**CRUISE INSTRUCTIONS: NOAA SHIP NANCY FOSTER**

Cruise Title: **Characterization of midwater seafloor habitats of the Buck Island Reef National Monument (BIRNM), St. Croix and the mid-shelf reef (MSR) of the Virgin Islands National Coral Reef Monument (VINCRM)**

Cruise Number NF-05-06-USVI

Period of Cruise:

DEP: 1/24/05 Ship transit to Frederiksted, St. Croix
ARR: 1/29/05 Ship arrive Frederiksted, St. Croix, USVI
DEP: 2/01/05 Begin seafloor mapping St. Croix, USVI
ARR: 2/12/05 Disembark at Charlotte Amalie, St. Thomas, USVI

Area of Operation: Buck Island National Monument and Salt River Bay National Historical Park and Ecological Preserve, St. Croix and Grammanik Bank, Mid-Shelf Reef, and Virgin Islands Coral Reef National Monument, St. Thomas and St. John

## 1.0 Scientific Objectives:

The Center for Coastal Monitoring and Assessment (CCMA) will be conducting the second year of an ongoing scientific research mission onboard the NOAA ship Nancy Foster. The purpose of the cruise will be to continue to collect swath bathymetry and acoustical backscatter data in six high priority areas within the USVI. Scientists will collect high resolution multibeam in mid-water depths approximately 15 to 300 meters so as to continue to characterize seafloor habitats within the USVI. The delineation and identification of seafloor habitats will be assisted by the use of a moderate depth Remotely Operated Vehicle (ROV). The vehicle has video and frame camera capability to depths of 300 meters and will be used to conduct transects within areas mapped in 2004 and 2005. This increased ROV capability in 2005 will enable us to characterize features identified in the 2004 multibeam acquisition, but were unable to previously video.

## 2.0 Schedule of Operations:

### 2.1 Daily Schedule:

See Table 1

30 January (Sunday):
*Survey:* Survey team installs remaining survey gear, does a gear shake-down of multibeam unit and survey planning.

31 January (Monday):
*Survey:* Survey team installs remaining survey gear, does a gear shake-down of multibeam unit and survey planning.
*ROV*: ROV team installs remaining survey gear, does a gear shake-down of ROV unit and video

planning.
*All*: Press Briefing. Science party stays on board vessel at Fredriksted, St. Croix in the evening for early start 2/1.

1 February (Tuesday):
*Transit/Patch Test:* (0800-1400) Ship transit from Frederiksted to Patch Test area. Survey team conducts Patch Test to calibrate the Multibeam Echosounder (MBES) system in an area in Lang Bank along the eastern tip of St. Croix 4.0 NMI east of Buck Island. The Patch test will continue until satisfactory calculations are derived. Ship safety briefing and scientific party mission briefing.
*Survey:* (1400-1800) MBES Buck Island shallow depths.
*ROV*: (1800-2400) ROV Buck Island.

2 February (Wednesday):
*ROV*: (2400-0700) ROV Buck Island
*Survey:* (0700-1800) MBES Buck Island
*Transit:* (1800-2400) Ship transit from Buck island St. Croix to Grammanik Bank, St. Thomas.

3 February (Thursday):
*Survey:* (2400-0800) MBES Grammanik Bank.
*ROV*: (0800-1600) ROV Grammanik Bank.
*Survey:* (1600-2400) MBES Grammanik Bank.

4 February (Friday):
*Survey:* (2400-0800) MBES Grammanik Bank.
*ROV*: (0800-1600) ROV Grammanik Bank.
*Survey:* (1600-2400) MBES Grammanik Bank.

5 February (Saturday):
*Survey:* (2400-0800) MBES NPS_Inshore Monument.
*ROV*: (0800-1600) ROV NPS_Inshore Monument.
*Survey:* (1600-2400) MBES NPS_Inshore Monument.

6 February (Sunday):
*Survey:* (2400-0800) MBES NPS_Inshore Monument.
*ROV*: (0800-1600) ROV NPS_Inshore Monument.
*Survey:* (1600-2400) MBES NPS_Inshore Monument.

7 February (Monday):
*Survey:* (2400-0800) MBES NPS_Inshore Monument.
*ROV*: (0800-1600) ROV NPS_ Inshore Monument.
*Survey:* (1600-2400) MBES NPS_ Inshore Monument.

8 February (Tuesday):
*Survey:* (2400-0800) MBES NPS_Offshore Monument.

*ROV*: (0800-1600) ROV NPS_ Offshore Monument.
*Survey:* (1600-2400) MBES NPS_ Offshore Monument.

