H11870

NOAA FORM 76-35A

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SURVEY

DESCRIPTIVE REPORT

Type of Survey **Hydrographic Lidar**
Field No. **H11870**
Registry No. **OPR-H328-KRL-08**

LOCALITY

State **Florida**

General Locality **Approaches to Miami**

Sub-locality **Virginia Key to Key Biscayne**

2008

HYDROGRAPHER
MARK SINCLAIR
CHIEF OF PARTY
SCOTT RAMSAY

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DATE

NOAA FORM 77-28 (11-72) | U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION | REGISTRY No.

HYDROGRAPHIC TITLE SHEET

H11870

State Florida

General Locality Approaches to Miami

Sub-Locality Virginia Key to Key Biscayne*

Scale 1:10,000 **Date of Survey** July 13 to August 26, 2008

Instructions dated March 25, 2008 **Project No.** OPR-H328-KRL-08

Vessel Tenix LADS Aircraft, call sign VH-LCL

Hydrographer M.J. Sinclair **Chief of Party** S.R. Ramsay

Surveyed by J.G. Guilford, W.T. Newsham, K.J. Oberhofer, B.A. Weidman, J.K. Young, D.J. Stubbing, C.N. Waite, V.X. Sicari, R.B. Touchstone.

Soundings by Laser Airborne Depth Sounder

Graphic record scaled by B.A. Weidman

Graphic record checked by S.R. Ramsay, J.G. Guilford **Automated Plot** N/A

Verification by ***Atlantic Hydrographic Branch Personnel***

Soundings in ~~Meters~~ ***Feet*** at MLLW

REMARKS * The sub-locality was amended in accordance with email at Appendix V.

Requisition / Purchase Req. # NCNJ3000-8-37170

Contractor Tenix LADS, Incorporated, 925 Tommy Munro Dr., Suite J, Biloxi, MS 39532

Sub-Contractor John Oswald and Associates, 12001 Audubon Dr., Anchorage, AK 99516

Times All times are recorded in UTC.

Datum and Projection NAD83, UTM (N) Zone 17

Purpose The purpose of this survey is to provide NOAA with modern, accurate hydrographic survey data with which to update the nautical charts of the assigned area.

Acronyms A complete list of all acronyms used throughout this report is provided at *Appendix I of the Separates Report. **** Data appended to this report.***

Bold, Italic, Red notes in the Descriptive Report were made during office processing.

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DESCRIPTIVE REPORT TO ACCOMPANY

HYDROGRAPHIC SURVEY H11870

SCALE 1:10,000, SURVEYED IN 2008

TENIX LADS AIRCRAFT, VH-LCL

TENIX LADS, INC. (TLI)

MARK SINCLAIR, HYDROGRAPHER

PROJECT

Project Number: OPR-H328-KRL-08 **Original:** DG 133C-06-CQ-0066
Date of Instructions: March 25, 2008 ***Concur*** **Task Order:** T0004

Date of Supplemental Instructions:

August 4, 2008 – Email from Dave Scharff (NOAA COTR) approving proposed modification to required survey area.

January 29, 2009 – Email from Dave Scharff (NOAA COTR) approving sub-locality name change in Statement of Work Attachment #4B.

Registry Number: H11870
Sheet: C

A. AREA SURVEYED

Survey operations covered five registered sheets over the OPR-H328-KRL-08 project area, Approaches to Miami, FL (see Figure 1 and Figure 2).

A total of 2836 lineal nautical miles were illuminated in the process of flying 375 main scheme survey lines. An additional 1512 lineal nautical miles were illuminated flying 193 reflies and 252 lineal nautical miles flying 60 crosslines / investigations. The total seabed area surveyed across the project area, from the Mean High Water (MHW) line to geographical extents of the survey area, was approximately 63 square nautical miles. Refer to ***Appendix III for further information.

Between July 13 and August 26, 2008, the LADS Mk II aircraft conducted 21 sorties in the vicinity of the Approaches to Miami, based out of Fort Lauderdale, FL. All survey flights were conducted between the hours of 22:30 and 06:00, due to the close proximity of the survey area to Miami International Airport. The specific dates of data acquisition for OPR-H328-KRL-08, hours flown and time on task were as follows:

***Data appended to this report.**

Date (UTC)	Sortie No.	Hours Flown	Time on Task
15-Jul-08	2	5:31	4:32
17-Jul-08	3	6:39	5:26
20-Jul-08	4	2:41	1:58
21-Jul-08	5	3:05	1:45
23-Jul-08	6	6:30	5:42
24-Jul-08	7	2:26	1:33
27-Jul-08	8	2:50	1:03
29-Jul-08	9	4:30	3:40
01-Aug-08	10	7:08	6:29
02-Aug-08	11	7:13	6:38
05-Aug-08	12	7:16	6:22
07-Aug-08	13	5:26	4:36
08-Aug-08	14	6:05	5:28
10-Aug-08	16	7:36	6:52
14-Aug-08	18	7:04	6:27
16-Aug-08	19	1:38	0:53
17-Aug-08	20	4:33	3:47
18-Aug-08	21	4:19	3:20
23-Aug-08	23	6:25	5:43
24-Aug-08	24	2:56	2:21
25-Aug-08	25	6:15	5:35

Table 1: Specific Dates of Data Acquisition

Environmental factors such as water clarity, tide, wind strength and direction and cloud base height influenced the area and duration of data acquisition on a daily basis. See Section B.2.3 for further details.

This Descriptive Report describes Sheet C, which covers Virginia Key to Key Biscayne (see Figure 2).

The sheet limits are as follows for Sheet C (coordinates are NAD83): ***Concur***

H11870 (C)	Latitude (N)	Longitude (W)
NW corner	25° 45' 16.74"	80° 13' 29.72"
SW corner	25° 41' 09.69"	80° 13' 31.32"
SE corner	25° 41' 07.01"	80° 05' 44.97"
NE corner	25° 45' 14.05"	80° 05' 43.10"

Figure 1 – General Locality of OPR-H328-KRL-08

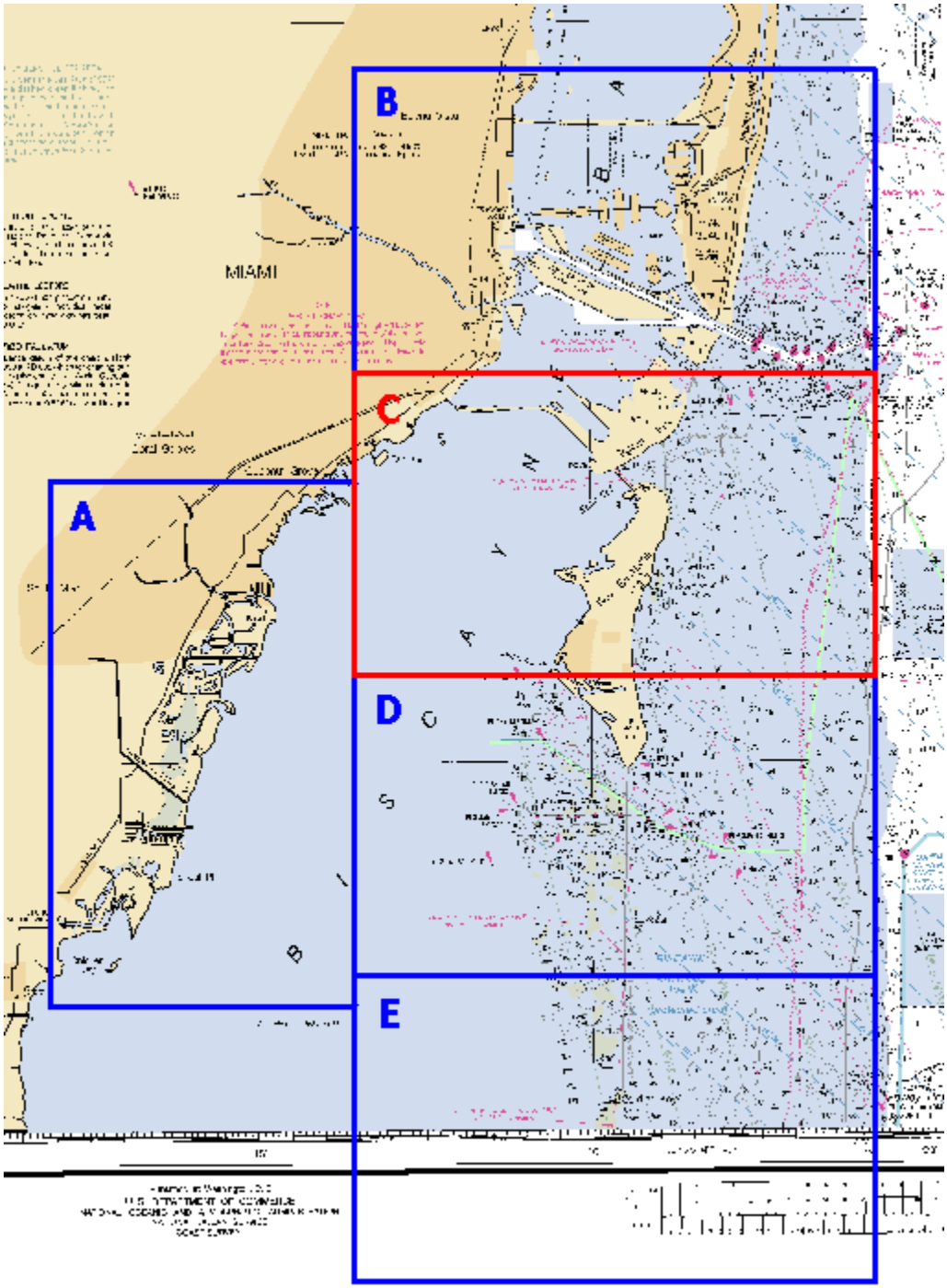

Figure 2 – Sub-Locality of H11870 (Sheet C)

B. DATA ACQUISITION AND PROCESSING *See also Evaluation Report*

Refer to the Data Acquisition and Processing Report for a detailed description of the equipment, processing, and quality control procedures used during LADS surveys. A general description and items specific to this survey are discussed in the following sections.

B.1 EQUIPMENT

Data collection was conducted using the LADS Mk II Airborne System (AS), data processing using the LADS Mk II Ground System (GS), and data visualization, quality control and final products using CARIS HIPS and SIPS 6.1 and CARIS BASE Editor 2.1.

B.1.1 Airborne System

The LADS Mk II AS platform consists of a De Havilland Dash 8-200 Series aircraft, which has a transit speed of 250kts at altitudes of up to 25,000ft, and an endurance of up to eight hours. Survey operations are conducted from heights between 1,200 and 2,200ft, at ground speeds of between 140 and 210kts. The aircraft is fitted with an Nd: YAG laser, which is eye safe in accordance with ANSI Z136.1-2000, American National Standard for Safe Use of Lasers. The laser operates at 900 Hertz from a stabilized platform to provide a number of different spot spacings across the seabed.

Green laser pulses are scanned beneath the aircraft in a rectilinear pattern. The pulses are reflected from the land, sea surface, within the water column and from the seabed. The height of the aircraft is determined by the infrared laser return, which is supplemented by the inertial height from the Attitude and Heading Reference System (AHRS) and a Global Positioning System (GPS) receiver. Real-time positioning is obtained by an Ashtech GG24 GPS receiver providing autonomous GPS, or is combined with WADGPS (Fugro Omnistar), to provide a differentially corrected position, when coverage is available. Ashtech Z12 GPS receivers are also provided as part of the AS and GS to log data on the aircraft and at a locally established GPS base station.

A digital camera installed on the LADS Mk II system platform allows high quality images to be captured in real-time. These images are georeferenced and can be overlaid with the processed survey data. The specifications for the Redlake MegaPlus II ES 2020 digital camera are provided in the ***Data Acquisition and Processing Report.

B.1.2 Ground System

The LADS Mk II GS 'Frodo' was used to conduct data processing in the field. Frodo consists of a portable Compaq Alpha ES40 Series 3 processor server with 1 GB EEC RAM, 764 GB disk space, digital linear tape (DLT) drives and magazines, a digital audio tape (DAT) drive, a CD ROM drive, and is networked to up to 12 Compaq 1.5 GHz PCs and a HP 800ps Design Jet Plotter, printers and QC workstations. The GS supports survey planning, data processing, quality control and data export. The GS also includes a KGPS base station, which provides independent post-processed position and height data. Quality control checks and editing of the data were conducted on GS 'Katrina', at the TLI office in Biloxi, MS, upon completion of the data collection phase of the survey. **** Data filed with original field records.***

B.2 QUALITY CONTROL

B.2.1 Quality Control Checks

The internal relative consistency of the survey data was checked with crossline depth comparisons, depth benchmark comparisons, dynamic position checks and by observing position confidence quality factors on the GS. System integrity was checked, in an absolute sense, with the local GPS base station site confirmation and the static position check.

B.2.1.1 Crosslines

No specific crosslines were planned due to many investigation / additional coverage lines being flown perpendicular to main scheme survey runs. Additionally, main scheme lines flown perpendicular to each other, were used in these comparisons. Below are the overall depth comparison results for the 448 crossline / main scheme line intersections. A complete summary is presented in the ***Separates Report. **** Data filed with original field records.***
Very few lines that qualify as crosslines were run over H11870. However, since the surveys within the project OPR-H328-KRL-08 junction and were acquired during the same relative time frame the crossline requirement for H11870 has been met adequately.

Total Number of Comparisons	Mean Depth Difference (m)	Mean Standard Deviation (m)
386500	-0.01 +/- 0.06	0.05 +/- 0.03

B.2.1.2 Depth Benchmarks

Six gridded depth benchmark areas were created from bathymetry collected over benchmark run 4.0, which was flown west of Fowey Rocks Lighthouse on July 23, 2008. Comparisons between the gridded benchmark areas and bathymetry collected on benchmark runs flown during each sortie were used to check the relative depth accuracy of the LADS Mk II system for the H11870 survey. Center coordinates for the benchmark areas are as follows:

		UTM (N) Zone 17	
Benchmark Name	**Nominal Depth**	**Easting**	**Northing**
BM_1	7m	589 776	2 835 064
BM_2	5m	590 426	2 831 735
BM_3	3m	590 662	2 830 568
BM_4	13m	590 955	2 829 053
BM_5	20m	591 100	2 828 298
BM_6	25m	591 169	2 827 951

Depth benchmark areas and benchmark flight lines were reduced to MLLW using Virginia Key verified tides, with time and range correctors as specified in Section C.2.

The LADS survey data is compared against the gridded benchmark surface in the GS, and statistics are generated which include the number of points compared, the mean depth difference (MDD) and the standard deviation (SD) between the data sets. The benchmark comparison function compares the data against the benchmark surface, and as this data is unedited, it may contain noise normally removed during the validation process. These noisy outliers are flagged as the shoalest and deepest differences.

A summary of the average of the MDD and SD for all depth benchmark area comparisons is presented below. Refer to the *Separates Report for detailed results of the depth benchmark comparison results. **** Data filed with original field records.***

GS ID	BM Name	Nominal Depth	Mean MDD (m)	Mean SD (m)
1	BM_1	7m	0.04 +/- 0.07	0.06 +/- 0.01
2	BM_2	5m	0.00 +/- 0.06	0.03 +/- 0.01
3	BM_3	3m	-0.02 +/- 0.05	0.06 +/- 0.01
8	BM_4	13m	0.12 +/- 0.08	0.04 +/- 0.01
5	BM_5	20m	0.16 +/- 0.10	0.07 +/- 0.01
6	BM_6	25m	0.19 +/- 0.12	0.08 +/- 0.02

The depth benchmark comparison results and the crossline comparisons results are within expected tolerances and show that the LADS Mk II depth performance was within specifications throughout the survey period.

B.2.1.3 Positioning Checks

Two independent positioning systems were used during the survey. Real-time positions were determined using an Ashtech GG24 GPS receiver, differentially corrected in real-time by a Fugro Omnistar GPS receiver on the aircraft, termed Wide Area Differential GPS (WADGPS) mode. Post-processed KGPS positions were determined relative to a local GPS base station that was established by Coastal Planning and Engineering (CPE) on the top of a light pole at the Fort Lauderdale Executive Airport. The post-processed KGPS positions were applied to each sounding during processing and the KGPS height was used in the topographic datum filter.

Position checks were conducted prior to, during, and following data collection as follows:

a. Local GPS Base Station Site Confirmation. A 24-hour certification of the local GPS base station established was conducted on July 18-19, 2008. The results reveal that the local GPS base station is free from site specific problems such as multipath and obstructions. Details are provided in the **Horizontal and Vertical Control Report and scatter plots in the *Separates Report. ****** Data included as part of AHB H-Cell Deliverables.***

b. Static Position Check. Prior to commencing data collection, the coordinates of the aircraft GPS antenna were determined relative to three marks, which were surveyed by CPE on

the tarmac at the Fort Lauderdale Executive Airport. Data was logged by each LADS Mk II positioning system while the aircraft was static, enabling the positions to be checked against the known GPS antenna point. The absolute accuracy of the post-processed KGPS solution during the static position check was 0.171m (95% confidence). The results and details of the static position check are enclosed in the **Horizontal and Vertical Control Report and *Separates Report. **** Data filed with original field records.***

c. Dynamic Position Check. During each sortie, GPS data was logged on the aircraft and at the local GPS base station. This provided a check between the real-time and post-processed GPS positions. The mean difference between the real-time and post-processed positions was 0.901m, with an average SD of 0.096m. Details are provided in the **Horizontal and Vertical Control Report.

d. Position Confidence. The position quality was also monitored on the GS by checking a post-processed position confidence (C3), which is determined from the AS platform error, GPS error, and residual errors between the actual GPS positions and aircraft position, as determined from the line of best fit. No position anomalies were detected.

The position checks were within the expected tolerances and demonstrated that the positioning systems were functioning correctly throughout the survey period.

B.2.2 Uncertainty Values

For this survey area, global horizontal and vertical uncertainties have been assigned based on the defined horizontal and vertical error budget, as stated in the **Horizontal and Vertical Control Report. The assigned horizontal uncertainty is 1.96m and the assigned vertical uncertainty is 0.39m. ***** Data included as part of AHB H-Cell Deliverables.***

However, when the calculated grid node SD is greater than the assigned vertical uncertainty, the SD is used as the uncertainty value. This has occurred in areas of high relief, such as along the limit of a channel or dredged area. In some cases the SD may exceed IHO Order-1 limits. This could be attributed to the seabed gradient and a 3m grid resolution being used.

B.2.3 Environmental Factors

B.2.3.1 Sea Conditions - Sea State, Waves, Swell, White Water

Adverse sea conditions were not a significant issue during this project. Apart from the period when Tropical Storm "Fay" hit the Florida coast, between the August 18 and 20, 2008 (no flights were conducted during this time), seas were generally slight. In fact, the absence of a slight to moderate chop on the sea surface during many flights was more of a concern than large sea state and white water. On a number of occasions glassy seas made lidar data acquisition difficult, and in a few cases sorties were terminated prematurely due to the "mirror-like" sea surface.

B.2.3.2 Water Clarity

Water clarity varied significantly throughout the survey area. Poor conditions were typically driven by storm activity, high rainfall and tidal state. The worst period of water clarity was observed following landfall of Tropical Storm "Fay" on August 18, 2008. The first flight conducted following this major storm was on August 22, 2008 and water conditions were

generally unsuitable for lidar during this short flight (aborted prematurely for low cloud and poor water clarity). However, by the next evening water clarity had improved considerably. By the third flight following the tropical storm, conducted on August 24, water clarity conditions were generally back to normal.

Under good weather conditions, areas of poor water clarity were typically localized to Miami Main Channel, the channels north, west and south of Virginia Key and a wide area west of Key Biscayne. These regions generally exhibited improved water clarity during the flooding tide and coverage was maximized by flying these areas during optimal tide periods. The turbidity observed in some areas did not improve with tidal state, such as the small bay adjacent to Marine Stadium on Virginia Key and the inlets on the south end of Key Biscayne. The water clarity through most of Biscayne Bay, and east and south of Virginia Key and Key Biscayne was very good throughout the survey period.

Water clarity did not affect the maximum lidar depth achieved along the eastern edge of the survey area, as maximum depths were only ~15m within the geographical extents of the flight lines. It is worth noting that depths beyond 45m were typically observed on the benchmark line flown west of Fowey Rocks on each survey flight

B.2.3.3 Sea Grass

Sea grass is present throughout much of Biscayne Bay. The automated gain control for the green receiver component of the LADS Mk II AS handled the transition from sandy to sea grass covered seabed very well. However, on occasion, returns from the sandy seabed were quite saturated and caused a false Bottom Object Detection (see B.2.4.3 for further details) that would have to be rejected by a surveyor during data cleaning. Typically, laser returns from sea grass areas were slightly more attenuated, but this only adversely affected data coverage in very shallow water (refer to B.2.4.2).

