab for routing audio (intercom), video, and computer (VGA) signals.

Installation of the IFE USBL beacon in the ship's moonpool will be performed by IFE personnel, but requires that the moonpool cover be removed by the ship's divers on July 16.

The sheave should be hung, and a pull test performed, before the ship departs Woods Hole.

C. Cruise Plan

We wish to depart Woods Hole late in the day on July 17, 2005 to begin the transit toward the first dive site. During the transit we will be collecting Seabeam data. Immediately after arriving at the first dive area (Figure 2, left box) on July 23, 2005, following the 6-day transit, we will be prepared to launch *Argus* and *Hercules* ROV system. The amount of time we spend surveying within the first dive area will depend on what we observe at this location. At some point during the first few days we will recover the vehicles and transit to the second dive (Figure 2, right box). Unless something quite significant is discovered in the first area, we will likely spend the rest of the cruise in the second area, diving on specific regions within LCHF (Figure 3). The plan is to keep the ROV's working as much as possible during the entire 10 days on site. If it is known that the ROV's will be out of the water for an extended period of time, we will conduct Seabeam surveys in selected locations. This mode of operation will be sustained until the time of departure on August 2, 2005, at which point the vehicles will be recovered and secured on the ship's deck. We wish to arrive in the Azores during the afternoon of August 4, 2005.

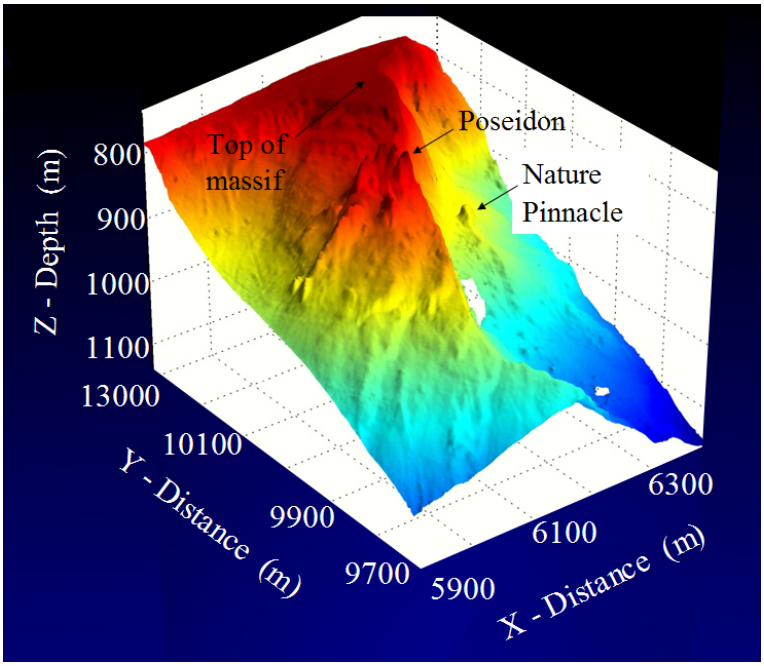

Figure 3. Three-dimensional map of the LCHF depicting the top of the Atlantis Massif, and the locations of two primary vent structures, Poseidon and Nature Pinnacle. XY meters are in Alvin dive coordinates (after Kelley et al., 2005).

D. Multibeam

The shipboard Seabeam 2112 (12 Khz) swath bathymetric sonar system is required for this cruise. Multibeam data already exists for much of the region where we are diving the ROVs, however, during vehicle down times, we intend to increase the coverage by surveying in new regions proximal to the dive sites. Raw multibeam data and geo-referenced images of the bathymetry will be needed following the survey for integration into the navigation system of the ROV. The raw data will be sent to UNH via the satellite link to be processed there. The map developed from the multibeam data will be used for selection of ROV dive sites. Specific survey lanes will be provided during the initial transit. XBT data will be collected in the survey region to improve the quality of the multibeam acquisition and processing.

E. ADCP

Upon arrival to a dive site, the ADCP should be turned on to measure the surface current speed and direction. This will aid in ROV deployment. It will be determined if the ADCP interferes with other acoustical instruments, which will in turn determine if the unit is operated during the course of the dive to assist ROV operators.

