NOAA FORM 76-35A

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

#### DESCRIPTIVE REPORT

H12068

Type of S	Survey:
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Hydrographic Survey

Registry Number:

H12068

#### LOCALITY

State: Alaska General Locality: Southwest Peninsula

Sub-locality: 26 NM SW of Sanak Island

#### 2009

CHIEF OF PARTY Marta Krynytzky TerraSond Ltd

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DATE

NOAA FORM 77-28 (11-72) U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION			
HYDROGRAPHIC TITLE SHEET	0	<b>OPR-P188-TE09</b>	
INSTRUCTIONS – The Hydrographic Sheet should be accompanied by filled in as completely as possible, when the sheet is forwarded to the Office	is form, <b>FIELD No.</b>	H12068	
State Alaska			
General Locality Southwest Peninsula			
Sub-Locality26 NM SW of Sanak Island			
Scale	Date of Survey	6/22/2009 - 8/22/2009	
Instructions dated March 30, 2009	Project No	OPR-P188-TE-09	
Vessel <u>M/V Bluefin</u>			
Chief of party Marta Krynytzky			
Surveyed by TerraSond Ltd			
Soundings by echo sounder, lead line, pole Echo S	inder		
Graphic record scaled by N/A			
Graphic record checked byN/A	Automated Plot	N/A	
Verification by Kathleen Mildon	lantic Hydrograph	ic Branch Personnel	
		ters, compiled in fathoms.	
REMARKS: Contract No.: DG133C-08-CQ-0005			
Contractor: TerraSond Ltd.	All tim	nes recorded in UTC	
1617 South Industrial Way, Suite 3			
Palmer, AK 99645			

Bold, italic, red notes in the Descriptive Report were made during office processing.

## DESCRIPTIVE REPORT OPR-P188-TE-09



Traffic in survey area H12066

Registry Number: **H12066** Vessels: *M/V Bluefin* Survey: **Sheet E** State: **Alaska** General Locality: **Southwest Peninsula** Sublocality: **26 NM SW of Sanak Is., AK** Survey Dates: **June 2 – August 22, 2009** Lead Hydrographer: **Marta Krynytzky** 

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## APPENDICES

- I Danger to Navigation Reports
- II Survey Feature Report
- III Progress Sketch
- IV Tide and Water Levels
- V Supplemental Survey Records and Correspondence

## **SEPARATES** *Filed with original field records.*

- I Acquisition and Processing Logs
- II Sound Velocity Profile Data
- III Hydrographic Survey Letter Instructions/Statement of Work
- IV Crossline Comparisons
- V Side Scan Contact Listings and Images of Significant Contacts



## A. AREA SURVEYED

A navigable area survey was conducted 26 NM SW of Sanak Is., AK in accordance with the NOAA, National Ocean Service, *Statement of Work*, OPR-P188-TE-09, dated December, 2008.

The purpose of this project was to provide NOAA with modern, accurate hydrographic survey data with which to update the nautical charts. The project encompasses an area commonly known as Unimak Pass. The safety fairway through Unimak Pass is a major shipping lane connecting the Pacific Ocean to the Bering Sea at the western edge of the Alaskan mainland. The pass is convenient to the great circle route between North America and Asia, as well as more local routes between Western Alaskan waters and South central Alaska. As such, Unimak Pass supports international shipping and a strong commercial fishing infrastructure. Unimak Pass is ice free year round but is well known for its fierce weather, strong currents and generally unforgiving conditions.

The frequency and density of high-risk marine traffic, proximity to pristine environments, dynamic seafloor profiles and powerful tides and currents demand the most accurate and up-to-date navigational charts to operate in a safe and efficient manner.

The survey area is the east end of the shipping corridor through Unimak Pass. H12066 comprises approximately 165.3 square nautical miles in area and presents a passage of 26.7 nautical miles in length.

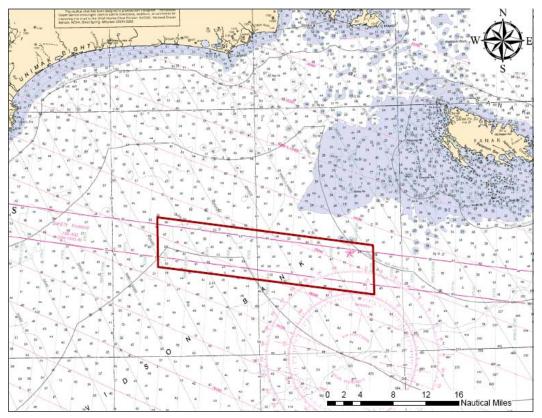


Figure 1– Overlay of H12066 on Chart 16520, 23rd Edition, August, 2008. Soundings in fathoms.



Full bottom shallow-water multibeam echosounder coverage was achieved within the limits of hydrography for this survey. This survey area has a maximum depth of 113.8 meters and a minimum depth of 44.3 meters below the Mean Lower Low Water (MLLW) tidal datum. *Concur* 

Data Type for Each Vessel	M/V Bluefin	Totals
Lineal Nautical Miles of Multibeam Mainscheme	1693.04	1693.04
Lineal Nautical Miles of Multibeam Crosslines (No Single Beam Cross Lines Acquired)	75.72	75.72
Lineal Nautical Miles of Developments	0	0
Lineal Nautical Miles of Shoreline Investigation	0	0
Number of Bottom Samples Collected	121	121
Number of Items Investigated (Detached Positions)	0	0

Table 1 - Data Acquisition Summary

Month	Dates
June	2-3, 7, 15-16
July	4-5, 10-14, 16, 18-19, 26-30
August	1, 5, 7, 13-22

 Table 2 - Specific Dates of Data Acquisition

For complete survey limits, refer to Figure 1 above and Appendix III: Final Progress Sketch\* and Survey Outline of this report. *Concur* 

\*Data attached to this report.

## **B.** DATA ACQUISITION AND PROCESSING SEE ALSO THE H-CELL REPORT.

#### **B.1.** Equipment

Bathymetry for this survey was acquired using the hydrographic survey vessel M/V Bluefin.

#### M/V Bluefin

The *M/V Bluefin* is steel hull vessel 53.6 meters length overall with an 11.6 meter beam and a 3.96 meter draft. Major systems used on the *M/V Bluefin* are listed in Table 3



VESSEL M/V Bluefin LOA: 53.6 m, BEAM 11.6 m, DRAFT: 3.96 m		
Equipment Manufacturer & Model		
Multibeam sonar	Reson SeaBat 8101	
Positioning	Applanix POS MV V4	
Sound speed	ODIM MVP 200 with Micro SV&P probe, Applied Microsystems SV Plus v2	
Vessel attitude	Applanix POS MV IMU	

Table 3 - Major systems used aboard the M/V Bluefin.

Equipment performance details are provided in the <u>Data Acquisition and Processing</u> <u>Report (DAPR)\*</u>, *Sections A: Equipment* and *B: Quality Control.* 

#### **B.2.** Quality Control

#### **B.2.1.** Crosslines

159 mainscheme lines totaling 1693.04 lineal nautical miles and 16 crosslines totaling 75.72 lineal nautical miles were run during the 2009 survey of H12066. The ratio of the lineal nautical miles of crosslines to the lineal nautical miles of mainscheme lines, at 4.47 %, exceeds the 4% required by NOAA <u>Hydrographic Surveys Specifications and Deliverables (HSSD</u>), *Section 5.1.4.3*.

The crossline analysis was conducted using CARIS HIPS' QC Report routine. Each crossline was selected and run through the process, which calculated the difference between each accepted crossline sounding and a BASE surface created from the mainscheme data.

The differences in depth were grouped by beam number and statistics computed which included the percentage of soundings compared whose differences from the BASE surface fall within IHO survey Order 1.

All beams meet IHO Order 1 at the 95 % confidence level or better. Refer to *Separate IV: Checkpoint Summary and Crossline Comparisons\*\** for the QC Reports.

\*Included with H-Cell deliverables.

\*\*Data filed with original field records.

#### **B.2.2.** Uncertainty Values

CUBE surfaces were built in CARIS HIPS in which the uncertainty value for the grid is the greater of the standard deviation and the a priority uncertainty at each node. The CUBE surface uncertainty child layer was examined to verify that no areas of high



uncertainty exceed IHO levels as described in HSSD section 5.1.2 and 5.2.2. However, there are isolated areas of elevated uncertainty which are typically relegated to outer beams presenting sound velocity (refraction) artifacts, areas of dynamic seabed morphology and areas of steep/changeable terrain.

#### **B.2.3.** Contemporary Survey Junctions *See also the H-Cell report.*

This survey junctions with two other contemporary surveys. See Table 4 and Figure 2 below.

Survey Registry Number	Project Number	Scale	Date	Junction with H12066 Edge
H12065 OPR-P188-TE-09		1:40,000	August 2009	West
H12067	OPR-P188-TE-09	1:40,000	August 2009	East

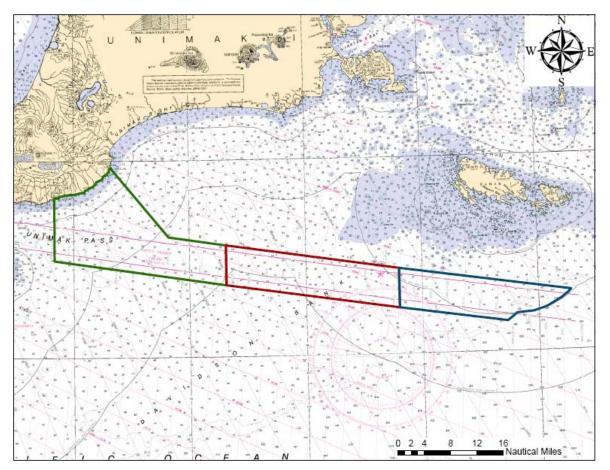


Table 4 - Contemporary survey junctions with H12066.

Figure 2 – Overlay showing the junction locations of H12066 (red) with H12065 (green) and H12067 (blue) from this project (OPR-P188-TE-09) on Chart 16520, 23rd Edition, August, 2008.



In CARIS HIPS the BASE surfaces for each survey sheet were opened. The tool tip feature was then incorporated to analyze the difference between sounding values for each sheet at multiple locations along the survey junction. The soundings are in good general agreement between the surveys. No adjustments or recommendations were made based on the junction analysis. *Concur* 

#### **B.2.4.** Sonar System Quality Control Checks

Multibeam confidence checks were conducted on the *M/V Bluefin* and *R/V Mt. Augustine* to verify proper operation of the multibeam suite on a weekly basis, weather permitting. The confidence checks were performed by comparing nadir beam depths with lead line depths or alternatively by comparing soundings collected on the *M/V Bluefin* with those collected by the *R/V Mt. Augustine* at the same location. The results of these comparisons and the acquisition logs detailing aspects of quality control for each survey line are contained in *Separate I: Acquisition and Processing Logs\*\** of this report. *Concur* 

#### **B.2.5.** Unusual Conditions Encountered

No conditions with the potential for adversely affecting data integrity were encountered with the multibeam suite used during this survey, with the exception of the following:

- 1. On the *M/V Bluefin*, the Applanix POS IMU was not mounted near the center of rotation of the vessel. The IMU was mounted approximately 16 m forward of the vessels center of rotation, directly above the Reson 8108 sonar head. This configuration resulted in a non-zero heave average, but did not otherwise affect the quality of the data. For further details refer to section A.1.1.1 of the DAPR\*.
- 2. Vessel to vessel line comparisons between the *M/V Bluefin* and the *R/V Mt*. *Augustine* reveal variable discrepancies in soundings. Lead line checks taken from each vessel agree with each vessel's sonar readings. TerraSond Ltd. suspects the discrepancies between underway soundings is due to separation of the center of motion and the IMU onboard the *M/V Bluefin*. For further details refer to section A.1.1.1 of the DAPR.\*
- 3. Twice during the survey the *M/V Bluefin* roll offset value changed. In both instances the change was noticed as an artifact during onboard processing, the *M/V Bluefin* was patch tested as soon as possible, and the new values applied in post processing from the time that the offset was noticed. Additionally, in both instances at the earliest convenience the sonar head was inspected by a diver in Dutch Harbor. Neither dive investigation revealed any noticeable change or alteration to the sonar mount. The changes were discrete changes and new patch values removed all roll artifacts from the data. Refer to the <u>DAPR</u>, *Section A.1.1.1\** for further details.

