NOAA FORM 76-35A

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

DESCRIPTIVE REPORT

H11558

Type of Survey Hydrographic/Lidar

Project No. OPR-I305-KRL-06

Registry No. H11558

LOCALITY

State Puerto Rico

General Locality Southwest Puerto Rico

Sublocality 8 NM West of Punta Ostiones

2006

HYDROGRAPHER MARK SINCLAIR

CHIEF OF PARTY DARREN STEPHENSON

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DATE

HYDROGRAPHIC TITLE SHEET

NOAA FORM 77-28U.S. DEPARTMENT OF COMMERCE (11-72) NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION **HYDROGRAPHIC TITLE SHEET**	REGISTRY NO. **H11558**
INSTRUCTIONS – The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office	FIELD No. **N/A**

State: Puerto Rico

General Locality: Southwest Puerto Rico

Sub-Locality: 8 NM West of Punta Ostiones

Scale: 1:10,000 **Date of Survey:** April 2 to May 15, 2006

Instructions dated: February 8, 2006 **Project No:** OPR-I305-KRL-06

Vessel: Tenix LADS Aircraft, VH – LCL

Hydrographer: M.J. Sinclair **Chief of Party:** D.J. Stephenson

Surveyed by: M.S. Hawkins, J.K. Young, B. McWilliam, M. Blackbourn

Soundings taken by echo sounder, hand lead, pole: Laser Airborne Depth Sounder

Graphic record scaled by: J.K. Young, L.R. Chamberlain, V. Sicari and B.A. Weidman

Graphic records checked by: S.R. Ramsay and J.G. Guilford

Protracted by: N/A **Automated plot:** N/A

Verification by: **NOAA Atlantic Hydrographic Branch (comments in bold red font)**

Soundings in: Meters at MLLW

REMARKS: Contract # NC-NJ3000-4-00010 01

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.

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. Projection is UTM Zone 19.

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DESCRIPTIVE REPORT TO ACCOMPANY

HYDROGRAPHIC SURVEY H11558

SCALE 1:10,000, SURVEYED IN 2006

TENIX LADS AIRCRAFT, VH-LCL

TENIX LADS, INC. (TLI)

MARK SINCLAIR, HYDROGRAPHER

PROJECT
Project Number: OPR-I305-KRL-06 **Original:** DG 133C-03-CQ-0011
Date of Instructions: February 8, 2006 **Task Order:** T0008

Date of Supplemental Instructions:

- Site visit by NOAA on September 12–13, 2006 to TLI to discuss the data delivery under the new Specifications and deliverables
- Email dated January 07, 2006 regarding rocks awash

Sheet Number: B
Registry Number: H11558

PURPOSE

To provide NOAA with modern, accurate hydrographic survey data with which to update the nautical charts of the assigned area.

A. AREA SURVEYED

Between April 7 and May 15, 2006 the LADS Mk II aircraft deployed to Puerto Rico for the project OPR-I305-KRL-06. During this period 21 survey sorties were flown under Task Order 8, Southwest Puerto Rico. Survey operations covered 11 survey registry numbers. This Descriptive Report describes H11558, which covers the area approximately 8NM west of Punta Ostiones (See Figure 1 and Figure 2). **Concur.**

Environmental factors such as wind strength and direction, cloud cover, high ground and water clarity influenced the area of data acquisition on a daily basis. See section B.2 Quality. **Concur.**

The planned and actual linear miles sounded for the areas are provided at Appendix III. **Concur.** The sheet limits are as follows for H11558, Sheet B:

	Latitude (NAD 83)	Longitude (NAD 83)
NW corner	18° 10’ 54.16” N	67° 22’ 47.11” W

SE corner	18° 02’ 11.54” N	67° 18’ 33.50” W

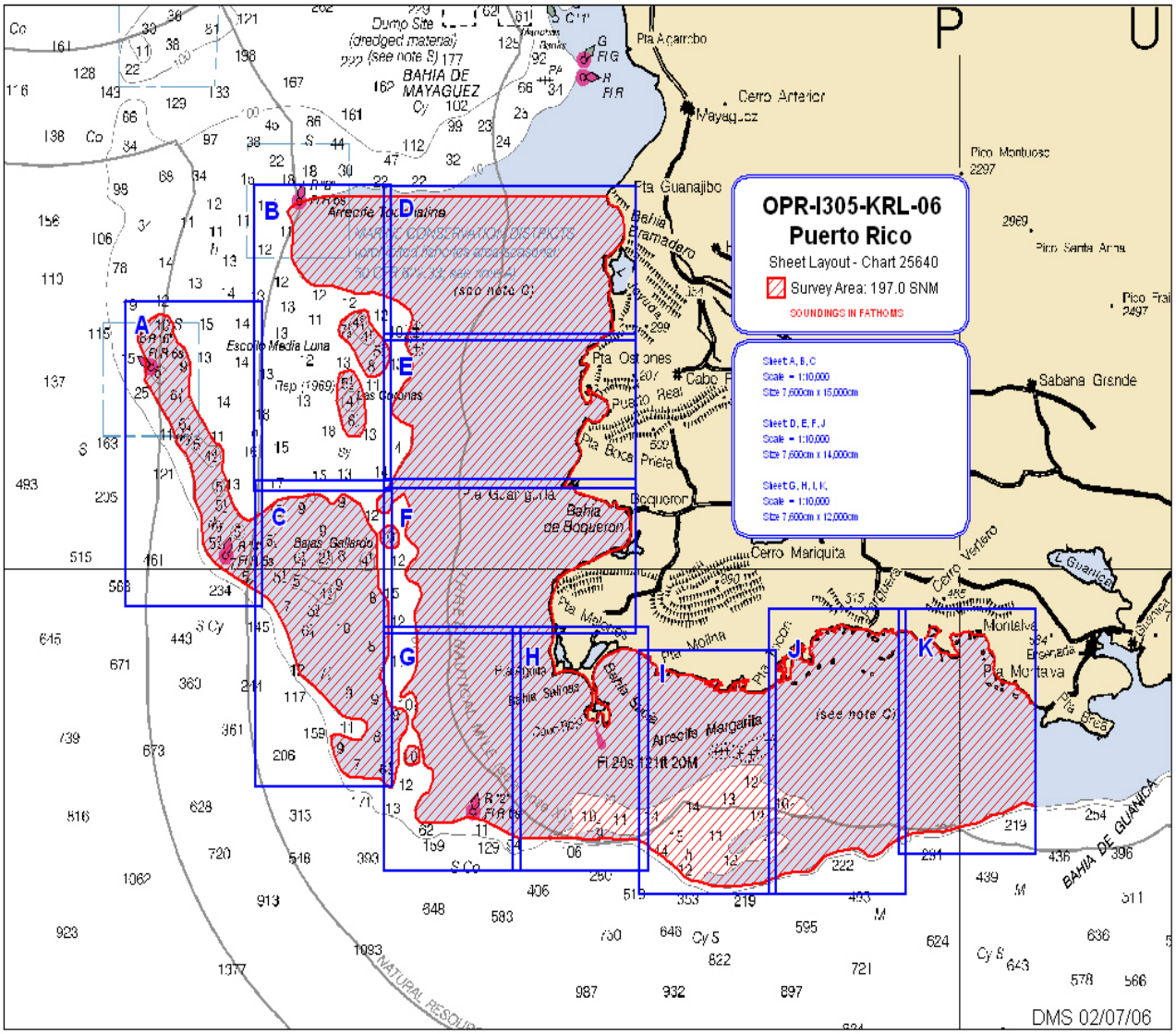


Figure 1 - Task Order 8 OPR-I305-KRL-06

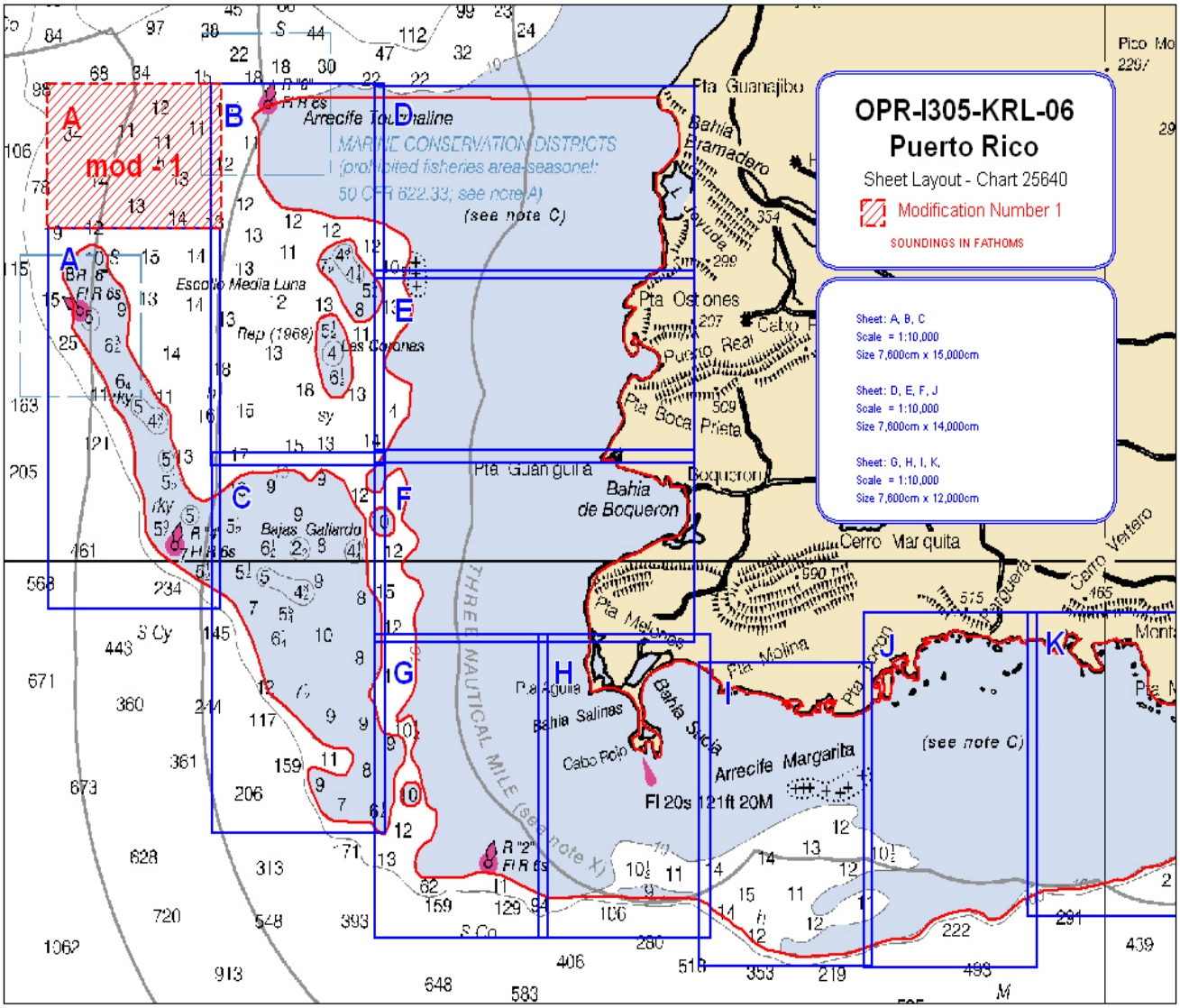


Figure 2 – Task Order 8 OPR-I305-KRL-06 Modification 1

B. ACQUISITION AND PROCESSING

Refer to the Data Acquisition and Processing Report* for a detailed description of the equipment, processing and quality control procedures. A general description and items specific to this survey are discussed in the following sections. ***DAPR submitted with original field report and included with survey deliverables.**