B.2.3.4 Topography

The LADS Mk II system can measure topographic heights up to 50m elevation, subject to the depth / topographic logging window selected. For this survey, a 20m topographic height logging window was selected. As a result, the coastline was surveyed and elevations up to 20m were measured. During the processing stage, a maximum height of ~3m above the sea surface was used to remove areas where trees, buildings or other cultural features exist in close proximity to the high waterline. In areas where the MHW line could not be determined due to trees, mangroves, buildings or other cultural features, the appropriate ‘gap’ tag was inserted in the GS. With the use of publicly available imagery (Florida Department of Environmental Protection) and exported tags, the MHW line has been interpolated in these areas and attributed to indicate an approximate location.

B.2.3.5 Buildings / Towers

For this survey the presence of tall buildings and towers was a significant issue. With all sorties being flown at night and the survey area being in close proximity to Miami International Airport, survey lines were flown at 2200ft to adhere to night operation lowest safe altitude guidelines.

B.2.3.6 Wind

Survey operations were conducted in wind strengths of up to 20kts during the survey. In general, the wind strength during sorties was between 0 and 15kts from the SE. In circumstances when wind speeds were forecast to be greater than 20kts, no flights were planned due to the possibility of dangerous levels of turbulence. On occasions where wind speeds at Fowey Rocks Lighthouse were reported at less than 5kts, sorties were cancelled due to the high likelihood of glassy seas throughout the survey area.

B.2.3.7 Cloud

Low cloud coverage, rain and thunderstorms were a significant factor during the survey. Low cloud coverage was often prevalent within the survey area, sometimes resulting in aborted lines and subsequent reflies, and premature termination of sorties. On many occasions a cloud base formed at 1800 – 2000ft in the early hours of each morning, and due to the limitations of the night operation lowest safe altitude guidelines, the aircraft could not descend to a lower survey altitude below the cloud base.

Poor weather was monitored using, and decisions on the flying program were based on:

Real-time satellite imagery

Radar data

Weather buoy data

On the ground personnel reports

B.2.4 Data Coverage and Object Detection

B.2.4.1 Nature of the Seabed

The nature of the seabed east of Key Biscayne is generally undulating with small sand ridges and the occasional small seabed object. To the northeast of Virginia Key there is a large concentration of small seabed objects and a bottom formation that follows a radial pattern. West of Key Biscayne is generally flat and featureless with the exception of Bear Cut where significant shoals can be observed west of the main channel. A significant pipeline is apparent running east from Virginia Key. A cable can also be observed running north-northwest from Key Biscayne. Maximum depths within the extents of this sheet are in the order of 8m.

B.2.4.2 Data Coverage

The survey area was illuminated at 2.5x2.5m laser spot spacing, resulting in a 75m swath width. Mainlines of sounding were spaced at 60 / 70m, which provided the required 100% coverage. Initially the survey was planned with 70m line spacing, but after analyzing coverage from the first flights, it was determined that some small coverage gaps were apparent between successive lines, due aircraft heading-track differences (drift) of up to 10 degrees. These small gaps were filled by flying new runs between the original lines. All un-flown survey sub areas were regenerated with 60m line spacing to avoid further data "holidays" due to aircraft drift.

Full coverage within the very shallow regions of the project area was difficult to achieve primarily due to bathymetric lidar limitations in discriminating between "mixed" sea surface and seabed returns. The inaccurate data that is recorded in very shallow water is automatically removed during data processing with the Secondary Exclusion Zone (SEZ) algorithm. This depth filter effectively removes erroneous data from the sea surface down to a depth of 0.5m. The SEZ gap is typically filled by flying 200% coverage lines, with each successive line at a significantly different tidal state (high tide, then low tide), or with additional very low or very high tide lines along the coast.

However, with a tide range in the order of just 0.7m at Virginia Key, the flight window limited to between 22:30 and 06:00 each night, and 100% lidar main line coverage across the project area, effective management of tides to fill the SEZ gaps in very shallow water proved extremely difficult. In fact, the limitations of the mixed sea surface / seabed return were further compounded by attenuated sea grass returns in Biscayne Bay and saturated glassy sea returns along most coastlines. This meant that in some areas, accurate detection of the seabed was not possible until the water depth was between 1 and 2m.

Once these unusually large shallow water gaps had been identified, the COTR was contacted in order to explain that lidar coverage in the shallow coastal areas of the project would be very limited. The option of not flying the most inshore main scheme survey lines was discussed and approved by the COTR. In lieu of flying these lines, where coverage would have been extremely poor, an expansion of the project area to the north, east and south was conducted. This modification meant that a greater area of seabed would be illuminated than that proposed in the Statement of Work. It also resulted in the requirement for a revised sheet layout and for an additional sheet to be created (H12008). See ***Appendix V for further details. **** Data appended to this Report.***

Apart from a turbidity gap in the vicinity of Marine Stadium, and secondary exclusion zone gaps in the vicinity of Virginia Key and north and west of Key Biscayne, full seabed coverage from ~2m depth to the maximum depth within the geographical extents of flight lines was achieved for the western half of H11870. East of Virginia Key and Key Biscayne, seabed coverage was generally achieved from above the MHW line to the limit of the survey area.

B.2.4.3 Object Detection

At the sea surface the footprint of the laser beam is approximately 2.5m in diameter. As the beam passes through the water column, it slowly diverges due to scattering. At 2.5x2.5m laser spot spacing, complete seabed illumination is achieved. However, there are areas within the survey area where object detection was not possible due to water clarity issues. When the noise within the water column due to turbidity reaches a level where discrimination of a small seabed object from the noise in the laser waveform becomes impossible, object detection capability cannot be claimed.

By considering the laser spot spacing, coverage achieved and the calculated Signal to Noise Ratio of the seabed laser return (measure of water clarity), a quantification of IHO Order 1A object detection specifications has been assigned to the survey area. Bathymetric coverage of

each sheet has been attributed as "bottom object detection achieved" or "bottom object detection not achieved" using the following S-57 feature object and attributes:

	S-57 Feature Object	S-57 Attribute CATZOC value	S-57 Attribute CATQUA value
IHO Order 1A bottom object detection achieved	M_QUAL	3 (zone of confidence B)	1 (data quality A)
IHO Order 1A bottom object detection not achieved	M_QUAL	3 (zone of confidence B)	2 (data quality B)

A description of the Bottom Object Detection (BOD) algorithm used in data processing is presented in the *Data Acquisition and Processing Report.

B.3 CORRECTIONS TO SOUNDINGS

Refer to the *Data Acquisition and Processing Report for a description of corrections to soundings. There were no deviations from the corrections described therein.

B.4 DATA PROCESSING

B.4.1 Data Management

The database is identified as follows:

Database Name	Sub-Locality	Sheet
08_4FL	Virginia Key to Key Biscayne	C

A detailed table of survey line identifiers is presented in the *Data Acquisition and Processing Report. **** Data included as part of AHB H-Cell Deliverables.***

B.4.2 Data Processing Sites

The data acquired during survey flights was processed at the operating site in Fort Lauderdale following each sortie. Final validation, checking, approving, reports and products were conducted at the office in Biloxi, MS. The quality control of the data was conducted using CARIS software in the Biloxi, MS office.

B.4.3 CARIS BASE Surface

One BASE Surface covers the extents of each sheet area. The "Shoal" layer of the BASE Surface is to be considered the official record of hydrography for the survey. A grid resolution of 3m was used for the BASE Surface. Grid resolution does not change relative to depth, as the laser pulse footprint stays relatively constant regardless of depth, and the laser spot spacing is constant irrespective of aircraft altitude. The 3m grid provides the largest amount of detail that can be supported by the lidar density.

B.4.4 Tagging

During data processing on the GS, the operators have the ability to assign S-57 and user-defined tags to gaps and features in the data. This enables accurate delineation and attribution of unsurveyed polygons, cultural features, artificial shoreline and navigation aids for the S-57 feature file (US511870.000).

For this survey, the following tags were used:

Tag	Abbrv	Description
BCNSPP	BC	Beacon, special purpose / general
BOYSPP	BY	Buoy, special purpose / general
BRIDGE	BR	Bridge
BRKWTR	BW	Breakwater
JETTY	JE	Jetty
OBSTRN	OB	Obstruction
PILPNT	PL	Pile
PIPSOL	PI	Pipeline, submerged / on land
SNDWAV	SW	Sand waves
UWTROC	RK	Underwater / awash rock
GROYNE	GR	Groyne
DSTRUCT	HO	Dry structure / house on water
HULKES	HU	Permanently moored vessel
DMPGRD	DG	Dumping ground / spoil area
SEAWALL	SE	Seawall
BLDG	BLDG	Building
GAPBOAT	GB	Gap due to boat, boat wake and / or dragged nets
GAPTURBID	GT	Gap due to poor water clarity
GLASSYSEAS	GGS	Gap due to glassy seas
SEZ	SEZ	Gap due to the secondary exclusion zone (SEZ)
MANGROVE	GM	Gap due to mangroves
GAPTREE	GTR	Gap due to trees (not mangroves)

Detailed descriptions of the gaps in seabed coverage are presented in Section B.8 of the ***Data Acquisition and Processing Report. ***Data included as part of AHB H-Cell Deliverables***

B.4.5 Georeferenced Imagery

Due to nighttime operations, no digital imagery was available for the validating, checking, and approval stages of survey data cleaning. No georeferenced mosaics were produced for the survey area. However, publicly available imagery from the Florida Department of

Environmental Protection was used as a guide during product compilation. The imagery used can be downloaded from the following website:

http://data.labins.org/2003/MappingData/DOQQ/doqq_04_utm_sid.cfm

Google Earth coupled with EarthNC was also used extensively during the data validation, checking and approval process, in lieu of the LADS digital imagery typically acquired during daylight operations.

B.4.6 Progress Sketches

Progress sketches were provided to NOAA on a monthly basis. The final progress sketch can be found at ***Appendix III. ***Data appended to this Report.***

B.4.7 Deliverables Data Formats

Data is provided in the following formats:

Digital S-57 feature file

CARIS BASE Surface

Lidar coverage and Lidar uncertainty images in geo .tif format

Chart comparison file in CARIS .hob format

CARIS compatible data – CAF Format – LADS soundings and waveforms, which can be imported into CARIS HIPS

CARIS compatible data – HDCS Format – LADS soundings in CARIS HIPS native format

Tidal data provided in ASCII, .xls and .csv formats

Refer to the ***Data Acquisition and Processing Report for specific details.

**** Data included as part of AHB H-Cell Deliverables***

C. VERTICAL AND HORIZONTAL CONTROL *See also Evaluation Report*

Refer to the Horizontal and Vertical Control Report for a detailed description of the horizontal and vertical control used during this survey. A summary of horizontal and vertical control used for the survey follows.

C.1 VERTICAL CONTROL

Vertical control for this survey was based on MLLW at the National Water Level Observation Network (NWLON) station at Virginia Key, FL (8723214).). *Concur*

Station details are as follows:

		NAD83	
Gauge	**Location**	**Latitude (N)**	**Longitude (W)**
8723214	Virginia Key, FL	25° 43.9'	80° 09.7'

C.2 ZONING

Tide zones that cover the extent of the survey were derived from tide zone coordinates supplied by NOAA. Each of these tide zones use time and range correctors relative to the Virginia Key tide station. These are as follows:

Tide Zone	GS Identifier	Time Corrector	Range Corrector	Reference Station
FSE1	TA1	-48 minutes	x1.12	8723214
FSE2	TA2	-48 minutes	x1.12	8723214
FSE5	TA3	-30 minutes	x1.05	8723214
FSE6	TA4	-30 minutes	x1.07	8723214
FSE8	TA5	-18 minutes	x1.02	8723214
FSE9	TA6	-6 minutes	x1.00	8723214
FSE10	TA7	-18 minutes	x1.02	8723214
FSE11	TA8	-18 minutes	x1.00	8723214
FSE14	TA9	-6 minutes	x0.98	8723214
FSE16	TA10	+12 minutes	x0.98	8723214
FSE18	TA11	+24 minutes	x0.98	8723214
FSE18A	TA12	+36 minutes	x0.95	8723214
FSE20	TA13	+42 minutes	x0.98	8723214
FSE21	TA14	+36 minutes	x1.00	8723214
FSE21A	TA15	+42 minutes	x0.98	8723214
FSE22	TA16	+24 minutes	x1.00	8723214
FSE23	TA17	+12 minutes	x1.00	8723214
FSE24	TA18	+6 minutes	x1.00	8723214

Tide Zone	GS Identifier	Time Corrector	Range Corrector	Reference Station
FSE25	TA19	+24 minutes	x1.02	8723214
FSE26	TA20	+18 minutes	x1.02	8723214
FSE27	TA21	+6 minutes	x1.02	8723214
FSE28	TA22	-6 minutes	x1.05	8723214
FSE29	TA23	-18 minutes	x1.07	8723214
FSE34	TA24	+12 minutes	x1.07	8723214
SA227	TA25	-54 minutes	x1.22	8723214
SA228	TA26	-48 minutes	x1.20	8723214

For final tide application, the time and range correctors were applied to the smoothed tidal data provided by JOA. Soundings were then reduced to MLLW using these corrected tides. An analysis of depth benchmark and crossline comparisons, and overlaps of the mainlines of sounding concluded that final tide zoning was adequate.

The derived value for the difference between MLLW and MHW at the Virginia Key tide gauge is 0.66m. From the final zoning, a range factor of 1.20, 1.12, 1.07, 1.02, 1.00, 1.02, 0.98, 0.98, 0.95, 1.00, 0.98, 1.00, 1.00, 1.00, 1.02, 1.02, 1.02, and 1.07 was applicable for Sheet C, resulting in a MHW value of 0.68m.

C.3 HORIZONTAL CONTROL

Data collection and processing were conducted on the AS and GS in World Geodetic System (WGS84) on Universal Transverse Mercator (Northern Hemisphere) projection UTM (N) in Zone 17, Central Meridian 81° W. This data was post-processed and all soundings are positioned relative to the North American Datum 1983 (NAD83). All units are in ~~meters~~ ***feet at MLLW. Concur***

C.3.1 LADS Local GPS Base Station – Fort Lauderdale

Real-time positions were determined using an Ashtech GG24 GPS receiver, differentially corrected in real-time by a Fugro Omnistar GPS receiver on the aircraft (WADGPS mode). A local GPS base station was coordinated by Coastal Planning and Engineering (CPE) on the top of a light pole at the Fort Lauderdale Executive Airport on July 10, 2008, in order to post-process more accurate KGPS positions following survey flights.

The derived NAD83 coordinates for the local GPS base station are:

NAD83		UTM (N) Zone 17		
Latitude (N)	**Longitude (W)**	**Easting (m)**	**Northing (m)**	**Ellipsoidal Height (m)**
26° 11' 42.4877"	80° 10' 17.4843"	582776.318	2897558.340	-14.957

Post-processed KGPS positions were determined offline using data logged at the local GPS base station and on the aircraft. This data was processed with Waypoint GrafNav Software to calculate a KGPS position solution for the survey flights. The post-processed KGPS positions were imported into the GS and applied to all soundings. This provided increased sounding position accuracy from the real-time WADGPS.

D. RESULTS AND RECOMMENDATIONS *See also Evaluation Report*

The results for the H11870 survey are submitted separately to this Descriptive Report as the S-57 feature file, BASE Surface, CARIS .hob files, Chart Comparison Spreadsheet, etc. on the USB hard drive. Refer to Appendix II of the *Data Acquisition and Processing Report for a list of all the deliverable files from H11870.

Below is a table listing the S-57 feature objects found in the S-57 feature file (US511870.000): ***Concur***

**** Data included as part of AHB H-Cell Deliverables.***

S-57 Object Class	S-57 Object Acronym	Geometry	Description	Spatial Attribute	Attribute 1	Attribute 2	Attribute 3	Attribute 4	Comments
Beacon, Lateral	BCNLAT	P	A lateral beacon is used to indicate the port or starboard hand side of the route to be followed.		Object Name (OBJNAM)	Status (STATUS)			The attribute STATUS is used to identify the Beacons as being privately maintained. OBJNAM defines the beacon name as indicated in the ENC.
Beacon, Special purpose/general	BCNSPP	P	Beacon in general: A beacon whose appearance or purpose is not adequately known.		Object Name (OBJNAM)	Status (STATUS)			The attribute STATUS is used to identify the Beacons as being privately maintained. OBJNAM defines the beacon name as indicated in the ENC.
Bridge	BRIDGE	A	A structure erected over a depression or an obstacle such as a body of water		Category of Bridge (CATBRG)				
Building	BUISGL	P	A relatively permanent structure, roofed and usually walled.						
Coastline	COALNE	L	The line where shore and water meet.	Quality of position (QUAPOS)	Category of Coasatine (CATCOA)				QUAPOS is used to identify interpolated coastline. CATCOA is used to identify where mangroves exist along the high water line.

S-57 Object Class	S-57 Object Acronym	Geometry	Description	Spatial Attribute	Attribute 1	Attribute 2	Attribute 3	Attribute 4	Comments
Depth Contour	DEPCNT	L	A line connecting points of equal water depth.		Value of contour (VALDCO)				DEPCNT used to define the MLLW line.
Hulk	HULKES	A	A permanently moored ship.						Used to define gaps in data coverage as a result of permanently moored vessels.
Land Elevation	LNDELV	P	An elevation is the vertical distance of a point or a level, on, or affixed to, the surface of the earth, measured from a specified vertical datum.		Elevation (ELEVAT)				
Pipeline	PIPSOL	L	A pipeline is a string of interconnected pipes used for the transport of matter, nowadays mainly oil or gas.		Category of pipeline (CATPIP)				Used for identifying both pipelines and sewers.
Seabed Area	SBDARE	A	An area of the sea where the nature of bottom is homogeneous.		Nature of Surface (NATSUR)				Used to define rocky areas.
Shoreline Construction	SLCONS	L, A	A fixed (not afloat) artificial structure between the water and the land, i.e. a man-made coastline.		Category of Shoreline Construction (CATSLC)				
Sand Waves	SNDWAV	A	A large mobile wave-like sediment feature in shallow water and composed of sand.						Used for identifying dynamic areas of sand waves. Current depth may vary from surveyed depth.
Sounding	SOUNDG	P	A measured water depth or spot which has been reduced to a vertical datum.						Used for defining surveyed depths that differ significantly from the chart.

S-57 Object Class	S-57 Object Acronym	Geometry	Description	Spatial Attribute	Attribute 1	Attribute 2	Attribute 3	Attribute 4	Comments
Unsurveyed Areas	UNSARE	A	Unsurveyed area.		Information (INFORM)				Used to define gaps in data coverage. INFORM has been identified as SEZ, gap for turbidity, gap for glassy seas or boat gaps, based on the GS tags.
Underwater/awash Rock	UWTROC	P	A concreted mass of stony material or coral which dries, is awash or is below the water surface.		Value of Sounding (VALSOU)	Water Level Effect (WATLEV)			Some of the Rocks may have been man made objects. Bottom objects were not investigated.
Vegetation	VEGATN	A	Collections of, or individual plants.		Category of Vegetation (CATVEG)				Used to identify offshore clumps of mangrove.
Wreck	WRECKS	P	The ruined remains of a stranded or sunken vessel which has been rendered useless.		Category of Wreck (CATWRK)	Value of sounding (VALSOU)			
Meta Objects									
Coverage	M_COVR	A	A geographical area that describes the coverage and the extent of spatial objects.		Category of coverage (CATCOV)				M_COVR: CATCOV = 1 polygons define the extents of good LIDAR data coverage.
Quality of Data	M_QUAL	A	An area within which a uniform assessment of the quality of the data exists.		Category of zone of confidence in data (CATZOC)	Category of quality of data (CATQUA)			CATQUA=1 is used to identify areas where object detection is achieved, CATQUA=2 is used to identify areas where object detection is not achieved.

Table 2: S-57 Attribution for the S-57 feature file (US511870.000)

Recommendations for registry number H11870 are divided into 2 components:

1. Recommended charting action, primarily for MCD.
2. Recommended further boatwork to sufficiently junction with lidar seabed coverage and examine uncertain lidar features.

Recommendations for charting action for registry number H11870 are provided in Sections D.1.1 to D.1.6 below. The Chart Comparison Spreadsheet has historically been one of the sources for the lidar features for examination list. In order to provide just one list of features for examination to field units, the Chart Comparison Spreadsheet has had some minor adjustments for this survey (H11870_ChartComp.xls). All features that appear in the chart comparison, but have not accurately had least depth determined by lidar, appear in the features for examination file. Where the least depth has not been found by lidar, no recommended charting action has been specified. The determination of least depth is at the discretion of the ships conducting junctioning / investigations and their results should be reported for charting action to MCD in due course.

Recommendations for ship junctioning are provided in Section D.2.1. There are six features recommended for investigation for sheet H11870.

A summary of charting actions is provided in Section D.2.2.

D.1 CHART COMPARISON *See also Evaluation Report*

H11870 LADS survey deliverables were compared to:

ENC US5FL21M Edition 11 and ENC US5FL22M Edition 18 compiled from Raster Charts 11465 38th Edition and 11468 41st Edition, ENC issue date February 11, 2009, and March 13, 2009, respectively, both at scale 1:40,000. ***See Section D.1 of the Evaluation Report.