\*Included with H-Cell deliverables. \*\*Filed with original field records.



4. On July 23, 2009 (Julian Day Number 204) the Reson 81-P began malfunctioning on the *M/V Bluefin*. The unit was immediately taken out of service. For the remainder of the project one Reson 81-P was transferred between the *R/V Mt*. *Augustine* and the *M/V Bluefin*. *M/V Bluefin* was patch tested once with the new Reson 81-P. Since the Reson 81-P is a topside processing unit with no positioning offsets, a new patch test was not performed each time the unit was moved from one vessel to the other. Refer to the <u>DAPR</u>, *Section A.1.1.1\** for further details.

#### **B.2.6.** Sound Speed

Unimak Pass is a dynamic area with strong tidal currents and major mixing occurs between the Northern Pacific Ocean, the Gulf of Alaska and the Bering Sea. Sound speed measurements throughout the area varied both spatially and temporally. To minimize sound speed errors, sound speed casts were taken every 2-4 hours, with frequency determined by an onboard review of data quality. Sound speed profiles were taken as deep as possible. Conservative line spacing and generous overlap also contributed to minimizing sound speed errors. All sound speed profiles were applied 'previous in time' in CARIS HIPS with the exception of the following:

CARIS Line Name	Vessel	Method used for applying Sound Speed Profiles
1051E	M/V Bluefin	SVP applied using Nearest in Time

 Table 5 - Sound speed application method exceptions

#### **B.2.7.** Requirements for Object Detection and Coverage

The *M/V Bluefin* was outfitted with a Reson SeaBat 8101 multibeam sonar and an Applanix POS MV V4 positioning system.

Complete coverage was achieved by building real time grids with QPS QINSy acquisition software. When several vessels were working in adjacent areas, each vessel's grid was updated frequently with the other vessels' progress and coverage. *Concur with clarification. Only the M/V Bluefin was utilized during H12066 survey operations.* 

A detailed discussion of multibeam system calibrations, patch tests, data acquisition and processing is provided in the <u>DAPR</u>.\*

#### **B.3.** Corrections to Echo Soundings

Survey H12066 was performed in conjunction with three other surveys in Project OPR-P188-TE-09. Any change to the corrections to echo soundings affects all surveys in the area and is described in detail in the <u>DAPR</u>\*.

\*Included with H-Cell deliverables.



All sounding data were corrected for true heave with the exception	of the following:
--	-------------------

CARIS line name	Vessel	Comment
0922-Е	M/V Bluefin	True Heave Not Available
0923-Е	M/V Bluefin	True Heave Not Available
0929-Е	M/V Bluefin	True Heave Not Available
0977-Е	M/V Bluefin	True Heave Not Available
1032-Е	M/V Bluefin	True Heave Not Available
1279-Е	M/V Bluefin	True Heave Not Available
1335-Е	M/V Bluefin	True Heave Not Available

Table 6 – Survey lines which do not have true heave applied.

Sounding data were reduced using zoning provided by John Oswald and Associates using data from installed tide gauges at the historic Scotch Cap, AK (946-2808) site, a new station installed at Akun Bay (946-2719) and the Coast Guard maintained station King Cove, AK (945-9881). Refer to the <u>Vertical and Horizontal Control Report</u> (<u>VHCR</u>)\* for tidal zoning methods and operations. *Concur* 

Final zoning and tides were applied during field operations.

#### B.4. Data Processing *See also the H-Cell report.*

The final depth information for this survey was submitted as a collection of CARIS BASE CUBE surfaces which best represented the seafloor at the time of the 2009 survey. All possible measures were taken to ensure the data were correctly processed and the appropriate designated soundings, representing the least depth of significant contacts, were selected and retained in the finalized surfaces.

Several grids of varying resolution were created for H1200466 due to the wide depth range and varying bathymetry found in the survey area. Grid spacing of 2 and 4 meters was used for the BASE surfaces. All grids are projected to UTM Zone 3 North, NAD 1983.

Depth Range (m)	BASE Surface Resolution (m)
20-52	2
46-115	4

Table 7 - BASE surface resolution vs. survey depth.

Two CUBE BASE surface digital products were submitted for the 2009 survey. The BASE surfaces are named with their resolution in the following format: 2m\_Final, and stored in a fieldsheet named with the survey number (H12066\_Final). *Concur* 

\*Included with survey deliverables.



A data set containing a single S-57 (.000) base cell file and supporting files were submitted in conjunction with the other 2009 survey deliverables. The base cell contains information on objects not represented in the depth grid, including, but not limited to, shoreline and nature of the seabed from bottom samples. Each feature object includes the mandatory S-57 attributes, contract specific attributes, and any additional attributes assigned. Survey outline nodes were filtered in CARIS Notebook to 30 meters to be able to create S-57 attributed metadata objects. *Concur* 

The <u>DAPR</u>, Sections A.2: Data Collection and B: Quality Control\* contain a detailed discussion of the steps followed when acquiring and processing the 2009 survey data. Concur

## C. VERTICAL AND HORIZONTAL CONTROL SEE ALSO THE H-CELL REPORT.

Sounding data were tide adjusted using final tide levels from installed stations at the historic United States Coast Guard (USCG) tide stations at Scotch Cap, AK (946-2808) and a new station at Akun Bay (946-2719) and the USCG maintained station King Cove, AK (945-9881). The original zoning was modified by JOA. Final zoning methodology is described in detail in the project-wide VHCR\*. *Concur* 

Final tides and zoning were applied by the field unit.

In the field, sounding position control was determined using a Global Positioning System (GPS). The primary source of navigation correctors was the USCG differential GPS (DGPS) station at Cold Bay, Station ID 289. A summary of weekly DGPS confidence checks is provided in *Separate I*\*\* of this report. *Concur* 

Final sounding position control was determined using Post Processed Kinematic Smoothed Best Estimate Trajectory (PPK SBET). SBET's were applied to the sounding data through CARIS. SBET processing is described in detail in the <u>DAPR</u> Section B: Quality Control\*. PPK navigation data was applied to the sounding data with the exception of the following:

CARIS line name	Vessel	Comment
0922E	M/V Bluefin	SBET Not Available
0923E	M/V Bluefin	SBET Not Available
0977E	M/V Bluefin	SBET Not Available
1155E_XL	M/V Bluefin	SBET Not Available
1279Е	M/V Bluefin	SBET Not Available

 Table 8 – Survey lines which do not have PPK navigation applied.

\*Included with H-Cell deliverables.

\*\*Data filed with original records.



The horizontal control datum used for this survey is the North American Datum of 1983 (NAD 83). The projection used was UTM, Zone 3 North. *Concur* 

## **D.** RESULTS AND RECOMMENDATIONS SEE ALSO THE H-CELL REPORT.

#### **D.1.** Chart Comparison

The chart comparison for H12066 was performed by examining the Raster Navigational Charts (RNCs) and Electronic Navigation Charts (ENCs) specified by the Project Instructions. See *Separates III: Hydrographic Survey Letter Instructions\** for this document.

Discrepancies are discussed in context of the largest scale chart available and assumed to apply to the smaller scale charts unless specifically mentioned.

All survey data were compared to the data published in the RNCs and ENCs listed in Table 9.

Chart	Туре	Scale	Edition	Issue Date	NM / LNM Through
16520	RNC	1:300,000	23 <sup>rd</sup>	2008-08-01	2008-08-09 2008-07-29
US3AK61M (16520)	ENC	N/A	11 <sup>th</sup>	2009-10-01	2009-10-01

Table 9 – Charts used during chart comparisons.

Notices to Mariners (NM) and Local Notice to Mariners (LNM) issued from April 2009 through August 2009 (from issuance of SOW to completion of survey) that affected the survey were examined as well, ending with NM 39/09 and LNM 35/09. No discrepancies were found. *Concur* 

\*Data filed with original field records.



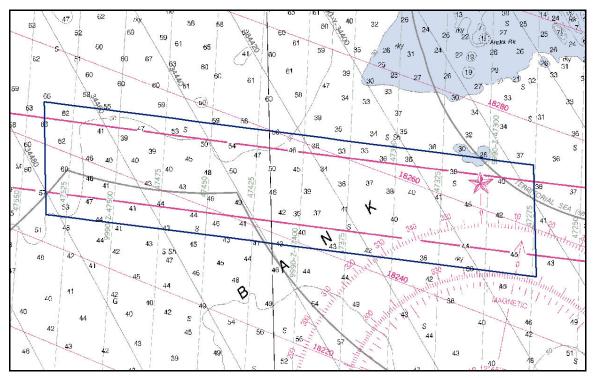


Figure 3 – Sheet limits of H12066 shown on chart 16520.

The chart comparison was accomplished by generating shoal-biased soundings and contours and overlaying them along with the finalized BASE surfaces on the latest edition NOAA charts. The general agreement between charted soundings and H12066 soundings was then examined and a more detailed comparison was undertaken for any shoals or other dangerous features.

General agreement between this survey and the charts is good. Significant differences are itemized in the sections below.

#### **D.1.1.** New Features

There are no new features identified within the survey extents.

Do not concur – See Appendix II attached to this report.

#### **D.1.2.** Charted Features

There are no charted features within the survey extents. *Concur* 

#### D.1.3. Soundings

Survey depth agreement with the charts was consistent across the project area.

There is no discernable shoaling or deepening areas. Concur



One significant difference (greater then  $\pm 10$  % of charted depth) is itemized in the table below. It is recommended that soundings from H12066 supersede previously charted soundings. *Concur* 

Chart	Charted Depth	Survey Depth in Vicinity	Charted Position	Comments
16520	35 fathoms	42 fathoms	54-10-44.62N, 163-27-41.13W	none

Table	10 -	Sounding	discrepancies
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#### **D.1.4.** Trends and Changeable Areas

Contours were created in CARIS Bathy DataBASE 2.3 and examined concurrently with the charted contours from chart 16520 (largest scale chart) in ArcMap.

Agreement is variable across the survey area, with a few areas comparing well but most showing a shift. In the western section of the survey area the 50 fathom contour has shifted southward approximately 7 kilometers extending towards existing charted soundings in agreement with survey soundings. In the same vicinity a shoal area of 47 fathoms depth (charted soundings in agreement with survey soundings) is now encircled by an additional 50 fathoms contour. An approximately 1.5 kilometer eastward shift of the 50 fathom contour is illustrated in the southwestern corner of the sheet. *Concur* 

An example of these shifts and additional contour are illustrated below.