B.1 EQUIPMENT

Data collection was conducted using the LADS Mk II Airborne System, data processing using the LADS Mk II Ground System and data visualization, quality control and final products using CARIS HIPS and SIPS 6.0.2 and CARIS BASE Editor 2.0.

A prototype Digital Imagery Capture system was installed at the commencement of this survey, which allowed digital images from the downward looking video to be captured.

B.1.1 Airborne System

The LADS Mk II Airborne System (AS) consists of a Dash 8-200 series aircraft, which has a transit speed of 250 knots 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 between 140 and 175 knots. The aircraft is fitted with a 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.

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 and GPS height. Real-time positioning is obtained by an Ashtech GG24 GPS receiver combined with Wide Area DGPS provided by the Fugro Omnistar to provide a differentially corrected position. Ashtech Z12 GPS receivers are also provided as part of the Airborne System and Ground Systems to log KGPS data on the aircraft and at a locally established GPS base station. For more details on the airborne system, refer to the Data Acquisition and Processing Report*.***DAPR submitted with original field report and included with survey deliverables.**

B.1.2 Ground System

The LADS Mk II Ground System (GS) ‘Gandalf’ was used to conduct data processing in the field. Gandalf 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, digital audio tape (DAT) drive, 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. Gandalf was transported to the deployment site. Quality control checks and editing of the data were conducted on GS ‘Katrina’ in the Biloxi office upon completion of the data collection phase of the survey.

The GS supports survey planning, data processing, quality control and data export. The GS component also includes a KGPS base station, which provides independent post-processed position and height data. A comprehensive description of the GS is provided in the Data Acquisition and Processing Report.

B.2 QUALITY

B.2.1 Data Density

The survey area was sounded at 4x4m laser spot spacing with main lines of sounding spaced at 80m, which provided the required 200% coverage. **Concur.**

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. It should be noted that at 4x4m laser spot spacing, there is a gap of between 1 to 1.5m between the illuminated area of adjacent soundings at the sea surface. There is a possibility that small objects in shallow water along the coastline may fall between consecutive 4x4m soundings and not be detected. **Concur.**

B.2.2 Water Clarity

The water clarity in the survey area was ideal for laser bathymetry as the water was very clear. Water depths to 55m were achieved before the reef dropped off quickly in the north. Consistent coverage was achieved throughout the survey area. The majority of the survey area is less than 30m depth. The water clarity did vary slightly. This can be seen at the extinction depth of lidar in the northeast portion of the survey area in 35m of water. Some data gaps and a stripe exists in the data as the water clarity was slightly different when adjacent lines were flown on different sorties. **Concur.**

B.2.3 Uncertainty values

For this survey area, global horizontal and vertical uncertainties have been assigned based on the defined horizontal and vertical error budget as determined and stated in the Vertical and Horizontal Control Report*****. The assigned horizontal uncertainty is 2.80m and the assigned vertical uncertainty is 0.4m. **Concur. *HVCR submitted with original field report and included with survey deliverables.**

However, when the calculated grid node standard deviation is greater than the assigned vertical uncertainty, the standard deviation is used as the uncertainty value. This has occurred in high relief areas such as reefs existing within the survey area. In some cases the standard deviation may exceed IHO order 1 limits. This could be attributed to the fact that a 3m grid resolution has been used. **Concur.**

B.2.4 Data Management

The database is identified as follows:

Database Name	General Locality	Sheet(s)
06_3CaboRojo	8 NM West of Punta Ostiones	B

A detailed table of survey line numbers is presented in the Data Acquisition and Processing Report*. ***DAPR submitted with original field reports and included with survey deliverables.**

B.2.5 Data Acquisition

Survey operations were planned when suitable weather conditions prevailed. The first survey sortie was flown on April 9, 2006.

In general, the aircraft departed at 7 a.m. local time, prior to the build up of thunderstorms in the early afternoon.

For a summary of data acquisition statistics, refer to Appendix III Final Progress Sketch. **Concur.**

B.2.6 Sea Conditions - Sea State, Waves, Swell, White Water

The sea state ranged from 1 to 3 throughout the survey and was generally between states 1 and 2 as determined from the Beaufort Wind Scale. This did not affect data quality.

Calm seas were experienced on occasions in the sheltered bays along the west and south coasts. Depending on the wind direction, calm seas occurred inshore of exposed reefs as well. Under such calm conditions, the sea may become glassy which degrades the sea surface model.

Long period swell was not significant during the survey, however an allowance has been made in the assessment of accuracy.

B.2.7 Gaps and Features in the Data

During the data processing the operators have the ability to assign S-57 and user-defined tags to gaps and features in the data. These tags are used to identify gaps in the data due to environmental and manmade features. Tags are also used for features that are deemed to require further examination to define the extent and least depth of a feature. For this survey area, no gaps or features were identified that require further examination. One navigation buoy was tagged and this is described in section D.1.6. **Concur.**

B.2.8 Nature of the Seabed

The seabed in general throughout the survey area is quite regular. **Concur with clarification. There are areas of seafloor characterized as sticky in between the rocky areas.**

The western part of Arrecife Tourmaline exists in the northeastern portion of the survey area, which is quite irregular, very undulating and complex, with depths varying from 8 – 12m. **Concur.**

The predominant reef structure drops off very deep to the north of Arrecife Tourmaline. **Concur.**

Shallow reef structures exist in the east of the survey area including the western part of Escollo Media Luna. **Concur.**

The southwestern portion of the survey area is strewn with coral outcrops and pinnacles rising from the seabed. **Concur.**

B.2.9 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. For this survey area there are no drying heights.

B.2.10 Datums

Upon the completion of each flight, the GPS data logged on the aircraft and at the base station was processed to determine the post-processed KGPS position and height of the aircraft. This data is used in the calculation of the sea surface datum.

B.2.11 Wind

Survey operations were conducted in wind strengths of up to 20 knots during the survey. In general, the wind strength during the time of survey was around 10 knots from the southwest.

During the morning wind strengths would increase slightly.

B.2.12 Cloud

Low cloud coverage was not a significant factor for the survey. During the early afternoon the clouds would build up over land and move offshore. The occurrence of cloud build up offshore increased towards the end of the survey. The effects of low cloud coverage were managed as follows:

a. Limited weather forecasts were available for the actual survey area. Weather conditions were interpolated from generic weather Internet sites and local media weather forecasts.

b. For long-term trends the National Weather Service in San Juan provided information.

c. An Internet site showed the current San Juan radar. This proved invaluable during the later part of the survey to monitor the movement of thunderstorms. This Internet site is http://www.wunderground.com/radar/.

B.2.13 Effects of High Ground

For this survey the high ground was not an issue and the majority of the survey lines were flown at 1,600ft.

B.2.14 Receiver Gain

Changes in gain levels in the Airborne System automatically accommodate for changes in the sea surface, water column and seabed conditions.

B.2.15 Raw Laser Waveforms

The raw laser waveforms become dispersed in very complex areas, such as coral reefs, and in such areas the bottom object detection algorithm in the GS was used to define the extents and least depth of features.

It is also used in the decision making process of removing noise and data artifacts from the final dataset.

B.2.16 Data Processing

The data was processed at the operating site in San Juan on the return from each sortie. Final validation, checking, approving, reports and products were conducted at this site and in Biloxi, MS.

The quality control of the data was done independently in Adelaide, South Australia.

B.2.17 Progress Sketches

Progress sketches were provided to NOAA on a bi-weekly basis, the final progress sketch can be found in Appendix III. **Concur.**

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. ***DAPR submitted with original field report and included with survey deliverables.**

B.4 DATA PROCESSING

One BASE Surface covers the entire survey area. 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 data density. **Concur.**

B.5 DATA FORMATS

Data is provided in the following formats:

- Digital S-57 feature file **Concur.**
- CARIS BASE surface **Concur.**
- CARIS chart comparison file in .hob format **Concur.**
- CARIS compatible data - LADS soundings and waveforms, which can be imported into CARIS HIPS (.CAF File) **Concur.**
- Tidal Data provided in ASCII, .xls and .csv formats **Concur.**

Refer to the Data Acquisition and Processing Report* for specific details. ***DAPR submitted with original field report and included with survey deliverables.**

B.6 BENCHMARKS

The depth benchmark areas were identified on the first survey sortie and two benchmark lines were planned. The benchmark areas were used to check the performance of the LADS Mk II system for the I305 project, including this H11558 survey. These benchmarks were surveyed to check the repeatability of the LADS Mk II system accuracy.

The location of the benchmark lines and the position of the benchmark areas are detailed in the Separates. **Concur.**

Either one or both benchmark lines were flown during each sortie. The total number of benchmarks compared during the survey was 86. Benchmark comparisons were conducted after the application of final verified tides. Comparison summaries are also provided in the Separates. **Concur.**

The LADS 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 outliers are flagged as the shoalest and deepest differences.