9 February (Wednesday):
*Survey:* (2400-0800) MBES NPS_ Offshore Monument.
*ROV*: (0800-1600) ROV NPS_ Offshore Monument.
*Survey:* (1600-2400) MBES NPS_ Offshore Monument

10 February (Thursday):
*Survey:* (2400-0800) MBES MSR.
*ROV*: (0800-1600) ROV MSR.
*Survey:* (1600-2400) MBES MSR.

11 February (Friday):
*Survey:* (2400-0800) MBES MSR.
*ROV*: (0800-1600) ROV MSR.
*Survey:* (1600-2400) MBES MSR.

12 February (Saturday):
*Survey:* (2400-0800) MBES MSR.
*ROV*: (0800-1400) ROV MSR. MBES break-down gear.
*All:* (1400-2400) Demobilization of gear from the NANCY FOSTER at Charlotte Amalie, St. Thomas.

## 2.2 Watches:

Vessel operations will typically be a ~ 24 hour workday. A "give and take" operation cycle will be instituted during these workdays via consultation between the Chief Scientist and Commanding Officer in order to balance crew complement with demands of day-night operations. One crew member will be required on deck to work the winch for the ROV and CTD casts.

In Science Party, the Field Party Chief is responsible for organization of operations and data, respectively.

## 3.0 Map of Operations:

(See Figures1 and 2 at end of text)

## 4.0 Description of Operations:

Multibeam Survey:

**Survey Schedule/Personnel**

A timeline has been developed for the installation and calibration of the sensors, as well as the data acquisition periods for surveying. A team from the Pacific Islands Fisheries Science Center (PIFSC) and a contract Lead Hydrographer will conduct the installation and calibration activities between the 12$^{th}$ and 23$^{rd}$ of January 2005 in the port of Charleston, S.C. A centerline survey will be conducted

with the assistance of the National Geodetic Survey (NGS) office on the 14th and 15th of January. Preliminary calibrations and confidence checks will be conducted in Charleston. Final calibrations and confidence checks will occur on the 31st of January, 2005 in Port Alucroix, St. Croix. Survey operations will follow for 12 days as demobilization is scheduled for the 12th of February in Charlotte Amalie, St. Thomas.

**Patch Test Survey Plan**

A verifiable patch test is essential to a multibeam survey. The angle offsets of the sonar with respect to the motion sensor need to be accurately measured. An area across the submerged eastern tip of St. Croix four nautical miles east of Buck Island will provide the bathymetric features necessary to accurately assess the angle bias with the sonar head. Two predetermined lines (A&B) oriented North-South will be parallel and spaced apart to ensure abundant overlap of outer beams on adjacent lines. The lines will be surveyed in the following order and speeds.

| Order | Line | Direction | Speed | Bias Measured |
|---|---|---|---|---|
| 1 | A | S | L | R1a, P1a, P2a, Y1a, L1a |
| 2 | A | N | L | R1b, P1b, P2b, Y2a |
| 3 | B | S | L | R2a, P3a, P4a, Y1b |
| 4 | B | N | L | R2b, P3b, P4b, Y2b L2a |
| 5 | A | S | H | L1b |
| 6 | B | N | H | L2b |

Ample time between passes on the same line will be given to ensure ship propeller disturbances have cleared and will not impact data quality. Additional lines can be included adjacent to planned lines and this schedule can be modified. Data from the patch test will be processed to the satisfaction of the Lead Hydrographer.

**Data Acquisition Methodology**

Six priority survey regions have been identified for benthic habitat mapping during this cruise and are shown in Figures 1 and 2. While the protocols for collecting high quality data do not change from one survey area to the next, one site, the National Park Service (NPS) Inshore area in Figure 2, has been identified as a high priority for charting updates. Therefore the mapping team has developed survey protocols that attempt to find a common ground that permits the Office of Coast Survey (OCS) to use the data without sacrificing benthic habitat mapping objectives. The additional efforts to ensure charting quality data are identified below.

Within the NPS Inshore project area a 120° swath of data will be accepted while using the additional 15° to both sides strictly for reconnaissance. Line spacing will be planned such that full bottom coverage is obtained using the limited swath. Cross checklines that meet the 5% of linear survey nautical miles criteria will be observed. Dangers to Navigation (DTONs) will be reported if located and an additional line focusing nadir beams over the object will be recorded. Any additional measures to identify and image the least depth will be used at the discretion of the Chief Scientist.