F. Remotely Operated Vehicle and Elevator Operations

The majority of the operations will consist of ROV dives on the LCHF not to exceed 3,000 meters. The ship's FOO and bosun will meet with the IFE operations crew, Chief Scientist, and watch leaders prior to operations to ensure clarity of ROV launch, dive and recovery procedures. Once a dive location has been

selected, the ship and IFE crew will determine the deployment site in order to maximize the probability of reaching the seafloor at the predetermined location.

During each deployment after the vehicles are launched and begin their decent to the seafloor, the ROV operations team will begin a 24 hour watch schedule, for example:

Time	Herc Pilot	Argus Pilot	Navigator	Video	Data
12-4	Todd Gregory	Brennan Phillips	Matt Naiman	Dave Raynes	Webb Pinner
4-8	Dave Lovalvo	Mark DeRoche	Chris Roman	Bill Bachman	Catalina Martinez
8-12	Tom Orvosh	Dave Wright	Jimmy Moore	Jeff Kulliver	Alicia Caporaso

Each watch will have a watch leader who is responsible for carrying-out the planned dive activities. We will adhere to the watch schedule for the duration of each dive.

During deployment of the ROV system, the *Hercules* ROV (Figure 4, middle) is launched using the articulating crane, and the *Argus* towsled (Figure 4, left) is launched using the A-frame. The ship will be driven from the aft control station during ROV launch and recovery operations. (Please see Appendix A for IFE ROV protocols.) During the dives in area 2, we will be deploying elevators to facilitate our sample collection activities. There will be a total of 3 elevator systems (Figure 4, right) with no more than 2 deployed at a time. Once launched using the ship's crane, the elevators float to the bottom where they can be repositioned by the ROV. Once samples are loaded, an acoustic command is sent to release the drop weights and the elevator floats to the surface. The elevators must be retrieved by a crew member in a RHIB who attaches the wire to the elevator's harness, so this activity will be performed only when weather permits. The biological and geological samples brought to the surface in the elevators will be processed onboard, in the ship's wet lab, biological lab, and main lab.

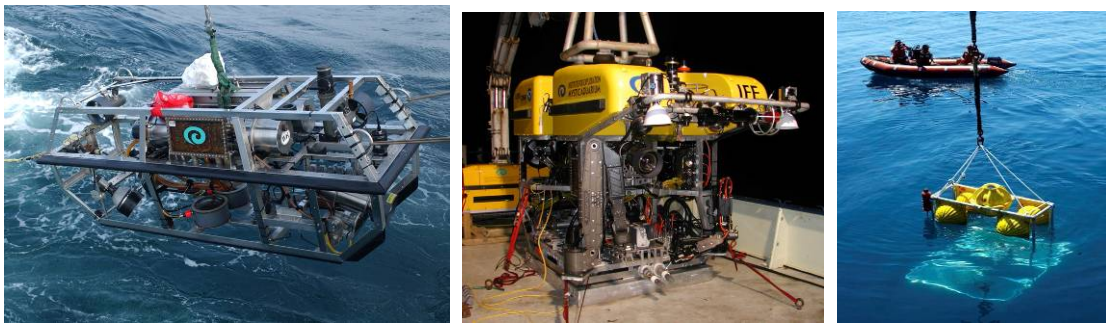

Figure 4. IFE vehicle systems: the towsled *Argus* (left) and the ROV *Hercules* (middle). One of IFE's elevator systems being recovered (right). Deployment of a RHIB is required in order to retrieve the elevator platform, and for a crew person to attach the recovery cable to the elevator.

The ROV system will only be recovered if necessary for transits, for repair or reconfiguration, or due to poor weather conditions. Following any recovery, our plan is to redeploy the ROVs as soon as possible.

G. Navigation

Navigation will be based on the best available information, including P-code GPS if available. The GPS will be linked to an integrated navigation system provided by the IFE operations crew. This will require

deployment and recovery of the transducer when not conducting ROV operations. All ship and ROV locations and activities will be logged by the IFE operations team. See more information on ROV operations in the Appendix A.

Ship's navigational information will be recorded on the Marine Operations Abstract (MOA) by the bridge watch. In addition to recording ROV dive events as they occur, various courses and speeds may be logged when on station. In the event of an SCS failure, the bridge watch will record hourly GPS positions in the MOA.