B.6.1 Mean Depth Differences (MDD) and Standard Deviation (SD)

The averages of the mean depth differences and standard deviation for each benchmark run are as follows:

Benchmarks on the first line

GS ID	BM Name	Nominal Depth	MDD	SD
1	BM_1	13 m	-0.02 +/- 0.05	0.14 +/- 0.02
2	BM_2	8 m	-0.13 +/- 0.10	0.09 +/- 0.01
3	BM_3	22 m	-0.08 +/- 0.07	0.09 +/- 0.01

Benchmarks on the second line

GS ID	BM Name	Nominal Depth	MDD	SD
4	BM_4	12 m	-0.11 +/- 0.09	0.10 +/- 0.01
5	BM_5	9 m	-0.03 +/- 0.05	0.09 +/- 0.01

These results are within expected tolerances and show that the LADS Mk II depth performance was within specifications.

B.7 CROSSLINES

Seven crosslines were planned across the (I305) survey extents to be used for crossline comparisons against the main lines of survey. Areas were selected where common data existed and ideally, where the seabed was reasonably flat. This minimizes the apparent differences in depths due to minor positional differences in steeper areas of seabed. **Concur.**

Due to the tethered TARS balloon located on the southwest coast of Puerto Rico, the two planned crosslines were not flown.

The middle of two crosslines were selected for comparisons against main survey lines within the H11558 survey area as follows:

Line 1001.0.1	95 intersections	Through the north of the survey area, across Arrecife Tourmaline.
Line 1002.0.1	86 intersections	Through the middle of the survey area, just south of Escollo Media Luna.

B.7.1 Mean Depth Differences (MDD) and Standard Deviation (SD)

The averages of the mean depth differences and standard deviation for this crossline are as follows:

Run No.	Comparisons	Mean Confidence	*Average MDD*	*Average SD*
1001.0.1	142119	7.1	0.02 +/- 0.07	0.1 +/- 0.03
1002.0.1	146235	7.3	0.03 +/- 0.10	0.1 +/- 0.03

Crossline comparison details are provided in Appendix V of the Separates. **Concur.**

All results are consistent with IHO Order-1 depth accuracy. **Concur.**

B.8 POSITION CHECKS

Two independent positioning systems were used during the survey. Real-time positions were aided by WADGPS. A post-processed KGPS position was also determined relative to a local GPS base station that was established on the rooftop of the Courtyard Marriott Hotel in San Juan. The post-processed KGPS position solutions were applied to each sounding during post-processing and the height used in the datum filter.

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

a. DGPS Site Confirmation. A 24-hour certification was conducted of the local GPS base station established on the roof of the Courtyard Marriott Hotel in San Juan. The results reveal that the local GPS base station is free from site specific problems such as multipath and obstructions.

b. Static Position Check. Prior to commencing data collection, the coordinates of the aircraft GPS antenna were determined relative to four NGS-CORS Base Stations in the southeast Puerto Rico area. Data was then logged by each LADS Mk II positioning system, enabling the positions to be checked against the NGS-CORS coordinated position of the aircraft GPS antenna. The accuracy of the post-processed KGPS solution during the static position check was 0.133m (95% confidence). The results and details of the static position check are enclosed in the Vertical and Horizontal Control Report*. ***HVCR submitted with original field report and included with survey deliverables.**

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 position solutions. The mean difference between the real-time and post-processed position was 0.873m, with an average standard deviation of 0.206. Details are provided in the Vertical and Horizontal Control Report*. ***HVCR submitted with original field report and included with survey deliverables.**

d. Navigation Position Check. Navigation checks were also conducted over a coordinated point on the roof of the terminal at Mayaguez airport. This enabled the known position of the structure to be checked against the image on the downward looking video. This provided a gross error check of position. The mean error was 1.9m with a standard deviation of 3.62m. Details are provided in the Separates.

e. Position Confidence. The position quality was also monitored 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 showed that the positioning systems were functioning correctly during the survey.

C. VERTICAL AND HORIZONTAL CONTROL

Refer to the Vertical and Horizontal Control Report for a detailed description of the vertical and horizontal control used during this survey. A summary of vertical and horizontal control for the survey follows. **HVCR submitted with original field reports and included with survey deliverables.**

C.1 VERTICAL CONTROL

Vertical control for the survey was based on the Mean Lower Low Water tidal datum (MLLW). The operating National Water Level Observation Network (NWLON) station at Magueyes Island, PR (9759110) located at the eastern extent of the survey area served as preliminary vertical control.

A subordinate tide station at Punta Guanajibo (9759421) located at the northern extent of the survey area was installed and operated for the duration of the survey. Upon completion of the survey, the datum was established for the subordinate gauge and the final verified tides for both the subordinate and NWLON tide gauges provided the vertical control.

Station details are as follows:

		WGS84	
Gauge	**Location**	**Latitude**	**Longitude**
975 9110	Magueyes Island	17° 58.3' N	67° 02.8' W
975 9421	Punta Guanajibo	18° 09.6’ N	67° 10.9’ W

C.2 ZONING

NOAA supplied tide zones that cover the extent of the survey area, with time and range correctors relative to the Magueyes Island tide station. These are as follows:

Tide Zone	GS Identifier	Time Corrector	Range Corrector	Reference Station
PRS15	1	-18 minutes	1.59	9759110
PRS14	2	-18 minutes	1.45	9759110
PRS13	3	-18 minutes	1.23	9759110
PRS12	4	-18 minutes	1.09	9759110
PRS11	5	-24 minutes	1.01	9759110
PRS10	6	-24 minutes	0.94	9759110
PRS9	7	-24 minutes	0.94	9759110
PRS9A	8	-18 minutes	0.94	9759110
PRS8	9	-6 minutes	0.94	9759110
PRS7	10	0 minutes	0.94	9759110

The proposed final tide zoning was computed once the datum for the subordinate tide gauge was established. The proposed final zoning is a combination of both the NWLON gauge, in which the zoning for the southern part of the survey area was derived, and the subordinate gauge, which provided zoning for the western part of the survey area. The proposed final zoning areas are as follows:

Tide Zone	GS Identifier	Time Corrector	Range Corrector	Reference Station
JOA14	1/2	0 minutes	x 1.00	9759421
JOA13	3	0 minutes	x 0.90	9759421
JOA12	4	0 minutes	x 0.85	9759421
JOA11	5	-6 minutes	x 0.81	9759421
JOA10	6	-6 minutes	x 0.77	9759421
JOA09	7	-24 minutes	x 0.94	9759110
JOA09A	8	-18 minutes	x 0.94	9759110
JOA08	9	-6 minutes	x 0.94	9759110
JOA07	10	0 minutes	x 0.94	9759110

An analysis of crosslines and overlaps of the mainlines of soundings concluded that tide zoning was adequate and therefore the proposed final tide zoning correctors have been considered to be the final zoning correctors for the survey.

The verified tides supplied by NOAA were independently checked by John Oswald and Associates. Once the data was checked, a fifth degree polynomial was applied to the tidal data and this data was then supplied to Tenix LADS Inc. for the application of tides.

The preliminary tide zone areas were adopted as the final tide zone areas. The range and time correctors changed, as zones JOA10-JOA14 are relative to the subordinate tide station.

For final processing, the time and amplitude correctors were applied to the tidal data delivered by John Oswald and Associates. Soundings were then reduced to MLLW using these corrected tides.

The data was viewed across the zone boundaries, which once again, validated the final verified tides and zoning.

C.3 HORIZONTAL CONTROL

Data collection and processing were conducted on the Airborne and Ground Systems in World Geodetic System (WGS84) on Universal Transverse Mercator (Northern Hemisphere) projection UTM (N) in Zone 19, Central Meridian 69° West. All units are in meters. This data was post-processed and all soundings are relative to the North American Datum 1983 (NAD83).

C.3.1 LADS Local GPS Base Station – Puerto Rico

Real-time positions were determined using an Ashtech GG24 GPS receiver aided by Wide Area Differential GPS (WADGPS). A local GPS base station was coordinated by John

Oswald and Associates on the roof of the Courtyard Marriott Hotel, San Juan on March 7, 2006.

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

NAD 83		**UTM (N) Zone 8**		
Latitude (N)	Longitude (W)	Easting (m)	Northing (m)	Ellipsoidal Height (m)
18° 27’ 20.277”	66° 04’ 56.271”	808 179.880	2 043 081.721	13.599

Post-processed KGPS positions were determined off-line using data logged at the local GPS base station and on the aircraft. This data was processed through Ashtech PNAV software to calculate both a DGPS and KGPS position solution. The post-processed KGPS positions were then imported into the GS and applied to all soundings. This provided increased sounding position accuracy and horizontal redundancy.

The local GPS base station site was checked for obstructions and multipath over a 24-hour period on April 20 and April 21, 2006. The results outlined in the Vertical and Horizontal Control Report* reveal that the local GPS base station site is free from site specific problems such as multipath and obstructions.

On April 12, 2006 static position checks of the LADS Mk II positioning systems were undertaken. The results outlined in the Vertical and Horizontal Control Report* revealed no gross errors and that all positioning systems functioned correctly.

During each sortie, GPS data was logged both on the aircraft and at the local GPS base station, which enabled a post-processed KGPS position solution to be determined. These positions were then compared to the position determined by the real-time positioning system. This dynamic positioning check provided quality control of the positioning systems, and the positional differences were within tolerance for the survey. These differences are tabulated in the Vertical and Horizontal Control Report*.

Navigation position checks were attempted over the terminal at the Mayaguez airport during each sortie when suitable weather conditions prevailed. Following each sortie the logged aircraft position was processed against the downward looking video record to determine the difference in position at the time of overflight. This provided a gross error check on the aircraft positioning.