For the other five survey areas, all soundings within a 140° swath will be accepted. Soundings

outside of the 70° filter will be flagged as reconnaissance beams. A minimum of one cross checkline will be recorded in each area. Sound velocity casts will be recorded at the start of each 8 hour watch and every 4 hours after. Survey speeds will be maintained that meet object detection standards specified in Section 5.2.2 of NOS Hydrographic Surveys Specifications and Deliverables. The Center for Operational Oceanographic Products and Services (CO-OPS) tide zoning will be applied real-time with predicted tides. CO-OPS smooth tides will be applied in post processing. A real-time coverage plot of attitude corrected data with the appropriate angle filters will be recorded.

The Salt River Canyon slope will be surveyed to ensure that minimum overlap is accomplished with those beams upslope of nadir due to incidence angles associated with a steep slope. The full acceptable swath will be used as soon as the ship is inshore of the bank/shelf escarpment. The Buck Island Reef Channel will be surveyed with the shoal channel depths controlling the line spacing. These areas will most likely require daylight operations due to the shoal depths and proximity to shoreline hazards. The Grammanik Bank area, the Mid Shelf Reef areas, and the National Park Service (NPS) Offshore area will be surveyed with similar line spacing used during the 2004 survey. An initial line plan for each survey area will be built with 5 meter spacing to allow the Hydrographer to track the changes to line spacing and respond to the changing depths. A general guide for line spacing follows.

| 70° | Line Spacing | | |
|---|---|---|---|
| **Depths (m)** | **Available Swath (m)** | **Overlap Constant (m)** | **Max Spacing (m)** |
| 10 | 54.9 | 10 | 44.9 |
| 15 | 82.4 | 10 | 72.4 |
| 20 | 109.9 | 10 | 99.9 |
| 25 | 137.4 | 10 | 127.4 |
| 30 | 164.8 | 10 | 154.8 |

| 60° | Line Spacing | | |
|---|---|---|---|
| **Depths (m)** | **Available Swath (m)** | **Overlap Constant (m)** | **Max Spacing (m)** |
| 10 | 34.6 | 10 | 24.6 |
| 15 | 52.0 | 10 | 42.0 |
| 20 | 69.3 | 10 | 59.3 |
| 25 | 86.6 | 10 | 76.6 |
| 30 | 103.9 | 10 | 93.9 |

The line plan for the nearshore survey area of the NPS boundary will take into account ship maneuverability and proximity to shore hazards. Data collected offline and during turns will be edited from the final dataset in all areas.

**Data Quality Assurance/Quality Control Methodology**
System confidence checks prior to the commencement of multibeam operations will be conducted. A position check that validates the navigational accuracies will be conducted between two independent DGPS receivers during mobilization of the Nancy Foster in Charleston and prior to survey operations in the USVI. A barcheck comparison to digital depth records will be conducted prior to survey operations in the USVI to verify the correct application of sonar offsets. CTD calibrations will be conducted with the primary SBE-19P unit and the backup SPE-19 belonging to the ship.

A crossline comparison will be observed to identify potential problems with tidal modeling. Confidence in beam quality will be demonstrated through the comparison. Sun-illuminated imagery of the data will be used for detection of artifacts and quality verification. Additional charting analysis will be conducted through OCS.

Video mapping:
ROV operations will be conducted at each of the six 2005 survey areas as well as visits to the areas surveyed in 2004 by CCMA onboard the Nancy Foster. NOAA's National Undersea Research Program (NURP), based out of the University of North Carolina at Wilmington office, will be providing three ROV operators and the full complement of equipment necessary to utilize the Spectrum Phantom 2. The ROV transects will primarily be conducted while the ship is drifting. See Figure 3 for preliminary transect lines for the cruise.

## 5.0 Requirements and Equipment:

### 5.1 Vessel Provided:

1) Hand held radios for communication between launches, NANCY FOSTER, and deck.
2) CCMA Steel Multibeam Mounting Pole
3) CTD 1000 m depth rating.

### 5.2 Program Provided:

| | Equipment | Leg |
|---|---|---|
| 1) | Underwater video + camera equipment + tow bodies (Phantom 2 ROV) (NURP). | Charleston |
| 2) | 3 USB 250GB Maxtor 5000XT harddrives (CCMA). | Charleston |
| 3) | Five high end laptops and two flat screen monitors. | Charleston |
| 4) | HYPACK, CARIS, MapInfo, ArcGIS, and VelociWin. | Charleston |
| 5) | Reson 8101 ER MB system, POS/MV, Saber, ISS2000 and DGPS (NMFS). | Charleston |

## 6.0 Scientific Personnel:

### 6.1 Chief Scientist Authority

The Chief Scientist has the authority to revise or alter the technical portions of the instructions provided that, after consultation with the Commanding Officer, it is ascertained that the proposed changes will not: 1) jeopardize the safety of the personnel on the ship, 2) exceed the time allotted for

the project, 3) result in undue additional expense, or 4) alter the general intent of the Project Instruction.