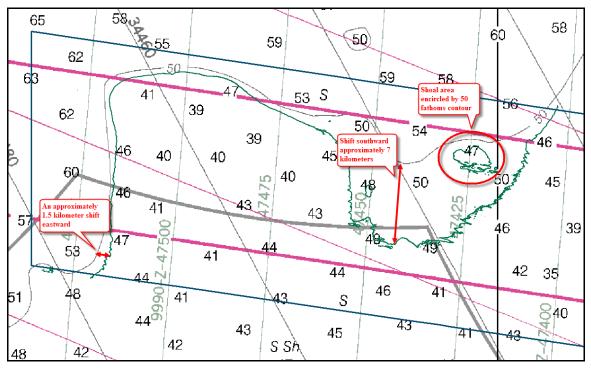


Figure 4 – Contours from H12066 (green) overlaid on chart 16520



The hydrographer recommends that the charted contours be updated to reflect the 2009 survey data. *Concur* 

#### D.1.5. AWOIS Items Summary

No Automated Wreck and Obstruction Information System (AWOIS) items were included in the area of this survey. See memos included in *Appendix V: Supplemental Survey Records & Correspondence\** for more detail. *Concur* 

#### D.1.6. Features Labeled PA, ED, PD, or Rep.

There were no charted features labeled "PA, ED, PD, or Rep." within the survey extents. *Concur* 

#### **D.1.7.** Danger to Navigation Reports.

There was no Danger to Navigation Reports submitted for this survey. Concur

#### **D.2.** Additional Results

#### **D.2.1.** Shoreline Verification

No shoreline verification was required for this survey. Concur

#### **D.2.2.** Aids to Navigation

There are no aids to navigation in this survey area. Concur

#### **D.2.3. Drilling Structures**

An investigation of drilling structures is not required under this task order. There are no drilling structures within the project area. *Concur* 

#### **D.2.4.** Comparison with Prior Surveys

A comparison with prior surveys was not required under this task order. See Section D.1 of this report for a comparison to the existing nautical charts. *Concur* 

#### **D.2.5.** Bottom Samples

One hundred twenty-one bottom samples were collected in support of the 2009 survey. The samples were distributed geographically to obtain a full representation of the bottom characteristics as specified in <u>HSSD</u>, *Section 7.1*. A listing and description of the bottom samples is provided in *Appendix V*\* of this report. *Concur with clarification – Only eleven bottom samples were included in the H-Cell*.

\*Data attached to this report.



## D.2.6. Bridges and Overhead Cables

There are no bridges or overhead cables in the survey area. Concur

## **D.2.7.** Submarine Cables and Pipelines

There are no submarine cables in the survey area. Concur

# LETTER OF APPROVAL REGISTRY NUMBER H12066

This report and the accompanying digital data are respectfully submitted.

Field operations contributing to the accomplishment of survey H12066 were conducted under my direct supervision with frequent personal checks of progress and adequacy. This report, digital data and accompanying records have been closely reviewed and are considered complete and adequate as per the *Statement of Work*. Other reports submitted with this survey include the <u>Data Acquisition and Processing Report</u> and the <u>Vertical and</u> Horizontal Control Report.

I believe this survey is complete and adequate for its intended purpose.

Marta Krynytzky DN: CN = Marta Krynytzky, C = US, O = TerraSond Ltd., OU = Charting Date: 2010.01.14 12:00:25 -09'00'

## Marta Krynytzky, Lead Hydrographer TerraSond Ltd.

Date January 14, 2010



OPR-P188-TE-09 Unimak Pass, Alaska H12066, Sheet E

**APPENDIX I Danger to Navigation Reports** 

There were no Dangers to Navigation Reported for this survey.

## **APPENDIX II FEATURES REPORT**

<b>Registry Number:</b>	
State:	
Locality:	
Sub-locality:	
Project Number:	
Survey Date:	08/17/2009

## **Charts Affected**

Number	Edition	Date	Scale (RNC)	RNC Correction(s)*
16520	23rd	08/01/2008	1:300,000 (16520_1)	USCG LNM: 10/12/2010 (1/18/2011) CHS NTM: None (12/31/2010) NGA NTM: 1/11/2003 (1/29/2011)
16011	37th	11/01/2007	1:1,023,188 (16011_1)	[L]NTM: ?
16006	35th	04/01/2008	1:1,534,076 (16006_1)	[L]NTM: ?
513	7th	06/01/2004	1:3,500,000 (513_1)	[L]NTM: ?
500	8th	06/01/2003	1:3,500,000 (500_1)	[L]NTM: ?
530	32nd	06/01/2007	1:4,860,700 (530_1)	[L]NTM: ?
50	6th	06/01/2003	1:10,000,000 (50_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	31 fm Rk	Rock	57.70 m	54° 13' 00.8" N	163° 39' 22.3" W	

## 1.1) 31 fm Rk

## **Survey Summary**

Survey Position:	54° 13' 00.8" N, 163° 39' 22.3" W
Least Depth:	57.70 m (= 189.30 ft = 31.550 fm = 31 fm 3.30 ft)
<b>TPU</b> (±1.96σ):	<b>THU (TPEh)</b> ±2.094 m ; <b>TVU (TPEv)</b> ±0.784 m
Timestamp:	2009-229.23:30:30.704 (08/17/2009)
Survey Line:	sheet_e / bluefin / 2009-229 / 1335e
Profile/Beam:	7269/101
Charts Affected:	16520_1, 16011_1, 16006_1, 500_1, 513_1, 530_1, 50_1

#### **Remarks:**

Rock found during office processing.

## **Feature Correlation**

Address	Feature	Range	Azimuth	Status
sheet_e/bluefin/2009-229/1335e	7269/101	0.00	000.0	Primary

## **Hydrographer Recommendations**

Chart rock with a depth of 31 fm in present survey location.

#### **Cartographically-Rounded Depth (Affected Charts):**

31fm (16520\_1, 16011\_1, 16006\_1, 530\_1) 58m (500\_1, 513\_1, 50\_1)

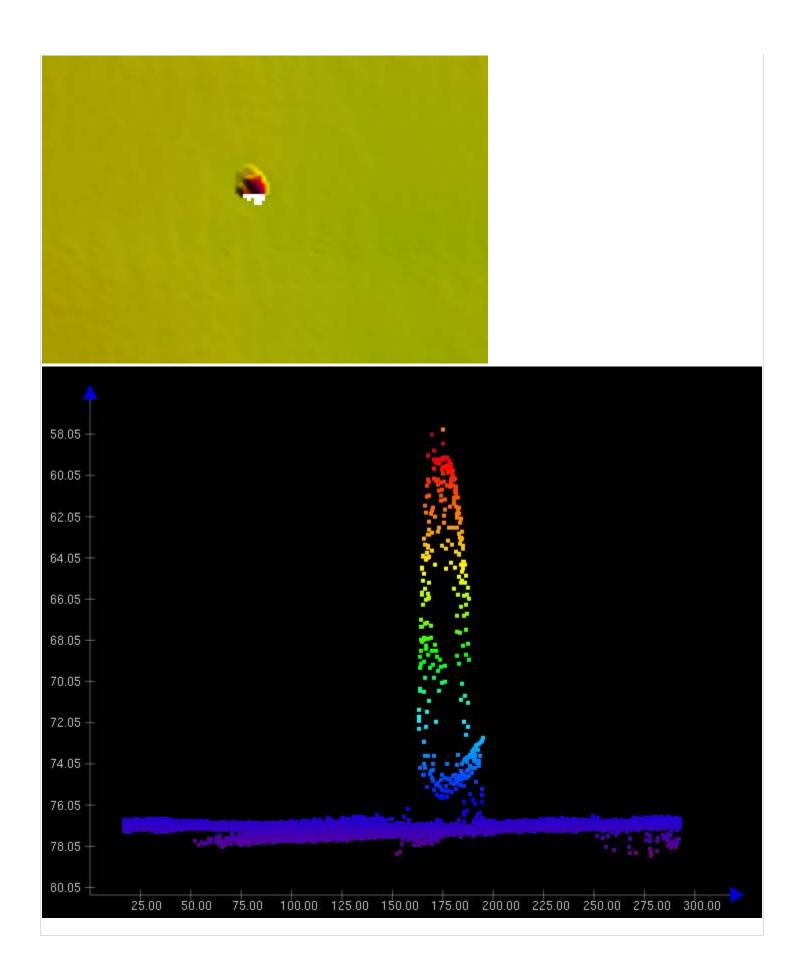
### S-57 Data

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

Attributes:QUASOU - 6:least depth known<br/>SORDAT - 20090822<br/>SORIND - US,US,graph,H12066<br/>TECSOU - 3:found by multi-beam<br/>VALSOU - 57.698 m<br/>WATLEV - 3:always under water/submerged

## **Office Notes**

Concur - Add 31 fm Rk.





OPR-P188-TE-09 Unimak Pass, Alaska H12066, Sheet E

#### APPENDIX III Final Progress Report

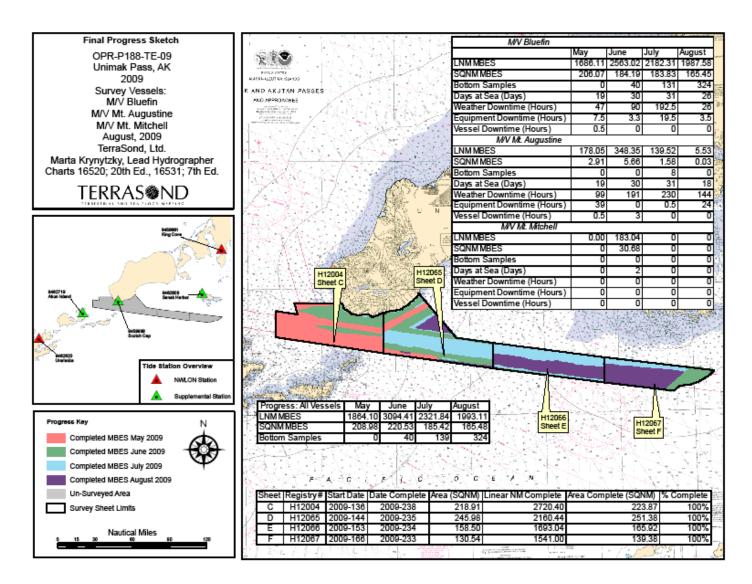


Figure 1 – Final Progress Sketch for OPR-P188-TE-09



APPENDIX IV Tides and Water Levels

## **Abstract of Times Hydrography**

Project: OPR-P188-TE-09

Registry No.: H12066

Inclusive Dates: June 2, 2009 – August 22, 2009. This Survey ran 24 hours a day.

STA	ART	E	ND
Day (Julian) Time (UTC)		Day (Julian)	Time (UTC)
153	22:16	234	13:35

#### Table 1 – Abstract Times of Hydrography

#### **Attachments:**

946-2719 Akun Island Installation and Closing Site Reports

946-2808 Scotch Cap Installation and Closing Site Reports

945-9968 Sanak Harbor Installation Site Report (Site was not part of CO-OPS submittal, so no Closing Report was generated.)