The tabulated results are presented in the Vertical and Horizontal Control Report* and revealed that the positioning systems functioned to within expectations. ***HVCR submitted with original field report and included with survey deliverables.**

D. RESULTS AND RECOMMENDATIONS

The results for the H11558 survey are submitted separately and in conjunction with this Descriptive Report as the S-57 feature file, BASE surface, CARIS .hob file, chart comparison spreadsheet, etc. on the USB hard drive. Refer to Appendix III of the Data Acquisition and Processing Report* for a list of all the applicable results files from H11558. ***DAPR submitted with original field report and included with survey deliverables.**

Below is a table listing the S-57 feature objects found in the S-57 feature file (US511558.000):

S-57 Object Class	S-57 Object Acronym	Geometry	Description	Spatial Attribute	Attribute 1	Attribute 2	Attribute 3	Attribute 4	Comments
Underwater / Awash Rock	UWTROC	P	A concreted mass of stony material or coral which dries, is awash or is below the water surface.		Water level effect (WATLEV)	Quality of sounding measurement (QUASOU)	Technique of sounding measurement (TECSOU)	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)				

Table 1: S-57 attribution for the S-57 feature file (US511558.000)

D.1 CHART COMPARISON – REGISTRY NUMBER H11558

H11558 was compared to:

ENC US4PR60M compiled from Raster Chart 25671, 18th Edition, updated application date March 2003, at scale 1:100,000, corrected through NM March 22, 2003 and LNM March 4, 2003. **Concur.**

This chart was downloaded from the NOAA Office of Coast Survey – NOAA Raster Navigational Charts download website on February 10, 2006. (http://chartmaker.ncd.noaa.gov/mcd/ENC/download.htm)

Recommendations for charting action are described in sections D.1.1to D.1.5.

D.1.1 Dangers to Navigation

No dangers to navigation were reported. **Concur.**

D.1.2 Charted Depths and Features

Survey H11558 covers part of NOAA ENC US4PR60M approximately 8 NM west of Punta Ostiones. From the Source Diagram the area covered by the H11558 was covered by the NOS surveys between 1940 and 1969, presumably by single beam echo sounder. Partial bottom coverage was achieved in both areas. The area surveyed is represented by the LADS deliverables in considerably more detail than is currently shown on the chart. **Concur.**

A total of 78 significant differences between the chart and the survey have been identified. Specific recommendations for these differences are described in the chart comparison spreadsheet. An expanded version of the spreadsheet is included digitally with the survey report on the USB hard drive. The digital .xls version contains information that may be useful for planning of boat sounding and is easy to download into other survey packages (H11558_V1_ChartComp.xls). **Concur.**

A CARIS .hob file containing just the chart comparison items has also been compiled and is provided as part of the survey deliverables (H11558_ChartComp.hob). The attribution methodology for this file is presented below. **Concur.**

S-57 Object Class	S-57 Object Acronym	Geometry	Description	Attribute 1	Attribute 2	Attribute 3	Attribute 4
Nautical publication information	M_NPUB	P	Used to relate additional nautical information or publications to the data.	INFORM (used for storing a unique chart comparison ID)	NINFOM (used for storing the charting recommendation)	PUBREF (used for storing a reference to a Feature for Investigation)	PICREP (used for storing a link to waveform screen captures)

Table 2: S-57 attribution for the CARIS ChartComp.hob file

The chart comparison was conducted by reviewing the ENC, raster chart, BASE surface, S-57 feature file and the georeferenced orthophoto image. For each item identified, screen dumps of the Local Area Display and Raw Waveform Display were extracted from the LADS Mk II Ground System. These have been reviewed in order to make the following assessments:

a. Type of Feature

b. Further Examination Recommended

c. Charting Recommendation

d. Remarks

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, witnessing survey operations on NOAA ship Rainier and from meetings at PHB and UNH. 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 in order to achieve further efficiencies in data handling.

D.1.3 AWOIS

No AWOIS were assigned to this Task Order.

D.1.4 Chart Comparison Spreadsheet

			CHARTED			SURVEYED						
Sequence No	**Shoal No**	**Category**	**Charted Depth (meters)**	**NAD 83 Latitude N (DMS)**	**NAD 83 Longitude W (DMS)**	**Surveyed Depth (meters)**	**NAD 83 Latitude N (DMS)**	**NAD 83 Longitude W (DMS)**	**Type of Feature**	**Further Examination Recommended**	**Charting Recommendation**	**Remarks** **All items covered by 4x4m laser spot spacing at 200% lidar coverage.**
1	B1	1				14.02	18° 9' 23.238"	67° 20' 49.02"	Rk	N	Insert	**Do not concur. Within rocky area. Chart sounding data.**
2	B2	1				6.76	18° 8' 12.966"	67° 18' 33.012"	Rk	N	Insert	**Do not concur. Within rocky area. Chart sounding data.**
3	B3	2	14.60	18° 7' 53"	67° 19' 57"	10.60	18° 7' 57.414"	67° 19' 51.834"	Rk	N	Replace	**Do not concur. Within rocky area. Chart sounding data.**
4	B4	1				10.59	18° 7' 34.284"	67° 19' 3.594"	Rk	N	Insert	**Do not concur. Within rocky area. Chart sounding data.**
5	B5	1				9.32	18° 7' 27.894"	67° 18' 47.664"	Rk	N	Insert	**Do not concur. Within rocky area. Chart sounding data.**
6	B6	2	14.60	18° 7' 37"	67° 18' 31"	9.38	18° 7' 37.56"	67° 18' 35.982"	Rk	N	Replace	**Do not concur. Within rocky area. Chart sounding data.**
7	B7	1				7.71	18° 6' 26.388"	67° 18' 45.864"	Rk	N	Insert	**Do not concur. Within rocky area. Chart sounding data.**
8	B8	2	12.80	18° 6' 13"	67° 18' 38"	9.69	18° 6' 15.66"	67° 18' 34.128"	Rk	N	Replace	**Do not concur. Within rocky area. Chart sounding data.**
9	B9	1				6.15	18° 6' 26.298"	67° 18' 52.956"	Rk	N	Insert	**Do not concur. Within rocky area. Chart sounding data.**
10	B10	1				17.10	18° 6' 30.762"	67° 19' 2.046"	Rk	N	Insert	**Do not concur. Within rocky area. Chart sounding data.**
11	B11	1				12.84	18° 6' 14.094"	67° 19' 9.426"	Rk	N	Insert	**Concur.**
12	B12	1				13.25	18° 6' 15.192"	67° 19' 26.85"	Rk	N	Insert	**Concur.**
13	B13	1				18.55	18° 5' 58.362"	67° 20' 9.276"	Rk	N	Insert	**Insignificant amongst surrounding depths. Chart sounding data.**
14	B14	1				17.80	18° 6' 1.062"	67° 18' 53.226"	Rk	N	Insert	**Do not concur. Within rocky area. Chart sounding data.**
15	B15	1				15.80	18° 5' 58.542"	67° 18' 46.098"	Rk	N	Insert	**Do not concur. Within rocky area. Chart sounding data.**

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

			CHARTED			SURVEYED						
Sequence No	Shoal No	Category	Charted Depth (meters)	NAD 83 Latitude N (DMS)	NAD 83 Longitude W (DMS)	Surveyed Depth (meters)	NAD 83 Latitude N (DMS)	NAD 83 Longitude W (DMS)	Type of Feature	Further Examination Recommended	Charting Recommendation	Remarks All items covered by 4x4m laser spot spacing at 200% lidar coverage.
16	B16	1				13.31	18° 5' 52.728"	67° 18' 36.684"	Rk	N	Insert	Do not concur. Within rocky area. Chart sounding data.
17	B17	1				16.29	18° 5' 44.124"	67° 18' 38.25"	Rk	N	Insert	Do not concur. Within rocky area. Chart sounding data.
18	B18	2	12.80	18° 5' 34"	67° 18' 32"	8.27	18° 5' 32.73"	67° 18' 34.902"	Rk	N	Replace	Do not concur. This rock is accounted for in junction survey H11561.
19	B19	1				16.47	18° 5' 21.228"	67° 18' 42.372"	Rk	N	Insert	Concur.
20	B20	1				17.51	18° 5' 36.672"	67° 19' 1.776"	Rk	N	Insert	Do not concur. In close proximity to shoaler rock.
21	B21	1				18.85	18° 5' 9.924"	67° 18' 58.644"	Rk	N	Insert	Concur.
22	B22	1				16.66	18° 5' 34.062"	67° 19' 15.798"	Rk	N	Insert	Concur.
23	B23	2	23.70	18° 4' 46"	67° 21' 10"	20.16	18° 4' 43.86"	67° 21' 3.06"	Rk	N	Replace	Do not concur. Insignificant.
24	B24	1				17.31	18° 4' 51.384"	67° 19' 21.054"	Rk	N	Insert	Do not concur. Within rocky area. Chart sounding data.
25	B25	1				22.13	18° 4' 53.1098"	67° 18' 34.8703"	Rk	N	Insert	Do not concur. In close proximity to shoaler sounding.
26	B26	1				16.79	18° 4' 16.86"	67° 18' 37.332"	Rk	N	Insert	Do not concur. Within rocky area. Chart sounding data.
27	B27	1				17.61	18° 4' 28.362"	67° 18' 43.686"	Rk	N	Insert	Do not concur. In close proximity to shoaler sounding.
28	B28	1				18.64	18° 4' 9.912"	67° 19' 2.622"	Rk	N	Insert	Do not concur. Chart sounding data.
29	B29	1				18.24	18° 4' 34.752"	67° 19' 14.304"	Rk	N	Insert	Do not concur. Chart sounding data.
30	B30	2	25.60	18° 4' 24"	67° 19' 40"	23.22	18° 4' 19.578"	67° 19' 41.808"	Rk	N	Replace	Do not concur. Chart sounding data.
31	B31	1				20.93	18° 4' 27.228"	67° 21' 1.026"	Rk	N	Insert	Do not concur. Insignificant.
32	B32	1				25.56	18° 4' 37.2"	67° 21' 34.56"	Rk	N	Insert	Do not concur. Chart sounding data