These charts were downloaded from the NOAA Office of Coast Survey – NOAA Electronic Navigational Charts download website ~~on April 23, 2009~~.
(http://chartmaker.ncd.noaa.gov/mcd/ENC/download.htm)

D.1.1 Dangers to Navigation

One (1) Danger to Navigation (DTON) was submitted to Atlantic Hydrographic Branch (AHB) for Sheet H11870 following data collection. No further DTONs were submitted during product compilation. ***Concur. See Evaluation Report Section D.1.1.a.***

D.1.2 AWOIS

No AWOIS were assigned to this Task Order. ***Concur***

D.1.3 Aids to Navigation

Ninety-eight (98) Aids to Navigation are charted within the survey area for H11870. Fifty-four (54) Aids to Navigation were detected by lidar and are presented in the following table: ***Recommend retaining ATON's as charted unless specified in the table below. Defer final disposition of ATON's to MCD Update Services Branch.***

No.	Navigation Aid Identifier	Charted Position		Surveyed Position		Lidar Hits	Diff. in Positions (m)	Comments
		NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)	NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)			
1	Government Cut Range Front Light	25° 45' 11.05"	80° 06' 28.82"					Outside area of lidar coverage. ***Retain as charted***
2	Government Cut Range Rear Light	25° 45' 01.29"	80° 06' 05.36"					Outside area of lidar coverage. ***Retain as charted***
3	Miami Main Channel Entrance Range Front Light	25° 45' 06.16"	80° 07' 38.68"	25° 45' 06.29"	80° 07' 38.66"	44	4	***Retain as charted***
4	Miami Main Channel Entrance Range Rear Light	25° 44' 59.26"	80° 07' 59.24"	25° 44' 59.44"	80° 07' 59.19"	56	6	***Retain as charted***
5	Biscayne Bay Light 67	25° 45' 08.90"	80° 11' 02.30"	25° 45' 08.92"	80° 11' 02.24"	8	4	Tagged in GS - Inshore of area of coverage. ***Retain as charted***
6	Biscayne Bay Light 69	25° 44' 31.34"	80° 10' 59.77"	25° 44' 31.33"	80° 10' 59.74"	7	1	***Retain as charted***
7	Bear Cut Daybeacon 2	25° 43' 34.00"	80° 08' 01.70"			0		Not detected by lidar. ***Retain as charted***
8	Beacon, special purpose / general (Private)	25° 43' 55.66"	80° 09' 36.17"	25° 43' 56.85"	80° 09' 36.32"	16	37	***Delete charted aid Add present survey aid***
9	Miami Seaquarium Intake Pipe Obstruction Light (Private)	25° 43' 52.29"	80° 10' 03.14"			0		Not detected by lidar. ***Retain as charted***
10	Deering Channel Light 2 (Private)	25° 44' 02.07"	80° 12' 05.91"	25° 44' 01.47"	80° 12' 05.08"	11	30	***Delete charted aid Add present survey aid***
11	Deering Channel Daybeacon 1 (Private)	25° 44' 01.32"	80° 12' 06.77"	25° 44' 00.78"	80° 12' 06.07"	4	26	***Delete charted aid Add present survey aid***
12	Deering Channel bn 3 (Private)	25° 44' 07.65"	80° 12' 11.90"	25° 44' 07.82"	80° 12' 11.87"	5	5	***Delete charted aid Add present survey aid***
13	Deering Channel bn 4 (Private)	25° 44' 08.27"	80° 12' 10.67"	25° 44' 08.49"	80° 12' 10.95"	6	10	***Delete charted aid Add present survey aid***

No.	Navigation Aid Identifier	Charted Position		Surveyed Position		Lidar Hits	Diff. in Positions (m)	Comments
		NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)	NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)			
14	bn 5 (Deering Channel) (Private)	25° 44' 14.18"	80° 12' 17.27"	25° 44' 14.24"	80° 12' 17.19"	3	3	Tagged in GS - Inshore of area of coverage. ***Delete charted aid. Add present survey aid.***
15	bn 6 (Deering Channel) (Private)	25° 44' 14.86"	80° 12' 15.17"	25° 44' 14.88"	80° 12' 16.07"	3	25	Tagged in GS - Inshore of area of coverage. ***Delete charted aid. Add present survey aid.***
16	bn 7 (Deering Channel) (Private)	25° 44' 20.71"	80° 12' 22.69"	25° 44' 20.71"	80° 12' 22.69"	2	10	Tagged in GS - Inshore of area of coverage. ***Delete charted aid. Add present survey aid.***
17	bn 8 (Deering Channel) (Private)	25° 44' 21.35"	80° 12' 21.68"	25° 44' 21.35"	80° 12' 21.68"	2	10	Tagged in GS - Inshore of area of coverage. ***Delete charted aid. Add present survey aid.***
18	bn 9 (Deering Channel) (Private)	25° 44' 27.95"	80° 12' 28.56"	25° 44' 27.98"	80° 12' 28.59"	2	1	Tagged in GS - Inshore of area of coverage. ***Delete charted aid. Add present survey aid.***
19	Deering Channel Daybeacon 10 (Private)	25° 44' 27.37"	80° 12' 27.38"	25° 44' 28.53"	80° 12' 27.54"	2	6	Tagged in GS - Inshore of area of coverage. ***Delete charted aid. Add present survey aid.***
20	Grove Isle Channel Daybeacon 1 (Private)	25° 44' 34.05"	80° 12' 35.07"					Outside area of lidar coverage. ***Retain as charted***
21	bn 1A (Grove Isle Channel) (Private)	25° 44' 33.62"	80° 12' 35.06"					Outside area of lidar coverage. ***Retain as charted***

No.	Navigation Aid Identifier	Charted Position		Surveyed Position		Lidar Hits	Diff. in Positions (m)	Comments
		NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)	NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)			
22	Gove Isle Channel Daybeacon 2 (Private)	25° 44' 34.38"	80° 12' 35.59"					Outside area of lidar coverage. ***Retain as charted***
23	bn 3 (Grove Isle Channel) (Private)	25° 44' 25.66"	80° 12' 35.85"					Outside area of lidar coverage. ***Retain as charted***
24	bn 4 (Grove Isle Channel) (Private)	25° 44' 26.86"	80° 12' 37.25"					Outside area of lidar coverage. ***Retain as charted***
25	bn 5 (Grove Isle Channel) (Private)	25° 44' 19.25"	80° 12' 44.17"					Outside area of lidar coverage. ***Retain as charted***
26	bn 6 (Grove Isle Channel) (Private)	25° 44' 20.00"	80° 12' 45.00"					Outside area of lidar coverage. ***Retain as charted***
27	bn 7 (Grove Isle Channel) (Private)	25° 44' 10.99"	80° 12' 51.44"			0		Not detected by lidar. Outside of area of accepted coverage. ***Retain as charted***
28	bn 8 (Grove Isle Channel) (Private)	25° 44' 11.79"	80° 12' 51.97"			0		Not detected by lidar. Outside of area of accepted coverage. ***Retain as charted***
29	Grove Isle Channel Light 9 (Private)	25° 44' 08.05"	80° 12' 56.11"			0		Not detected by lidar. Outside of area of accepted coverage. ***Retain as charted***
30	bn 10 (Grove Isle Channel) (Private)	25° 44' 09.60"	80° 12' 55.60"	25° 44' 09.36"	80° 12' 55.50"	2	7	Tagged in GS - Inshore of area of coverage. ***Delete charted aid. Add present survey aid.***
31	bn 11 (Grove Isle Channel) (Private)	25° 44' 09.99"	80° 12' 58.10"					Outside area of lidar coverage. ***Retain as charted***
32	bn 12 (Grove Isle Channel) (Private)	25° 44' 10.85"	80° 12' 57.05"					Outside area of lidar coverage. ***Retain as charted***

No.	Navigation Aid Identifier	Charted Position		Surveyed Position		Lidar Hits	Diff. in Positions (m)	Comments
		NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)	NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)			
33	bn 13 (Grove Isle Channel) (Private)	25° 44' 13.46"	80° 13' 00.99"					Outside area of lidar coverage. ***Retain as charted***
34	bn 14 (Grove Isle Channel) (Private)	25° 44' 13.89"	80° 13' 00.38"					Outside area of lidar coverage. ***Retain as charted***
35	bn 15 (Grove Isle Channel) (Private)	25° 44' 14.99"	80° 13' 03.22"					Outside area of lidar coverage. ***Retain as charted***
36	bn 16 (Grove Isle Channel) (Private)	25° 44' 15.93"	80° 13' 03.37"					Outside area of lidar coverage. ***Retain as charted***
37	Grove Isle Channel Daybeacon 18 (Private)	25° 44' 15.60"	80° 13' 08.40"					Outside area of lidar coverage. ***Retain as charted***
38	L'Hermitage Light 1 (Private)	25° 43' 57.68"	80° 13' 22.13"					Outside area of lidar coverage. ***Retain as charted***
39	bn 2 (L'Hermitage) (Private)	25° 43' 58.70"	80° 13' 21.00"					Outside area of lidar coverage. ***Retain as charted***
40	bn 3 (L'Hermitage) (Private)	25° 44' 00.00"	80° 13' 23.60"					Outside area of lidar coverage. ***Retain as charted***
41	bn 4 (L'Hermitage) (Private)	25° 43' 59.97"	80° 13' 22.75"					Outside area of lidar coverage. ***Retain as charted***
42	bn 5 (L'Hermitage) (Private)	25° 44' 01.34"	80° 13' 25.84"					Outside area of lidar coverage. ***Retain as charted***
43	L'Hermitage Daybeacon 6 (Private)	25° 44' 02.40"	80° 13' 24.60"					Outside area of lidar coverage. ***Retain as charted***
44	Dinner Key Seaplane Channel Approach Light 2	25° 43' 15.27"	80° 12' 30.00"	25° 43' 14.92"	80° 12' 29.74"	8	13	***Delete charted aid. Add present survey aid unless other data proves otherwise.***

No.	Navigation Aid Identifier	Charted Position		Surveyed Position		Lidar Hits	Diff. in Positions (m)	Comments
		NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)	NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)			
45	Dinner Key Seaplane Channel Daybeacon 1 (Private)	25° 43' 08.84"	80° 12' 43.89"			0		Not detected by lidar. ***Retain as charted***
46	Dinner Key Seaplane Channel Daybeacon 2 (Private)	25° 43' 14.43"	80° 12' 44.19"			0		Not detected by lidar. ***Retain as charted***
47	Dinner Key Seaplane Channel Daybeacon 3 (Private)	25° 43' 15.94"	80° 13' 00.12"			0		Not detected by lidar. ***Retain as charted***
48	Dinner Key Seaplane Channel Daybeacon 4 (Private)	25° 43' 20.68"	80° 12' 58.34"			0		Not detected by lidar. ***Retain as charted***
49	Dinner Key Seaplane Channel Daybeacon 5 (Private)	25° 43' 22.16"	80° 13' 14.55"	25° 43' 22.33"	80° 13' 14.33"	4	8	***Delete charted aid. Add present survey aid.***
50	Dinner Key Seaplane Channel Daybeacon 6 (Private)	25° 43' 25.51"	80° 13' 12.27"	25° 43' 25.57"	80° 13' 12.07"	2	6	***Delete charted aid. Add present survey aid.***
51	Dinner Key Seaplane Channel Daybeacon 7 (Private)	25° 43' 29.54"	80° 13' 26.40"	25° 43' 29.52"	80° 13' 26.21"	5	5	Tagged in GS - Inshore of area of coverage. ***Delete charted aid. Add present survey aid***
52	Dinner Key Seaplane Channel Daybeacon 8 (Private)	25° 43' 32.94"	80° 13' 24.19"			0		Not detected by lidar. Outside of area of accepted coverage. ***Retain as charted***
53	Dinner Key Channel Light 1	25° 42' 48.00"	80° 12' 38.35"	25° 42' 48.02"	80° 12' 38.04"	19	9	***Retain as charted***
54	Dinner Key Channel Daybeacon 2	25° 42' 51.46"	80° 12' 40.09"	25° 42' 51.35"	80° 12' 39.95"	2	5	***Retain as charted***
55	Dinner Key Channel Daybeacon 3	25° 42' 58.28"	80° 12' 56.84"			0		Not detected by lidar. ***Retain as charted***
56	Dinner Key Channel Daybeacon 4	25° 42' 58.00"	80° 12' 54.54"	25° 42' 58.13"	80° 12' 54.13"	2	12	***Retain as charted***

No.	Navigation Aid Identifier	Charted Position		Surveyed Position		Lidar Hits	Diff. in Positions (m)	Comments
		NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)	NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)			
57	Dinner Key Channel Daybeacon 5	25° 43' 03.13"	80° 13' 07.64"	25° 43' 03.48"	80° 13' 07.71"	5	11	***Retain as charted***
58	Dinner Key Channel Daybeacon 6	25° 43' 08.37"	80° 13' 17.45"	25° 43' 08.72"	80° 13' 14.84"	3	74	***Delete charted aid. Add present survey aid unless other data proves otherwise.***
59	Dinner Key Channel Daybeacon 7	25° 43' 10.62"	80° 13' 22.39"	25° 43' 10.66"	80° 13' 22.44"	2	2	***Retain as charted***
60	Four Way Entrance Channel Light 2 (Private)	25° 42' 25.86"	80° 13' 20.05"			0		Not detected by lidar. ***Retain as charted***
61	Four Way Entrance Channel Daybeacon 3 (Private)	25° 42' 26.71"	80° 13' 27.08"			0		Not detected by lidar. ***Retain as charted***
62	Four Way Entrance Channel Daybeacon 4 (Private)	25° 42' 29.81"	80° 13' 29.10"			0		Not detected by lidar. ***Retain as charted***
63	Beacon, special purpose / general (Notice Mark)	25° 43' 44.62"	80° 09' 17.54"			0		Not detected by lidar. ***Retain as charted***
64	Beacon, special purpose / general (Notice Mark)	25° 43' 40.45"	80° 09' 36.53"			0		Not detected by lidar. ***Retain as charted***
65	Crandon Park Marina South Channel Daybeacon 2 (Private)	25° 43' 20.56"	80° 09' 28.97"	25° 43' 19.19"	80° 09' 27.59"	2	57	***Delete charted aid. Add present survey aid.***
66	Crandon Park Marina South Channel Daybeacon 4 (Private)	25° 43' 15.36"	80° 09' 29.06"	25° 43' 15.57"	80° 09' 27.00"	4	58	***Delete charted aid. Add present survey aid.***
67	bn 1 (Private)	25° 42' 58.42"	80° 10' 37.41"	25° 42' 53.59"	80° 10' 38.99"	6	156	***Delete charted aid. Add present survey aid.***
68	bn 2 (Private)	25° 42' 46.94"	80° 10' 35.11"	25° 42' 45.35"	80° 10' 37.64"	4	86	***Delete charted aid. Add present survey aid.***

No.	Navigation Aid Identifier	Charted Position		Surveyed Position		Lidar Hits	Diff. in Positions (m)	Comments
		NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)	NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)			
69	bn 3 (Private)	25° 42' 59.86"	80° 10' 26.59"	25° 42' 59.13"	80° 10' 25.02"	4	49	***Delete charted aid. Add present survey aid.***
70	bn 4 (Private)	25° 42' 53.04"	80° 10' 20.43"	25° 42' 52.56"	80° 10' 20.23"	3	16	***Delete charted aid. Add present survey aid.***
71	bn 5 (Private)	25° 43' 05.19"	80° 10' 15.31"	25° 43' 05.12"	80° 10' 14.54"	3	22	***Delete charted aid. Add present survey aid.***
72	bn 6 (Private)	25° 43' 01.35"	80° 10' 11.54"	25° 43' 01.05"	80° 10' 11.11"	6	15	***Delete charted aid. Add present survey aid.***
73	bn 7 (Private)	25° 43' 13.60"	80° 10' 06.19"	25° 43' 13.42"	80° 10' 05.39"	3	23	***Delete charted aid. Add present survey aid.***
74	bn 8 (Private)	25° 43' 09.67"	80° 10' 01.87"	25° 43' 09.83"	80° 10' 01.59"	4	9	***Delete charted aid. Add present survey aid.***
75	Crandon Park Marina Channel Daybeacon 9 (Private)	25° 43' 20.85"	80° 09' 57.38"	25° 43' 21.51"	80° 09' 56.53"	2	31	***Delete charted aid. Add present survey aid.***
76	Crandon Park Marina Channel Daybeacon 10 (Private)	25° 43' 18.06"	80° 09' 52.70"	25° 43' 18.23"	80° 09' 52.61"	2	6	***Delete charted aid. Add present survey aid.***
77	bn 11 (Private)	25° 43' 30.01"	80° 09' 47.45"	25° 43' 29.91"	80° 09' 47.40"	2	3	***Delete charted aid. Add present survey aid.***
78	bn 12 (Private)	25° 43' 26.56"	80° 09' 43.53"	25° 43' 25.92"	80° 09' 42.75"	9	30	***Delete charted aid. Add present survey aid.***
79	bn 13 (Private)	25° 43' 36.48"	80° 09' 32.80"	25° 43' 35.84"	80° 09' 33.48"	7	28	***Delete charted aid. Add present survey aid.***
80	bn 14 (Private)	25° 43' 34.49"	80° 09' 34.35"	25° 43' 34.85"	80° 09' 34.57"	11	13	***Delete charted aid. Add present survey aid.***
81	bn 15 (Private)	25° 43' 33.80"	80° 09' 31.32"			0		Not detected by lidar. ***Retain as charted***
82	bn 16 (Private)	25° 43' 32.67"	80° 09' 32.85"	25° 43' 32.09"	80° 09' 32.48"	3	21	***Delete charted aid. Add present survey aid.***

No.	Navigation Aid Identifier	Charted Position		Surveyed Position		Lidar Hits	Diff. in Positions (m)	Comments
		NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)	NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)			
83	Crandon Park Marina Channel Daybeacon 17 (Private)	25° 43' 31.54"	80° 09' 28.79"	25° 43' 31.62"	80° 09' 29.23"	1	13	***Delete charted aid. Add present survey aid.***
84	Biscayne Bay Danger Shoal Light	25° 42' 34.65"	80° 10' 58.57"	25° 42' 34.60"	80° 10' 58.54"	4	2	***Retain as charted***
85	Key Biscayne Yatch Club Channel Light 1	25° 42' 05.04"	80° 11' 00.07"	25° 42' 04.95"	80° 11' 00.02"	5	3	***Retain as charted***
86	Beacon 4, lateral (Private)	25° 42' 00.64"	80° 10' 14.15"	25° 41' 59.49"	80° 10' 13.59"	3	39	***Delete charted aid. Add present survey aid.***
87	Key Biscayne Yatch Club Channel Light 3	25° 41' 51.30"	80° 10' 27.70"	25° 41' 51.54"	80° 10' 27.69"	6	7	***Retain as charted***
88	Hurricane Harbour Light 2	25° 41' 19.81"	80° 10' 37.15"	25° 41' 19.75"	80° 10' 37.10"	7	2	***Retain as charted***
89	Southwest Shoal Daybeacon	25° 41' 27.90"	80° 11' 00.06"	25° 41' 27.93"	80° 11' 00.09"	4	4	***Retain as charted***
90	Beacon, special purpose / general (Notice Mark)	25° 41' 19.01"	80° 09' 20.57"	25° 41' 23.78"	80° 09' 19.84"	4	148	***Delete charted aid. Add present survey aid unless other data proves***
91	Beacon, special purpose / general (Notice Mark)	25° 42' 16.63"	80° 09' 05.09"			0		Not detected by lidar. ***Retain as charted***
92	Beacon, special purpose / general (Notice Mark)	25° 42' 20.40"	80° 09' 01.09"			0		Not detected by lidar. ***Retain as charted***
93	Beacon, special purpose / general (Notice Mark)	25° 42' 26.08"	80° 09' 01.79"			0		Not detected by lidar. ***Retain as charted***
94	Beacon, special purpose / general (Notice Mark)	25° 42' 30.37"	80° 08' 58.68"			0		Not detected by lidar. ***Retain as charted***
95	Beacon, special purpose / general (Notice Mark)	25° 42' 34.52"	80° 08' 55.23"			0		Not detected by lidar. ***Retain as charted***
96	BCN			25° 43' 52.62"	80° 09' 58.38"	4		Possible Beacon detected by lidar. ***No changes to chart.***

No.	Navigation Aid Identifier	Charted Position		Surveyed Position		Lidar Hits	Diff. in Positions (m)	Comments
		NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)	NAD83 Latitude N (DMS)	NAD83 Longitude W (DMS)			
97	BCN (Dinner Key Seaplane Channel)			25° 43' 19.87"	80° 13' 02.95"	2		Possible Beacon detected by lidar. Could be Dinner Key Seaplane Channel Daybeacons 3 or 4. ***No changes to chart.***
98	BCN (Dinner Key Seaplane Channel)			25° 43' 15.68"	80° 12' 57.31"	5		Possible Beacon detected by lidar. Could be Dinner Key Seaplane Channel Daybeacons 3 or 4. ***No changes to chart.***

Table 3: H11870 Aids to Navigation

D.1.4 Charted Depths and Features

Registry number H11870 lies over part of NOAA charts ***11451,*** 11465 and 11468, in the vicinity of Virginia Key and Key Biscayne. From the Source Diagrams, the area covered by H11870 was covered by NOS surveys between 1900 and 1939, presumably by lead line, and between 1990 and 1998, probably using an echo sounder. In both instances, partial bottom coverage was achieved. The chart in this area appears to be well surveyed, with the coastline being well portrayed. ***Concur.***

The area surveyed is represented by the BASE Surface and S-57 feature file in considerably more detail than is currently shown on the chart. The following general recommendations are relevant:

a. Coastline. The charted coastline agrees fairly well with the surveyed coastline. The surveyed coastline differs from the charted position by a maximum of 40m along one section of Key Biscayne. Numerous buildings and cultural features, differing types of artificial coastline, the presence of mangroves, along with the small tidal range made the delineation of the MHW line difficult in some areas. It is recommended that the coastline on the chart be amended to match the LADS surveyed and extrapolated MHW line. Do not concur. ***Concur with conditions. See also Evaluation Report.***

b. Inshore Islets. 4 surveyed islets within Sheet H11870 have previously been charted. ***Concur with conditions. See also Evaluation Report..***

c. Rocks. The seafloor covering H11870 was generally undulating with some areas exhibiting many seabed objects. No drying rocks were identified for the area covered by this sheet. Where a significant difference in depth existed between the chart and the BASE Surface, a sounding or rock was placed in the S-57 feature file and was referenced in the Chart Comparison Spreadsheet in Section D.1.6. ***Concur.***

D.1.5 Detailed Chart Comparison

In addition to the general recommendations above, 20 specific differences between the chart and the LADS survey have been identified and are described in Section D.1.6. An expanded version of the spreadsheet is included digitally on the USB hard drive (H11870_ChartComp.xls). A CARIS .hob file containing just the chart comparison items has also been compiled and is provided as part of survey deliverables (H11870_ChartComp.hob). The attribution methodology for this file is presented below:

S-57 Object Class	S-57 Object Acronym	Geometry	Description	Attribute 1	Attribute 2	Attribute 3	Attribute 4
Built-up Area	BUAARE	P	Used as a placeholder to store information relating to the chart comparison	OBJNAM (used for storing a unique chart comparison ID)	INFORM (used for storing the charting recommendation)	NINFOM (used for storing a reference to a Feature for Investigation)	PICREP (used for storing a link to GS screen captures)

The chart comparison was conducted by reviewing the chart and the LADS survey deliverable. For each item identified, screen dumps of the Local Area Display and Raw Waveform Display were extracted from the LADS Mk II GS.
These have been reviewed in order to make the following assessments:

a. Type of Feature
b. Least Depth Found
c. Charting Recommendation
d. Remarks

When the least depth has been adequately surveyed by lidar, the LDF Column is populated with a 'Y' for yes. The charting recommendation for a feature that has an adequately surveyed least depth will be either 'Insert' for a new feature, 'Replace' for an amendment to an existing charted feature or 'Remove' for a disproved charted feature.