H. Ongoing Operations

In addition to the scientific objectives of this cruise, the following ongoing operations will be conducted by ship's personnel in accordance with general instruction contained in the MOA OP ORDER:

a. SEAS Data Collection and Transmission (MOA OP ORDER 1.2.1)
b. Marine Mammal Reporting (MOA OP ORDER 1.2.2)
c. Nautical Charting (MOA OP ORDER 1.2.6)
d. Bathymetric Trackline (MOA OP ORDER 1.2.7)
e. Sea Turtle Observation (SP-MOA-2-94)

I. Waypoints

Most of the time the NOAA Ship RONALD H. BROWN will be holding station within the dive areas listed below. More waypoints will be added for the Seabeam survey.

Center of Dive Area 1: 40.95° W, 30.3° N
Center of Dive Area 2: 40.1° W, 30.1° N

J. Station Operations

The initial launch site will be several hundred meters down current of the first dive target in the western survey location. It will take less than half an hour for the ROVs to reach the bottom. After arriving at the seafloor, the scanning sonar and vehicle tracking system will be used to navigate the ROVs. The first dive will be a reconnaissance survey looking at the seafloor geological and biological features. If interesting discoveries are made, the ROV will collect samples and perform additional mapping and imaging tasks. During the ROV survey, the navigator will instruct the bridge to move the ship, which will reposition the *Argus* towsled, and the pilots will maneuver *Hercules* accordingly. The ROV Navigator will maintain constant communication between the ROV operators in the control vans and the officers on the bridge during the entire dive operation. After the vehicles are recovered, we will either conduct a Seabeam survey or reposition the vessel for the next dive.

A separate station operation that is planned is to conduct a series of CTD tow-yo's around LCHF and in the adjacent rift valley of the Mid-Atlantic Ridge. This will be performed by scientists working with the ship's survey technician to deploy the CTD sensor. The tow-yo survey will be conducted by towing the CTD at slow speed along pre-determined tracklines. During the survey, the CTD will be raised and lowered by the winch operator to collect data from different water depths. The real time data stream will be stored on the logging computer. The tow-yo will only occur when the ROV systems are secured safely on deck.

K. Underway Operations

The only underway operations, as previously mentioned, will be the collection of multibeam bathymetric data using the Seabeam system.

L. Applicable Restrictions

ROV operations will require use of Dynamic Positioning. Consideration of the effect of wind, current and seas on the ship is critical to the operation. ROV operations will be performed on station and will require the RHB to display Restricted Maneuverability lights/insignia as appropriate.

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

M. Small Boat Operations

Small boat operations are weather dependent and at the Command's discretion. As mentioned before, it will be a requirement of the expedition to utilize a small boat to retrieve the elevators. In addition, during one of these recoveries, we may want to have the production team film the vessel. We may also request to use a small boat to film a launch or recovery of the vehicles. Small boat operations are not normally required for ROV operations, but may be requested if recovery difficulty arises.

N. De-staging Plan

After arrival in the Azores, there will be a change-out of the scientific party. Several pieces of technical equipment associated with the ROVs will be taken off the ship during this time. Many of the ROV engineers and technicians will remain onboard for the second leg, "Deep Atlantic Stepping Stones." A complete de-staging will occur after the second leg on September 4 in Woods Hole, when all of the equipment is offloaded.

III. Education and Outreach

During the 10 days on site, from about July 23 – August 1, live broadcasts will occur four times per day according to a predetermined schedule. A shipboard production team will facilitate these broadcasts by collecting video footage of all activities onboard. These broadcasts will be distributed via the Internet to a variety of sites throughout the USA in partnership with Immersion Presents, including museums, aquariums, science centers, and Boys and Girls Clubs of America groups. In addition, the Jason Foundation for Education will make these broadcasts available to their membership and networked downlink sites, mostly at K-12 educational facilities. The Jason Foundation for Education and Immersion Presents will highlight the expedition on their Web sites, Jason.org and http://www.mysticaquarium.org/immersion/, respectively.

NOAA Ocean Explorer Web site: NOAA OE education and outreach tasks involve the development of text documents, images, and videos that will be transmitted to shore (and from UW and URI) for posting on the NOAA Ocean Explorer Web site (oceanexplorer.noaa.gov). This effort will be conducted in

conjunction with PI's and in collaboration with Jason, Immersion, UW, URI, Mystic Aquarium, and National Geographic, as described in the Lost City Web Production Plan.