#### Site Report

#### 946-2719 Akun Island, Akun Bay, AK

Site Visit	Purpose of Visit	Installation	Team Leader	Nathan Wardwell, JOA	Date of Visit	4/7/09 - 4/11/09
ertiary Station	Installation	April 10, 2009	Removal		Number of Days	
roject	OCS	OPR-P188-TE-09			JOA	141
osition (NAD83)	Latitude (N)	54° 14' 20"	Longitude (W)	165° 32' 28"	Time Meridian	0° (UTC)
ocal Values	Gravity (milligals)	981539	GOES Angles	Elev 22°/ Az 144°	Magnetic Declination	11° E, +0° 8' W/ye
ontractor	1617	Prime TerraSond Ltd. South Industrial Way, Su Palmer, AK 99645 (907) 745-7215 ATTN: Kathleen Mildon	ite 3		Tide Consultant JOA Surveys, LLC 2000 E. Dowling Rd, Suite Anchorage, AK 99507 (907) 561-0136 phone ATTN: John Oswald	10
wner	Akutan Corporation PO Box 8 Akutan, AK 99553 (907) 698-2206					
ocation	Akutan Island, then pr 26km (14nm) to Billing	oceed NE for 37km (20nn	n) to the entrance to Akun Island, then p	Akutan Pass betwee oceed 5km (3nm) Se	boat NNE 26km (14nm) to n Akutan and Akun islands, buth to Akun Bay, then proc	then proceed East
ide House	anchored down with g the SW corner. The o orifice tubing is attach anchor the orifice lines	uide wires. There is barb rifice line for the two bubb ed to 3/8" cable. There is and cable. From the tide	ed-wire fence surrou oler gauges run outsi a Duckbill anchor at a house to the barbe	nding the tide house de to the grass edge the grass ledge and d-wire fence the orifi	ide) by 3' (high) by 3' (deep and solar cells. A gate to t then across the boulders o just outside the tide house ce tubing is covered with gr GPS and GOES antennas	he fence is located in n the beach. The that are used to ass, then from outsid
auge 1	Installed	4/10/2009	Removed			
	Pressure Sensor	DAA H350XL	Serial No. Averaging Interval	1354 180 seconds	Vent Value (m) Slope Constant in Gauge	NA 0.68398
	Data Logger	combined in H350XL	Firmware	2.120		
	Pump	DAA H355	Serial No.	TID 1899		
	GOES Radio	DAA H222	Serial No.	1002	GPS timing	Yes
	GOES Address	9070464A	Channel	170	Format	NGWLMS
	Interval	1 hour	Offset	0:01:00	Transmit Window	10 seconds
	Power	Two 12v deep cycle O	ptima batteries with a	70watt solar panel a	and solar controller.	
	Orifice	The bubbler orifice is h	ose clamped to a 4"	3/4" pipe that is wel	e that is mounted vertically ded to the anchor. Between e length of the orifice tubing	n the orifice pipe and
	Anchors	by 20cm (tall). Inside e buoy line is 3/4" blue p one large white inflatat main buoy line with a s	each leg are four 60 l olyline that is approx ole drag buoy and an eparate piece of floa	bs lengths of railroad imately 45' long. The other small foam trai	paced. Each leg is 50cm (N d rail. At the end of each leg ere are two buoys used as ling buoy. The trailing buoy	g is a handle. The surface expressions
auge 2	Installed	4/10/2009	Removed			
	Pressure Sensor	DAA H350XL	Serial No.	3541	Vent Value (m)	NA
			Averaging Interval	180 seconds	Slope Constant in Gauge	0.68398
	Data Logger	combined in H350XL	Firmware	2.12		
	Pump	DAA H355	Serial No.	1803		
	GOES Radio	DAA H222	Serial No.	1003	GPS timing	Yes
	GOES Address	907060A6	Channel	170	Format	NGWLMS
	Interval	1 hour	Offset	0:01:20	Transmit Window	10 seconds
	Power	Two 12v deep cycle O	ptima batteries with a	70watt solar panel a	and solar controller.	
	Orifice				e that is mounted vertically voke. Between the orifice p	
	Anchors	by 20cm (tall). Inside e buoy line is 3/4" blue p	each leg are four 60 l olyline that is approx ble drag buoy and an	bs lengths of railroad imately 45' long. The other small foam trai	paced. Each leg is 50cm (v d rail. At the end of each leg ere are two buoys used as ling buoy. The trailing buoy	g is a handle. The surface expressions
auge 3	Installed	4/10/2009	Removed			
	Pressure Sensor	SBE 26+ (100 psi)	Serial No.	1158	Vent Value (m)	NA
			Averaging Interval	180 seconds		
	Data Logger	combined in SBE 26+	Firmware	NA		
	Acoustic Modem	LinkQuest UWM 1000	Serial No.	010216		
	Power for modem	Link quest	Serial No.	010220		
	Power	12 D-Cell (1.5v) batteri	es for the seabird an	d extra battery pack	for the modem	
	Anchors	by 20cm (tall). Inside e buoy line is 3/4" blue p	each leg are four 60 l olyline that is approx	bs lengths of railroad imately 60' long. The	paced. Each leg is 50cm (v d rail. At the end of each leg ere are two buoys used as a	g is a handle. The surface expressions
		one large Green inflata main buoy line with a s			ailing buoy. The trailing buc	by is attached to the
dal Bench Marks	Primary	Recovered	Established		Designations	
	. minut y	1100010104	Lotabiloriod	946 2719 TIDAL 1	946 2719 TIDAL 2, 946 27	
		4	1	946 2719 TIDAL 4,		
eveling	Date	Order	Туре		Bench Marks Connected	d
Joung	4/9/09 - 4/11/09	Third	Optical	946 2719 TIDAL 1, 946 2719 TIDAL 4,	946 2719 TIDAL 2, 946 27	
	NAVD88 Level Tie	No NAVD88 marks with	hin 1.6km (1 mi).	1		
PS & OPUS	Bench Mark	Date	Session Length	Latitude (N)	Longitude (W)	Ellipsoid Height (
	9462719 A	4/9/2009	22.5 hrs	54° 14' 20.08925"		19.789
	NAVD88 GPS Tie	Not required per OCS				
	Comments	· · ·			Datasheet.jsp?PID=BBBH9	3&style=modern
tation History					our historic marks were four	
,, ,, ,	rod) was established.			COUDIG. 10		