When the least depth has NOT been found by lidar (populated with an 'N'), the chart comparison number has been used as the identifier within the S-57 feature file that contains the features for examination. If a chart comparison item had previously been identified as a feature for examination during data processing, a reference is made in the 'Remarks' column to the S-57 feature for examination item.

Each chart comparison was categorized as follows:

1. New shoal found
2. Charted shoal disproved / not found

The fields in the Chart Comparison Spreadsheet have been developed from experience learned and feedback received from previous lidar surveys in Alaska, witnessing survey operations aboard NOAA ship Rainier, from meetings at PHB and UNH and the 2007 NOAA Field Procedures Workshop. They have been designed for ease of use and to minimize double handling of data and transcription. Continued feedback is welcomed in order to develop these formats to achieve further efficiencies in data handling.

D.1.6 Chart Comparison Spreadsheet ***Concur with clarification. *See also Evaluation Report.***

			CHARTED			SURVEYED							
Sequence No	**Shoal No**	**Category**	**Charted Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Surveyed Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Type of Feature**	**Full Coverage**	**Least Depth Found**	**Charting Recommendation**	**Remarks** **All items covered by 2.5x2.5m laser spot spacing at 100% lidar coverage.**
1	C1	1				3.85	25° 42' 26.9"	80° 7' 31.62"	Rk	Y	Y	Insert	See Danger to Navigation Report. Item 1. Submitted following field operations. Note: 4.5m Rk has been inserted on chart. ***Concur. See Evaluation Report Section D.1.1.a.***
2	C2	2	5.4	25° 45' 10.79"	80° 7' 51.82"	3.03	25° 45' 9.79"	80° 7' 53.11"	Rk	Y	Y	Replace	***Update chart with present survey data***
3	C3	2	6.4	25° 44' 25.92"	80° 7' 12.89"	5.30	25° 44' 27.17"	80° 7' 11.01"	Rk	Y	Y	Replace	***Chart shoal 17 ft sounding***
4	C4	1				3.59	25° 44' 42.71"	80° 7' 46.4"	Rk	Y	Y	Insert	***Delete charted sewer and add present survey sewer unless other data proves otherwise.***
5	C5	1				1.26	25° 44' 6.45"	80° 11' 41.95"	Rk	Y	Y	Insert	***Chart shoal 4 ft sounding***
6	C6	2	2.7	25° 44' 16.61"	80° 10' 40.18"					Y	Y	Remove	Note: Charted 2.7m sounding charted twice on adjacent ENCs (US5FL21M, US5FL22M). ***Update charts with present survey data.***
7	C7	1				0.40	~~25° 44' 7.64"~~ ***25-44-07.64N***	~~80° 8' 37.34"~~ ***080-08-37.34W***	*Sndg*	Y	Y	Insert	***Chart 1ft sounding***
8	C8	1	5.1							Y	Y	Remove	Note: Charted 5.1m sounding charted twice on adjacent ENCs (US5FL21M, US5FL22M). ***Update charts with present survey data.***

Shoal Categories
1-New Shoal Found
2-Charted Shoal Disproved / Not Found

			CHARTED			SURVEYED							
Sequence No	**Shoal No**	**Category**	**Charted Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Surveyed Depth (meters)**	**NAD83 Latitude N (DMS)**	**NAD83 Longitude W (DMS)**	**Type of Feature**	**Full Coverage**	**Least Depth Found**	**Charting Recommendation**	**Remarks** **All items covered by 2.5x2.5m laser spot spacing at 100% lidar coverage.**
9	C9	2	Wreck	25° 43' 1.42"	80° 11' 59.77"		25° 43' 1.42"	80° 11' 59.77"	Slope	Y	Y	Remove	Note: Not detected by lidar. ***Concur. Retain charted wreck.***
10	C10	1				5.07	25° 42' 39.2"	80° 7' 15.17"	Rk	Y	Y	Insert	***Chart shoal 16 ft sounding***
11	C11	1				5.62	25° 42' 15.88"	80° 7' 11.15"	Rk	Y	N	Insert	Possible detection of small object on seabed. Refer to FEC6. ***See Section D.1.5.b of the Evaluation Report.***
12	C12	2	6.4	25° 42' 19.44"	80° 7' 21.79"	5.27	25° 42' 21.07"	80° 7' 21.78"	Rk	Y	Y	Replace	***Update charts with present survey data.***
13	C13	1				5.06	25° 42' 14.19"	80° 7' 23.8"	Rk	Y	N	Insert	Shoaler depth may exist on this small seabed object. ***Update charts with present survey data.***
14	C14	1				4.12	25° 42' 23.1"	80° 7' 38.5"	Rk	Y	Y	Insert	***Update charts with present survey data.***
15	C15	1				4.12	25° 42' 29.98"	80° 7' 46.18"	Rk	Y	Y	Insert	***Update charts with present survey data.***
16	C16	2	5.1	25° 42' 22.44"	80° 7' 48.07"	3.71	25° 42' 20.77"	80° 7' 51.26"	Rk	Y	Y	Replace	***Chart shoal 12ft sounding***
17	C17	2	4.8	25° 42' 7.32"	80° 8' 31.86"	3.38	25° 42' 9.37"	80° 8' 33.36"	Rk	Y	Y	Replace	***Chart shoal 11 ft sounding***
18	C18	2	3.9	25° 41' 47.99"	80° 10' 27.55"	2.51	25° 41' 47.31"	80° 10' 28.15"	Rk	Y	Y	Replace	***Chart shoal 8 ft sounding***
19	C19	2	5.7	25° 43' 14.71"	80° 7' 24.94"	4.66	25° 43' 15.05"	80° 7' 22.1"	Rk	Y	Y	Replace	***Chart shoal 15 ft sounding***
20	C20	2	6.4	25° 45' 13.7"	80° 7' 18.95"	5.32	25° 45' 12.95"	80° 7' 20.46"	Rk	Y	Y	Replace	***Do not chart – 17 ft sounding exists in charted Spoil Area***

Table 4: Chart Comparison Spreadsheet

Shoal Categories
1-New Shoal Found
2-Charted Shoal Disproved / Not Found

D.2 ADDITIONAL RESULTS

D.2.1 Supplemental Information for Boatwork

For the H11870 survey, the supplemental information for further boatwork was compiled by defining the seaward limit of good lidar seabed coverage as a M_COVR, CATCOV=1 polygon. ***Concur.***

D.2.1.1 Seaward Limit of Lidar Coverage

The lidar coverage across H11870 is fairly consistent with a few turbidity gaps and a number of expansive very shallow water gaps due to the SEZ in the vicinity of Virginia Key and Key Biscayne. This is reflected by the extents of, and gaps within, the BASE Surface.

In particular, the areas of poor lidar seabed coverage include:

N of Marine Stadium, at position 25°44' 40" N, 80°10' 07" W, due to turbidity.

N of Marine Stadium, at position 25°44' 58" N, 80°09' 55" W, due to the SEZ.

N of Northwest Point, at position 25°43' 44" N, 80°08' 57" W, due to the SEZ.

N and S of West Point, at positions 25°42' 49" N, 80°10' 07" W, and 25°42' 12" N, 80°10' 08" W, due to the SEZ. Concur.

When planning multibeam junctioning with lidar seabed coverage, the NALL and the following must be taken into consideration:

Lidar derived MHW line, MLLW line.

Shallow features detected by lidar.

Features for examination.

'Unsurveyed' polygons due to poor water clarity, the SEZ, glassy seas, and boats. Concur.

These are all provided in the S-57 feature file (US511870.000) for H11870.

The areas of good lidar seabed coverage include:

E of Virginia Key.

E of Key Biscayne.

Within Biscayne Bay in water deeper than 2m. Concur.

The seaward limit of good lidar data coverage has been described by the S-57 feature object M_COVR in the S-57 feature file (US511870.000).

D.2.1.2 Lidar Features Requiring Further Investigation

A list of uncertain lidar soundings was collated during data processing and is presented in a CARIS *.hob file. ***This is not part of final processed data.***

Tagging in the GS was used to flag features for which the least depth has not been found. Typically this meant that there were less than 4 supporting soundings, within 0.5 – 1.0m of the depth, on the primary and overlapping lines. These tags were then exported from the GS and compiled in CARIS BASE Editor. Features for examination have been captured within the H11870_Inv.hob as BUAARE feature objects. Where these features correlate with an item listed in the Chart Comparison Spreadsheet, a reference has been made in the H11870_Inv.hob file. The S-57 attribution methodology for lidar features requiring further investigation is presented below:

S-57 Object Class	S-57 Object Acronym	Geometry	Description	Attribute 1	Attribute 2	Attribute 3
Built-up Area	BUAARE	P	Used as a placeholder to store information relating to the item for further investigation	OBJNAM (used for storing a unique feature for investigation ID)	INFORM (used for storing a reference to a chart comparison, where applicable)	PICREP (used for storing a link to GS screen captures)

Refer to Section B.4.4 for the descriptions of the GS tagging philosophy used for all lidar seabed coverage gaps and recommended features for investigation.

In circumstances where least depth has not been found over a significant feature, a recommendation for investigation by boat for 6 uncertain soundings has been made in the CARIS H11870_Inv.hob file. All features in the chart comparison that have not had least depth adequately surveyed also appear in this file. ***These should be retained as charted and are in the ENC Retain file.***

D.2.1.3 Recommended Junctioning with Unsurveyed Lidar Areas

The 'unsurveyed' gaps in lidar seabed coverage are defined as polygons in the S-57 feature file. They were constructed utilizing the export of the operator assigned gap tags described in Section B.4.4. In the case of 'unsurveyed' areas for the SEZ and glassy seas, junctioning is not recommended for the obvious risks to surface vessels. ***Concur.***

D.2.1.4 Comparison with prior Surveys

Comparison with prior surveys was not required under this Task Order. See Section D.1 for comparison to the nautical charts. ***Concur.***

D.2.2 Summary of Charting Actions and Investigations – H11870

D.2.2.1 Summary of Charting Actions – H11870

Total number of new significant islets recommended for insertion on chart: 0
Total number of new significant drying rocks recommended for insertion on chart: 0
Total number of new significant rocks awash recommended for insertion on chart: 0
Total number of new significant rocks recommended for insertion on chart: 9
Total number of charted features disproved by lidar (Remove): 3
Total number of charted features recommended for amendment by lidar (Replace): 8
Total number of chart comparison items requiring further investigation: 0

Total number of DTONs submitted to AHB during data acquisition: 1
Total number of DTONs submitted to AHB during data processing: 0
Total number of DTONs submitted to AHB for H11870: 1

D.2.2.2 Summary of Lidar Features Requiring Further Investigation – H11870

Total number of investigations recommended during data processing: 5
Total number of investigations recommended from chart comparison compilation: 1
Total number of recommended feature investigations: 6

E. APPROVAL SHEET

LETTER OF APPROVAL – OPR-H328-KRL-08

This report and the accompanying LADS survey deliverables are respectfully submitted.

Field operations contributing to the accomplishment of this survey were conducted under my direct supervision with frequent personal checks of progress and adequacy. This report and the accompanying LADS survey deliverables have been closely reviewed and are considered complete and adequate as per the Statement of Work.

Report	Submission Date
Descriptive Report – H11870	May 18, 2009

Mark Sinclair
Hydrographer
Tenix LADS, Incorporated

Date: May 18, 2009

APPENDIX I – DANGERS TO NAVIGATION

DTONS Submitted to AHB

I.1.1 Danger to Navigation Report

Hydrographic Survey Registry Number: H11870

State: Florida

Locality: Approaches to Miami

Sub-locality: Virginia Key to Key Biscayne

Project Number: OPR-H328-KRL-08

Survey Dates: July – August, 2008

Depths are in meters and reduced to Mean Lower Low Water using final verified tides. Drying heights are in meters relative to MLLW. Islets are related to MHW. Positions are based on the NAD83 horizontal datum. All times and dates are relative to UTC.

Number	Edition	Date	Scale
US5FL21M	11th	2/11/2008	1:40,000
US5FL22M	18th	3/13/2008	1:40,000

The following items were found during hydrographic survey operations:

No.	Feature	Depth (m)	Latitude (N)	Longitude (W)	Time, Date, Year	Investigate
1	Rk	3.85	25° 42' 26.9"	80° 7' 31.62"	07:55:51, July 17, 2008	No

COMMENTS: Final verified tides have been applied from the Virginia Key tide gauge (8723214). The Rk was found using LIDAR. DTON item 1 was submitted following data collection.

Questions concerning this report should be directed to the Survey Manager, Mr. Scott Ramsay, in the Tenix LADS Inc. office in Biloxi MS. at (228) 594 6800.

DTONS Submitted to MCD

I.1.2 Danger to Navigation Report

H11870 DtoN #1

Registry Number: H11870
State: Florida
Locality: Approaches to Miami
Sub-locality: To be Determined
Project Number: OPR-H328-KRL-08-TE
Survey Date: 07/17/2008

Charts Affected

Number	Edition	Date	Scale (RNC)	RNC Correction(s)*
11465	38th	11/01/2007	1:40,000 (11465_1)	USCG LNM: 07/29/2008 (01/13/2009) NGA NTM: 08/14/1999 (01/24/2009)
11467	41st	06/01/2008	1:40,000 (11467_6)	[L]NTM: ?
11466	37th	08/01/2005	1:80,000 (11466_1)	[L]NTM: ?
11451	33rd	09/01/2007	1:495,362 (11451_17) 1:495,362 (11451_16) 1:80,000 (11451_1)	[L]NTM: ?
11469	8th	12/01/2007	1:100,000 (11469_1)	[L]NTM: ?
11460	40th	09/01/2005	1:466,940 (11460_1)	[L]NTM: ?
11013	47th	02/01/2008	1:1,200,000 (11013_1)	[L]NTM: ?
411	52nd	09/01/2007	1:2,160,000 (411_1)	[L]NTM: ?

* Correction(s) - *source: last correction applied (last correction reviewed--"cleared date")*

Features

No.	Name	Feature Type	Survey Depth	Survey Latitude	Survey Longitude	AWOIS Item
1.1	12-ft Rock 1.1	Rock	3.80 m	25° 42' 26.9" N	080° 07' 31.5" W	---

Generated by Pydro v8.7 (r2586) on Thu Jan 29 18:43:31 2009 [UTC]

1 - Danger To Navigation

1.1) GP No. - 1 from H11870_DtoN#1.xls

DANGER TO NAVIGATION

Survey Summary

Survey Position:	25° 42' 26.9" N, 080° 07' 31.5" W
Least Depth:	3.80 m (= 12.47 ft = 2.078 fm = 2 fm 0.47 ft)
TPU (±1.96σ):	**THU (TPEh)** [None] ; **TVU (TPEv)** [None]
Timestamp:	2008-199.07:55:51.000 (07/17/2008)
GP Dataset:	H11870_DtoN#1.xls
GP No.:	1
Charts Affected:	11465_1, 11467_6, 11451_1, 11466_1, 11469_1, 11460_1, 11451_16, 11451_17, 11013_1, 411_1

Remarks:

Depths are in meters and reduced to Mean Lower Low Water using final verified tides. Drying heights are in meters relative to MLLW. Islets are related to MHW. Positions are based on the NAD83 horizontal datum. All times and dates are relative to UTC.

Final verified tides have been applied from the Virginia Key tide gauge (8723214). The shoals were found using LIDAR. DTON items 1 was submitted following field operations.

Feature Correlation

Address	Feature	Range	Azimuth	Status
H11870_DtoN#1.xls	1	0.00	000.0	Primary

Hydrographer Recommendations

Recommend charting 12-ft Rock.

Cartographically-Rounded Depth (Affected Charts):

12ft (11465_1, 11467_6, 11451_1, 11466_1, 11451_16, 11451_17)

2fm (11460_1, 11013_1, 411_1)

2fm 0ft (11469_1)

S-57 Data

Geo object 1: Underwater rock / awash rock (UWTROC)

Page 3

H11870 DtoN #1 1 - Danger To Navigation

Attributes:

QUASOU - 1:depth known
SORDAT - 20080717
SORIND - US,US,survy,H11870
TECSOU - 7:found by laser
VALSOU - 3.8 m
VERDAT - 12:Mean lower low water
WATLEV - 3:always under water/submerged

Office Notes

This danger submission is preliminary. No data has been provided to AHB for verification. Feature will be reviewed and verified once the survey data has been submitted.