**6.2 Scientific Personnel List**:
*Chief Scientist*: Tim Battista
*Lead Hydrographer*: Jay Lazar
*ROV*: Matt Kendall

| Male: | Organization | ROV | Multibeam | Legs |
|---|---|---|---|---|
| Tim Battista | NOAA | | X | STC/STJ |
| Jay Lazar | Contractor | | X | STC/STJ |
| Scott Ferguson | NOAA | | X | STC/STJ |
| Matt Kendall | NOAA | X | | STC/STJ |
| Charles Menza | NOAA | X | | STC/STJ |
| Jason Vasques | USVI | X | | STC/STJ |
| Lance Horn | UNCW NURP | X | | STC/STJ |
| Glen Taylor | UNCW NURP | X | | STC/STJ |
| Jeffrey Williams | UNCW NURP | X | | STC/STJ |

| Female | | ROV | Multibeam | Legs |
|---|---|---|---|---|
| Joyce Miller | NOAA | | X | STC/STJ |
| Ada Otter | NOAA | | X | STC/STJ |
| Zandy Hills-Starr | NPS | X | | STC |
| Paige Rothenberger | USVI | X | | STJ |
| Danielle Pattison | NOAA | | X | STC/STJ |

## TASK TEAMS

ROV
1) **Menza**, Horn, Williams, and Vasques
2) **Kendall,** Taylor, Hills-Starr/Rothenberger

MULTIBEAM
1) **Lazar**, Battista, Otter
2) **Miller**, Ferguson, Pattison

Person in **bold** is field party chief – responsible for prepping rest of team
Identification: All scientific personnel planning to board the ship should have in their possession at the time of boarding, a proper photo identification card (agency ID, drivers license, etc.).

**6.4 History Reports**:
Upon acceptance of this proposal, and receipt by the Chief Scientist of the forms, the Chief Scientist will forward completed copies of the NOAA Health Services Questionnaire for all embarking

scientific personnel to the Commanding Officer for review at lease 7 days in advance of the cruise.

**7.0 Miscellaneous Activities:**
None known at this time.

**7.1 Bridge Activities:**
It is requested that a copy of the ship's *Deck Log - Weather Observation Sheet NOAA 77-13d* for and digital SCS data for the entire cruise be provided to the Chief Scientist upon departure of the science party or transmitted within 2 weeks thereafter.

**8.0 Modification of Cruise Instructions:**
Additional operations and ancillary projects, not covered under the main project, may be performed on a "not to interfere" basis. The Chief Scientist is responsible for determining the priority of the additional work, provided that any changes are discussed with the Commanding Officer and do not constitute a risk to the safety of the ship or personnel and do not significantly change the schedule for this cruise. If the requirements for the additional work place significantly different requirements on the ship, amendments to the Cruise Instructions must be prepared and approved.

**9.0 Ancillary Tasks:**
Ship's personnel conduct ancillary tasks. Instructions for ancillary tasks routinely assigned to Marine Operations Center ships are contained in *Marine Operations Center Directive 1803.00, Ancillary Tasks for NOAA Vessels*.

**10.0 Hazardous Materials**:
An inventory list and a *Material Safety Data Sheet* for each hazardous material will accompany hazardous material brought on board NANCY FOSTER by scientific parties. This information should be provided to the Commanding Officer. On departure from the ship, scientific parties will provide an inventory of hazardous material to the Commanding Officer showing that all hazardous material brought on board have been properly used up or removed in suitable waste containers. No anticipated hazardous materials is anticipated to be brought onboard.

The *Material Safety Data Sheet* is normally available from the manufacturer of the hazardous product. Procedures followed for use of chemicals will be those outlined in the *Chemical Hygiene Plan for Chemical Labs* aboard NOAA ships. The Science Party will provide a small spill containment kit appropriate for these chemicals.

**11.0 Navigation:**
Survey and ROV operations will be operated using DGPS. Navigation information via Hypack software will be fed to the Bridge monitor from the Wet and Dry labs via cable.