#### Site Report 946-2719 Akun Island, Akun Bay, AK

Site Visit Fertiary Station			Tanana Lanadan	NL M/sectorell 104						
Gruary StatiOn	Purpose of Visit	Removal	Team Leader	N. Wardwell, JOA	Date of Visit	9/5/09 - 9/7/09				
Project	Installation OCS	April 10, 2009 OPR-P188-TE-09	Removal	September 7, 2009	Number of Days JOA	151				
Position (NAD83)	Latitude (N)	54° 14' 20"	Longitude (W)	165° 32' 28"	Time Meridian	0° (UTC)				
ocal Values	Gravity (milligals)	981539	GOES Angles	Elev 22°/ Az 144°	Magnetic Declination	11° E, +0° 8' W/yea				
ontractor	chaining (hining and )	Prime	g		Tide Consultant	,,.,				
	TerraSond Ltd. JOA Surveys, LLC									
	1617	South Industrial Way, Su		2000 E. Dowling Rd, Suite 10						
		Palmer, AK 99645			Anchorage, AK 99507					
		(907) 745-7215 ATTN: Kathleen Mildon			(907) 561-0136 phone ATTN: Nathan Wardwell					
		ATTN. Kauneen wildon			ATTN. Natilali Walu	weii				
)wner	Akutan Corporation PO Box 8									
	Akutan, AK 99553									
	(907) 698-2206									
ocation	To reach the tidal benc	h marks from the Unalas	ka (Dutch Harbor) C	ity Dock, proceed by be	oat NNE 26km (14nm) to	the north side of Akutar				
		E for 37km (20nm) to the								
		NE point of Akun Island, ocated on a rock ledge/bl		nm) South to Akun Bay	/, then proceed SVV 6km	(3nm) to Helianthus Co				
ide House		nics are housed in individ	-	ounted incide o Al (wide	) hu 2! (high) hu 2! (deer	) weeden ahed enchare				
iue nouse		. There is barbed-wire fe								
		for the two bubbler gaug								
		There is a Duckbill anch								
		de house to the barbed-w								
	the tubing is covered v	vith rocks to protect from	lox and callie. GPS	and GOES antennas a	re mounted to the shed i	ISEII.				
auge 1	Installed	4/10/2009	Removed	9/7/2009						
	Pressure Sensor	DAA H350XL	Serial No.	1354	Vent Value (m)	NA				
			Averaging Interva		Slope Constant in Gau					
	Data Logger	combined in H350XL	Firmware	2.120	Job Sonotant in Odu					
	Pump	DAA H355	Serial No.	TID 1899						
	GOES Radio	DAA H355 DAA H222	Serial No.	1002	GPS timing	Yes				
	GOES Address	9070464A	Channel	170	Format	NGWLMS				
	Interval	1 hour	Offset	0:01:00	Transmit Window	10 seconds				
	Power			a 70watt solar panel ar		10 30001103				
	Orifice		•		that is mounted vertical	v to a 1100 lbs anchor				
	Onnice				ed to the anchor. Betwee					
					th of the orifice tubing is					
	Anchors				aced. Each leg is 50cm					
					. At the end of each leg i					
			is 3/4" blue polyline that is approximately 45' long. There are two buoys used as surface expressions: one large white inflatable drag buoy and another small foam trailing buoy. The trailing buoy is attached to the main buoy lin							
		with a separate piece								
auge 2	Installed	4/10/2009	Removed	9/7/2009						
	Pressure Sensor	DAA H350XL	Serial No.	3541	Vent Value (m)	NA				
			Averaging Interva	I 180 seconds	Slope Constant in Gau	ge 0.68398				
	Data Loggor	11 11 105014								
	Data Lugger	combined in H350XL	Firmware	2.12						
	Data Logger Pump	DAA H355	Firmware Serial No.	2.12						
					GPS timing	Yes				
	Pump	DAA H355	Serial No.	1803	GPS timing Format	Yes NGWLMS				
	Pump GOES Radio	DAA H355 DAA H222	Serial No. Serial No.	1803 1003	-					
	Pump GOES Radio GOES Address	DAA H355 DAA H222 907060A6 1 hour	Serial No. Serial No. Channel Offset	1803 1003 170	Format Transmit Window	NGWLMS				
	Pump GOES Radio GOES Address Interval	DAA H355 DAA H222 907060A6 1 hour Two 12v deep cycle O	Serial No. Serial No. Channel Offset ptima batteries with	1803 1003 170 0:01:20 a 70watt solar panel ar	Format Transmit Window nd solar controller.	NGWLMS 10 seconds				
	Pump GOES Radio GOES Address Interval Power	DAA H355 DAA H222 907060A6 1 hour Two 12v deep cycle O The bubbler orifice is a	Serial No. Serial No. Channel Offset ptima batteries with attached to a 3/4" dia	1803 1003 170 0:01:20 a 70watt solar panel ar meter galvanized pipe	Format Transmit Window	NGWLMS 10 seconds y to the metal yoke for th				
	Pump GOES Radio GOES Address Interval Power	DAA H355 DAA H222 907060A6 1 hour Two 12v deep cycle O The bubbler orifice is a	Serial No. Serial No. Channel Offset ptima batteries with attached to a 3/4" dia	1803 1003 170 0:01:20 a 70watt solar panel ar meter galvanized pipe	Format Transmit Window nd solar controller. that is mounted verticall	NGWLMS 10 seconds y to the metal yoke for th				
	Pump GOES Radio GOES Address Interval Power	DAA H355 DAA H222 907060A6 1 hour Two 12v deep cycle O The bubbler orifice is a 1100 lbs anchor. Hos welded The anchor is 1.2m in	Serial No. Serial No. Channel Offset ptima batteries with attached to a 3/4" dia e are used to clamp diameter. They hav	1803         1003         170         0:01:20         a 70watt solar panel ar         meter galvanized pipe         the orifice to the yoke.         a three legs equally spa	Format Transmit Window d solar controller. that is mounted verticall Between the orifice pipe aced. Each leg is 50cm	NGWLMS 10 seconds y to the metal yoke for th and the pipe that is (wide) by 50cm (long) by				
	Pump GOES Radio GOES Address Interval Power Orifice	DAA H355 DAA H222 907060A6 1 hour Two 12v deep cycle O The bubbler orifice is a 1100 lbs anchor. Hos welded The anchor is 1.2m in 20cm (tall). Inside eac	Serial No. Serial No. Channel Offset ptima batteries with attached to a 3/4" dia e are used to clamp diameter. They hav th leg are four 60 lbs	1803       1003       170       0:01:20       a 70watt solar panel ar       meter galvanized pipe       the orifice to the yoke.       a three legs equally spip       lengths of railroad rail	Format Transmit Window ad solar controller. that is mounted verticall Between the orifice pipe aced. Each leg is 50cm . At the end of each leg i	NGWLMS 10 seconds y to the metal yoke for th and the pipe that is (wide) by 50cm (long) by s a handle. The buoy lin				
	Pump GOES Radio GOES Address Interval Power Orifice	DAA H355 DAA H222 907060A6 1 hour Two 12v deep cycle O The bubbler orifice is a 1100 lbs anchor. Hos welded The anchor is 1.2m in 20cm (tall). Inside ead is 3/4* blue polyline th	Serial No. Serial No. Channel Offset ptima batteries with attached to a 3/4" dia e are used to clamp diameter. They hav, th leg are four 60 lbs at is approximately 4	1803       1003       170       0:01:20       a 70watt solar panel ar       meter galvanized pipe       the orifice to the yoke.       a three legs equally spa- lengths of railroad rail       5 long. There are two	Format Transmit Window d solar controller. that is mounted verticall Between the orifice pipe aced. Each leg is 50cm . At the end of each leg buoys used as surface e	NGWLMS 10 seconds y to the metal yoke for th and the pipe that is (wide) by 50cm (long) b is a handle. The buoy lin xpressions: one large				
	Pump GOES Radio GOES Address Interval Power Orifice	DAA H355 DAA H222 907060A6 1 hour Two 12v deep cycle O The bubbler orifice is a 1100 lbs anchor. Hos welded The anchor is 1.2m in 20cm (tall). Inside ead is 3/4* blue polyline th	Serial No. Serial No. Channel Offset ptima batteries with attached to a 3/4" dia e are used to clamp diameter. They hav h leg are four 60 lbs at is approximately 4 uoy and another sma	1803       1003       170       0:01:20       a 70watt solar panel ar       meter galvanized pipe       the orifice to the yoke.       a three legs equally spa- lengths of railroad rail       5 long. There are two	Format Transmit Window ad solar controller. that is mounted verticall Between the orifice pipe aced. Each leg is 50cm . At the end of each leg i	NGWLMS 10 seconds y to the metal yoke for th and the pipe that is (wide) by 50cm (long) b is a handle. The buoy lin xpressions: one large				
auge 3	Pump GOES Radio GOES Address Interval Power Orifice	DAA H355 DAA H222 907060A6 1 hour Two 12v deep cycle O The bubbler orifice is a 1100 lbs anchor. Hos- welded The anchor is 1.2m in 20cm (tall). Inside ead is 3/4* blue polyline the white inflatable drag b	Serial No. Serial No. Channel Offset ptima batteries with attached to a 3/4" dia e are used to clamp diameter. They hav h leg are four 60 lbs at is approximately 4 uoy and another sma	1803       1003       170       0:01:20       a 70watt solar panel ar       meter galvanized pipe       the orifice to the yoke.       a three legs equally spa- lengths of railroad rail       5 long. There are two	Format Transmit Window d solar controller. that is mounted verticall Between the orifice pipe aced. Each leg is 50cm . At the end of each leg buoys used as surface e	NGWLMS 10 seconds y to the metal yoke for th and the pipe that is (wide) by 50cm (long) by is a handle. The buoy lin xpressions: one large				
iauge 3	Pump GOES Radio GOES Address Interval Power Orifice Anchors	DAA H355 DAA H222 907060A6 1 hour Two 12v deep cycle O The bubbler orifice is a 1100 lbs anchor. Host welded The anchor is 1.2m in 20cm (tall). Inside ead is 3/4" blue polyline th white inflatable drag b with a separate piece	Serial No. Serial No. Channel Offset ptima batteries with attached to a 3/4" dia e are used to clamp diameter. They hav the g are four 60 lbs at is approximately 4 uoy and another sma of floating line.	1803       1003       170       0:01:20       a 70watt solar panel ar       meter galvanized pipe       the orifice to the yoke.       a three legs equally spip       lengths of railroad rail       5' long. There are two       all foam trailing buoy. T	Format Transmit Window d solar controller. that is mounted verticall Between the orifice pipe aced. Each leg is 50cm . At the end of each leg buoys used as surface e	NGWLMS 10 seconds y to the metal yoke for th and the pipe that is (wide) by 50cm (long) b is a handle. The buoy lin xpressions: one large				
sauge 3	Pump GOES Radio GOES Address Interval Power Orifice Anchors	DAA H355 DAA H222 907060A6 1 hour Two 12v deep cycle O The bubbler orifice is a 1100 lbs anchor. Hos welded The anchor is 1.2m in 20cm (tall). Inside eac is 3/4" blue polyline tha white inflatable drag b with a separate piece 4/10/2009	Serial No. Serial No. Channel Offset ptima batteries with attached to a 3/4" dia e are used to clamp diameter. They hav the g are four 60 lbs at is approximately 4 uoy and another sm. Removed	1803         1003         170         0:01:20         a 70watt solar panel ar         meter galvanized pipe         her orifice to the yoke.         a three legs equally spa- lengths of railroad rail         5' long. There are two all foam trailing buoy. 1         9/7/2009         1158	Format Transmit Window d solar controller. that is mounted verticall Between the orflice pipe aced. Each leg is 50cm . At the end of each leg buoys used as surface of the trailing buoy is attact	NGWLMS 10 seconds y to the metal yoke for th and the pipe that is (wide) by 50cm (long) by is a handle. The buoy line inxpressions: one large ned to the main buoy line				
iauge 3	Pump GOES Radio GOES Address Interval Power Orifice Anchors	DAA H355 DAA H222 907060A6 1 hour Two 12v deep cycle O The bubbler orifice is a 1100 lbs anchor. Hos welded The anchor is 1.2m in 20cm (tall). Inside eac is 3/4" blue polyline tha white inflatable drag b with a separate piece 4/10/2009	Serial No. Serial No. Channel Offset ptima batteries with attached to a 3/4" dia e are used to clamp diameter. They hav heg are four 60 lbs at is approximately 4 uoy and another sma of floating line. Removed Serial No.	1803         1003         170         0:01:20         a 70watt solar panel ar         meter galvanized pipe         her orifice to the yoke.         a three legs equally spa- lengths of railroad rail         5' long. There are two all foam trailing buoy. 1         9/7/2009         1158	Format Transmit Window d solar controller. that is mounted verticall Between the orflice pipe aced. Each leg is 50cm . At the end of each leg buoys used as surface of the trailing buoy is attact	NGWLMS 10 seconds y to the metal yoke for th and the pipe that is (wide) by 50cm (long) by is a handle. The buoy line inxpressions: one large ned to the main buoy line				
auge 3	Pump GOES Radio GOES Address Interval Power Orifice Anchors Installed Pressure Sensor	DAA H355 DAA H222 907060A6 1 hour Two 12v deep cycle O The bubbler orifice is a 1100 lbs anchor. Hos welded The anchor is 1.2m in 20cm (tall). Inside ead is 3/4* blue polyline the white inflatable drag b with a separate piece 4/10/2009 SBE 26+ (100 psi)	Serial No. Serial No. Channel Offset plima batteries with attached to a 3/4" dia e are used to clamp diameter. They hav the g are four 60 lbs at is approximately 4 uoy and another sma of floating line. Removed Serial No. Averaging Interva Firmware	1803       1003       170       c.01:20       a 70watt solar panel ar       meter galvanized pipe       the orifice to the yoke.       a three legs equally spi- lengths of railroad rail       5' long. There are two       1003       9/7/2009       1158       180 seconds	Format Transmit Window d solar controller. that is mounted verticall Between the orflice pipe aced. Each leg is 50cm . At the end of each leg buoys used as surface of the trailing buoy is attact	NGWLMS 10 seconds y to the metal yoke for th and the pipe that is (wide) by 50cm (long) b is a handle. The buoy line inxpressions: one large ned to the main buoy line				