Feature Images

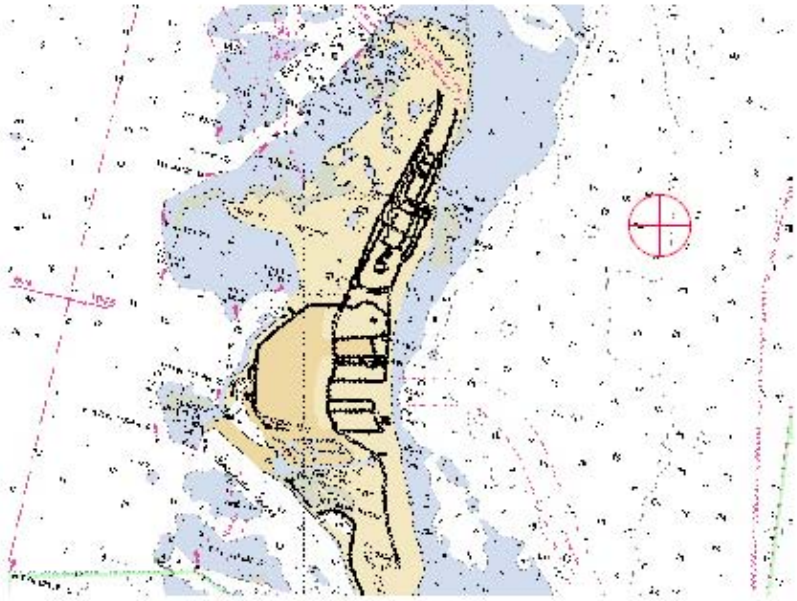

Figure 1.1.1

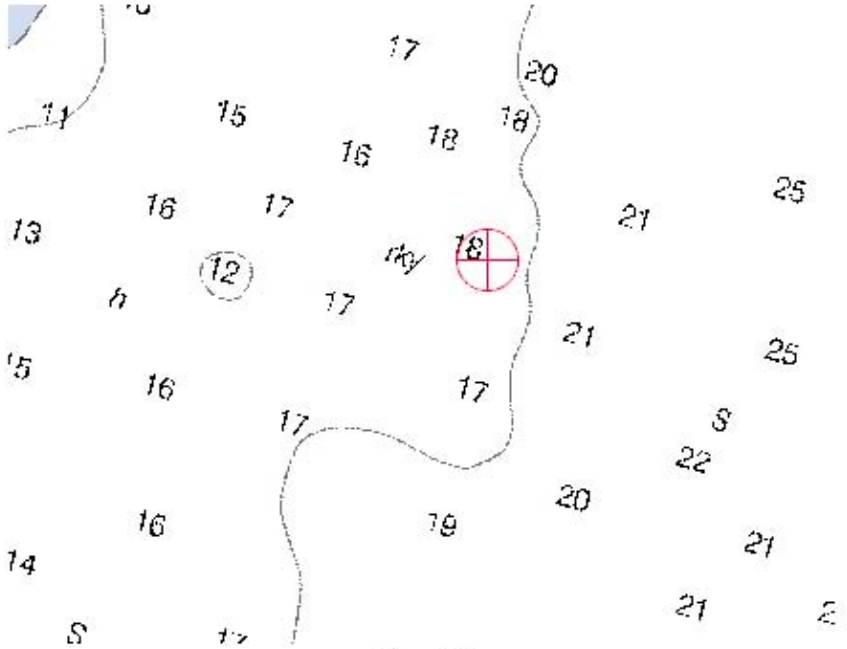
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Figure 1.1.2

H11870 DtoN #1

Registry Number: H11870

State: Florida

Locality: Approaches to Miami

Sub-locality: Virginia Key to Key Biscayne

Project Number: OPR-H328-KRL-08-TE

Survey Date: 07/17/2008

Charts Affected

Number	Edition	Date	Scale (RNC)	RNC Correction(s)*
11465	38th	11/01/2007	1:40,000 (11465_1)	USCG LNM: 07/29/2008 (01/13/2009) NGA NTM: 08/14/1999 (01/24/2009)
11467	41st	06/01/2008	1:40,000 (11467_6)	[L]NTM: ?
11466	37th	08/01/2005	1:80,000 (11466_1)	[L]NTM: ?
11451	33rd	09/01/2007	1:495,362 (11451_17) 1:495,362 (11451_16) 1:80,000 (11451_1)	[L]NTM: ?
11469	8th	12/01/2007	1:100,000 (11469_1)	[L]NTM: ?
11460	40th	09/01/2005	1:466,940 (11460_1)	[L]NTM: ?
11013	47th	02/01/2008	1:1,200,000 (11013_1)	[L]NTM: ?
411	52nd	09/01/2007	1:2,160,000 (411_1)	[L]NTM: ?

* Correction(s) - *source: last correction applied (last correction reviewed--"cleared date")*

Features

No.	Name	Feature Type	Survey Depth	Survey Latitude	Survey Longitude	AWOIS Item
1.1	12-ft Rock 1.1	Rock	3.80 m	25° 42' 26.9" N	080° 07' 31.5" W	---

1 - Danger To Navigation

1.1) GP No. - 1 from H11870_DtoN#1.xls

DANGER TO NAVIGATION

Survey Summary

Survey Position: 25° 42' 26.9" N, 080° 07' 31.5" W

Least Depth: 3.85 m (= 12.63 ft = 2.105 fm = 2 fm 0.63 ft)

TPU (±1.96σ): **THU (TPEh)** [None] ; **TVU (TPEv)** [None]

Timestamp: 2008-199.07:55:51.000 (07/17/2008)

GP Dataset: H11870_DtoN#1.xls

GP No.: 1

Charts Affected: 11465_1, 11467_6, 11451_1, 11466_1, 11469_1, 11460_1, 11451_16, 11451_17, 11013_1, 411_1

Remarks:

Depths are in meters and reduced to Mean Lower Low Water using final verified tides. Drying heights are in meters relative to MLLW. Islets are related to MHW. Positions are based on the NAD83 horizontal datum. All times and dates are relative to UTC.

Final verified tides have been applied from the Virginia Key tide gauge (8723214). The shoals were found using LIDAR. DTON items 1 was submitted following field operations.

Feature Correlation

Address	Feature	Range	Azimuth	Status
H11870_DtoN#1.xls	1	0.00	000.0	Primary

Hydrographer Recommendations

Recommend charting 12-ft Rock.

Cartographically-Rounded Depth (Affected Charts):

12ft (11465_1, 11467_6, 11451_1, 11466_1, 11451_16, 11451_17)

2fm (11460_1, 11013_1, 411_1)

2fm 0ft (11469_1)

S-57 Data

Geo object 1: Underwater rock / awash rock (UWTROC)

Attributes:

QUASOU - 1:leastdepth known
SORDAT - 20080717
SORIND - US,US,nsurf,H11870
TECSOU - 7:found by laser
VALSOU - 3.85 m
VERDAT - 12:Mean lower low water
WATLEV - 3:always under water/submerged

Office Notes

Concur with clarification. See Evaluation Report Section D.1.1. for final recommendations.

Feature Images

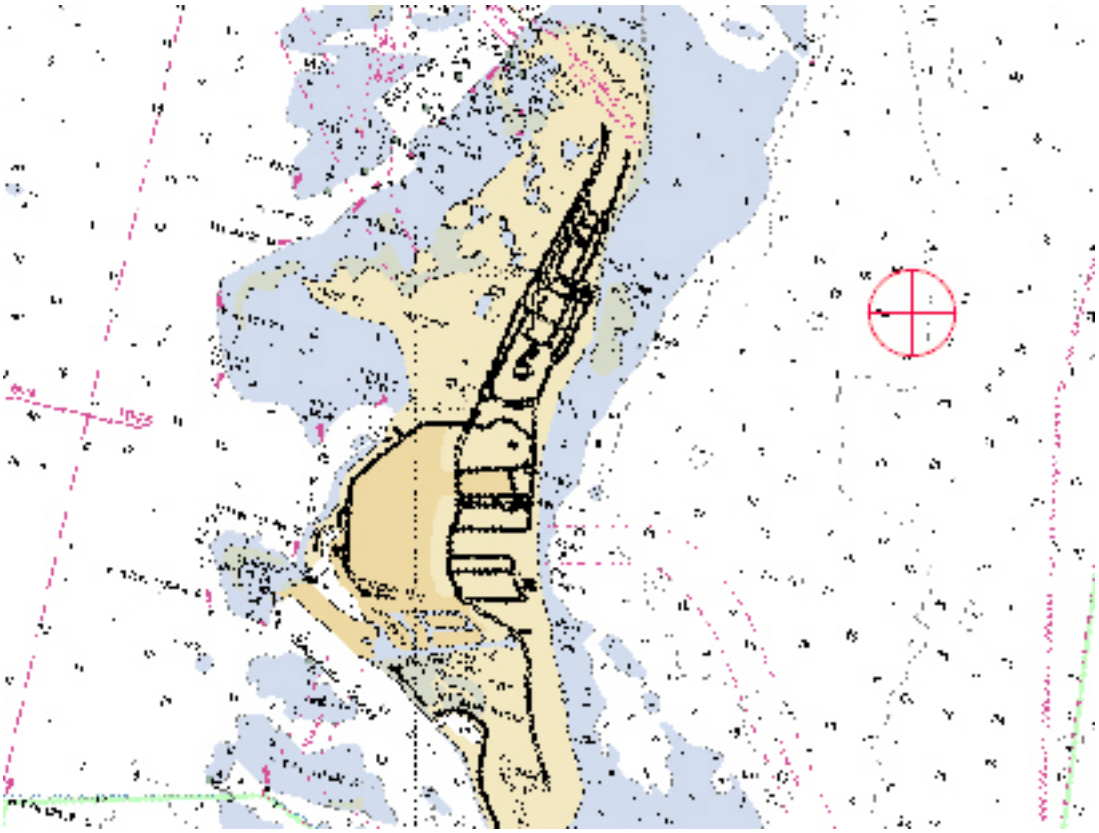

Figure 1.1.1

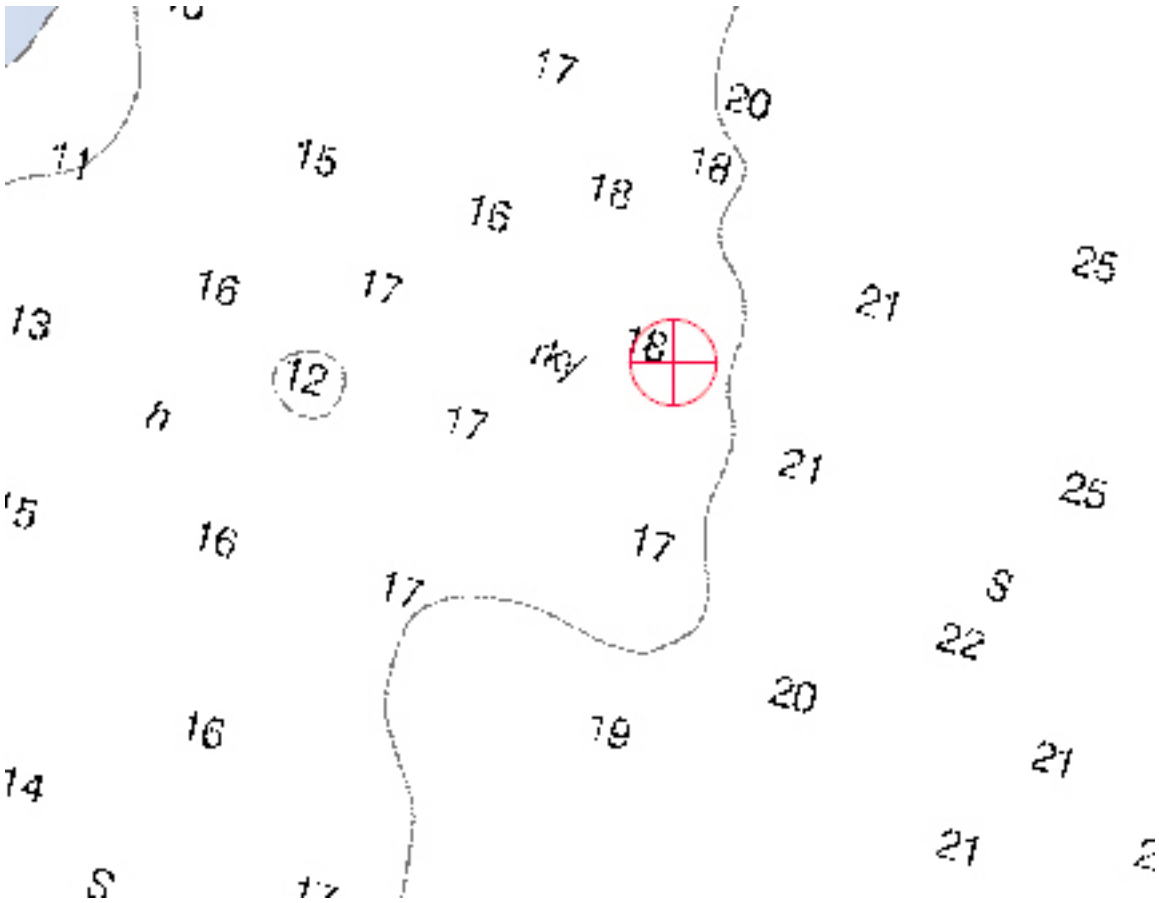
17
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Figure 1.1.2

APPENDIX II – SURVEY FEATURE REPORT

No AWOIS were assigned to this task order.

APPENDIX III – FINAL PROGRESS SKETCH

FINAL PROGRESS SKETCH

July 13 – August 26, 2008

OPR-H328-KRL-08
Approaches to Miami, FL

Tenix LADS Inc.
Scott Ramsay, Project Manager

The Tenix LADS aircraft arrived in Fort Lauderdale on July 12, 2008, during a temporary suspension of operations in support of OPR-O190-KRL-08. The site mobilization was undertaken during the following day. The first survey flight was conducted in the OPR-H328-KRL-08 project area on July 14, 2008. A total of twenty-one survey flights were flown in the Approaches to Miami, FL project area during July and August. Operations were temporarily suspended on July 27, 2008, in order to conduct a sortie for Broward County. Demobilization of the site was conducted on August 26, 2008 and the aircraft departed Fort Lauderdale for Ketchikan, to complete OPR-O190-KRL-08 operations, on August 27, 2008.

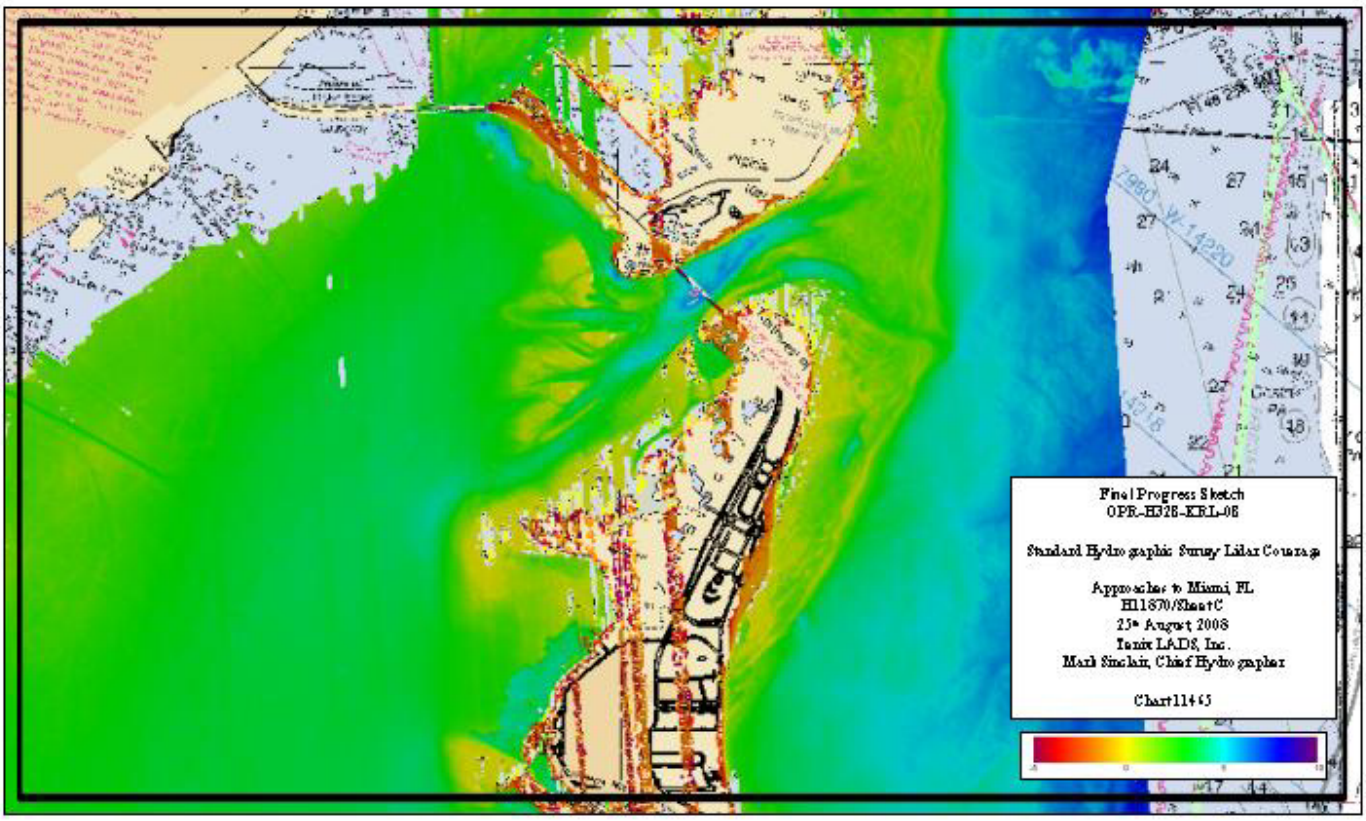
Of the 21 survey flights, 14 were deemed fully effective. The remaining sorties were aborted prematurely for adverse environmental conditions in the survey area, such as low cloud, glassy seas or poor water clarity, or due to system problems. Following some early aborts from the project area, when weather conditions were suitable to the North, the Broward County survey was completed. All flight and on task times reported below are calculated for the Approaches to Miami, FL project only.

The total area covered is 63 SNM, from the Mean High Water line to the limits of the survey area, at 2.5m laser spot spacing, 100% coverage.

OPR-H328-KRL-08	July	August	Total 2008	Total Budgeted	% Budgeted
Days on project	18	26	44	30	147%
Days mob / demob	1	1	2	2	100%
Survey flights	9	12	21	12	175%
No flight - weather	2	3	5	-	-
No flight – pilot hours	6	10	16	-	-
Linear nautical miles flown	1365	3235	4600	3828	120%
Area surveyed (NM^2)	20 *	43 *	63 *	55 **	115%
Aircraft flown hours	41:20	66:46	108:06	72:00	150%
Aircraft on task hours	32:08	58:02	90:10	57:30	157%
Hours lost to weather	1:06	0:00	1:06	-	-
Hours lost to system	2:11	0:22	2:33	-	-

Effective flights conducted	14	12	117%
Average time on task per effective flight	5:45	5:16	109%
Survey lines flown	628	506	124%

*Area surveyed value derived from CARIS BASE Surface at Aug 25, from MHWL to survey limits
** Total planned area sourced from OPR-H328-KRL-08 Statement of Work, Attachment #2



Progress Sketch OPR-H328-KRL-08: Lidar Coverage – H11870 at August 25, 2008

APPENDIX IV – TIDES AND WATER LEVELS

Abstract of Times of Hydrography

Start and End times refer to tidal applications requirement.

Time on Task indicates actual time of task in the survey area. All times and dates are in UTC.

08_4fl

Date	JD	Sortie	Start Time	End Time	Tide Duration	Time on Task
15-Jul-08	197	2	0200	1000	8:00	4:32
17-Jul-08	199	3	0200	1000	8:00	5:26
20-Jul-08	202	4	0200	0606	4:06	1:58
21-Jul-08	203	5	0200	0606	4:06	1:54
23-Jul-08	205	6	0200	1100	9:00	5:42
24-Jul-08	206	7	0200	1100	9:00	1:33
27-Jul-08	209	8	0100	1000	9:00	1:03
29-Jul-08	211	9	0100	1000	9:00	3:40
01-Aug-08	214	10	0100	1100	10:00	6:29
02-Aug-08	215	11	0100	1100	10:00	6:38
05-Aug-08	218	12	0100	1100	10:00	6:22
07-Aug-08	220	13	0100	1100	10:00	4:36
08-Aug-08	221	14	0100	1048	09:48	5:28
10-Aug-08	223	16	0100	1100	10:00	6:52
14-Aug-08	227	18	0100	1100	10:00	6:15
16-Aug-08	229	19	0100	1100	10:00	0:53
17-Aug-08	230	20	0100	1054	09:54	3:47
18-Aug-08	231	21	0100	1054	09:54	3:20
23-Aug-08	236	23	0100	0954	08:54	3:20
24-Aug-08	237	24	0100	0906	08:06	2:21
25-Aug-08	238	25	0100	1054	09:54	5:35

T I D A L D A T U M S

ELEVATIONS ON STATION DATUM
National Ocean Service (NOAA)

Station: 8723214 T.M.: 0 W
Name: VIRGINIA KEY, BISCAYNE BAY, FL Units: Meters
Status: Accepted Epoch: 1983-2001

Datum	Value	Description
MHHW	3.774	Mean Higher-High Water
MHW	3.752	Mean High Water
DTL	3.432	Mean Diurnal Tide Level
MTL	3.439	Mean Tide Level
MSL	3.431	Mean Sea Level
MLW	3.126	Mean Low Water
MLLW	3.090	Mean Lower-Low Water

APPENDIX V – SUPPLEMENTAL SURVEY RECORDS AND CORRESPONDENCE

FW Proposed modification_to_OPR-H328-KRL-08.txt

From: RAMSAY Scott
Sent: Monday, August 04, 2008 4:11 PM
To: 'David.Scharff'
Cc: SINCLAIR Mark - LADS; GUILFORD James
Subject: RE: Proposed modification to OPR-H328-KRL-08

Dave,

Thanks for considering our recommendation.

Just so we are clear, I don't think it is necessary to completely remove sub area 3 & 4 - just the 15 most inshore lines of both sub areas. A lot of data has already been collected within sub area 3.

I think that we could achieve the Option 1 area you have suggested, and about 1/3 of the area in Option 3, with one new sub area totaling 40 lines and the coverage we have already acquired in the east of the area.

Please see the attached diagram demonstrating the original eastern survey extent (from the SOW), our current coverage with the Option 3 area and the recommended sub area for further collection within the Option 1 area.

I hope this works for NOAA and the OSI contract, and that we can devise a suitable modification to the SOW for the H328 project, that still gets us up to more than 55sqNM lidar coverage.