IV. Facilities

A. Equipment and capabilities provided by ship

1. Seabeam or equivalent multibeam bathymetric mapping sonar
2. XBT for speed of sound calibration
3. Differential GPS navigation and serial data output, NMEA format
4. Heading and water depth instruments with serial data output
5. HIAB articulating crane for launching *Hercules*
6. A-frame for launching *Argus*
7. Power to the winch and four vans
8. Dynamic positioning system for vessel station-keeping
9. INMARSAT satellite telephone service for voice and data (email)
10. Networked computer printers and plotter
11. Use of walk in cold room and freezer for sample storage
12. Use of Compressed Air in main lab
13. Use of compressed air in staging bay
14. Three air tuggers
15. Narrow band Acoustic Doppler Current Profiling (ADCP) system
16. Laboratory and storage space
17. PC based SCS workstation
18. Zodiac, or equivalent, and motor for elevator recovery, ROV contingencies, and video and still photo acquisition
19. 6,000 m CTD main pressure assembly with two temperature conductivity pair sensors, including a rosette frame and bottle firing assembly

B. Major equipment and capabilities provided by scientists (see complete list in staging plan above)

1. Dynacon winch with 4200 m 0.68" steel-armored fiber optic cable and overboarding sheave
2. *Argus* optical tow sled
3. *Hercules* remotely operated vehicle
4. *Little Herc* remotely operated vehicle (as backup)
5. Control van, imaging van, satellite van, tool van, two shipping vans
6. Satellite tracking antenna (on 20' ISO flat rack)
7. Low temperature chest freezer rated to –80 (10.1 cubic foot capacity) purchased by NOAA OE for use on RB-05-03

V. Communications

The NOAA Ship RONALD H. BROWN will communicate daily with the NOAA Marine Operations Center-Atlantic.

Inmarsat Mini-M: 011-874-761 831 360 (Voice)
Inmarsat B: 011-874-336 899 620 (Voice)
Inmarsat B: 011-874-336 899 621 (Fax)

The Chief Scientist, his designee, or the ROV Operations Manager may request the use of the ship's radio to communicate with other research or commercial vessels in the operating area.

The NOAA Ship RONALD H. BROWN is equipped with INMARSAT and cellular telephones. The Chief Scientist or other members of the science party may need access to these systems with permission from the Commanding Officer on a cost-reimbursable basis. Payment may be made by direct payment via Credit Card during the cruise for INMARSAT calls.

The ship's cell phone number is 843-693-2082.

An account on Netscape E-Mail for each embarked personnel will be established by the shipboard electronics staff. The general format is: Firstname.Lastname.atsea@rbnems.ronbrown.omao.noaa.gov. Due to the escalating volume of E-mail and its associated transmission costs, each member of the ship's complement (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 the party whose e-mail costs exceed the complimentary entitlement.

VI. Disposition of Data and Reports

A. Data responsibilities

1. 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 Co-PI's in a timely manner. The ship may assist in copying data and reports insofar as facilities allow.

2. The Chief Scientist will receive all original data gathered by the ship for the primary project. This data transfer will be documented on NOAA form 61-29 "Letter Transmitting Data."

3. 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 project data to NESDIS (ROSCOP form) is the responsibility of the program office sponsoring those projects.

4. NOAA OE: To ensure proper archive of metadata, and to ensure that all metadata meets FGDC compliance, OE will see that NESDIS receives the following (all metadata information will be generated from the EIS).

a. The NOAA Central Library will receive all metadata associated with video, and will also receive a copy of the highlight video for archive.
b. NODC will receive all metadata associated with oceanographic data sets.
c. NGDC will receive all geophysical metadata such as Seabeam, side scan, etc.
d. NCDDC will receive all shipboard digital data (such as CTD, fathometer, and ship track information), ROV navigational data, and additional metadata from the EIS, to develop future products in collaboration with PI's such as the NOAA Digital Atlas. For this requirement, OE requests copies of shipboard digital data and ROV navigational data on CD or DVD at the end of the cruise.
e. The NOAA OE Data Manager will help the science party access all pertinent data files collected by the vessel and ROV.

5. The science party will be responsible for the collection and organization of all data (other than shipboard digital data and ROV data) relative to meeting the goals and objectives of their projects. This includes working with the appropriate ship's personnel to obtain relevant data collected by the Scientific Computer System (SCS), and compilation of metadata records associated with physical samples.