**12.0 Communications:**
A progress report on operations prepared by the Chief Scientist may be relayed to the program office. Sometimes it is necessary for the Chief Scientist to communicate with another vessel, aircraft, or shore facility. Through various modes of communication, the ship is able to maintain

contact with the Marine Operations Center on an as needed basis. These methods will be made available to the Chief Scientist upon request, in order to conduct official business. Due to a new directive from Marine Operations Center, the ship must charge the science party for all calls made on the cell or sky-cell telephone. INMARSAT, Sky Cell and cellular communication costs shall be reimbursed to the ship for telephone calls made by all scientific personnel. Currently, Sky Cell and cellular telephone services are about $0.89 per minute and INMARSAT Mini-M is around $1.68 per minute for voice. These charges will be assessed against the program after NANCY FOSTER receives the bill. There is generally a three-month delay receiving the bill for review. The Chief Scientist will be required to keep a log of all calls made by the science party. The program will also provide a cell phone to be kept on the bridge.

**13.0 Disposition of Data**:
The Chief Scientist is responsible for the disposition of data.

**14.0 Reports**:
The requirement for a formal cruise report by the Chief Scientist is left to the discretion of the CCMA Center Director. A Ship Operations Evaluation Form is to be completed by the Chief Scientist(s) and forwarded to:

Office of Marine and Aviation Operations
Program Services and Outsourcing Division
SSMC3, Room 12872
1315 East-West Highway
Silver Spring, MD 20910-3282

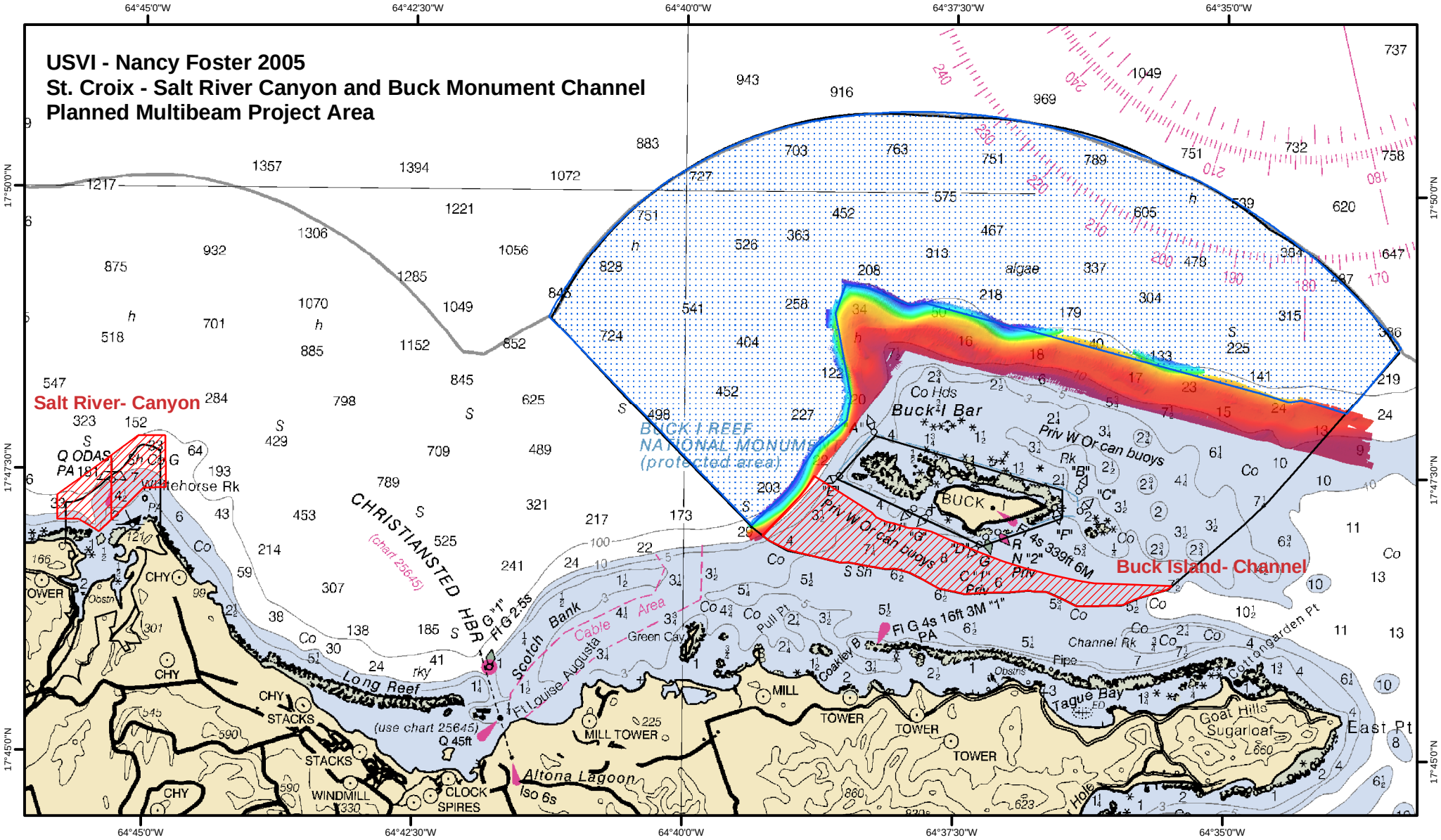
**15.0 Cruise Instruction Approvals**:

The Marine Operations Center and NANCY FOSTER will acknowledge receipt of these instructions.