Regards,
Scott

-----Original Message-----
From: David.Scharff [mailto:David.Scharff@noaa.gov]
Sent: Monday, August 04, 2008 9:41 AM
To: RAMSAY Scott
Cc: SINCLAIR Mark - LADS; GUILFORD James
Subject: Re: Proposed modification to OPR-H328-KRL-08

Scott,

Attached are 3 optional coverage areas in order of priority. You may survey any part of the three areas indicated to replace sub areas 3-4. Please note that overlapping with OSI's assigned project is our lowest priority. Let me know what option you would be interested in pursuing.

FYI - I'm in training downtown all week if you need me I'll be checking my voice/email each morning or you can contact Crescent if you need help.

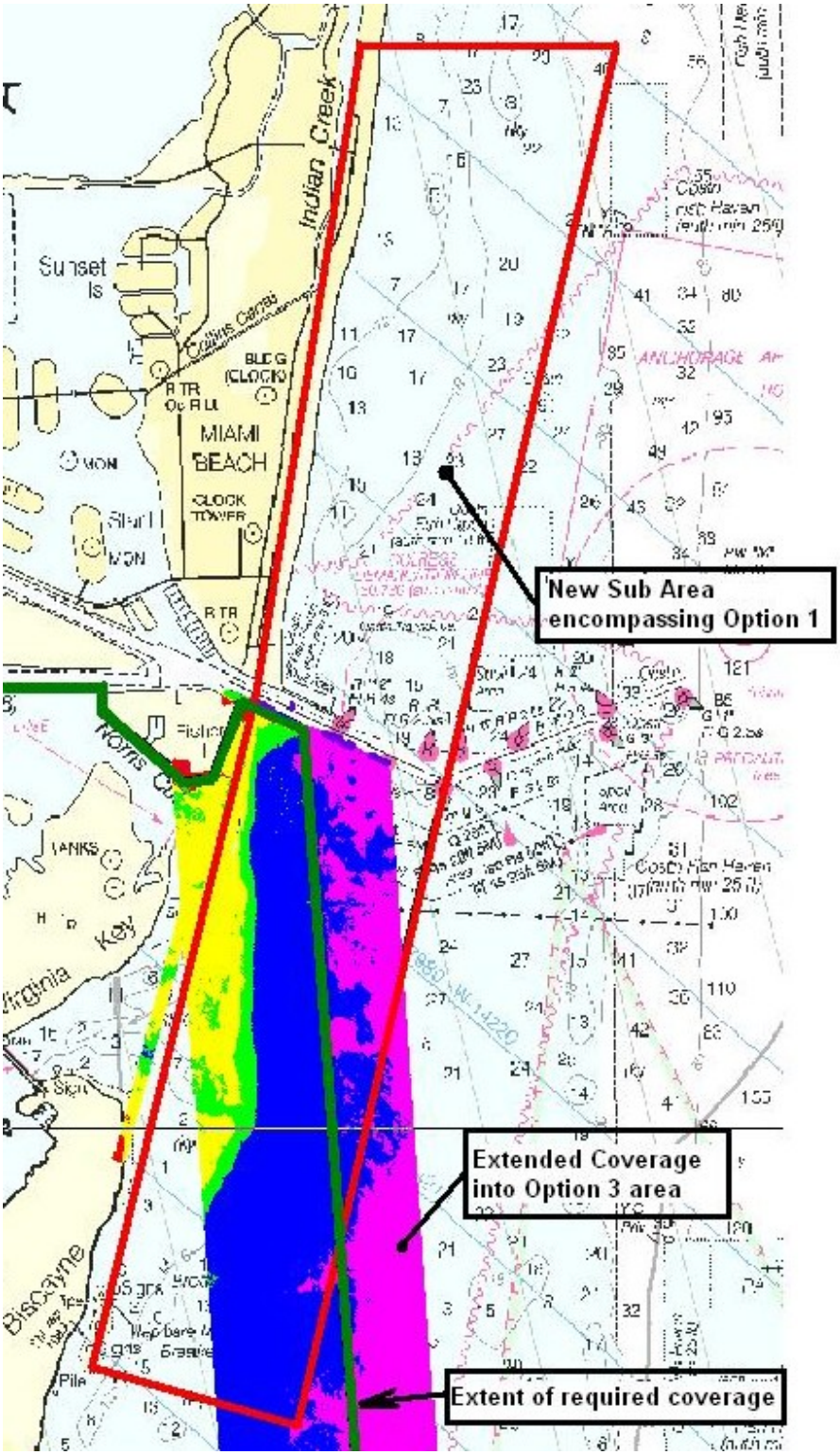
Regards,
Dave

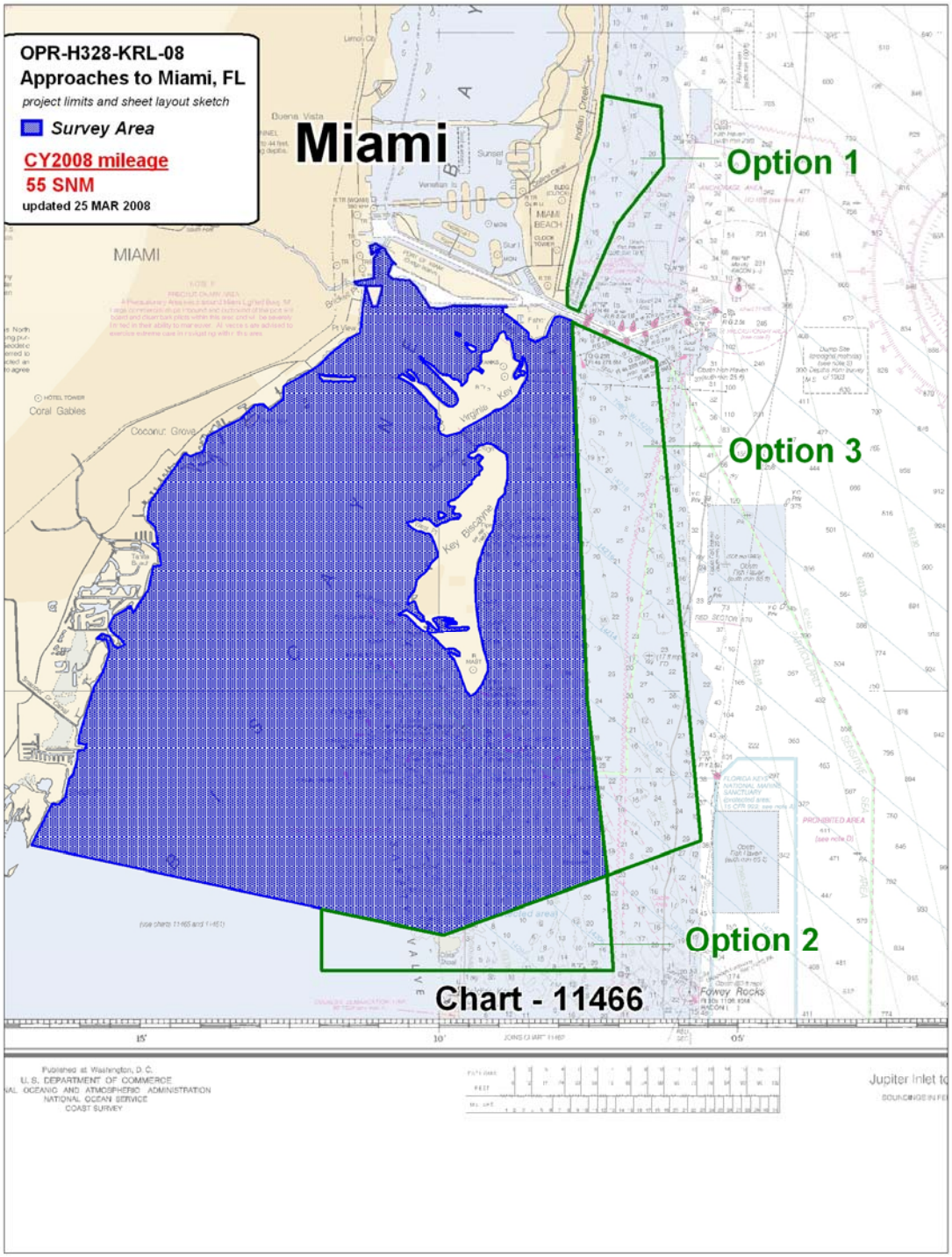
RAMSAY Scott wrote:
>
> Dave,
>
> Following our discussion this morning, attached is an image showing
> the contracted lidar survey sub areas 1-4 and proposed modification to
> areas (in black and dark green).
>
> As you are aware, we have limited capability in the very shallow,
> inshore areas of Biscayne Bay where seagrass is present (indicated as
> black on image in sub area 3 and 4). The coverage has been quite
> sparse throughout these regions, despite flying lines at the highest
> possible tide (tide range is only about 0.8m). At the Eastern edge of
> our area, which is the intended OSI junction line, we are still

Page 1

FW Proposed modification_to_OPR-H328-KRL-08.txt

> surveying 5-10m water depth. This is obviously not a very efficient
> depth for a multibeam platform to be operating in.
>
> I am proposing that lidar coverage across the Florida project area
> would be significantly improved if the "black" areas were removed from
> the required area (15 inshore lines from sub area 3 and 15 lines from
> sub area 4) and an additional 30 lines were planned to the East of the
> Eastern edge of sub area 1, indicated in dark green. This modification
> will actually improve the total SQNM coverage of lidar across the
> project area, as the offshore sub area 1 lines are significantly
> longer than those in sub area 3 and 4. I would propose that we still
> fly investigation lines down the middle of all the channels within sub
> area 3 and 4, as you mentioned this data was important to the survey.
>
> I have also attached coverage plots demonstrating the achieved lidar
> coverage up until July 30. We have had 2 very successful flights since
> this plot was produced, acquiring an additional 90 main scheme lines.
> We are currently about 50% through the required Florida data
> acquisition with the next flight programmed for Monday night.
>
> I look forward to your comments.
>
> Best Regards,
>
> Scott Ramsay
>
> Survey Manager
>
> Tenix LADS, Inc.
>


New Sub Area encompassing Option 1
Extended Coverage into Option 3 area
Extent of required coverage
Indian Creek
Sunset Is
MIAMI BEACH
CLOCK TOWER
Key Biscayne


OPR-H328-KRL-08
Approaches to Miami, FL
project limits and sheet layout sketch
Survey Area
CY2008 mileage
55 SNM
updated 25 MAR 2008
Miami
Option 1
Option 3
Option 2
Chart - 11466
MIAMI
Coral Gables
Coconut Grove
Key Biscayne
Virginia Key
Fowey Rocks
Published at Washington, D.C.
U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SERVICE
COAST SURVEY

Re Modification to SOW OPR-H328-KRL-08 Sub Locality Names.txt
From: David.Scharff [David.Scharff@noaa.gov]
Sent: Thursday, 29 January 2009 12:32 PM
To: RAMSAY Scott
Cc: Edward.Owens@noaa.gov; james.guilford@tenix.com; WEIDMAN Brett; NEWSHAM Wayne; BELL Rachel
Subject: Re: Modification to SOW OPR-H328-KRL-08 Sub Locality Names

Attachments: David_Scharff.vcf

Scott,

Thanks for the update. I have updated our system to reflect the new sub locality information you provided. Unfortunately registry number H11872 has already been assigned to a different project so we can't use it. The new number for sheet "*E*" will be *H12008*, please make the appropriate changes on your end.

Thanks,
Dave

RAMSAY Scott wrote:
> Dave,
>
> Based on the final lidar coverage for OPR-H328-KRL-08 I would propose
> the following sub-locality name modifications from the original SOW,
> for each of the registered sheets:
>
> H11868 (Sheet A) - 76x131cm, 1:10,000
>
> Sub locality: Dinner Key Channel to Shoal Point
>
> H11869 (Sheet B) - 76x131cm, 1:10,000
>
> Sub locality: Miami Beach to Fisher Island
>
> H11870 (Sheet C) - 76x131cm, 1:10,000
>
> Sub locality: Virginia Key to Key Biscayne
>
> H11871 (Sheet D) - 76x131cm, 1:10,000
>
> Sub locality: Biscayne Channel (remains the same)
>
> _Additional Sheet:_
>
> H11872 (Sheet E) - 76x131cm, 1:10,000
>
> Sub locality: Vicinity of Soldier Key
>
> Please let me know if these sub locality names are suitable for us to
> proceed with. For sheet layout and limits see the attached files.
>
> Regards,
> Scott Ramsay
> Survey Manager
> Tenix LADS, Inc.

Page 1

ATLANTIC HYDROGRAPHIC BRANCH
EVALUATION REPORT to ACCOMPANY
SURVEY H11870 (2008)

This Evaluation Report has been written to supplement and/or clarify the original Descriptive Report. Sections in this report refer to the corresponding sections of the Descriptive Report.

B. DATA ACQUISITION AND PROCESSING

B.1 DATA PROCESSING

The following software was used to process data at the Atlantic Hydrographic Branch:

CARIS HIPS/SIPS version 6.1 SP2, HF 7
CARIS Bathy Manager version 2.1.0.0 SP1, HF 1-10
CARIS Bathy Manager version 2.3.0.0 Build 192
CARIS S-57 Composer version 2.1 HF 4
CARIS HOM version 3.3 SP3 HF 8

B.2. QUALITY CONTROL

B.2.1. H-Cell

The AHB source depth grid for the survey's nautical chart update product was a 3m resolution shoal BASE surface derived from the field's original LIDAR 3m*.hns BASE surface. The survey scale soundings were created from the surface at single defined radius of one millimeter at chart scales of 1:10,000, 1:24,000, and 1:40,000. A TIN was created from the survey scale soundings from which an interpolated surface was generated. The chart scale soundings were selected from the filtered interpolated surface using a single defined radius at the 10,000, 24,000, and 40,000 chart scales. The chart scale selected soundings are a subset of the survey scale selected soundings. The surface model was referenced when selecting the chart scale soundings, to ensure that the selected soundings portrayed the bathymetry within the common area.

Depth contours were created from a shifted interpolated TIN surface of 12m resolution. The depth contours are forwarded to MCD for reference only. The contours were utilized during chart scale sounding selection and quality assurance efforts at AHB. The depth contours are incorporated into the SS H-Cell product as per 2009 H-Cell Specifications.

The pre-compilation products or components (Stand Alone HOB files (SAHOB)) are detailed in the Compile Log attached at the end of this document. The SAHOB files included depth areas (DEPARE), depth contours (DEPCNT), sounding selections (SOUNDG), features (BCNLAT, BCNSPP, DAYMAR, HULKES, LIGHTS, PIPSOL, SBDARE, UWTROC), H11870_US4FL27M_US5FL21M_US5FL22M_ENC_ retain (BCNLAT, DAYMAR, LIGHTS, MORFAC, OBSTRN, PILPNT, SBDARE, UWTROC, WEDKLP, WRECKS), Meta objects (M_QUAL, M_COVR, M_CSCL), and cartographic Blue Notes ($CSYMB).

All of the components with the exception of the sounding selection and depth contours were inserted into one feature layer (including the Bluenotes, as dictated by Hydrographic Technical Directive 2008-8, and this layer was exported into S-57 format in order to create the H-Cell deliverable. Similarly, the sounding selection and depth contours were exported into S-57 format separately, and then both S-57 files were processed in CARIS HOM to convert the metric units to feet/fathoms and feet. The final products are two S-57 files, in Lat/Lon NAD-83, one that contains the chart soundings, all the features, Meta objects, and Bluenotes (H11870_CS.000), and one that contains the depth contours, and sounding selection (H11870_SS.000). Finally, quality assurance checks were made utilizing CARIS S-57 Composer version 2.1 validation checks.

Chart compilation was performed by Atlantic Hydrographic Branch personnel in Norfolk, Virginia. Compilation data will be forwarded to Marine Chart Division, Silver Spring, Maryland.

H11870 CARIS H-Cell final deliverables include the following products:

H11870_CS.000	1:10,000 Scale	H11870 H-Cell with Chart Scale Selected Soundings
H11870_SS.000	1:10,000 Scale	H11870 Selected Soundings (Survey Scale)

B.2.2. Junctions

Survey H11870 (2008) junctions with survey H11871 (2008) to the south. There was excellent agreement between the present survey and survey H11871 with all soundings being within a 0-1 foot agreement.

Survey H11870 (2008) junctions with survey H11869 (2008) to the north. There was excellent agreement between the present survey and survey H11869 with all soundings being within a 0-1 foot agreement.

Survey H11870 (2008) junctions with survey H11868 (2008) to the west. There was excellent agreement between the present survey and survey H11868 with all soundings being within a 0-1 foot agreement.

To the east, north of Latitude 25-44-12N, comparison with NOS chart 11468 is poor with present survey depths of as much as 15 feet inside the charted 6 foot contour in the vicinity of Latitude 25-45-00.6789N, Longitude 080-08-00.8822W; depths as shoal as 1 foot in Latitude 25-42-13.2611N, Longitude 080-08-53.1798W and as deep as 16 feet in Latitude 25-45-00N, Longitude 080-08-00.5545W are inside the charted 12 foot contour; depths of 12 feet in Latitude 25-44-42.6273N, Longitude 080-07-46.3936W to 20 feet are inside the charted 18 foot contour, and a few shoal 17 foot depths are outside the charted 18 foot contour in the vicinity of Latitude 25-44-26.2165N, Longitude 080-07-13.1351W.

To the east, south of Latitude 25-44-12N, comparison with NOS chart 11465 is better than with NOS chart 11468. Present survey depths inside the charted 6 foot contour are from 0 to 11 feet. Present survey depths inside the charted 12 foot contour are from 7 to 15 feet. Present survey depths inside the charted 18 foot contour are from 12 to 20 feet.

C. VERTICAL AND HORIZONTAL CONTROL

The OPR-H328-KRL-08 Horizontal and Vertical Control Report (HVCR) was submitted with survey H11870.

D. RESULTS AND RECOMMENDATIONS

D.1 CHART COMPARISON

11468 (41st Edition, May/07)
Miami Harbor
Corrected through NM 5/19/2007
Corrected through LNM 5/15/2007
Scale 1:10,000

11451 (34th Edition, Oct/09)
Miami to Marathon and Florida Bay
Corrected through NM 10/24/2009
Corrected through LNM 10/13/2009
Scale 1:24,000

11465 (38th Edition, Nov./07)
Intracoastal Waterway Miami to Elliot Key
Corrected through NM 11/24/2007
Corrected through LNM 11/20/2007
Scale 1:40,000

ENC Comparison

US5FL22M
Miami Harbor
Edition 21
Application Date 2009-10-28
Issue Date 2009-10-28
Chart 11468

US4FL27M
Miami to Marathon and Florida Bay
Edition 3
Application Date 2009-09-02
Issue Date 2010-01-22
Chart 11451

US5FL21M
Miami to Elliott Key
Edition 15
Application Date 2010-02-02
Issue Date 2010-02-24
Chart 11465

D.1.1. Dangers to Navigation

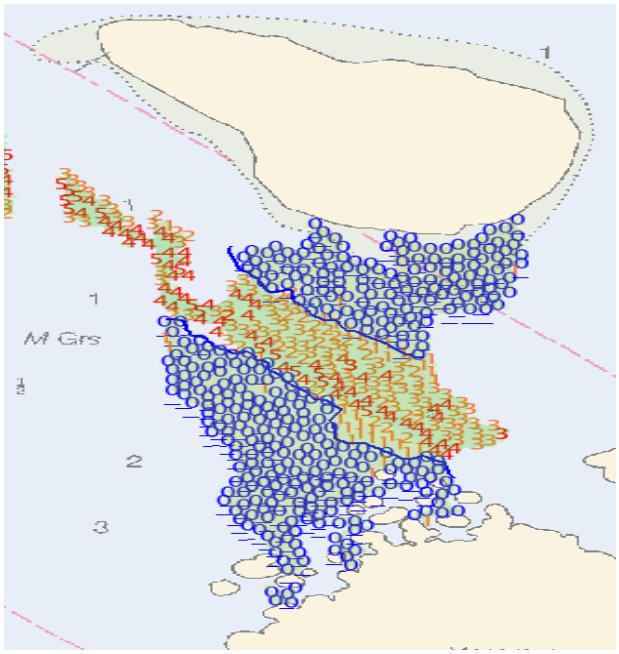
A dangerous underwater rock with a least depth of 3.85 meters (12.631 feet) was found by the present survey and is currently charted on NOS Chart 11465 in Latitude 25-42-26.919N, Longitude 080-07-31.5182W. It is also on ENC US5FL21M in the same location but with a depth of 4.5 meters (14.765 feet). The source of this feature

is the present survey as Danger to Navigation 1, and the correct depth is 12.631 feet. It is recommended that a 12 foot dangerous underwater rock be added to NOS chart 11465 and ENC US5FL21M. It is also recommended that the 14.765 foot dangerous underwater rock in Latitude 25-42-26.900N, Longitude 080-07-31.500W be deleted from ENC US5FL21M.