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

			CHARTED			SURVEYED						
Sequence No	Shoal No	Category	Charted Depth (meters)	NAD 83 Latitude N (DMS)	NAD 83 Longitude W (DMS)	Surveyed Depth (meters)	NAD 83 Latitude N (DMS)	NAD 83 Longitude W (DMS)	Type of Feature	Further Examination Recommended	Charting Recommendation	Remarks All items covered by 4x4m laser spot spacing at 200% lidar coverage.
33	B33	1				25.90	18° 4' 6.204"	67° 21' 37.044"	Rk	N	Insert	**Do not concur. Chart sounding data.**
34	B34	1				22.96	18° 3' 52.722"	67° 22' 8.562"	Rk	N	Insert	**Do not concur. Chart sounding data.**
35	B35	1				24.78	18° 3' 38.97"	67° 22' 10.812"	Rk	N	Insert	**Do not concur. Within rocky area. Chart sounding data.**
36	B36	1				23.13	18° 3' 32.616"	67° 22' 2.658"	Rk	N	Insert	**Do not concur. Within rocky area. Chart sounding data.**
37	B37	1				25.82	18° 3' 54.864"	67° 21' 54.162"	Rk	N	Insert	**Do not concur. Insignificant amongst surrounding soundings.**
38	B38	1				25.49	18° 3' 34.344"	67° 21' 53.55"	Rk	N	Insert	**Do not concur. Within rocky area. Chart sounding data.**
39	B39	2	31.00	18° 3' 37"	67° 21' 47"	26.04	18° 3' 35.658"	67° 21' 47.772"	Rk	N	Insert	**Do not concur. Within rocky area. Chart sounding data.**
40	B40	1				25.48	18° 3' 43.632"	67° 21' 43.704"	Rk	N	Insert	**Do not concur. Insignificant amongst surrounding soundings.**
41	B41	1				26.14	18° 3' 46.656"	67° 21' 27.738"	Rk	N	Insert	**Do not concur. Insignificant amongst surrounding soundings.**
42	B42	1				26.76	18° 3' 41.832"	67° 21' 10.638"	Rk	N	Insert	**Do not concur. Insignificant amongst surrounding soundings.**
43	B43	1				28.34	18° 3' 40.914"	67° 19' 45.228"	Rk	N	Insert	**Do not concur. Insignificant amongst surrounding soundings.**
44	B44	1				28.29	18° 3' 46.818"	67° 19' 28.47"	Rk	N	Insert	**Do not concur. Insignificant amongst surrounding soundings.**
45	B45	1				21.26	18° 3' 56.772"	67° 19' 6.06"	Rk	N	Insert	**Do not concur. Insignificant amongst surrounding soundings.**
46	B46	2	25.60	18° 3' 38"	67° 18' 58"	21.56	18° 3' 32.454"	67° 18' 58.554"	Rk	N	Insert	**Do not concur. In close proximity to shoaler rock.**
47	B47	1				17.18	18° 3' 38.484"	67° 18' 35.802"	Rk	N	Insert	**Do not concur. Within rocky area. Chart sounding data.**
48	B48	1				20.60	18° 3' 17.442"	67° 21' 1.8"	Rk	N	Insert	**Do not concur. Within rocky area. Chart sounding data.**

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

			CHARTED			SURVEYED						
Sequence No	**Shoal No**	**Category**	**Charted Depth (meters)**	**NAD 83 Latitude N (DMS)**	**NAD 83 Longitude W (DMS)**	**Surveyed Depth (meters)**	**NAD 83 Latitude N (DMS)**	**NAD 83 Longitude W (DMS)**	**Type of Feature**	**Further Examination Recommended**	**Charting Recommendation**	**Remarks** **All items covered by 4x4m laser spot spacing at 200% lidar coverage.**
49	B49	2	27.40	18° 3' 22"	67° 22' 10"	24.63	18° 3' 20.736"	67° 22' 8.022"	Rk	N	Replace	**Do not concur. Within rocky area. Chart sounding data.**
50	B50	1				21.42	18° 3' 24.624"	67° 22' 40.512"	Rk	N	Insert	**Do not concur. Within rocky area. Chart sounding data.**
51	B51	1				21.02	18° 3' 3.654"	67° 22' 33.906"	Rk	N	Insert	**Do not concur. Within rocky area. Chart sounding data.**
52	B52	2	29.20	18° 3' 3"	67° 22' 22"	22.21	18° 3' 7.434"	67° 22' 21.09"	Rk	N	Replace	**Do not concur. Within rocky area. Chart sounding data.**
53	B53	1				21.33	18° 3' 11.988"	67° 21' 54.756"	Rk	N	Insert	**Do not concur. Within rocky area. Chart sounding data.**
54	B54	2	27.40	18° 3' 15"	67° 21' 21"	24.17	18° 3' 13.752"	67° 21' 20.97"	Rk	N	Insert	**Do not concur. Within rocky area. Chart sounding data.**
55	B55	1				20.37	18° 2' 49.596"	67° 18' 36.45"	Rk	N	Insert	**Do not concur. Insignificant amongst surrounding soundings.**
56	B56	1				22.48	18° 2' 54.78"	67° 21' 33.822"	Rk	N	Insert	**Do not concur. Within rocky area. Chart sounding data.**
57	B57	2	33.00	18° 2' 56"	67° 21' 46"	22.17	18° 2' 56.382"	67° 21' 48.024"	Rk	N	Replace	**Do not concur. Within rocky area. Chart sounding data.**
58	B58	1				20.92	18° 2' 50.334"	67° 22' 12.81"	Rk	N	Insert	**Do not concur. Within rocky area. Chart sounding data.**
59	B59	2	27.40	18° 2' 31"	67° 22' 20"	23.60	18° 2' 36.006"	67° 22' 20.478"	Rk	N	Replace	**Do not concur. Within rocky area. Chart sounding data.**
60	B60	1				20.58	18° 2' 40.074"	67° 21' 47.466"	Rk	N	Insert	**Do not concur. Within rocky area. Chart sounding data.**
61	B61	2	35.00	18° 2' 38"	67° 21' 30"	25.06	18° 2' 39.282"	67° 21' 34.992"	Rk	N	Replace	**Do not concur. Within rocky area. Chart sounding data.**
62	B62	1				20.48	18° 2' 19.266"	67° 19' 16.716"	Rk	N	Replace	**Do not concur. Insignificant.**
63	B63	1				22.71	18° 2' 16.08"	67° 19' 46.704"	Rk	N	Insert	**Do not concur. Insignificant.**
64	B64	1				23.90	18° 2' 21.498"	67° 19' 59.754"	Rk	N	Insert	**Do not concur. In close proximity to shoaler sounding.**

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

			CHARTED			SURVEYED						
Sequence No	Shoal No	Category	Charted Depth (meters)	NAD 83 Latitude N (DMS)	NAD 83 Longitude W (DMS)	Surveyed Depth (meters)	NAD 83 Latitude N (DMS)	NAD 83 Longitude W (DMS)	Type of Feature	Further Examination Recommended	Charting Recommendation	Remarks All items covered by 4x4m laser spot spacing at 200% lidar coverage.
65	B65	1				17.27	18° 2' 16.728"	67° 20' 22.65"	Rk	N	Insert	**Do not concur. Within rocky area. Chart sounding data.**
66	B66	2	33.00	18° 2' 21"	67° 20' 36"	27.99	18° 2' 21.57"	67° 20' 38.4"	Rk	N	Replace	**Do not concur. Within rocky area. Chart sounding data.**
67	B67	1				20.77	18° 2' 16.44"	67° 21' 20.268"	Rk	N	Insert	**Do not concur. Within rocky area. Chart sounding data.**
68	B68	1				21.06	18° 2' 25.53"	67° 21' 14.796"	Rk	N	Insert	**Do not concur. Within rocky area. Chart sounding data.**
69	B69	1				21.14	18° 2' 28.374"	67° 21' 42.858"	Rk	N	Insert	**Do not concur. Within rocky area. Chart sounding data.**
70	B70	1				19.75	18° 2' 26.448"	67° 21' 58.806"	Rk	N	Insert	**Do not concur. Within rocky area. Chart sounding data.**
71	B71	1				21.27	18° 2' 20.508"	67° 22' 11.748"	Rk	N	Insert	**Do not concur. Within rocky area. Chart sounding data.**
72	B72	1				19.93	18° 2' 13.47"	67° 21' 38.412"	Rk	N	Insert	**Do not concur. Within rocky area. Chart sounding data.**
73	B73	1				21.32	18° 3' 11.592"	67° 22' 5.124"	Rk	N	Insert	**Do not concur. Within rocky area. Chart sounding data.**
74	B74	1				21.75	18° 3' 13.716"	67° 22' 23.844"	Rk	N	Insert	**Do not concur. Within rocky area. Chart sounding data.**
75	B75	1				24.74	18° 2' 39.948"	67° 20' 22.236"	Rk	N	Insert	**Do not concur. Within rocky area. Chart sounding data.**
76	B76	1				22.85	18° 3' 16.344"	67° 18' 52.902"	Rk	N	Insert	**Do not concur. Insignificant.**
77	B77	1				21.01	18° 2' 58.902"	67° 18' 48.258"	Rk	N	Insert	**Do not concur. Insignificant.**
78	B78	1				22.42	18° 3' 21.978"	67° 22' 2.64"	Rk	N	Insert	**Do not concur. Within rocky area. Chart sounding data.**

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

D.1.5 Features Requiring Investigation

No features requiring further investigation were identified for this survey.

D.1.6 Aid To Navigation

During the survey one navigation buoy was detected by lidar for H11558. This navigation buoy has been identified from the published light list 'Atlantic and Gulf Coasts', Volume III, 2006, which includes Puerto Rico. The published position is as follows:

Light List Number	Name	Latitude (N)	Longitude (W)
32315	Arrecife Tourmaline Lighted Buoy 8	18° 09' 42"	67° 20' 42"

This buoy was detected four times on one survey line.

Number	Line	Easting	Northing	Depth
32315	403.0.1	675 080	2 008 839	-4.0
		675 084	2 008 839	-4.1
		675 081	2 008 835	-4.2
		675 087	2 008 836	N/A
	Mean	**675 083**	**2 008 837**	**-4.1**

Mean surveyed position: 18° 09' 41.2" N, 67° 20' 41.3" W

It should be noted that the buoy was not necessarily surveyed on both the flood and ebb streams. No charting recommendation has been made.

D.1.7 Recommended Overlap With Lidar Data

The recommended overlap by surface vessels for smooth sheet H11558 is to seaward of the data coverage polygon defined by S-57 object M_COVR, CATCOV = 1.

E. APPROVAL SHEET

LETTER OF APPROVAL – OPR-I305-KRL-06

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 – H11558	May 25, 2007

Mark Sinclair
Hydrographer
Tenix LADS Incorporated

Date May 25, 2007

APPENDIX I – DANGERS TO NAVIGATION

No Dangers to Navigation were reported for survey H11558.

APPENDIX II – LIST OF GEOGRAPHIC NAMES

Geographical names were not checked during the survey, and no amendments are proposed.