**Table 1.** Mission operation schedule.

| DAY | DATE | LOCATION | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sun | 30-Jan | STX | MOBILIZATION/TRAINING/PRESS | | | | | | | | | | | | | | | | | | | | | | | |
| Mon | 31-Jan | STX | | | | | | | | | | | | | | | | | | | | | | | | |
| Tue | 1-Feb | STX | OFF DUTY | | | | | | | | Transit/ Patch Test | | | | | | Multibeam Buck: All | | | | | ROV Buck | | | | |
| Wed | 2-Feb | STX | ROV Buck | | | | | | | Multibeam Buck/Salt River | | | | | | | | | | | | TRANSIT TO STJ | | | | |
| Thu | 3-Feb | STJ/STT | Multibeam Grammanik Bank | | | | | | | | ROV Grammanik Bank | | | | | | | | Multibeam Grammanik Bank | | | | | | | |
| Fri | 4-Feb | STJ/STT | Multibeam Grammanik Bank | | | | | | | | ROV Grammanik Bank | | | | | | | | Multibeam Grammanik Bank | | | | | | | |
| Sat | 5-Feb | STJ/STT | Multibeam NPS_A Monument | | | | | | | | ROV NPS_A Monument | | | | | | | | Multibeam NPS_A Monument | | | | | | | |
| Sun | 6-Feb | STJ/STT | Multibeam NPS_A Monument | | | | | | | | ROV NPS_A Monument | | | | | | | | Multibeam NPS_A Monument | | | | | | | |
| Mon | 7-Feb | STJ/STT | Multibeam NPS_A Monument | | | | | | | | ROV NPS_A Monument | | | | | | | | Multibeam NPS_A Monument | | | | | | | |
| Tue | 8-Feb | STJ/STT | Multibeam NPS_B Monument | | | | | | | | ROV NPS_B Monument | | | | | | | | Multibeam NPS_B Monument | | | | | | | |
| Wed | 9-Feb | STJ/STT | Multibeam NPS_B Monument | | | | | | | | ROV NPS_B Monument | | | | | | | | Multibeam NPS_B Monument | | | | | | | |
| Thu | 10-Feb | STJ/STT | Multibeam MSR | | | | | | | | ROV MSR | | | | | | | | Multibeam MSR | | | | | | | |
| Fri | 11-Feb | STJ/STT | Multibeam MSR | | | | | | | | ROV MSR | | | | | | | | Multibeam MSR | | | | | | | |
| Sat | 12-Feb | STJ/STT | Multibeam MSR | | | | | | | | ROV MSR | | | | | | DEMOBILIZATION | | | | | | | | | |
| Sun | 13-Feb | STT | DEMOBILIZATION | | | | | | | | | | | | | | | | | | | | | | | |

**Figure 1.** Salt River Canyon and Buck Island Monument survey areas around St. Croix.




Salt River- 2005
Buck Island- 2005
Buck Island- 2006
Salt River NPS Boundary
BIRNM NPS Boundary

NOAA chart 25641. Scale 1:100,000, units in fathoms.