B. Data Requirements

The following data products will be included in the cruise data package:

1. Marine Operations Abstracts
2. CTD data (on CD's) and CTD data notebook including CTD cast logs
3. Salinity sample analysis floppy
4. ADCP digital recordings
5. Multibeam digital data on CD or DVD
6. Marine weather observation logs
7. Hard copy, large format maps of multibeam surveys
8. Calibration information for ship's salinometer and thermosalinograph
9. SCS data tapes
10. Cruise operations spreadsheet w/ actual speed/dates made good along trackline

C. Marine Observation Log

A Marine Operations Abstract (MOA) form will be maintained by the ship's officers during the cruise. The critical information to record at each station is:

1. GMT date
2. GMT time
3. Position
4. Station number
5. Bottom depth

At present, a paper form (hard copy) MOA is the most secure method for ensuring that these data are recorded and preserved. However, a secure electronic version could be used to replace the paper MOA.

D. NOAA OE Expedition Information System (EIS)

Metadata Management:

a. The NOAA OE Data Manager will be responsible for collecting and organizing metadata for all activities conducted during the expedition, and entering the data into the EIS.
b. Many types of information are compiled in the EIS, including daily events and all forms of metadata. This information will be archived in NOAA NESDIS as described below.
c. Daily situation reports (SITREPS) will be generated by the OE data manager that will be sent to OE headquarters via E-mail after review by the Chief Scientist. OE headquarters will transmit the SITREPS to interested parties. All cruise participants are encouraged to submit E-mail addresses to OE for any partners who should receive copies during the cruise.
d. The EIS can be used to assist with the compilation of information to develop the OE Quick Look Report, web summaries, and reports to help meet grant requirements.

E. Records and Reports

1. The ship's officers will maintain the Marine Operations Abstract (MOA) during the cruise and will provide the Chief Scientist with a copy at the end of the cruise.

2. The NOAA OE Data Manager will ensure that designated members of the science party complete a Dive Information Form for each ROV dive. This information will be included in the EIS, will be further developed in collaboration with the Chief Scientist, and will be included in the OE Digital Atlas. Copies of the completed forms will be provided to the Chief Scientist at the end of the cruise.

3. The Chief Scientist will complete the ship's Operations Evaluation Form and forward a copy to the Director, NOAA Marine Operations Center and to the OE Data Manager. The ship's Field Operations Officer will provide the Chief Scientist with this form.

4. The Chief Scientist is required to provide NOAA OE with the following.
   a. A quick look report (QLR) focused on accomplishments of the cruise. OE will provide a general outline for the QLR, and it should be submitted no later than 10-12 days post-cruise, but ideally, before disembarking.
   b. An OE cruise summary for the Web site with images, as specified in the Web Production Plan. This should be submitted no later than 30 days post-cruise, and is designed to build on the accomplishments described in the QLR.

5. Media products that will be developed by OE in collaboration with PI's include the following.
   a. Select ROV HD video will be used to develop a highlights video that will be provided to news media at the end of the cruise. An annotation file will be developed that will describe the contents of the video, and will include proper credit and contact information.
   b. Select high-resolution still images (10-20) will be used to develop a CD that will be provided to print media at the end of the cruise. A file of captions will be developed that will describe each still image, and will include proper credit and contact information.
   c. As described in the Web Production Plan, the Ocean Explorer Web site will contain background essays, daily logs, and summaries generated by members of the science party. The Web site will also contain still images, video clips, and slide shows generated by the OE Web Coordinator under the approval of the Chief Scientist and members of the science party.

F. Pre- and post-cruise meetings

Meetings will be arranged and conducted at the discretion of the Chief Scientist. During transit to the site and periodically throughout the cruise science meetings will be held in the ship's lounge or the main science lab.

G. Ship operation evaluation report

A Ship Operations Evaluation Report will be completed by the Chief Scientist and forwarded to NC3.

VII. Hazardous Materials

The Chief Scientist shall be responsible for complying with MOCDOC 15, Fleet Environmental Compliance #07, Hazardous Material and Hazardous Waste Management Requirements for Visiting Scientists, released July 2002. The MOCDOC web site address is: http://205.156.48.106/.