auge 3	Pump GOES Radio GOES Address Interval Power Orifice Anchors Installed Pressure Sensor Data Logger	DAA H355 DAA H322 907060A6 1 hour Two 12v deep cycle O The bubbler orifice is a 1100 lbs anchor. Hose welded The anchor is 1.2m in 20cm (tall). Inside ead is 3/4* blue polyline th white inflatable drag b with a separate piece 4/10/2009 SBE 26+ (100 psi)	Serial No. Serial No. Channel Offset ptima batteries with attached to a 3/4" dia e are used to clamp diameter. They hav the g are four 60 lbs at is approximately 4 uoy and another sma of floating line. Removed Serial No. Averaging Interva Firmware	1803         1003         170         0:01:20         a 70watt solar panel ar         meter galvanized pipe         the orifice to the yoke.         athree legs equally spilengths of railroad rail         form Trailing buoy. T         9/7/2009         1158         180 seconds         NA	Format Transmit Window d solar controller. that is mounted verticall Between the orflice pipe aced. Each leg is 50cm . At the end of each leg buoys used as surface of the trailing buoy is attact	NGWLMS 10 seconds y to the metal yoke for th and the pipe that is (wide) by 50cm (long) by is a handle. The buoy line inxpressions: one large ned to the main buoy line				
auge 3	Pump GOES Radio GOES Address Interval Power Orifice Anchors Installed Pressure Sensor Data Logger Acoustic Modem	DAA H355 DAA H322 907060A6 1 hour Two 12v deep cycle O The bubbler orifice is a 1100 lbs anchor. Hos welded The anchor is 1.2m in 20cm (tall). Inside ead is 3/4" blue polyline th white inflatable drag b with a separate piece 4/10/2009 SBE 26+ (100 psi) combined in SBE 26+ LinkQuest UWM 1000 Link quest	Serial No. Serial No. Channel Offset ptima batteries with attached to a 3/4" dia e are used to clamp diameter. They hav the leg are four 60 lbs at is approximately 4 uoy and another sma of floating line. <b>Removed</b> Serial No. Averaging Interva Serial No. Serial No. Serial No.	1803       1003       170       0:01:20       a 70watt solar panel ar       meter galvanized pipe       the orifice to the yoke.       a three legs equally spice       lengths of railroad rail       5' long. There are two       all foam trailing buoy.       9/7/2009       1158       1 80 seconds       NA       010216	Format Transmit Window d solar controller. that is mounted verticall Between the orflice pipe aced. Each leg is 50cm At the end of each leg buoys used as surface efficient trailing buoy is attact	NGWLMS 10 seconds y to the metal yoke for th and the pipe that is (wide) by 50cm (long) by is a handle. The buoy line inxpressions: one large ned to the main buoy line				
Sauge 3	Pump GOES Radio GOES Address Interval Power Orifice Anchors Installed Pressure Sensor Data Logger Acoustic Modem Power for modem	DAA H355 DAA H222 907060A6 1 hour Two 12v deep cycle Q The bubbler orifice is a 1100 lbs anchor. Hos welded The anchor is 1.2m in 20cm (tall). Inside eac is 3/4" blue polyline thi white inflatable drag b with a separate piece 4/10/2009 SBE 26+ (100 psi) combined in SBE 26+ LinkQuest UWM 1000 Link quest 12 D-Cell (1.5v) batter	Serial No. Serial No. Channel Offset ptima batteries with attached to a 3/4" dia e are used to clamp diameter. They hav the gare four 60 lbs at is approximately 4 uoy and another sm floating line. Removed Serial No. Averaging Interva Firmware Serial No. Serial No. Serial No.	1803         1003         170         0.01:20         a 70watt solar panel ar         meter galvanized pipe         the orifice to the yoke.         e three legs equally spatiation         lengths of railroad rail         5' long. There are two         all foam trailing buoy. 1         9/7/2009         1158         180 seconds         NA         010216         010220         nd extra battery pack for	Format Transmit Window Id solar controller. that is mounted verticall Between the orifice pipe aced. Each leg is 50cm . At the end of each leg buoys used as surface e fne trailing buoy is attach Vent Value (m)	NGWLMS 10 seconds y to the metal yoke for th and the pipe that is (wide) by 50cm (long) by is a handle. The buoy line interpressions: one large ned to the main buoy line NA				
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idal Bench Marks	Pump         GOES Radio         GOES Address         Interval         Power         Orifice         Installed         Pressure Sensor         Data Logger         Acoustic Modem         Power for modem         Power         Anchors         Installed         Pressure Sensor         Data Logger         Acoustic Modem         Power for modem         Power         Anchors         Pote 2719 TIDAL 1         Date         4/9/09 - 4/11/09         9/5/2009	DAA H355 DAA H322 907060A6 1 hour Two 12v deep cycle O The bubbler orifice is a 1100 lbs anchor. Hos- welded The anchor is 1.2m in 20cm (tall). Inside eaa is 3/4* blue polyline the white inflatable drag b with a separate piece - 4/10/2009 SBE 26+ (100 psi) combined in SBE 26+ LinkQuest UWM 1000 Link quest 12 D-Cell (1.5v) batter The anchor is 1.2m in 20cm (tall). Inside eaa is 3/4* blue polyline the Green inflatable drag b with a separate piece - Recovered 4 Order Third	Serial No. Serial No. Serial No. Channel Offset ptima batteries with attached to a 3/4" dia e are used to clamp diameter. They have the g are four 60 lbs at is approximately 4 Serial No.	1803           1803           1003           170           c.01:20           a 70watt solar panel ar           meter galvanized pipe           the orifice to the yoke.           a three legs equally spi- lengths of railroad rail           sthree legs equally spi- lengths of railroad rail           of loam trailing buoy.           97/2009           1158           180 seconds           NA           010220           nd extra battery pack for           a three legs equally spi-           long. There are two           all foam trailing buoy.           946 2719 TIDAL 1,           946 2719 TIDAL 1,           946 2719 TIDAL 1,           946 2719 TIDAL 4,	Format Transmit Window d solar controller. that is mounted verticall Between the orifice pipe aced. Each leg is 50cm . At the end of each leg buoys used as surface e fne trailing buoy is attach Vent Value (m) Vent Value (m) or the modem aced. Each leg is 50cm . At the end of each leg buoys used as surface e The trailing buoy is attach Designations 946 2719 TIDAL 2, 946 2 946 2719 A 946 2719 A	NGWLMS 10 seconds y to the metal yoke for tt and the pipe that is (wide) by 50cm (long) b is a handle. The buoy line NA (wide) by 50cm (long) b is a handle. The buoy line (wide) b is				
idal Bench Marks eveling	Pump         GOES Radio         GOES Address         Interval         Power         Orifice         Anchors         Installed         Pressure Sensor         Data Logger         Acoustic Modem         Power for modem         Power         Anchors         2         Primary         946 2719 TIDAL 1         Date         4/9/09 - 4/11/09         9/5/2009         NAVD88 Level Tie	DAA H355 DAA H322 907060A6 1 hour Two 12v deep cycle O The bubbler orifice is a 1100 lbs anchor. Hose welded The anchor is 1.2m in 20cm (tall). Inside ead is 3/4* blue polyline th white inflatable drag b with a separate piece i 4/10/2009 SBE 26+ (100 psi) combined in SBE 26+ LinkQuest UWM 1000 Link quest 12 D-Cell (1.5v) batter The anchor is 1.2m in 20cm (tall). Inside ead is 3/4* blue polyline th Green inflatable drag b with a separate piece i Recovered 4 Order Third Third	Serial No. Serial No. Serial No. Channel Offset Diffset Diffact Diffset Diffact are used to clamp diameter. They have the gare four 60 lbs at is approximately 4 Serial No. Seri	1803           1803           1003           170           0:01:20           a 70watt solar panel ar           meter galvanized pipe           the orifice to the yoke.           a three legs equally spilengths of railroad rail           5 long. There are two           all foam trailing buoy. T           9/7/2009           1158           1 180 seconds           NA           010216           010220           Inde extra battery pack for           a three legs equally spile           lengths of railroad rail           0'long. There are two           all foam trailing buoy.           946 2719 TIDAL 1,           946 2719 TIDAL 4,	Format Transmit Window d solar controller. that is mounted verticall Between the orifice pipe aced. Each leg is 50cm At the end of each leg buoys used as surface of the trailing buoy is attact Vent Value (m) Vent Value (m) At the end of each leg is buoys used as surface of The trailing buoy is attact Vent Value (m) Designations 946 2719 TIDAL 2, 946 2 946 2719 A 946 2719 A 947 271	NGWLMS 10 seconds  y to the metal yoke for tr and the pipe that is (wide) by 50cm (long) by is a handle. The buoy line NA (wide) by 50cm (long) by is a handle. The buoy line (wide) by 50cm (long) by is a handle. The buoy line 2719 TIDAL 3, 2719 TIDAL 3, 2719 TIDAL 3,				
idal Bench Marks eveling	Pump         GOES Radio         GOES Address         Interval         Power         Orifice         Anchors         Installed         Pressure Sensor         Data Logger         Acoustic Modem         Power         Anchors         Data Logger         Acoustic Modem         Power         Anchors         Power for modem         Anchors         Power         Anchors         946 2719 TIDAL 1         Date         4/9/09 - 4/11/09         9/5/2009         NAVD88 Level Tie         Bench Mark	DAA H355 DAA H322 907060A6 1 hour Two 12v deep cycle O The bubbler orifice is a 1100 lbs anchor. Host welded The anchor is 1.2m in 20cm (tall). Inside ead is 34 <sup>4</sup> blue polyline th white inflatable drag b with a separate piece o 4/10/2009 SBE 26+ (100 psi) combined in SBE 26+ LinkQuest UWM 1000 Link quest 12 D-Cell (1.5v) batter The anchor is 1.2m in 20cm (tall). Inside ead is 34 <sup>4</sup> blue polyline th Green inflatable drag b with a separate piece o <b>Recovered</b> 4 <b>Order</b> Third Third No NAVD88 marks wi	Serial No. Serial No. Serial No. Channel Offset ptima batteries with attrached to a 3/4" dia e are used to clamp diameter. They have the leg are four 60 lbs at is approximately 4 down and another sma of floating line. Removed Serial No. Seria	1803           1803           1003           170           c:01:20           a Towatt solar panel ar           meter galvanized pipe           the orifice to the yoke.           a three legs equally spilengths of railroad rail           5' long. There are two           all foam trailing buoy.           9/7/2009           1158           180 seconds           NA           010216           010220           rd extra battery pack for           a three legs equally spi           lengths of railroad rail           0'long. There are two           all foam trailing buoy.           946 2719 TIDAL 1,           946 2719 TIDAL 4,           946 2719 TIDAL 4,           946 2719 TIDAL 4,           1004 2010	Format Transmit Window d solar controller. that is mounted verticall Between the orifice pipe aced. Each leg is 50cm . At the end of each leg buoys used as surface effective trailing buoy is attact Vent Value (m) Vent Value (m) or the modem aced. Each leg is 50cm . At the end of each leg buoys used as surface effective The trailing buoy is attact Designations 946 2719 TIDAL 2, 946 2 946 2719 A Bench Marks Conne 946 2719 TIDAL 2, 946 2 946 2719 A	NGWLMS 10 seconds  y to the metal yoke for tr and the pipe that is (wide) by 50cm (long) by is a handle. The buoy line NA (wide) by 50cm (long) by is a handle. The buoy line (wide) by 50cm (long) by is a handle. The buoy line (wide) by 50cm (long) by is a handle. The buoy line 2719 TIDAL 3, 2719 TIDAL 3, Ellipsoid Height (r				