APPENDIX III – PROGRESS SKETCH

PROGRESS SKETCH

15 May 2006

OPR-I305-KRL-06

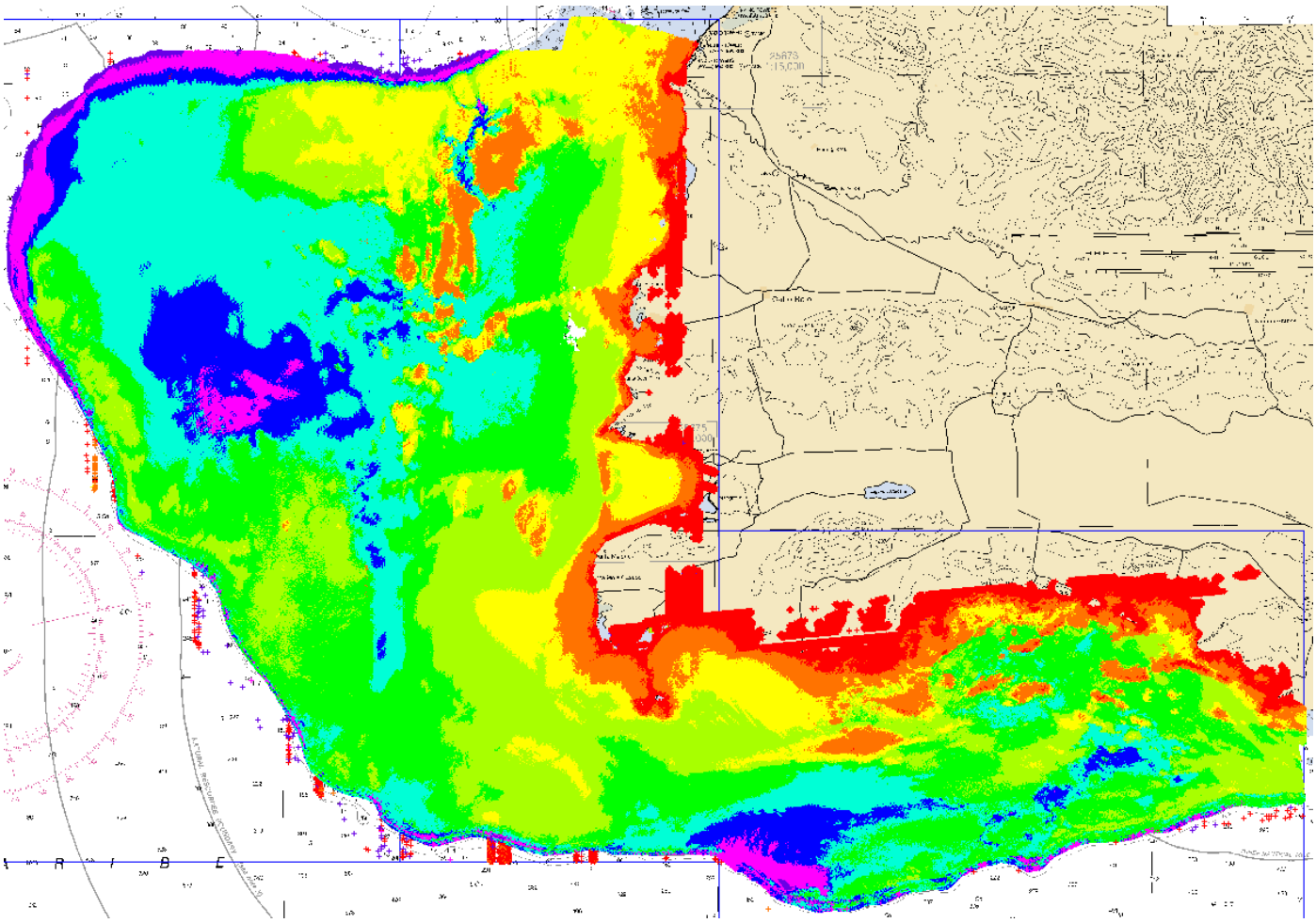
Puerto Rico
Tenix LADS Inc.
Darren Stephenson, Lead Hydrographer

Deployed to the field on April 07, 2006 and conducted the first survey sortie on April 09, 2006.

This status is of May 15, 2006 after 21 survey flights and the status includes an additional area to the west covered by the modification 1 to this task order T0008.

The area covered is 265SNM at 200% coverage.

	April	**May**	**Total**	**Total Planned**	**% Complete**
Days on project	22	15	37	36	
Line – nm - flown	7023.16	1264.44	8287.60	7581.26	109.3
Aircraft flown hours	111.1	23.0	134.1		
Aircraft on task hours	85.0	17.3	102.3		
Days with flight	17	4	21	23	91.3
No flight due to weather	0	0	0		
No flight due to system	0	0	0		
No flight due to aircraft	0	8	8		
Hours lost to weather	1.5		1.5		
Hours lost to system	2.5	1	3.5		



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.

06_3caborojo

Date Flown	JD	Sortie No	Start Time	End Time	Tide Duration	Time on Task
April-09-06	99	1	12:30	18:24	5:54	4:17
April-10-06	100	2	12:00	19:00	7:00	4:45
April-11-06	101	3	10:30	18:30	8:00	5:16
April-12-06	102	4	11:00	18:30	8:30	5:28
April-13-06	103	5	9:00	15:00	6:00	3:21
April-15-06	105	6	9:00	17:30	8:30	5:09
April-17-06	107	7	8:00	19:00	11:00	5:24
April-18-06	108	8	9:30	18:00	8:30	5:07
April-19-06	109	9	9:30	17:30	8:00	4:15
April-20-06	110	10	10:00	16:30	6:30	4:49
April-22-06	112	11	10:00	18:00	8:00	5:04
April-24-06	114	12	10:00	18:30	8:30	5:31
April-25-06	115	13	9:30	18:00	8:30	5:46
April-26-06	116	14	9:30	17:30	8:00	4:37
April-28-06	118	16	10:00	17:30	7:30	5:47
April-29-06	119	17	10:00	18:00	8:00	5:30
April-30-06	120	18	10:00	18:00	8:00	4:50
May-10-06	130	19	9:30	17:30	8:00	5:02
May-11-06	131	20	14:30	20:30	6:00	4:19
May-12-06	132	21	13:30	20:00	6:30	4:05
May-13-06	133	22	9:00	16:00	7:00	3:55

Magueyes Island, PR

Magueyes Island, PR: Data Inventory

Station ID: 9759110

Page Help

Datums

Click HERE for printable version

Data Units:

Feet Meters Apply Change

Nov 8 2006 12:49 ELEVATIONS ON STATION DATUM
National Ocean Service (NOAA)

Station: 9759110 **T.M.: 0**
W
Name: MAGUEYES ISLAND, CARIBBEAN SEA, PR **Units:**
Meters
Status: Accepted **Epoch: 1983-**
2001

Datum	Value	Description
MHHW	1.294	Mean Higher-High Water
MHW	1.292	Mean High Water
DTL	1.192	Mean Diurnal Tide Level
MTL	1.193	Mean Tide Level
MSL	1.191	Mean Sea Level
MLW	1.094	Mean Low Water
MLLW	1.091	Mean Lower-Low Water
GT	0.204	Great Diurnal Range
MN	0.198	Mean Range of Tide
DHQ	0.003	Mean Diurnal High Water Inequality
DLQ	0.003	Mean Diurnal Low Water Inequality
HWI		Greenwich High Water Interval (in Hours)
LWI		Greenwich Low Water Interval (in Hours)
NAVD		North American Vertical Datum
Maximum	1.781	Highest Water Level on Station Datum
Max Date	19980922	Date Of Highest Water Level
Max Time	05:48	Time Of Highest Water Level
Minimum	0.823	Lowest Water Level on Station Datum
Min Date	19680611	Date Of Lowest Water Level
Min Time	11:30	Time Of Lowest Water Level

To refer Water Level Heights to a Tidal Datum, apply the desired Datum Value.

Click HERE for further station information including New Epoch products.

T I D A L D A T U M S

Tidal datums at MAGUEYES ISLAND, CARIBBEAN SEA based on:

LENGTH OF SERIES:	19 Years
TIME PERIOD:	January 1983 - December 2001
TIDAL EPOCH:	1983-2001
CONTROL TIDE STATION:	

Elevations of tidal datums referred to Mean Lower Low Water (MLLW), in METERS:

HIGHEST OBSERVED WATER LEVEL (09/22/1998)	= 0.690
MEAN HIGHER HIGH WATER (MHHW)	= 0.204
MEAN HIGH WATER (MHW)	= 0.201
MEAN TIDE LEVEL (MTL)	= 0.102
MEAN SEA LEVEL (MSL)	= 0.101
MEAN LOW WATER (MLW)	= 0.003
MEAN LOWER LOW WATER (MLLW)	= 0.000
LOWEST OBSERVED WATER LEVEL (06/11/1968)	= -0.268

National Geodetic Vertical Datum (NGVD 29)

Bench Mark Elevation Information In METERS above:

Stamping or Designation	MLLW	MHW
TIDAL BM NO 1 CAMA UPR 1955 ELEV	3.664	3.463
TIDAL BM NO 2 CAMA UPR 1955 ELEV	6.959	6.758
TIDAL BM NO 3 CAMA UPR 1955 ELEV	10.246	10.045
9110 B 1980	3.183	2.982
9110 D 1980	0.671	0.470
9110 E 1980	0.937	0.736
9110 F 1982	1.746	1.545
9110 G 1982	3.244	3.042
9110 H 1998	3.019	2.818
975 9110 J 2000	1.424	1.223