By Federal regulations and NOAA Marine and Aviation Operations policy, the ship may not sail without a complete inventory of all hazardous materials by name and the anticipated quantity brought aboard, MSDS and appropriate neutralizing agents, buffers, and/or absorbents in amounts adequate to address spills of a size equal to the amount of chemicals brought aboard and a chemical hygiene plan. The amount of hazardous material arriving and leaving the vessel shall be accounted for by the Chief Scientist.

RHB will operate in full compliance with all environmental compliance requirements imposed by NOAA. All hazardous materials/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. RHB 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.

A. HAZMAT Locker

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. 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 OSH/NFPA standards to be provided by the science party. Scientific groups requiring HAZMAT storage should compute volume of storage required prior to the cruise and ensure adequacy onboard.

B. Spill Response

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. The ship's Environmental Compliance Officer will review the onboard inventory of MSDS's and will advise Chief Scientist if ship already has compounds listed in Appendices. Ship's personnel are not first responders

and will act in a support role only 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.
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.

C. Inventory

For this cruise, the following items are classified as hazardous materials:

Chemical	**Quantity**
Ammonia Solutions (with 10-35% ammonia)	30 ml
Ammonium Chloride	1.6 g
Ammonium Hepta-molybdate	40 gram
Cadmium Acetate	25 gram
N,N-Dimethyl-1,4-phenylenediamine dihydrochloride	54 g
Ethanol	4 Liter
Ferric Chloride, anhydrous	120 gram
Hydrochloric Acid Solution	5+2.5 liter
Hydrochloric Acid, 0.1M	5 liter
Hypochlorite solutions (5-16% available Chlorine)	0.45 liter
Mercury (II) Chloride	15 grams
4-Methylaminophenol Sulfate	60 gram
Nitrogen, compressed	2x240 cu ft
Oxalic acid dihydrate	250 gram
Phenol, solid	60 gram
pH buffers pH= 3 & 4	3 x 1 liter
pH buffers pH= 7 & 8	3 x 1 liter
Potassium Chloride (3 Molar)	5 liter
Potassium Iodate	1.1 gram
Potassium Iodide,	60 gram
Sodium Citrate (dihydrate)	600 gram
Sodium fluorosilicate	0.5 gram
Sodium Hydroxide	30 gram
Sodium Nitroferricyanide-dihydrate	6 gram
Sodium Sulfide hydrated (> 30% water)	10 gram
Sodium Sulfite	60 gram
Sulfuric acid, <51%	3 liter
Thiourea	21 gram
Saf Sol (trichloroethane)	12 spray can
Isopropanol, 99%	1 liter
Acetone	1.5 gallons
Acetylene	1 b-sized
Sulfamic acid (in powder pillow)	50 gms
Various vacuum pump oils	2 quarts
Degreasing spray cleaner, nonflammable	2 cans

compressed air gas with fluorcarbons	
Ethanol, 95%	1 liter
Formaldehyde 37%	500 ml
Gluteraldehyde 50%	500 ml
N2 Gas	1 tank
H2 gas	1 tank
H2/CO2 mix	Small cylinder
13 labelled NaHCO3 stable isotope	Small ampoules
13CH4 stable isotopes	Small ampoules
Mercuric chloride	100 ml (7-10 gms)
Stove Alcohol	1 gallon
Hydraulic oil	2 - 55 gallon drums, one for waste, one clean

*NOTE: Stable isotopes do not require isolation vans or the use of certified Geiger counters.

D. Material safety data sheets (MSDS)

In accordance with NC Instruction 6280B, the Chief Scientist will provide an inventory of all hazardous material, including Material Safety Data Sheets (MSDS) and quantities, to the Commanding Officer at least two weeks prior to sailing. The 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. 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. Compressed gas storage cylinders (including those containing air) will also be included in the inventory with the date of the last hydrostatic certification.

VIII. Miscellaneous

A. Scientific Berthing

The Chief Scientist is responsible for assigning berthing for scientific party within the spaces designated as scientific berthing. The Chief Scientist is responsible for returning the scientific berthing spaces back over to the ship in the condition in which they were received; for stripping bedding and 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 spaces and the storage areas utilized by the scientific party, both during the cruise and its conclusion prior to departing the ship.

In accordance with NC Instruction 5355.0, Controlled Substances Aboard NOAA Vessels dated 06 August 1985; all persons boarding NOAA vessels give implied consent to conform to 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.