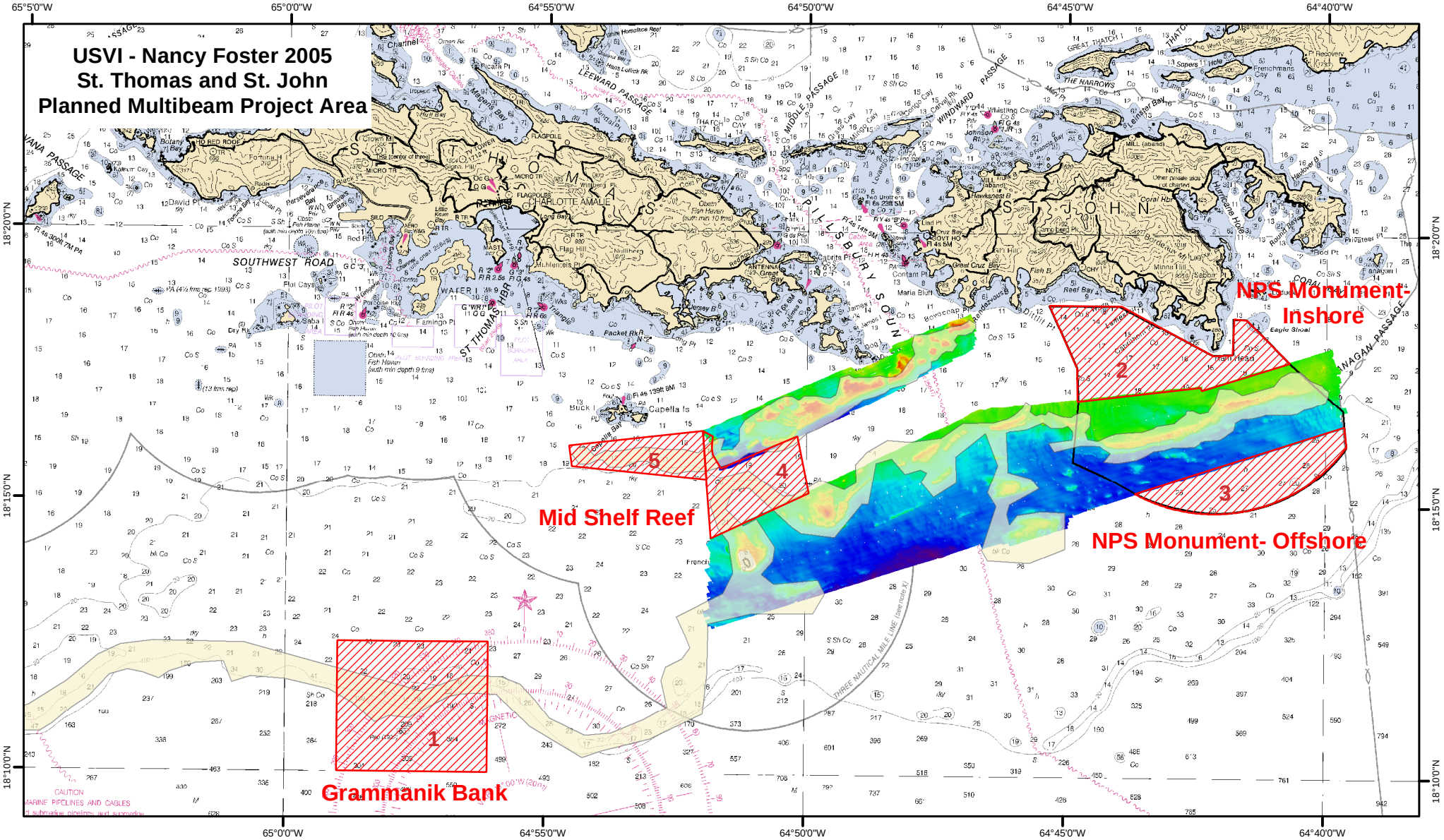
Salt River Bay National Historical Park and Ecological Preserve- Canyon:
Area 0.44 Square Nautical Miles (1,513,680 square meters)
Charted Depth Range 8.2 - 331 meters (4.5 - 181 fathoms)

Buck Island Reef National Monument (BIRNM)- Channel:
Area 1.19 Square Nautical Miles (4,099,361 square meters)
Charted Depth Range 6.4 - 49.3 meters (3.4 - 27.0 fathoms)

0 0.25 0.5 1 1.5 2 Nautical Miles

National Ocean Service
Center for Coastal Monitoring and Assesment
Biogeography Program
1/24/05

**Figure 2.** Grammanik Bank, Mid Shelf Reef, and NPS Monument (Inshore and Offshore) survey areas around St. John and St. Thomas.




Grammanik Bank- 2005

VICRNM NPS Monument- 2005

Mid Shelf Reef- 2005

Mid Shelf Reef System

VINCRM NPS Boundary

NOAA chart 25641. Scale 1:100,000, units in fathoms.

National Park Service (NPS) Inshore and Offshore
Virgin Islands Coral Reef National Monument (VICRNM):
Area 7.1 Square Nautical Miles (24,373,686 square meters)
Charted Depth Range 14.6 - 49.3 meters (7.9 - 26.9 fathoms)

National Marine Fisheries Service (NMFS) Grammanik Bank:
Area 6.6 Square Nautical Miles (22,628,552 square meters)
Charted Depth Range 31 - 665 meters (16.6 - 363.6 fathoms)