idal Bench Marks	Pump         GOES Radio         GOES Address         Interval         Power         Orifice         Anchors         Installed         Pressure Sensor         Data Logger         Accoustic Modem         Power for modem         Power         Anchors         Pata Logger         Accoustic Modem         Power for modem         Power         Anchors         Pata 2719 TIDAL 1         Date         4/9/09 - 4/11/09         9/5/2009         NAVD88 Level Tie         Bench Mark         9462719 A	DAA H355 DAA H322 907060A6 1 hour Two 12v deep cycle O The bubbler orifice is a 1100 lbs anchor. Hose welded The anchor is 1.2m in 20cm (tall). Inside ead is 3/4* blue polyline th white inflatable drag b with a separate piece i 4/10/2009 SBE 26+ (100 psi) combined in SBE 26+ LinkQuest UWM 1000 Link quest 12 D-Cell (1.5v) batter The anchor is 1.2m in 20cm (tall). Inside ead is 3/4* blue polyline th Green inflatable drag b with a separate piece i Recovered 4 Order Third Third	Serial No. Serial No. Serial No. Channel Offset Diffset Diffact Diffset Diffact are used to clamp diameter. They have the gare four 60 lbs at is approximately 4 Serial No. Seri	1803           1803           1003           170           0:01:20           a 70watt solar panel ar           meter galvanized pipe           the orifice to the yoke.           a three legs equally spilengths of railroad rail           5 long. There are two           all foam trailing buoy. T           9/7/2009           1158           1 180 seconds           NA           010216           010220           Inde extra battery pack for           a three legs equally spile           lengths of railroad rail           0'long. There are two           all foam trailing buoy.           946 2719 TIDAL 1,           946 2719 TIDAL 4,	Format Transmit Window d solar controller. that is mounted verticall Between the orifice pipe aced. Each leg is 50cm At the end of each leg buoys used as surface of the trailing buoy is attact Vent Value (m) Vent Value (m) At the end of each leg is buoys used as surface of The trailing buoy is attact Vent Value (m) Designations 946 2719 TIDAL 2, 946 2 946 2719 A 946 2719 A 947 271	NGWLMS 10 seconds  y to the metal yoke for tr and the pipe that is (wide) by 50cm (long) by is a handle. The buoy line NA (wide) by 50cm (long) by is a handle. The buoy line (wide) by 50cm (long) by is a handle. The buoy line (wide) by 50cm (long) by is a handle. The buoy line 2719 TIDAL 3, 2719 TIDAL 3, Ellipsoid Height (r				
idal Bench Marks eveling	Pump         GOES Radio         GOES Address         Interval         Power         Orifice         Anchors         Installed         Pressure Sensor         Data Logger         Accustic Modern         Power for modern         Anchors         Power for modern         Power for modern         Power for modern         Power for modern         Anchors         Power for modern         Anchors         Power for modern         Pressure for modern         Power for modern         Anchors         Power for modern         Anchors         Power for modern         Anchors         Power for modern         Anchors         Power for modern         Anchor	DAA H355 DAA H322 907060A6 1 hour Two 12v deep cycle O The bubbler orifice is a 1100 lbs anchor. Hos- welded The anchor is 1.2m in 20cm (tall). Inside eac is 3/4" blue polyline the white inflatable drag b with a separate piece 4/10/2009 SBE 26+ (100 psi) combined in SBE 26+ LinkQuest UVM 1000 Link quest 22 D-Cell (1.5v) batter The anchor is 1.2m in 20cm (tall). Inside eac is 3/4" blue polyline the Green inflatable drag b with a separate piece Recovered 4 0 Order Third Third Third No NAVD88 marks with Date 4/9/2009	Serial No. Serial No. Serial No. Channel Offset ptima batteries with attached to a 3/4" dia e are used to clamp diameter. They hav the leg are four 60 lbs at is approximately 4 uoy and another sm of floating line. Removed Serial No. Established 1 Type Optical Optical Coptical thin 1.6km (1 mi). Session Length 22.5 hrs	1803           1803           1003           170           c:01:20           a 70watt solar panel ar           meter galvanized pipe           the orifice to the yoke.           attraction of railroad rail           5' long. There are two           9/7/2009           1158           1180 seconds           NA           010216           010220           dd extra battery pack for           athree legs equally spi-           lengths of railroad rail           of extra battery pack for           athree legs equally spi-           lengths of railroad rail           946 2719 TIDAL 1,           946 2719 TIDAL 4,           Vectors 179 TIDAL 4,           946 2719 TIDAL 4,           946 2719 TIDAL 4,           Startude (N)           54° 14' 20.08925"	Format Transmit Window d solar controller. that is mounted verticall Between the orfice pipe aced. Each leg is 50cm - At the end of each leg buoys used as surface e The trailing buoy is attack Vent Value (m) Vent Value (m) or the modem aced. Each leg is 50cm - At the end of each leg buoys used as surface e The trailing buoy is attack Designations 946 2719 TIDAL 2, 946 2 946 2719 A Bench Marks Conne 946 2719 A Bench Marks Conne 946 2719 A Marks Conne 946 2719 A Longitude (W) 165° 32' 28.209267	NGWLMS         10 seconds         10 seconds         y to the metal yoke for the and the pipe that is         (wide) by 50cm (long) by is a handle. The buoy line         NA         (wide) by 50cm (long) by is a handle. The buoy line         NA         (wide) by 50cm (long) by is a handle. The buoy line         (wide) by 50cm (long) by is a handle. The buoy line         (wide) the main buoy line         (wide) the second sec				
idal Bench Marks eveling PS & OPUS	Pump         GOES Radio         GOES Address         Interval         Power         Orifice         Installed         Pressure Sensor         Data Logger         Acoustic Modem         Power for modem         Power         Anchors         Installed         Pressure Sensor         Data Logger         Acoustic Modem         Power for modem         Power         Anchors         Installed         Power         A	DAA H355 DAA H322 907060A6 1 hour Two 12v deep cycle O The bubbler orifice is a 1100 lbs anchor. Hose welded The anchor is 1.2m in 20cm (tall). Inside ead is 3/4' blue polyline th white inflatable drag b with a separate piece 4/10/2009 SBE 26+ (100 psi) combined in SBE 26+ LinkQuest UWM 1000 Link quest 12 D-Cell (1.5v) batter The anchor is 1.2m in 20cm (tall). Inside ead is 3/4' blue polyline th Green inflatable drag f with a separate piece 4 <b>Corder</b> The anchor is 1.2m in 20cm (tall). Inside ead is 3/4' blue polyline th Green inflatable drag f with a separate piece 4 <b>Corder</b> Third No NAVD88 marks with Date 4/9/2009 Link to OPUS-DB data	Serial No. Serial No. Serial No. Channel Offset ptima batteries with attached to a 3/4" dia e are used to clamp diameter. They have the gare four 60 lbs at is approximately 4 uoy and another sm of floating line. Removed Serial No.	1803           1803           1003           177           c:01:20           a 70watt solar panel ar           meter galvanized pipe           the orifice to the yoke.           a three legs equally sp.           lengths of railroad rail           5' long. There are two           9/7/2009           1158           1180 seconds           NA           010216           010220           nd extra battery pack for           a three legs equally sp.           lengths of railroad rail           0' long. There are two           all foam trailing buoy.           946 2719 TIDAL 1,           946 2719 TIDAL 1,           946 2719 TIDAL 4,           946 2719 TIDAL 4,           946 2719 TIDAL 4,           946 2719 TIDAL 4,           104 consequeree           1054° 14' 20.08925"           noa.gov/OPUS/getDa	Format Transmit Window d solar controller. that is mounted verticall Between the orffice pipe aced. Each leg is 50cm At the end of each leg buoys used as surface of the trailing buoy is attact Vent Value (m) Vent Value (m) Vent Value (m) Designations 946 2719 TIDAL 2, 946 2 946 2719 A Bench Marks Conne 946 2719 A Bench Marks Conne 946 2719 A 946 2719 A 947 2719 A 948	NGWLMS 10 seconds 10 s				
idal Bench Marks eveling	Pump         GOES Radio         GOES Radio         GOES Address         Interval         Power         Orifice         Anchors         Installed         Pressure Sensor         Data Logger         Acoustic Modem         Power         Anchors         Data Logger         Acoustic Modem         Power         Anchors         Power for modem         Power         Anchors         Power         Anchors         Power         Anchors         Power for modem         Power         Anchors         Power         Anchors         Power for modem         Power         Anchors         Power of the power         NAVD88 GPS Tie         Comme	DAA H355 DAA H325 DAA H222 907060A6 1 hour Two 12v deep cycle O The bubbler orifice is a 1100 lbs anchor. Hos welded The anchor is 1.2m in 20cm (tall). Inside ead is 34* blue polyline thi white inflatable drag b with a separate piece - 4/10/2009 SBE 26+ (100 psi) combined in SBE 26+ LinkQuest UWM 1000 Link quest 12 D-Cell (1.5v) batter The anchor is 1.2m in 20cm (tall). Inside ead is 34* blue polyline thi Green inflatable drag l with a separate piece - <b>Recovered</b> 4 Order Third Third No NAVD88 marks wi Date 4/9/2009 link to OPUS-DB datas de station was re-occupie	Serial No. Serial No. Serial No. Channel Offset ptima batteries with attached to a 3/4" dia e are used to clamp diameter. They have the gare four 60 lbs at is approximately 4 uoy and another sm of floating line. Removed Serial No.	1803           1803           1003           177           c:01:20           a 70watt solar panel ar           meter galvanized pipe           the orifice to the yoke.           a three legs equally sp.           lengths of railroad rail           5' long. There are two           9/7/2009           1158           1180 seconds           NA           010216           010220           nd extra battery pack for           a three legs equally sp.           lengths of railroad rail           0' long. There are two           all foam trailing buoy.           946 2719 TIDAL 1,           946 2719 TIDAL 1,           946 2719 TIDAL 4,           946 2719 TIDAL 4,           946 2719 TIDAL 4,           946 2719 TIDAL 4,           104 consequeree           1054° 14' 20.08925"           noa.gov/OPUS/getDa	Format Transmit Window d solar controller. that is mounted verticall Between the orffice pipe aced. Each leg is 50cm At the end of each leg buoys used as surface of the trailing buoy is attact Vent Value (m) Vent Value (m) Vent Value (m) Designations 946 2719 TIDAL 2, 946 2 946 2719 A Bench Marks Conne 946 2719 A Bench Marks Conne 946 2719 A 946 2719 A 947 2719 A 948	NGWLMS 10 seconds 10 s				
dal Bench Marks eveling PS & OPUS	Pump         GOES Radio         GOES Address         Interval         Power         Orifice         Anchors         Installed         Pressure Sensor         Data Logger         Acoustic Modem         Power for modem         Power         Anchors         Pata Logger         Acoustic Modem         Power for modem         Power         Anchors         Potate         4/9/09 - 4/11/09         9/5/2009         NAVD88 Level Tie         Bench Mark         9462719 A         NAVD88 GPS Tie         Comments         4/7/09 - 4/11/09: The tilless steel deep rod roce	DAA H355 DAA H325 DAA H222 907060A6 1 hour Two 12v deep cycle O The bubbler orifice is a 1100 lbs anchor. Hos welded The anchor is 1.2m in 20cm (tall). Inside ead is 34* blue polyline thi white inflatable drag b with a separate piece - 4/10/2009 SBE 26+ (100 psi) combined in SBE 26+ LinkQuest UWM 1000 Link quest 12 D-Cell (1.5v) batter The anchor is 1.2m in 20cm (tall). Inside ead is 34* blue polyline thi Green inflatable drag l with a separate piece - <b>Recovered</b> 4 Order Third Third No NAVD88 marks wi Date 4/9/2009 link to OPUS-DB datas	Serial No. Serial No. Serial No. Channel Offset Diffset Diffse	1803           1803           1003           170           c.01:20           a 70watt solar panel ar           meter galvanized pipe           the orifice to the yoke.           a form and the provided pipe           efforts of railcoad rail           offorts of railcoad rail           form trailing buoy.           9/7/2009           1158           180 seconds           NA           010220           od extra battery pack for           a three legs equally spi           longtrs           offorts of railcoad rail           offorts of railcoad rail           ologts           g46 2719 TIDAL 1,           g46 2719 TIDAL 4,           Latitude (N)           54° 14' 20.08925''           noa.a.gov/OPUS/getDa           and one seabird. Four	Format Transmit Window Id solar controller. that is mounted verticall Between the orflice pipe aced. Each leg is 50cm . At the end of each leg buoys used as surface of the trailing buoy is attack Vent Value (m) Vent Value (m) Vent Value (m) Control (Control (Co	NGWLMS 10 seconds  y to the metal yoke for tt and the pipe that is (wide) by 50cm (long) b is a handle. The buoy lin  NA  (wide) by 50cm (long) b is a handle. The buoy lin  (wide) b is a handl				