B. Medical Forms and Emergency Contacts

The NOAA Health Services Questionnaire (NHSQ) must be completed in advance by each participating scientist. Scientists are required to be medically approved by NOAA Marine Operations Center Atlantic

prior to sailing should reach the ship no later than 1 week prior to the cruise. This will allow time to medically clear the individual and to request more information if needed. All personnel must also provide results of PPD (TB) test taken within 12 months of sailing. We ask that all personnel 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.

Contact for NHSQ's:
LCDR Les Cruise
Les.Cruise@noaa.gov
NOAA MOC-Atlantic
439 West York Street
Norfolk, VA 23510
Voice: 757-441-6320
FAX: 757-441-3760

Prior to departure, the Chief Scientist will provide a listing of emergency contacts to the Executive Officer, RHB for all members of the scientific party, with the following information: name, passport number and expiration, name of contact, address of contact, relationship to member, and contact telephone number. Protocol for entering and exiting port areas will vary. In US ports, you must have a government ID to enter. All others (visitors and scientists outside of the government) may (depending on port security) require an escort to and from the ship. All personnel, including crew, are still checked against lists supplied to port security. A passport is recommended for all personnel embarking aboard the RHB. Chief Scientist shall ensure that all members of the scientific party have the required valid passports, visas and immunization certificates. The Chief Scientist is to gather participant passport numbers, expiration dates and travel arrival dates and provide them to the ship at least a week before the team arrives.

C. Shipboard Safety

Safety of operations is of utmost importance. Scientists will attend all safety briefings as required by the vessel Command. Wearing open-toed footwear of any kind outside of private berthing areas (i.e. to and from showers) is not permitted onboard this ship. This shipboard safety regulation is included in the Commanding Officer's Standing Orders, and will be enforced. All members of the scientific party should be aware of this regulation before embarking.

D. Emergency Information

Due to the ship's long deployments, the Medical Officer assigned to the ship is a US Public Health Service Commissioned Corps nurse. The Medical Officer is available at any hour of the day to provide emergency medical care as required. Regularly scheduled sick call will be held in the ship's hospital from 0800 - 1130 daily and patients will be seen on a first-come/first served basis; however, patients with acute conditions will take priority. Do not hesitate to contact the Medical Officer at any hour of the day to receive treatment for an injury or illness, no matter how slight it might appear. The ship's hospital is equipped with a complete inventory of modern medical equipment and stocked with a wide range of medications and supplies. Several members of the ship's operating crew are certified Emergency Medical Technicians or are certified in CPR/first-aid and may assist the Medical Officer as required. Should additional medical expertise and advice be required, a medical advisory service can be contacted at any hour of the day. This

service provides physicians specialized in emergency medical care who are immediately available to provide consultation, advice, and if necessary, medical evacuation coordination services.

In addition to routine and emergency medical care, the Medical Officer provides wellness services on an individual and confidential basis. Available services include:

- Blood pressure, diabetes, and general health assessment and monitoring.
- Weight management information and support.
- Substance abuse information and support.
- Smoking cessation information and support.
- Stress management and mental health information.
- General medical and wellness information and advice upon request

There are numerous first-aid kits distributed throughout the ship. Notify the Medical Officer if their use is required.

E. Wage marine working hours and rest periods

The Chief Scientist shall be cognizant of the reduced capability of the NOAA Ship RONALD H. BROWN 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 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 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.

F. Drug and alcohol policy

In accordance with NMAO Drug and Alcohol Policy (NMAO #3, dated May 7, 1999), which forbids the possession and/or use of illegal drugs and alcohol aboard NOAA Vessels, 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.

G. Shipping Information

All items to be shipped in advance for mobilization in Woods Hole July 16, 2005 should be sent to the following address. A list of shipped items should be sent via e-mail at the contact address below.

Master
NOAA Ship RONALD H. BROWN
C/O Woods Hole Oceanographic Shipping & Receiving Dept
266 Woods Hole Rd.
Woods Hole, MA 02543

Contact: Al Gordon
tel. (508) 289-2484
fax: (508) 457-2195
email: agordon@whoi.edu

H. Port agent services

Every cruise generates costs associated with preparations, logistical support, underway at sea operations, communications and demobilization. The Chief Scientist has financial responsibility for these costs and is advised to assure that provisions are made to properly assign charges to the projects participating on a cruise. The ship prefers you arrange direct payment to the agent for the portion of services you make use of, as opposed to after-the-fact reimbursement to the ship's accounts.