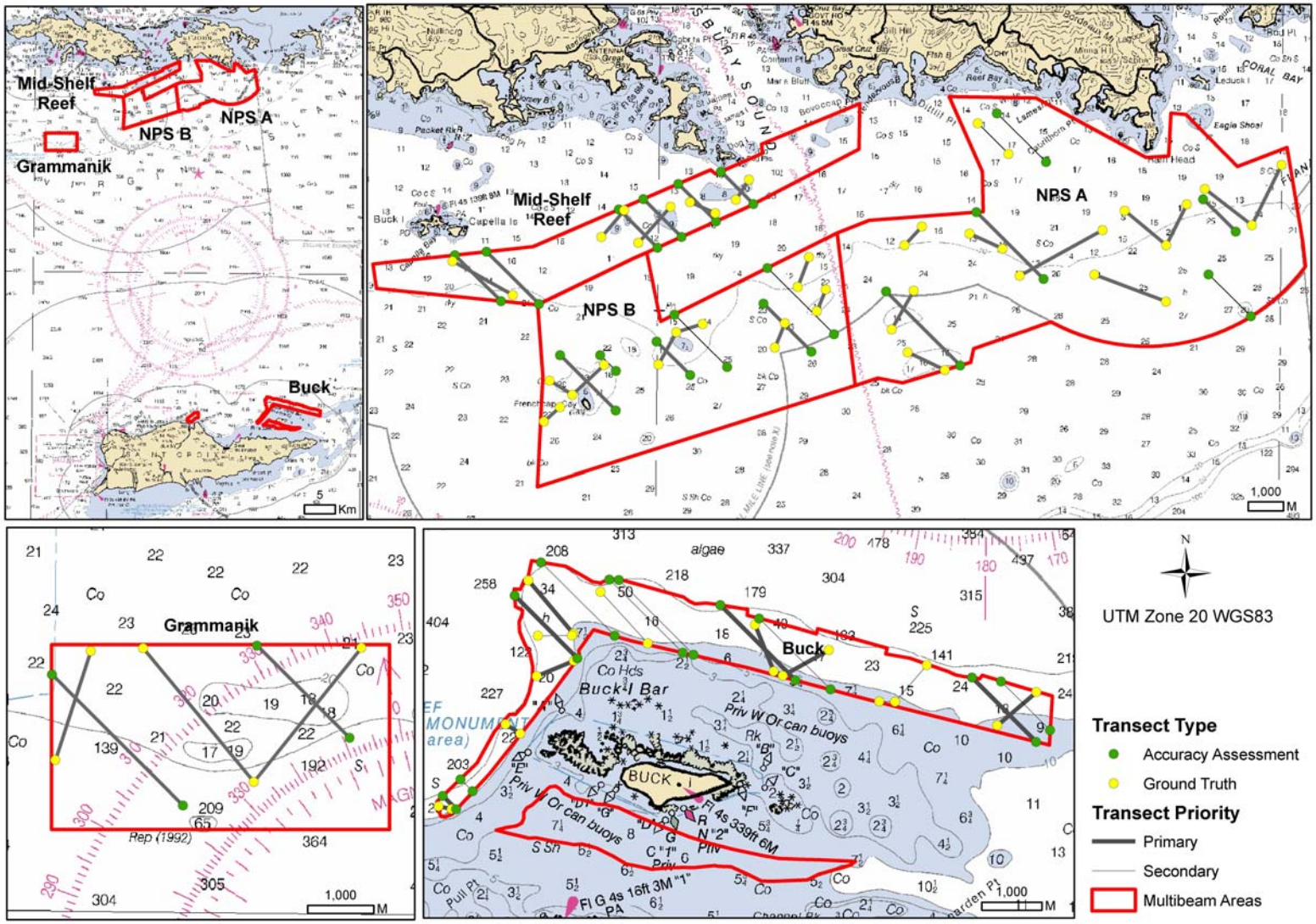
NOAA Mid Shelf Reef System:
Area 3.7 Square Nautical Miles (12,773,686 square meters)
Charted Depth Range 20.1 - 38.4 meters (10.9 - 20.9 fathoms)

*Each component project area is labeled 1 - 5 according to priority and planned order of completion.*

0 0.5 1 2 Nautical Miles

National Ocean Service
Center for Coastal Monitoring and Assesment
Biogeography Program
1/24/05

**Figure 3**. ROV transects around St. Croix, St. John, and St. Thomas.



**Submitted by**:

| | |
|---|---|
| _____ | _____ |
| Dr. Russell Callender<br>Center Director,<br>Center for Coastal Monitoring<br>and Assessment | Mr. Timothy A. Battista<br>Biogeographic Team,<br>Center for Coastal Monitoring<br>and Assessment |
| Date_____ | Date_____ |

**Approved by**:

_____

Captain Gary Bulmer, NOAA
Commanding Officer, Marine Operations Center Atlantic

Date_____