Tide Station Report

Punta Guanajibo, Puerto Rico 975-9421

Position (NAD83):	18° 09' 36"	67° 10' 53"	Time Meridian = 0° (UTC)
Owner:	Dept. de Recursos Naturales y Ambientales Laboratoria de Investigaciones Pesqueras Aida Rosario Jimenez (Director) Juan De La Cruz Rasado Cruz (Admin. Dir)		P.O. Box 3665 (mailing) Mayaguez Puerto Rico, 00681 office: (787) 833-2025
Established:	March 14, 2006		Removed: June 1, 2006
Type of station:	Tertiary		Density Observations: Yes
Prime Contractor:	Tenix LADS Inc.		Darren Stephenson, project mgr.
Tides Consultant:	John Oswald & Assoc, Anchorage, AK.		John Oswald, PLS, project mgr.
Project Numbers:	OPR-I305-KRL-2006		JOA WO No: 81
To Reach:	To reach the tide station by vehicle from the junction of Route 2 and Route 63 located about 1.6 km (1.0 mile) SW of the center of Mayaguez, proceed west on Route 63 (Avenida William C. Dunscombe) for 0.5 km (0.3 mile) to a T-intersection with Route 102, turn left on Route 102 and proceed southerly following the coast for 4.5 km (2.8 miles) to the top of a hill, continue down the hill for 0.40 km (0.25 miles) to a reverse turn on the right at the bottom of the hill, turn right on this reverse turn and proceed NWly for 0.32 km (0.20 mile) on a paved road to the security gate and guard shack. Check in with the guard to get access to the Fisheries Research property. The tide station, dock and all bench marks are inside this fenced and secured area.		
Tide House:	Established two digital bubbler tide gauges and the electronics for a radar tide gauge in 4' by 4' by 2' wood shed at the south end of a wooden dock. This dock is in poor condition, and is about 3 meters wide and 30 meters long, with a plank wood deck supported by concrete filled PVC and wood pilings. The radar gauge sensor was suspended off the damaged end of the dock, with wood and unistrut brackets. Orifices were mounted on the end of 3/4 " iron pipe attached to treated 4 by 6 timbers. These orifice boards were in turn, banded to separate concrete filled PVC pilings about 25 meters from the shore.		
Tide Gauge(s):	Three gauges: Two digital bubblers: Design Analysis (DAA) H350XL, with H355 pump, and H222 (Signal Engineering) GOES radios, with Yagi antennas. One DAA H360 Radar gauge interfaced to a DAA H350XL DCP and H222 Goes Radio with Yagi Antenna. Bubbler range is 0 >30 psi, and the radar gauge range is 0.3 > 22 m. Gauge #1 (Bubbler) H350XL S/N: 1042, Gauge #2 (Bubbler) H350XL S/N 1039, Gauge #3 (Radar) H360 S/N 1288 with H350XL S/N 1043. Two 12vdc batteries run each system are charged by individual 20 watt solar cells. GPS modules provide time syncing.		
Tide Staff	A 1.25 meter fiberglass survey rod, graduated in centimeters from 2.79 to 4.04 meters, was bolted to a 2" x 6" board which was banded to a dock piling about 15 meters from shore. A stilling well with orange float was placed next to the graduations. The tide staff was leveled directly into the primary bench mark (BM 1 1975). The base of the radar gauge was also directly leveled into the PBM.		
GPS Tie:	Static L1/L2 GPS observations made on bench mark 975 9421 A.		
Tidal Bench Marks:	4 recovered Tidal 1, Tidal 3, Tidal 4, Tidal 5	1 established 975 9421 A	Primary Bench Mark: 975 9421 Tidal 1 (975 9421 Tidal 2 searched for, not found)
Third Order Leveling:	Initial: March 13-14, 2006		Closeout: May 31, 2006

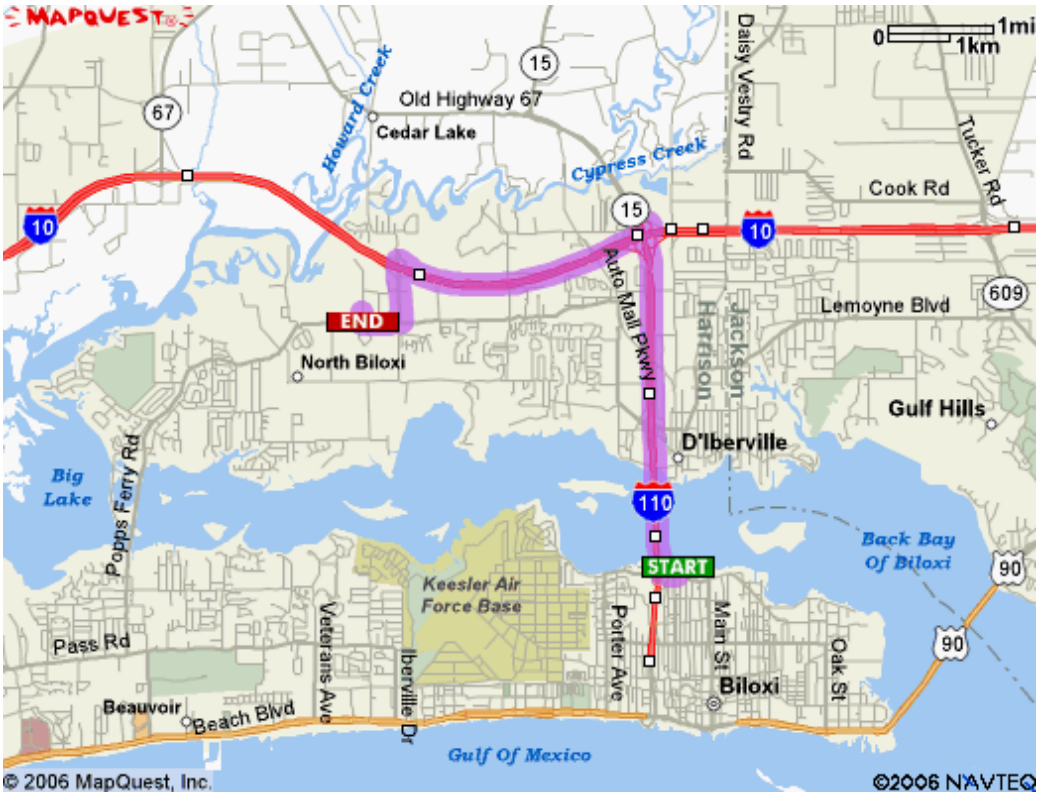
APPENDIX V – SUPPLEMENTAL SURVEY RECORDS AND CORRESPONDENCE

NOAA SITE VISIT – SEPTEMBER 12-13, 2006

NOAA Attendees:

David Scarff – COTR
Gene Parker – AHB
Toshi Uozumi – PHB
Megan Palmer - PHB

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



Maneuvers	Distance	Maps
START 1:Start out going WEST on BAYVIEW AVE toward FAYARD ST.	0.1 miles	Map
2:Merge onto I-110 N / MS-15 N toward I-10.	2.9 miles	Map
3:Merge onto I-10 W via EXIT 4B toward NEW ORLEANS.	2.4 miles	Map

4:	Take the CEDAR LAKE RD exit- EXIT 44- toward COAST COLISEUM / BILOXI NATIONAL CEMETERY / HOSPITAL.	0.2 miles	Map
5:	Turn LEFT onto CEDAR LAKE RD.	0.5 miles	Map
6:	Turn RIGHT onto POPPS FERRY RD.	0.3 miles	Map
7:	Turn RIGHT onto TOMMY MUNRO DR.	0.1 miles	Map
8:	End at **925 Tommy Munro Drive** Biloxi, MS 39532, US		Map

Total Est. Time: 10 minutes **Total Est. Distance:** 6.78 miles

SCHEDULE

Tuesday, September 12, 2006

1.1. Morning – Scott Ramsay

- Waveform Analysis
- Signal to noise ratio (SNR)
- Choosing contenders
- Bottom Object Detection (BODs)
- No Bottoms (NBs)
- No Bottom At (NBAs)
- Topographic lidar

1.2. Lunch

1.3. Afternoon – James Guilford

- Overview of 2006 Deliverables Workflow
- BAG in detail
- Creating S-57 features/feature management
- Chart comparisons

1.4. Evening

- Dinner for 7pm at Mary Mahony's (can give directions at office)

Wednesday, September 13, 2006

1.5. Morning – NOAA

- Branch Processing

- Quick Survey Acceptance Review (SAR)
- CARIS data review

Lunch

1.6. Afternoon – Darren Stephenson

- Spec and Deliverable Requirements: compliant or not?
- How to use these deliverables
- Metadata
- Meeting wrap-up

Original Message-----
From: GUILFORD James
Sent: Tuesday, 23 January 2007 4:38 AM
To: STEPHENSON Darren
Subject: FW: Visit

James Guilford
Senior Hydrographer
Tenix LADS Inc.
925 Tommy Munro Dr. Ste J
Biloxi, MS 39532

Ph (O): 228-594-6800
Ph (M): 228-342-3028
Fax: 228-594-6887

-----Original Message-----
From: GUILFORD James
Sent: Wednesday, September 06, 2006 6:44 AM
To: 'David.Scharff'
Cc: STEPHENSON Darren; RAMSAY Scott
Subject: Visit

Hi Dave,

I have attached directions to the office from the Imperial Palace (I think thats where you guys are staying). Also there is a rough schedule for the two days. I have left the second morning to you. There are some topics that morning where I wasn't sure what you wanted to see from our end.

Also, if you guys are interested I was thinking of making reservations for dinner for Tuesday night.

Could you please forward this to the people involved. If you have any questions, please don't hesitate to contact me.

See you in a week
James

James Guilford
Senior Hydrographer
Tenix LADS Inc.
925 Tommy Munro Dr. Ste J
Biloxi, MS 39532

Ph (O): 228-594-6800
Ph (M): 228-342-3028
Fax: 228-594-6887
-----Original Message-----
From: GUILFORD James
Sent: Tuesday, 23 January 2007 4:36 AM

Email regarding rocks awash

To: STEPHENSON Darren
Subject: FW: [Fwd: Re: UWTROC WATLEV Thresholds]

James Guilford
Senior Hydrographer
Tenix LADS Inc.
925 Tommy Munro Dr. Ste J
Biloxi, MS 39532

Ph (O): 228-594-6800
Ph (M): 228-342-3028
Fax: 228-594-6887

-----Original Message-----
From: gene_parker [mailto:Castle.E.Parker@noaa.gov]
Sent: Thursday, January 04, 2007 1:23 PM
To: GUILFORD James
Subject: [Fwd: Re: UWTROC WATLEV Thresholds]

James, If the attached file does not arrive (sent twice) try the following FTP site. You can copy, but you can't write! It's the following address: ftp://205.156.4.84/4AHB_H115577_ShtA-FromTenix/ncm_vol1.pdf

gene
-------- Original Message --------

Subject: Re: UWTROC WATLEV Thresholds
Date: Thu, 04 Jan 2007 13:56:58 -0500
From: gene_parker <castle.e.parker@noaa.gov>
Organization: NOAA / Atlantic Hydrographic Branch
To: GUILFORD James <James.GUILFORD@Tenix.com>
CC: RAMSAY Scott <Scott.RAMSAY@Tenix.com>
References: <200701041625.l04GP2n4020866@sprint2.tenix.com>

Back to ya James, I'm going to list a reference at which you may obtain the information. I could regurgitate the information as Cathleen Barry has done for the west coast, but this would take me some time to modify the document. Instead, I'll point you back to the source which is Marine Chart Division's Nautical Chart Manual which is available via web access and one may download.