Azores:
Contact: Eduardo Cordeiro
E-mail: azores.shipping@mail.telepac.pt
http://sapp.telepac.pt/allships.agency.azores
Phone: 351 296 284 620
Fax: 351 296 284 501
after office hours: 351 917 861 923

llships-Agencia de Navegação, Lda.
Avenida Infante D. Henerique, 33-5 Dto.
9500-150 Ponta Delgada
AZORES ISLANDS

Also, please be aware of NOAA customs procedures found at the following URL for the Brown.
http://www.moc.noaa.gov/rb/science/planning.htm

Mobilization and Demobilization Port:
Contact: Elizabeth Caporelli
Marine Operations Coordinator
Woods Hole Oceanographic Institution
38 Water Street, Mail Stop #37
Woods Hole, MA 02543
E-mail: ecaporelli@whoi.edu
Phone: (508)289-2277
Fax: (508)457-2185

For all shipments to WHOI:
Contact: Al Gordon
tel. (508) 289-2484
fax: (508) 457-2195
email: agordon@whoi.edu

Master
NOAA Ship RONALD H. BROWN

C/O Woods Hole Oceanographic Shipping & Receiving Dept
266 Woods Hole Rd.
Woods Hole, MA 02543

APPENDICES:

A. IFE ROV Protocols

1. Navigation

USBL acoustic navigation system installation: IFE's equipment includes a LinkQuest TL5000 ultra-short baseline (USBL) acoustic navigation system. The primary shipboard component of this system is a pair of transducers that will be installed in the Brown's moonpool (in the staging area), using an aluminum mast and inflatable bladders to immobilize it. The assembly is raised up above the bottom of the moonpool for transits and lowered so that the transducers are below the hull when the ship is on station. (This was done the same way for IFE's installation in 2004.) To this end, IFE will need the moonpool's outer cover removed no later than the first morning of the mobilization.

The only other ship's resource required for the navigation system is pressurized air. Ideally, air should be available in the staging area to avoid having to run hoses through the wet lab doors as last year. IFE's chainfall hoist, used to raise and lower the USBL transducers, was inadvertently left aboard the Brown last year, and the bosun reported last year that he had stashed it away safely onboard the ship.

2. Communication

Navigator's protocol: The Navigator watchstander in the IFE control van is designated as the sole conduit for communications between the science party and the bridge during the dive evolution. The exception to this is during launch and recovery, when the IFE deck chief (Mark DeRoche) is explicitly given control. Communications between the van/aft deck and the bridge normally use IFE's intercom system, but may be over UHF or VHF radio as needed.

3. Launch and Recovery Operations

HERCULES and ARGUS launch and recovery: Launch and recovery of the IFE vehicles will be similar to 2004, except for the use of the Brown's aft control station for ship control during these operations. Launching the vehicles starts with the ship steaming very slowly forward through the water. The HERCULES ROV is put in the water on the port quarter using the knuckle boom crane. The vehicle is powered up and released, and is then allowed to trail out astern dragged by the tether, which is about 100 feet long. The ARGUS towsled vehicle, at the other end of the tether, is at this point still strapped down on deck under the A-frame. ARGUS is then released, lifted over the stern, and the vehicles descend together, still with the ship moving slowly forward through the water.

Recovery is similar. The ship will be asked to steam slowly forward through the water, usually into the wind. The vehicles are brought to the surface with HERCULES streaming aft of ARGUS. When both vehicles are on the surface, ARGUS is brought aboard and secured. A spectra line brailed onto the tether is released and used to tie into a similar line on the crane winch, which takes the load off the tether and pulls HERCULES in close to the stern before lifting it out of the water.

In all cases the vehicles and associated components are treated as serious shock hazards when high voltage power is on (or possibly on). Both vehicles are powered on together; there is no independent switching of each vehicle's high voltage power. High voltage gloves are used by anyone touching the

vehicles or the tether. Normal cautions when lifting heavy items are followed, particularly steel toed shoes and hard hats.

Any questions or concerns about these procedures should be directed to IFE's Chief Engineer, Jim Newman.

Contact:
Jim Newman, IFE Chief Engineer
Woods Hole Marine Systems, Inc
jim@whmsi.com
Phone: 508-548-6665
fax: 508-540-1036
mobile: 508-274-1584