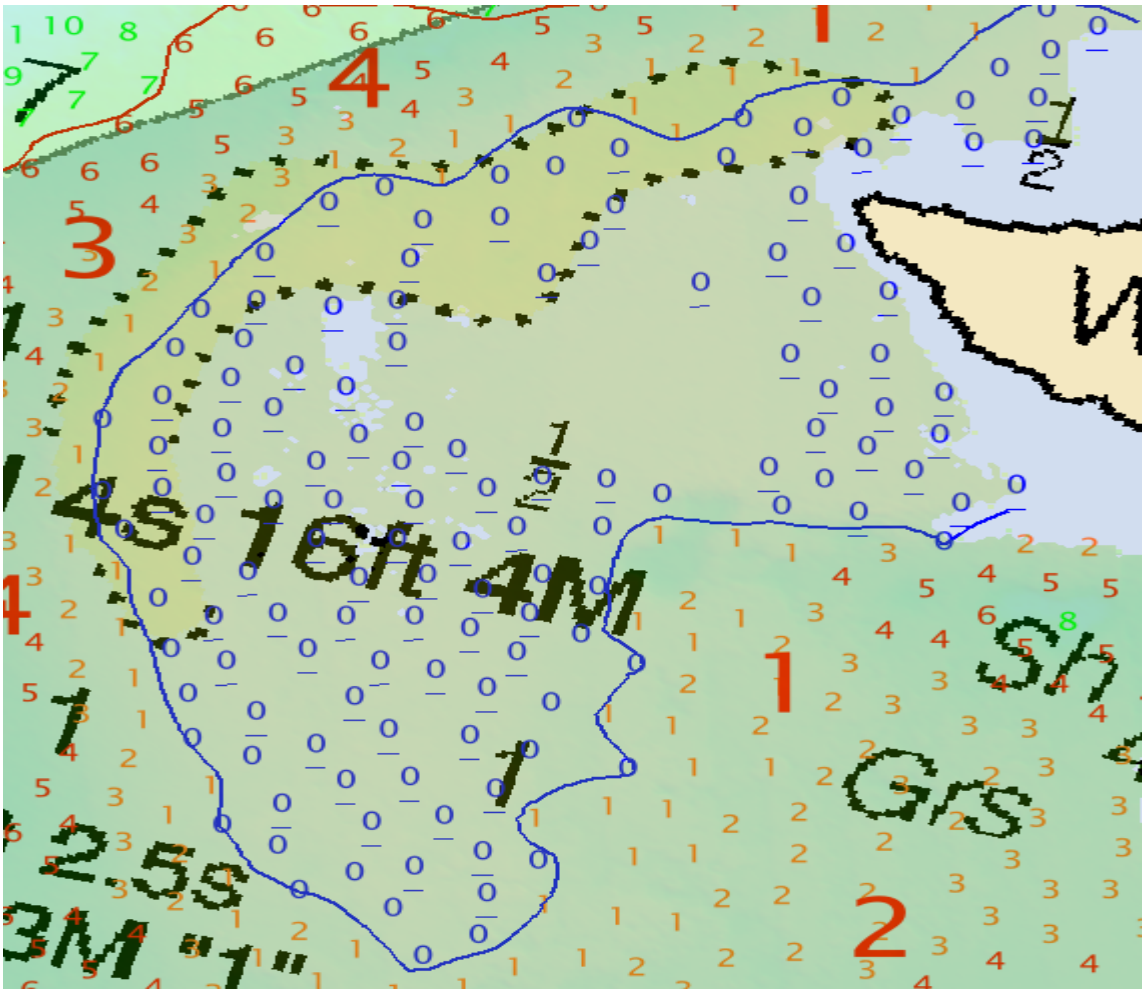
D.1.4. Charted Depths and Features

a.) Coastline

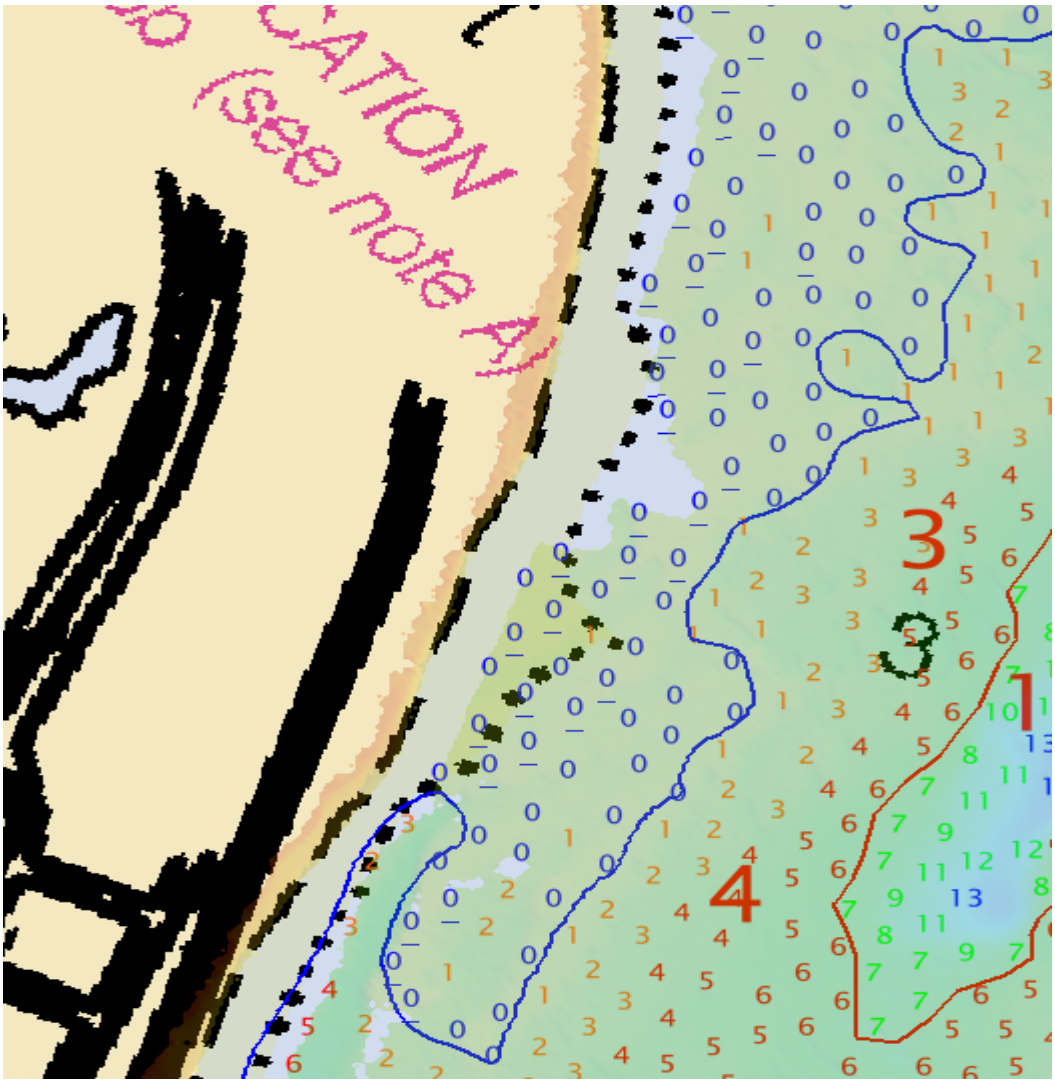
The present survey area has numerous charted intertidal areas. There have been dramatic changes in the charted intertidal areas. All the charted areas have changed drastically and there are many new intertidal areas throughout the survey area. It is recommended that the charted intertidal areas be deleted and new intertidal areas charted according to the present survey data. See examples below:



NOS Chart 11468, vicinity of Latitude 25-45-02.010N, Longitude 080-09-30.7440W



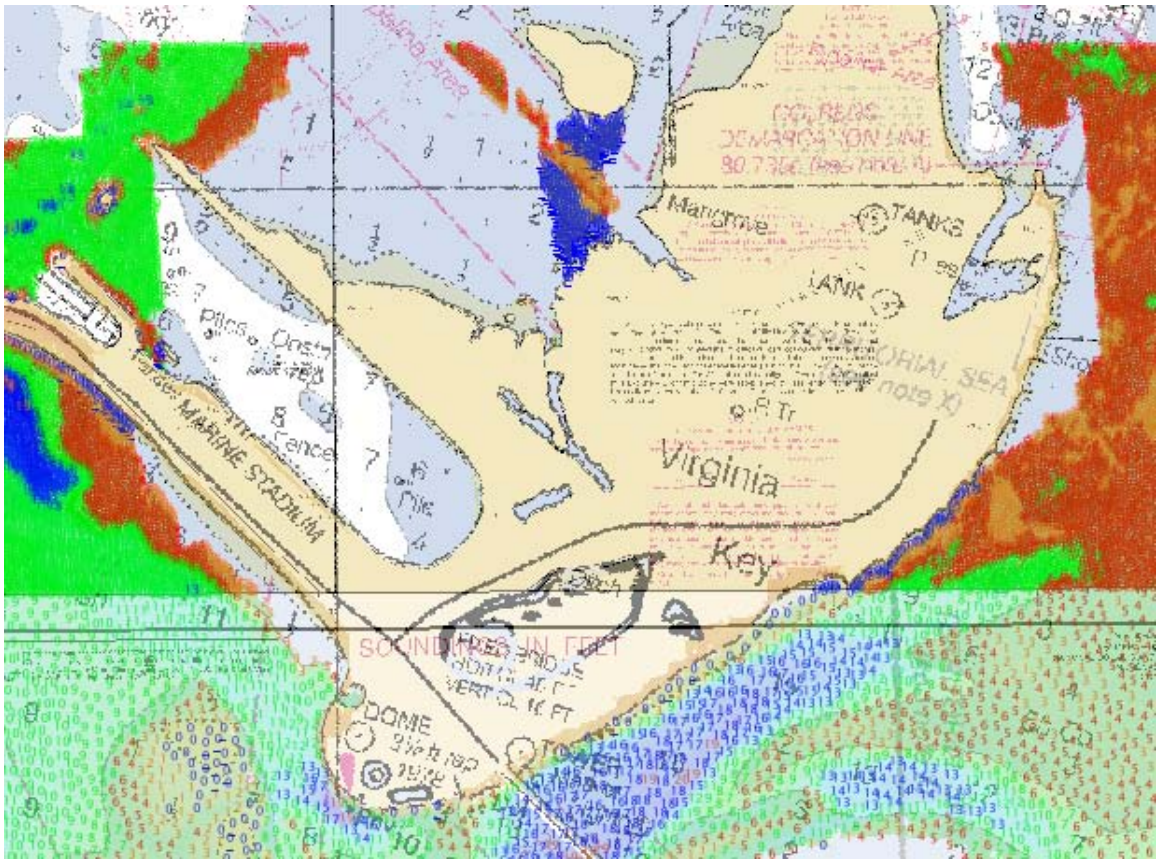
NOS Chart 11465, area west of West Point in the vicinity of Latitude 25-42-29.1319N, Longitude 080-10-43.6927W.



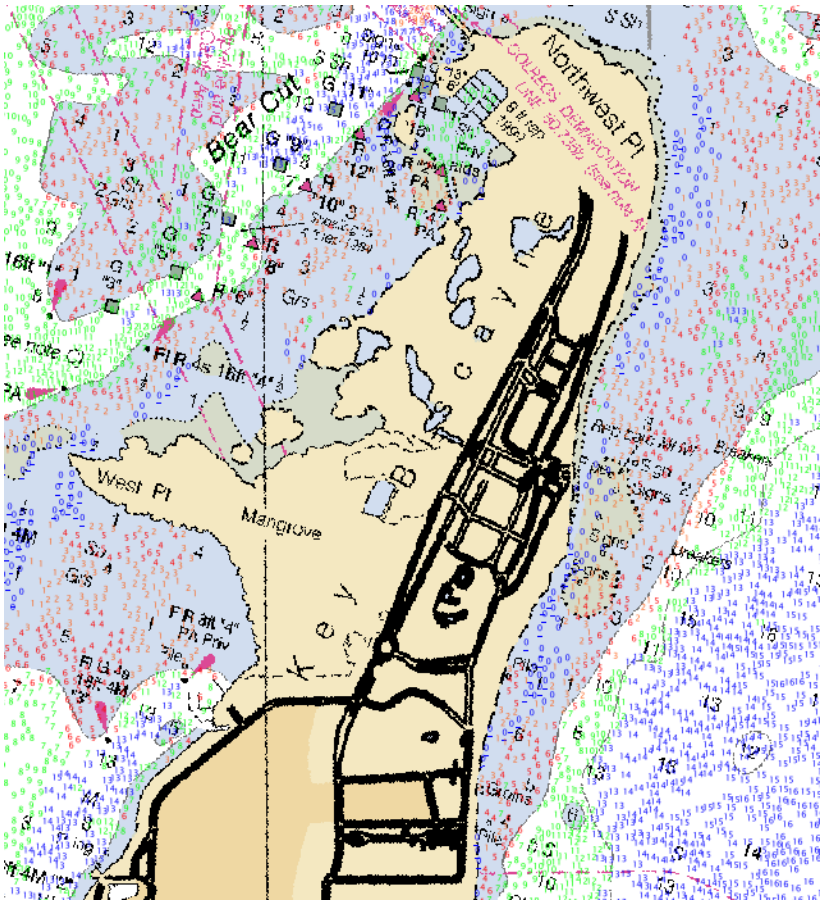
NOS Chart 11465, area east of Key Biscayne in the vicinity of Latitude 25-43-14.6684N, Longitude 080-08-46.3733W.

b.) Inshore Islets

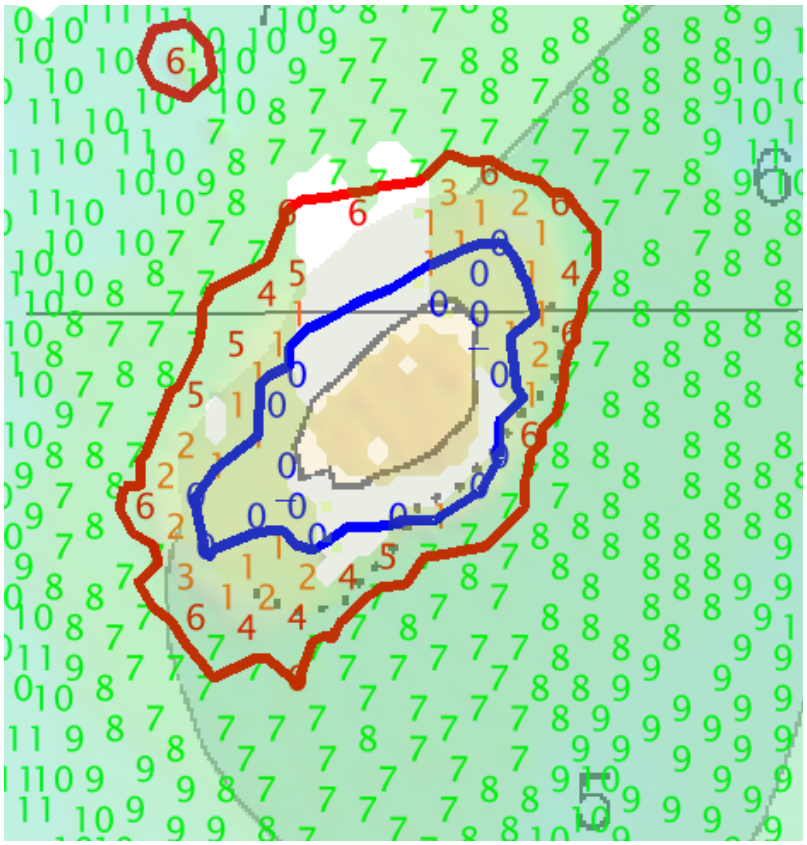
There are six surveyed land areas within the present survey limits. These are Virginia Key, centered in Latitude 25-44-41.-673W, Longitude 080-09-15.8218W; Key Biscayne centered in Latitude 25-42-17.1856W, Longitude 080-09-48.1876W; a land area in Latitude 25-44-59.241W, Longitude 080-10-27.0183W; a land area in Latitude 25-43-27.886W, Longitude 080-09-34.760W; the tip of a land area in Latitude 25-44-42.384W, Longitude 080-10-19.915W; and the tip of a land area in Latitude 25-41-12.3604W, Longitude 080-10-34.5567W. The intertidal area surrounding all of these land areas needs to be revised based on present survey findings.



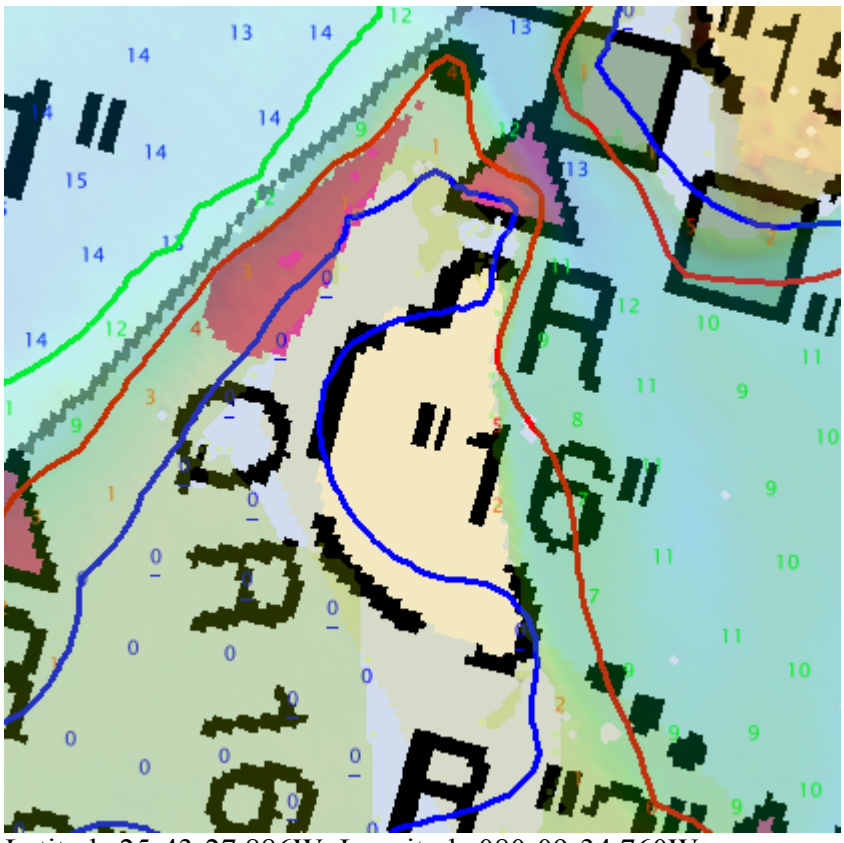
Virginia Key, centered in Latitude 25-44-41.-673W, Longitude 080-09-15.8218W



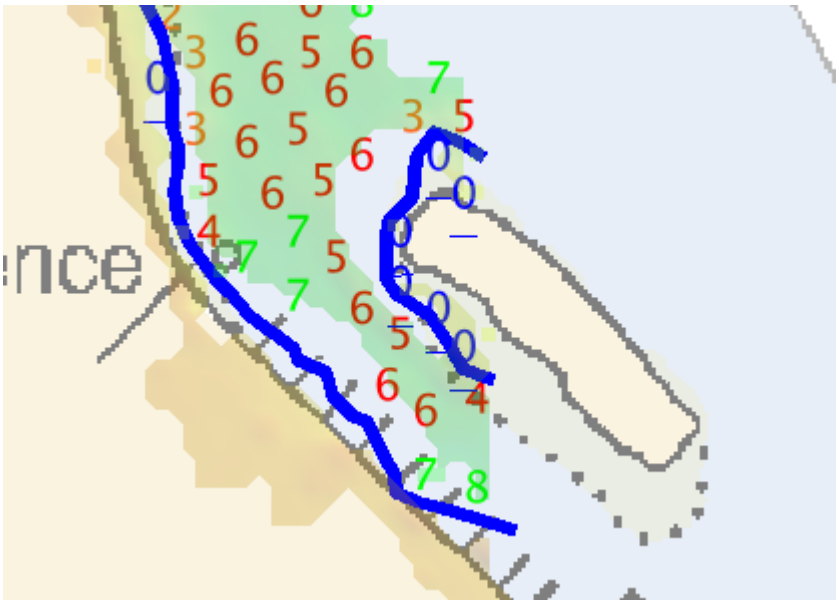
Key Biscayne centered in Latitude 25-42-17.1856W,
Longitude 080-09-08.1876W