The Nautical Chart Manual (NCM) is now considered source documents and specifications for raster charts and ENC when generating H-cells or BASE Cell Files. The documents are available at the following web site:
http://chartmaker.noaa.gov/staff/ncum/ncum.htm

The attached version should be the same as on the web site is attached in one complete document. Within the NCM go to page 386 of 787 in the attached pdf file, or reference Figure 4-11a within chapter 4. Also reference page 383 of 787 through 386 of 787 of the

attached document.

land area is -0.3047m above MHW (MHW reference in the final tide note from OCS COOPS or with SOW and tidal information provided with SOW.
MHW ----------

Exposed == **covers and uncovers** (Any feature that is between -0.30479m above MLLW and -0.30479 above MHW)

-0.30479m (-1-ft) above MLLW
MLLW ----------**awash** (0.30479 to -0.30479 MLLW)
0.30479m (1-ft) below MLLW
---------- **submerged** (0.30479m and deeper MLLW)

The document that you provided from PHB sources values that are referenced in Figure 4-11a.

Hope this is what you needed, if not please reply.

Regards, Gene

GUILFORD James wrote:

> Hey Gene,
>
> How are you? Hope you had a Merry Christmas and a Happy New Year. I have
> a question for you concerning WATLEV values to be used for UWTROC objects. We have been given depth ranges from PHB for determining WATLEV
> attribute values and what is considered Covers and Uncovers, Awash, and Always Submerged as well as what is an islet.
>
> These values don't mesh for the Puerto Rico surveys as a result of the large difference in tidal ranges between AK and PR. Would you be able to supply me with appropriate values for PR?
>
> Attached is a document from PHB
>
> All the best in 2007
> Thanks
> James
>
> ---
> James Guilford
> Senior Hydrographer
> Tenix LADS Inc.

925 Tommy Munro Dr. Ste J
Biloxi, MS 39532

Ph (O): 228-594-6800
Ph (M): 228-342-3028
Fax: 228-594-6887

-----Original Message-----
From: gene_parker [mailto:Castle.E.Parker@noaa.gov]
Sent: Wednesday, December 13, 2006 6:04 AM
To: GUILFORD James
Cc: David.Scharff; Tod Schattgen
Subject: Re: US Hydro Call for Papers

Hey James, Sounds OK with me. I need to think about it and then let's talk. I'm going on leave till the first of the year starting Friday; it's a case of use or loose.

I had been thinking about a paper from an AHB perspective but think we could approach from a different angle as you've mentioned. My original thoughts were similar to paper written in 2001 but an updated version of AHB QA/QC processing with the new deliverables. I would be interested in
broadening the subject as it could be enlightening from the KR point of view and the issues that you've encountered with the new deliverables. Sounds good, let me think on it and let is bounce around for a little bit.

Hold that thought... Talk to you again, let's see if others approve. For me, I think it's a good idea and win-win situation for OCS.

Gene

GUILFORD James wrote:

> Hey Guys,
>
> How are things? I have been talking with Darren this morning and he mentioned that you guys might be interested in submitting a joint paper for the US Hydro conference.
>
> As far as a paper goes....I kind of want to avoid talking about the nitty gritty of processing using caris but rather focus on the shift made from how we used to deliver data to delivery of the new products. This is all still very preliminary but I was thinking for a title something like:
> Transitioning from the Paper to Digital Survey.
>
> The paper would overview how we used to deliver data and focus on how we are delivering data now and how it is being used by you guys.

>
> The paper would also touch on the use of internation standards and open source formats, challenges, advantages, disadvantages....
>
> What do you think?
>
> ---
> James Guilford
> Senior Hydrographer
> Tenix LADS Inc.
> 925 Tommy Munro Dr. Ste J
> Biloxi, MS 39532
>
> Ph (O): 228-594-6800
> Ph (M): 228-342-3028
> Fax: 228-594-6887
>
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Name: S57_Encoding_Guide-Rock_Elevations.pdf
Type: Portable Document Format (application/pdf)
S57_Encoding_Guide-Rock_Elevations.pdf Encoding: base64
Description: S57_Encoding_Guide-Rock_Elevations.pdf
Download Status: Not downloaded with message

APPENDIX VI – AWOIS

No AWOIS were assigned to this task order.

ATLANTIC HYDROGRAPHIC BRANCH
EVALUATION REPORT to ACCOMPANY
SURVEY H11558 (2006)

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.

A. AREA SURVEYED

No changes from DR.

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
CARIS Bathy Manager version 2.1 SP1
DKART INSPECTOR, version 5.0 Build 732 SP1
CARIS HOM version 3.3
CARIS S57 Composer version 2.0

B.2. QUALITY CONTROL

B.2.1. H-Cell

The final product from the review was a 3 meter resolution surface. The shoal layer was extracted from this surface and the depth layer regenerated from the shoal layer. The resultant surface was used for chart compilation.

The surface was generalized into a product surface with a 5 meter resolution. The sounding selection was created from this product surface using a 50 meter radius. A filter was applied to exclude the generalized soundings. An interpolated surface was created from the sounding selection with a 100 meter radius in order to create depth contours. The interpolated surface was then shifted by -0.229 for contours of 10 fathoms or less, and -1.372 for contours greater than 10 fathoms.

The initial chart sounding selection was created by automated means. Another surface was interpolated from the dense sounding selection, with a 20 meter resolution. The chart sounding selection was created from this surface with a 700 meter radius to correlate with chart 25671 (1:100,000). Interpolated soundings were excluded from selection to ensure the selected soundings are a subset of the dense sounding set. This initial chart sounding set was then manually edited, with special attention to the rocky areas and features.

The Meta layers submitted by the field unit were edited slightly on the eastern edge such that the border aligns with the Meta border for junction surveys H11560 and H11561.

Bottom samples were not obtained in this survey, hence the SBDARE point objects were imported from the ENC. In addition, rocky SBDARE area objects were

established from careful examination of the bathymetry. The rocky seabed areas that overlap with H11560 and H11561 to the east were delineated to align with the rocky seabed areas from those surveys.

Several rocks were included in the field unit-submitted feature file. Only the most significant rocks that lie outside of the rocky areas were designated for charting. Inside of the rocky areas, the rocks are represented with chart soundings and removed from compilation. Outside of the rocky areas, the vast majority of the field unit-submitted rocks are adequately represented by shoaler rocks or a shoaler sounding in close proximity, or were deep enough to be considered navigationally insignificant, and were removed from compilation. Five rocks (UWTROC) were retained for charting.

Rock #18 from the DR already exists on the chart, and it is represented in the bathymetry, however it was not included in this H-Cell. The rock lies on the border between this survey and H11561, and this rock has already been accounted for in H11561.

The pre-compilation components included the dense sounding selection and the chart sounding selection (SOUNDG), features (DEPARE, DEPCNT, SBDARE, UWTROC), cartographic blue notes ($CSYMB), and Meta objects (M_COVR, M_QUAL). With the exception of the dense sounding selection and depth contours, all of the other pre-compilation components listed above were inserted into one feature layer, and this layer was exported into S-57 format in order to create the H-Cell deliverable. The dense 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 fathoms. The final products are two S-57 files, one that contains the chart soundings, all of the features, Meta products, and blue notes (H11558_CS.000) and one that contains the dense sounding selection and contours (H11558_SS.000). Finally, quality assurance checks were made utilizing both DKART Inspector version 5.0 and Caris S-57 Composer version 2.0 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.

The H11558 CARIS H-Cell final deliverables include the following products:

H11558_CS.000	1:100,000 Scale	H11558 H-Cell with Chart Scale Selected Soundings
H11558_SS.000	1:10,000 Scale	H11558 Selected Soundings (Survey Scale)

B.22. Junctions

H11558 junctions with H11560 to the northeast and H11561 to the southeast. Soundings compare favorably with both junction surveys. As mentioned above, Meta objects and seabed area objects were aligned to correlate with junction surveys.

H11558 also junctions with H11557 to the west and H11559 to the south. H11557 and H11559 have yet to be compiled. During compilation of these surveys, junctions with H11558 will be analyzed and area borders drawn accordingly.

C. VERTICAL AND HORIZONTAL CONTROL

Final corrections were applied by the field unit and no other tidal corrections were required.

D. RESULTS AND RECOMMENDATIONS

D.1 CHART COMPARISON — 25671 (18th Edition, 2003-03-01)

Corrected through NM 04/14/2007
Corrected through LNM 04/10/2007
Scale 1:100,000

ENC Comparison — US4PR60M

West Coast of Puerto Rico
Edition 6
Application Date 2007-10-22
Issue Date 2007-10-22
Chart 25671

D.1.1 Hydrography

The hydrographer makes adequate chart comparisons in section D of the Descriptive Report, which includes AHB verification notes. Also see the attached spreadsheet for a complete list of all the individual features and blue notes.

D.2. ADDITIONAL RESULTS

D.2.1. Aids to Navigation

No changes from DR.

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.

APPROVAL SHEET
H11558

Initial Approvals:

The completed survey has been inspected with regard to survey coverage, delineation of depth curves, representation 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.

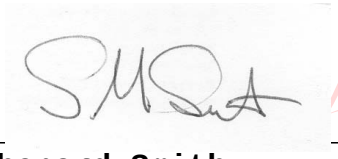
All final products have undergone a comprehensive reviews per the Hydrographic surveys Division Office Processing Manual and are verified to be accurate and complete except where noted.

Matthew J Wilson

Digitally signed by Matthew J Wilson
DN: cn=Matthew J Wilson, o=NOAA, ou=Atlantic Hydrographic Branch, email=matthew.wilson@noaa.gov, c=US
Date: 2009.02.27 11:51:14 -05'00'

Matthew J. Wilson
Physical Scientist
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.

Approved: 

Digitally signed by Shepard Smith
DN: cn=Shepard Smith, o=NOAA, ou=AHB, email=shep.smith@noaa.gov, c=US
Date: 2009.02.27 16:44:36 -05'00'

Shepard Smith
Commander, NOAA
Chief, Atlantic Hydrographic Branch

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: 2009.03.04 08:55:46 -05'00'