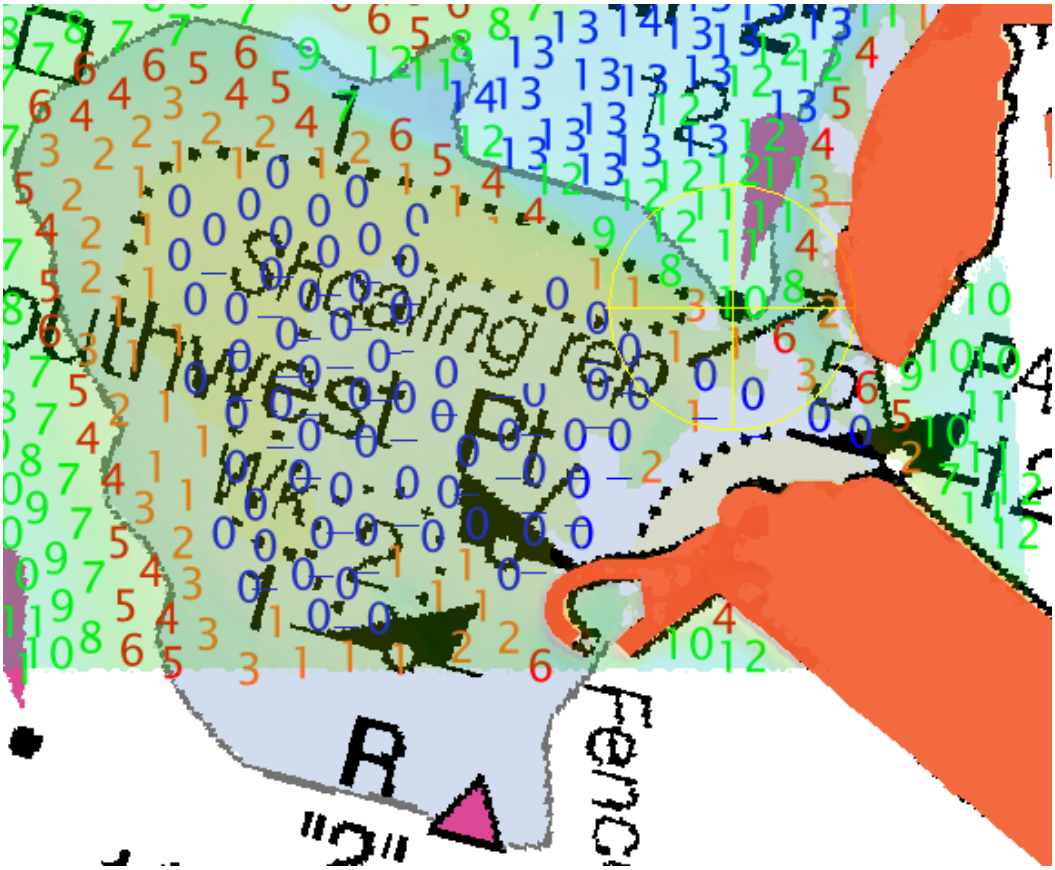
Latitude 25-44-59.241W, Longitude 080-10-27.0183W



Latitude 25-43-27.886W, Longitude 080-09-34.760W



Latitude 25-44-42.384W, Longitude 080-10-19.915W



Latitude 25-41-12.3604W, Longitude 080-10-34.5567W

D.1.5. <u>Detailed Chart Comparison</u>

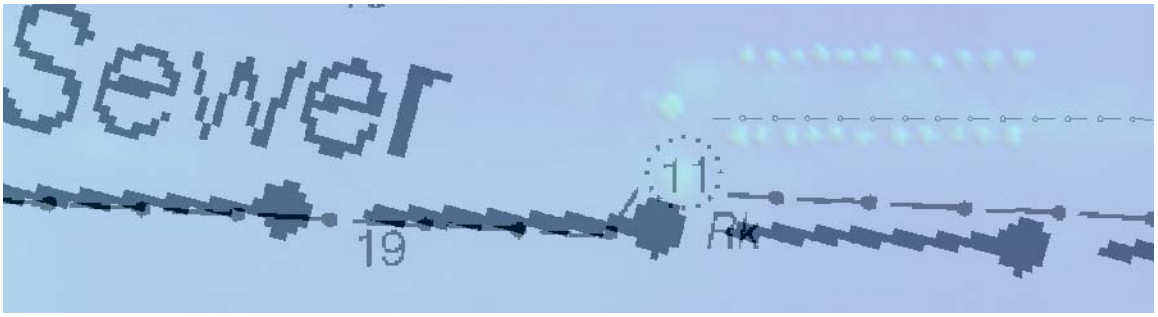
The charted hydrography originates with prior surveys and requires no further consideration. The hydrographer makes adequate chart comparisons in section "D" of the Descriptive Report. The following exceptions are noted:

a.) The following underwater rocks were submitted by the field but were not discussed in the Descriptive Report. They were revised to shoal depths during office verification of the survey.

Feature Submitted	Latitude	Longitude	Depth (Meters)	Remarks
UWTROC	25-41-27.69324N	080-10-51.35736W	2.82	Do not chart
UWTROC	25-41-31.73676N	080-10-34.52124W	3.70	Do not chart
UWTROC	25-41-37.93056N	080-10-30.82008W	2.26	Chart 7 ft sounding
UWTROC	25-41-51.96840N	080-10-14.99340W	1.39	Do not chart
UWTROC	25-41-58.12728N	080-10-11.27532W	2.04	Do not chart
UWTROC	25-42-10.16820N	080-07-41.84400W	4.72	Chart 15 ft sounding
UWTROC	25-42-11.89008N	080-07-32.63088W	4.34	Chart 14 ft sounding
UWTROC	25-42-19.12284N	080-07-34.95612W	4.38	Do not chart
UWTROC	25-42-24.79104N	080-07-49.03680W	4.07	Do not chart
UWTROC	25-42-26.83044N	080-07-40.30860W	4.40	Do not chart
UWTROC	25-43-33.16584N	080-11-03.18948W	2.50	Chart 8 ft sounding
UWTROC	25-44-44.27232N	080-10-58.48356W	2.11	Chart 7 ft sounding
UWTROC	25-45-02.45124N	080-10-29.19792W	1.97	Chart 6 ft sounding
UWTROC	25-45-13.01760N	080-07-00.60672W	6.06	Chart 20 ft sounding
UWTROC	25-45-14.23584N	080-07-23.78460W	5.04	Do not chart – 16 ft sounding exists in a charted Spoil Area

b) Two hulks were detected by the field during the present survey. One hulk is in the vicinity of Latitude 25-45-00.7192N, Longitude 080-10-27.6957W and the other one is in the vicinity of Latitude 25-44-32.7706N, Longitude 080-09-47.2460W. We are recommending that the one in the vicinity of Latitude 25-45-00.7192N, Longitude 080-10-27.6957W be added to the chart as shown from the present survey. We are recommending that the one in Latitude 25-44-32.7706N, Longitude 080-09-47.2460W not be charted because it is located so close to the shoreline and poses no problem for navigation. We are deferring the final decision about the charting of these hulks to the MCD Update Services Branch.

c) The field position the sewer charted as originating in the vicinity of Latitude 25-44-43.4818N, Longitude 080-08-34.8448W and continuing eastward. It is charted correctly from the origination at the above location eastward to just south of the 11 ft dangerous rock in Latitude 25-44-41.7002N, Longitude 080-07-46.30016W. At that point the sewer jogs northeast to where the present survey located the sewer in Latitude 25-44-42.5662N, Longitude 080-07-45.8232W and continues eastward to the eastern limit of the present survey. It is believed that the sewer continues on the present survey track, north of its charted track, to its termination but there is no present survey data to prove this. It is therefore recommended that final decision about the charting of the sewer be deferred to MCD Update Services Branch,



NOS chart 11468 vicinity of Latitude 25-44-41.7002N, Longitude 080-07-46.30016W.

d) Four-Way Channel was partially inside the limits of the present survey. No conflicts exist between the charted least centerline depth and the present survey depths. It is recommended that no changes be made to charted centerline reported depth.

e) Dinner Key Channel was partially inside the limits of the present survey. The charted channel least depth note is 7 ft rep 1998. No conflicts exist between the charted least depth and the present survey depths. It is recommended that no changes be made to the charted depth notation.

f) No conflicts exist between the unnamed channel whose limits are partially inside the present survey in the vicinity of Latitude 25-43-27.891N, Longitude 080-13-19.904W. It is recommended that no changes be made to the charted depth notation.

g) During the present survey, there was no collection of seabed area characteristics; therefore it is recommended that the fifty-two characteristics charted within the present survey limits be retained as charted.

h) This survey was conducted using Lidar Technology. Lidar is not considered accurate enough to disprove charted features. It is therefore recommended that the following charted features within the limits of the present survey be retained as charted:

FEATURE	LATITUDE	LONGITUDE
BCNLAT	25-42-25.85772N	080-13-20.04708W
BCNLAT	25-42-26.71128N	080-13-27.08400W
BCNLAT	25-42-29.81484N	080-13-29.09676W
BCNLAT	25-43-08.84028N	080-12-43.89048W
BCNLAT	25-43-14.42640N	080-12-44.19036W
BCNLAT	25-43-15.93912N	080-13-00.12036W
BCNLAT	25-43-20.68428N	080-12-58.33584W
BCNLAT	25-43-33.80160N	080-09-31.31640W
DAYMAR	25-43-33.80160N	080-09-31.31640W
LIGHTS	25-42-25.85772N	080-13-20.04708W
MORFAC	25-44-49.78968N	080-10-40.33812W
MORFAC	25-44-50.02296N	080-10-41.16216W
MORFAC	25-44-50.42832N	080-10-39.84384W
MORFAC	25-44-50.55864N	080-10-40.72260W
MORFAC	25-44-51.33444N	080-10-40.31076W
MORFAC	25-44-51.42372N	080-10-37.48152W
MORFAC	25-44-51.76032N	080-10-38.16840W
MORFAC	25-44-51.85644N	080-10-36.95988W
MORFAC	25-44-52.31652N	080-10-37.70148W
MORFAC	25-44-52.42632N	080-10-36.43788W
MORFAC	25-44-52.50192N	080-10-39.07488W
MORFAC	25-44-52.92744N	080-10-35.83380W
MORFAC	25-44-52.96200N	080-10-37.17948W
MORFAC	25-44-52.98936N	080-10-38.25084W
MORFAC	25-44-53.31192N	080-10-35.00976W

MORFAC	25-44-53.52504N	080-10-36.68520W
MORFAC	25-44-53.64168N	080-10-37.72884W
MORFAC	25-44-53.82708N	080-10-35.66892W
MORFAC	25-44-54.32820N	080-10-37.28928W
MORFAC	25-44-54.52044N	080-10-36.27336W
MORFAC	25-44-55.21416N	080-10-36.82236W
OBSTRN (Fish Haven)	25-44-46.72910N	080-10-52.93714W
PILPNT	25-42-02.95560N	080-10-13.71000W
PILPNT	25-43-19.80516N	080-13-20.84628W
PILPNT	25-44-49.70724N	080-10-39.23940W
PILPNT	25-44-51.62964N	080-10-35.44932W
PILPNT	25-44-51.78084N	080-10-35.55912W
PILPNT	25-44-52.31652N	080-10-35.03712W
PILPNT	25-44-53.78568N	080-10-33.19716W
PILPNT	25-44-53.88900N	080-10-32.56536W
SBDARE	25-41-32.91000N	080-08-48.22440W
SBDARE	25-41-33.68040N	080-09-12.18960W
SBDARE	25-41-42.06120N	080-07-19.31880W
SBDARE	25-41-42.28440N	080-10-30.84240W
SBDARE	25-41-45.78000N	080-11-51.40320W
SBDARE	25-41-49.67520N	080-08-16.99080W
SBDARE	25-42-11.04480N	080-07-05.86560W
SBDARE	25-42-15.86160N	080-12-38.30040W
SBDARE	25-42-19.10880N	080-11-24.16200W
SBDARE	25-42-20.91960N	080-11-14.48880W
SBDARE	25-42-21.37680N	080-10-29.67600W
SBDARE	25-42-22.74120N	080-08-12.50880W
SBDARE	25-42-26.25120N	080-11-59.22960W
SBDARE	25-42-26.96040N	080-07-41.27160W
SBDARE	25-42-51.52320N	080-08-33.30600W
SBDARE	25-42-57.52080N	080-07-02.89920W
SBDARE	25-43-03.02880N	080-11-07.51200W
SBDARE	25-43-06.17160N	080-11-59.26920W
SBDARE	25-43-19.03800N	080-10-22.69920W
SBDARE	25-43-29.03880N	080-07-51.42000W
SBDARE	25-43-34.12920N	080-10-52.53960W
SBDARE	25-43-38.07120N	080-09-47.49840W
SBDARE	25-43-38.79120N	080-08-13.41960W
SBDARE	25-43-43.16160N	080-12-50.37840W
SBDARE	25-43-44.14800N	080-11-40.94520W
SBDARE	25-43-59.94840N	080-08-33.36000W
SBDARE	25-44-02.63760N	080-07-20.53560W
SBDARE	25-44-16.79604N	080-10-25.49604W
SBDARE	25-44-17.73744N	080-10-27.26796W
SBDARE	25-44-25.71252N	080-07-55.18812W
SBDARE	25-44-26.71296N	080-07-16.72860W
SBDARE	25-44-30.19020N	080-08-18.16584W

SBDARE	25-44-36.64608N	080-07-23.09124W
SBDARE	25-44-37.82148N	080-07-44.15844W
SBDARE	25-44-39.43644N	080-08-11.98932W
SBDARE	25-44-41.13708N	080-08-14.34840W
SBDARE	25-44-47.41440N	080-08-05.48844W
SBDARE	25-44-47.70816N	080-07-36.31224W
SBDARE	25-44-49.77888N	080-08-17.46240W
SBDARE	25-44-50.30700N	080-08-00.31812W
SBDARE	25-44-50.31024N	080-10-53.01336W
SBDARE	25-44-53.35476N	080-08-06.40356W
SBDARE	25-44-57.24816N	080-07-51.89196W
SBDARE	25-45-00.98604N	080-08-19.49316W
SBDARE	25-45-04.54536N	080-08-26.42820W
SBDARE	25-45-05.61528N	080-08-11.87628W
SBDARE	25-45-12.16980N	080-08-18.10752W
SBDARE	25-45-12.41712N	080-10-10.26624W
SBDARE	25-45-12.78720N	080-08-39.08760W
SBDARE	25-45-13.53672N	080-07-32.69136W
SBDARE	25-45-15.35940N	080-10-23.04228W
UWTROC	25-42-15.90012N	080-07-11.10000W
UWTROC	25-44-34.00008N	080-07-07.29984W
UWTROC	25-44-41.70012N	080-07-46.30008W
UWTROC	25-45-07.49988N	080-07-46.30008W
UWTROC	25-45-07.99992N	080-07-41.19996W
WEDKLP	25-41-16.58400N	080-08-14.35200W
WEDKLP	25-42-16.97040N	080-10-32.60640W
WEDKLP	25-43-16.41000N	080-10-24.94200W
WRECKS	25-42-31.44420N	080-13-29.32500W
WRECKS	25-43-03.60012N	080-11-57.80004W
WRECKS	25-43-06.46104N	080-13-06.37248W
WRECKS	25-43-37.81560N	080-08-04.72200W
WRECKS	25-45-07.61292N	080-08-07.76004W

D.3. MISCELLANEOUS

Chart compilation was done by Atlantic Hydrographic Branch personnel, in Norfolk, Virginia. Compilation data will be forwarded to Marine Chart Division, Silver Spring, Maryland. See Section D.1. of this report for a list of the Raster Charts and Electronic Navigation Charts (ENC) used for compiling the present survey:

D.4. ADEQUACY OF SURVEY

The present survey is adequate to supersede the charted bathymetry within the common area. Any features not specifically addressed either in the H-Cell BASE Cell File or the Blue Notes should be retained as charted. Refer to the Descriptive Report for further recommendations by the hydrographer.

This Document is for Office Process use only and is intended to supplement, not supersede or replace, information/recommendations in the Descriptive or Evaluation Reports

AHB COMPILATION LOG

General Survey Information	
REGISTRY No.	H11870
PROJECT No.	OPR-H328-KRL-08
FIELD UNIT	TENIX LADS
DATE OF SURVEY	JULY 13 - AUGUST 26, 2008
LARGEST SCALE CHART	***11468-1, edition 41, 20070519, 1:10,000***
ADDITIONAL CHARTS	***11451-4, edition 34, 20091001, 1:24,000*** ***11465-1, edition 38, 20071124, 1:40,000***
SOUNDING UNITS	**Feet**
COMPILER	James J Miller II/Deborah A. Bland

Source Grids	**File Name** H:\Compilation\H11870_H328-TENIX\AHB_H11870\E-SAR Final Products\GRIDS
	H11870_3m_UNC_Final_shoal_Extract.csar
Surfaces	**File Name** H:\Compilation\H11870_H328-TENIX\AHB_H11870\COMPILE\Working
Combined	**N/A**
Interpolated TIN	\Interpolated TIN**H11870_12m_InterpTIN.csar**
Shifted Interpolated TIN	\Interpolated TIN\Shifted Surface**H11870_12m_InterpTIN_Shifted.csar**
Product Surface	**N/A**
Final HOBs	**File Name** H:\Compilation\H11870_H328-TENIX\AHB_H11870\COMPILE\Final_Hobs\
Survey Scale Soundings	**H11870_SS_Soundings.hob**
Chart Scale Soundings	**H11870_CS_Soundings.hob**
Contour Layer	**H11870_Contours.hob**
Feature Layer	**H11870_Features.hob**
Meta-Objects Layer	**H11870_MetaObjects.hob**
Blue Notes	**H11870_BlueNotes.hob**
ENC Retain Soundings	**H11870_US4FL27M_US5FL21M_US5FL22M_ENC_retained.hob**

Meta-Objects Attribution	
Acronym	**Value**
M_COVR	
CATCOV	available
SORDAT	20080826
SORIND	US,US,survy,H11870
M_QUAL	
CATZOC	U(data not assessed)
INFORM	H11870,OPRRegistry Number, Project Number, Vessel
POSACC	10
SORDAT	20080826
SORIND	US,US,survy,H11870
SUREND	20080826
SURSTA	20080713

DEPARE	
DRVALV 1	0.00 ft
DRVALV2	26.11549 ft
SORDAT	20080826
SORIND	US,US,nsurf,H11870
DEPARE	
DRVALV 1	0.00 ft
DRVALV2	7.74278 ft
SORDAT	20080826
SORIND	US,US,nsurf,H11870
DEPARE	
DRVALV 1	19.88189 ft
DRVALV2	24.70472 ft
SORDAT	20080826
SORIND	US,US,nsurf,H11870
M_CSCL	
CSCALE	24000
SORDAT	20091001
SORIND	US,US,graph,Chart11451
M_CSCL	
CSCALE	40000
SORDAT	20071101
SORIND	US,US,graph,Chart11465

SPECIFICATIONS:

I. COMBINED SURFACE:
   a. Number of ESAR Final Grids: 1
   b. Resolution of Combined (m): 3

II. SURVEY SCALE SOUNDINGS (SS):
   a. Radius
   b. Shoal biased
   c. Use Single-Defined Radius (mm at Map Scale): ; Radius Value = 1
   d. Queried Depth of All Soundings
      i. Minimum: 0.00
      ii. Maximum: 26.115

III. INTERPOLATED TIN SURFACE:
   a. Resolution (m): 12
   b. Linear
   c. Shifted value: *[-0.229m (feet), (≤ 10 fathoms)]*
      [-1.372m (fathoms), (> 10 fathoms)]

IV. CONTOURS:
   a. Use a Depth List: H11870_NOAA_depth_curves_list.txt
   b. Line Object: DEPCNT
   c. Value Attribute: VALDCO

V. FEATURES:
   a. Total Number of Features: 83

b. Number of Insignificant Features:

VI. CHART SURVEY SOUNDINGS (CS):

a. Number of ENC CS Soundings:
b. Radius
c. Shoal biased
d. Use Single-Defined Radius: m on the ground
    i. Radius Value (m):
    ii. Or use a Sounding Space Range Table (if applicable): HXXXXX_SSR.txt
e. Filter: Interpolated != 1
f. Number Survey CS Soundings: 805

VII. Notes:

APPROVAL SHEET
H11870

Initial Approvals:

The completed survey has been inspected with regard to survey coverage, delineation of depth contours, disposition of critical depths, cartographic symbolization, and verification or disproval of charted data. All revisions and additions made to the H-Cell files during survey processing have been entered in the digital data for this survey. The survey records and digital data comply with National Ocean Service and Office of Coast Survey requirements except where noted in the Descriptive Report and the Evaluation Report.

All final products have undergone a comprehensive reviews per the Hydrographic surveys Division Office Processing Manual and are verified to be accurate and complete except where noted.

_____

James Miller
Hydrographic Intern
Atlantic Hydrographic Branch

Deborah A. Bland

Digitally signed by Deborah A. Bland
DN: cn=Deborah A. Bland, o=Atlantic Hydrographic Branch, ou=NOAA/NOS, email=Deborah.A.Bland@NOAA.gov, c=US
Date: 2010.03.11 16:43:34 -05'00'

_____

Deborah A. Bland
Cartographer
Atlantic Hydrographic Branch

I have reviewed the H-Cell files, accompanying data, and reports. This survey and accompanying Marine Chart Division deliverables meet National Ocean Service requirements and standards for products in support of nautical charting except where noted.

Richard T. Brennan
I am approving this document
2010.04.30 15:31:00 -04'00'

Approved: _____

Richard T. Brennan
Lieutenant Commander, NOAA
Chief, Atlantic Hydrographic Branch

David Scharff

Digitally signed by David Scharff
DN: cn=David Scharff, o=OCS, ou=NOAA, email=david.scharff@noaa.gov, c=US
Reason: AWOIS and Surf Check complete
Date: 2010.05.13 09:30:05 -04'00'