		946-2808 S	Site Rep Scotch Cap, I	oort Unimak Island	I, AK						
Site Visit Tertiary Station	Purpose of Visit	Installation	Team Leader Removal	Nathan Wardwell JOA		4/26-4/28/2009					
Project	OCS	April 28, 2009 OPR-P188-TE-09	Removal		Number of Days JOA	141					
Position (NAD83)	Latitude (N)	54° 23' 37.1"	Longitude (W)	164° 44' 44.6"	Time Meridian	0° (UTC)					
ocal Values	Gravity (milligals)	981562	GOES Angles	Elev 22.9°/ Az 147.1°	Magnetic Declination	11.5° E, +0° 8' W/year					
Contractor		Prime			Tide Consultant						
		TerraSond Ltd. South Industrial Way, S Palmer, AK 99645 (907) 745-7215 ATTN: Kathleen Mildor			John Oswald & Associates 2000 E. Dowling Rd, Suit Anchorage, AK 9950 (907) 561-0136 phon ATTN: John Oswald	te 10 7 e					
Dwner	United States Coast Sector Anchorage 510 L Street Suite 10 Anchorage, Alaska 9 (907) 271-6700	uite 100 aska 99501									
Location	east 47 nautical miles unmanned Coast Gu on the next rock outo	ch the tidal bench marks from the Unalaska (Dutch Harbor) City Dock, proceed by boat northeast 30 nautical miles past Akutan Island, then ' nautical miles past Akun Island and across Unimak Pass to the southwestern shore of Unimak Island SSE of Scotch Cap to the ned Coast Guard light and ruins of the Scotch Cap Lighthouse. The bench marks are located on the rock outcrop below the lighthouse and next rock outcrop down the beach to the east. The submersible tide gauges are located to the east in around 10 fathoms, the bubbler is mounted in the ruins of the lighthouse destroyed by the 1946 tsunami.									
Tide House	gauge runs through a that the orifice is bolt	a hole in the SE facing of ed on. The orifice line i	concrete wall of the light is weighted down with	ghthouse, down the hill a large lead weights. Th	ruins of the lighthouse. The on the ground and down a s ne GPS and GOES antennas	hort cliff to the rock outcrop					
Primary DCP	are mounted on the c	outside wall of the SE fa	Removed	une lightenouse ruins.							
	Sensor	4/28/2009 Seabird 26-plus	Serial No.	1155	Slope Constant	0.00000					
	Data Logger	combined in 26-plus	Averaging Interval	180 seconds	Firmware	6.1 d					
	Aprox. Depth	10 Fathoms (18m)	Latitude	N 54° 23' 30.66"	Longitude	W 164° 43' 43.38"					
	Modem	Link Quest	Wake Up Period	120sec	Serial No.	10589					
	Modem Address	3									
	Power		Il batteries inside and	Link Quest Modem has	s external battery pack on a	nchor.					
	Anchor / Rigging	The 1000 pound steel modem and external p and one small trailing	anchor is roughly for power source for the bouy made of hard fo	atteries inside and Link Quest Modem has external battery pack on anchor. chor is roughly four feet across with the Seabird mounted in an aluminum tube. An a ver source for the modem are mounted to exterior of tube. A surface bouy line with the uy made of hard foam are attached to the end of the buoyline which is 18 fathoms lor ong the bottom from anchor to a 150 lb. steel weight.							
Secondary DCP	Installed	4/28/2009	Removed								
	Sensor	Seabird 26-plus	Serial No.	1156	Slope Constant	0.00000					
	Data Logger	combined in 26-plus	Averaging Interval	180 seconds	Firmware	6.1 d					
	Aprox. Depth	11 Fathoms (20m)	Latitude	N 54° 23' 31.44"	Longitude	W 164° 43' 26.64"					
	Modem	Link Quest	Wake Up Period	120sec	Serial No.	009869					
		2									
	Modem Address		Il hatteries inside and	L ink Quest Modem has	s external battery pack on a	nchor					
	Power Anchor / Rigging	SBE 26-plus has d-ce The 1000 pound steel modem and external p and one small trailing	anchor is roughly for power source for the bouy made of hard fo	ur feet across with the S modem are mounted to	s external battery pack on an Beabird mounted in an alumin exterior of tube. A surface h end of the buoyline which is teel weight.	num tube. An acoustic bouy line with two hard floats					
Fertiary DCP	Power	SBE 26-plus has d-ce The 1000 pound steel modem and external p and one small trailing	anchor is roughly for power source for the bouy made of hard fo	ur feet across with the S modem are mounted to pam are attached to the	Seabird mounted in an alumin exterior of tube. A surface l end of the buoyline which is	num tube. An acoustic bouy line with two hard floats					
Fertiary DCP	Power Anchor / Rigging	SBE 26-plus has d-ce The 1000 pound steel modem and external p and one small trailing ground line runs south 4/28/2009 Seabird 26-plus	anchor is roughly for ower source for the bouy made of hard for along the bottom fro <b>Removed</b> Serial No.	ur feet across with the S modem are mounted to pam are attached to the om anchor to a 150 lb. s 1131	Seabird mounted in an alumin exterior of tube. A surface l end of the buoyline which is	num tube. An acoustic bouy line with two hard floats 18 fathoms long. A 150' 0.00000					
Fertiary DCP	Power Anchor / Rigging Installed Sensor Data Logger	SBE 26-plus has d-ce The 1000 pound steel modem and external p and one small trailing ground line runs south 4/28/2009 Seabird 26-plus combined in 26-plus	anchor is roughly for ower source for the bouy made of hard for along the bottom fro <b>Removed</b> Serial No. Averaging Interval	ur feet across with the S modem are mounted to pam are attached to the pm anchor to a 150 lb. s 1131 180 seconds	Seabird mounted in an alumin exterior of tube. A surface le end of the buoyline which is teel weight. Slope Constant Firmware	num tube. An acoustic bouy line with two hard floats 18 fathoms long. A 150' 0.00000 6.1 d					
Fertiary DCP	Power Anchor / Rigging Installed Sensor Data Logger Aprox. Depth	SBE 26-plus has d-ce The 1000 pound steel modem and external p and one small trailing ground line runs south 4/28/2009 Seabird 26-plus combined in 26-plus 10 Fathoms (18m)	anchor is roughly for ower source for the bouy made of hard for along the bottom fro <b>Removed</b> Serial No. Averaging Interval Latitude	ur feet across with the S modem are mounted to barn are attached to the om anchor to a 150 lb. s 1131 180 seconds N 54° 23' 27.42"	Seabird mounted in an alumin exterior of tube. A surface h end of the buoyline which is teel weight. Slope Constant Firmware Longitude	num tube. An acoustic bouy line with two hard float 18 fathoms long. A 150' 0.00000 6.1 d W 164° 43' 10.44"					
ertiary DCP	Power Anchor / Rigging Installed Sensor Data Logger Aprox. Depth Modem	SBE 26-plus has d-ce The 1000 pound steel modem and external p and one small trailing ground line runs south 4/28/2009 Seabird 26-plus combined in 26-plus	anchor is roughly for ower source for the bouy made of hard for along the bottom fro <b>Removed</b> Serial No. Averaging Interval	ur feet across with the S modem are mounted to pam are attached to the pm anchor to a 150 lb. s 1131 180 seconds	Seabird mounted in an alumin exterior of tube. A surface le end of the buoyline which is teel weight. Slope Constant Firmware	num tube. An acoustic bouy line with two hard float 18 fathoms long. A 150' 0.00000 6.1 d					
Fertiary DCP	Power Anchor / Rigging Installed Sensor Data Logger Aprox. Depth Modem Modem Address	SBE 26-plus has d-ce The 1000 pound steel modem and external p and one small trailing ground line runs south 4/28/2009 Seabird 26-plus combined in 26-plus 10 Fathoms (18m) Link Quest 1	anchor is roughly for ower source for the bouy made of hard for along the bottom fro <b>Removed</b> Serial No. Averaging Interval Latitude Wake Up Period	ur feet across with the S modem are mounted to barn are attached to the orm anchor to a 150 lb. s 1131 180 seconds N 54° 23' 27.42" 120sec	Seabird mounted in an alumin exterior of tube. A surface h end of the buoyline which is teel weight. Slope Constant Firmware Longitude Serial No.	num tube. An acoustic bouy line with two hard float 18 fathoms long. A 150' 0.00000 6.1 d W 164° 43' 10.44" 010215					
Fertiary DCP	Power Anchor / Rigging Installed Sensor Data Logger Aprox. Depth Modem	SBE 26-plus has d-ce The 1000 pound steel modem and external p and one small trailing ground line runs south 4/28/2009 Seabird 26-plus combined in 26-plus 10 Fathoms (18m) Link Quest 1 SBE 26-plus has d-ce The 1000 pound steel modem and external p and one small trailing	anchor is roughly for ower source for the bouy made of hard for along the bottom fro Removed Serial No. Averaging Interval Latitude Wake Up Period Il batteries inside and anchor is roughly for ower source for the bouy made of hard for	ur feet across with the S modem are mounted to oam are attached to the om anchor to a 150 lb. s 1131 180 seconds N 54° 23' 27.42" 120sec I Link Quest Modem has ur feet across with the S modem are mounted to	Seabird mounted in an alumin exterior of tube. A surface h end of the buoyline which is teel weight. Slope Constant Firmware Longitude Serial No. s external battery pack on an Seabird mounted in an alumin exterior of tube. A surface h end of the buoyline which is	num tube. An acoustic bouy line with two hard floats 18 fathoms long. A 150' 0.00000 6.1 d W 164° 43' 10.44" 010215 nchor. num tube. An acoustic bouy line with two hard floats					
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Backup DCP	PowerAnchor / RiggingAnchor / RiggingInstalledSensorData LoggerAprox. DepthModem AddressPowerAnchor / RiggingData LoggerGOES RadioGOES RadioGOES RadioGOES AddressIntervalPowerOrifice MountOrifice MountOrifice MountData LoggerGOES RadioGOES AddressIntervalPowerOrifice MountOrifice MountMate4/27/2009NAVD88 Level Tie	SBE 26-plus has d-ce The 1000 pound steel modem and external p and one small trailing ground line runs south 4/28/2009 Seabird 26-plus combined in 26-plus 10 Fathoms (18m) Link Quest 1 SBE 26-plus has d-ce The 1000 pound steel modem and external p and one small trailing ground line runs south 4/27/2009 DAA H350XL DAA H350XL DAA H350XL DAA H350XL DAA H222 9070B6CE 1 hour Two batteries with a 2 The Orifice is mounter house. Orifice was dry concrete wedge anch This gauge installed a Recovered 2 Order Third No NAVD88 marks wi	anchor is roughly for over source for the is bouy made of hard for along the bottom from Removed Serial No. Averaging Interval Latitude Wake Up Period Il batteries inside and anchor is roughly for over source for the is bouy made of hard for along the bottom from Serial No. Averaging Interval Serial No. Averaging Interval Serial No. Channel Offset Owatt solar panel with d with a clamp to a set y at install, roughly a - ors. s a partial tide check Established 3 Type Optical thin 1.6km (1 mi).	ur feet across with the S modem are mounted to barn are attached to the om anchor to a 150 lb. s 1131 180 seconds N 54° 23' 27.42" 120sec Link Quest Modem has ur feet across with the S modem are mounted to barn are attached to the om anchor to a 150 lb. s 1051 181 seconds 1051 181 seconds 170 0:02:10 n solar controller. ection of Uni-Strut that is -1.4' low tide. Tubing wa for the primary offshore 9462808 TIDAL 2,	Seabird mounted in an alumin exterior of tube. A surface h end of the buoyline which is teel weight. Slope Constant Firmware Longitude Serial No. Sector of tube. A surface h end of the buoyline which is teel weight. Level Point to orifice "0" Slope Constant in Gauge Firmware GPS timing Format Transmit Window s boltted to an area of the be as joined to 1/4" cable and w a gauges. Designations 9462808 TIDAL 4, 9462808 Bench Marks Connect	num tube. An acoustic bouy line with two hard float 18 fathoms long. A 150' 0.00000 6.1 d W 164° 43' 10.44" 010215 nchor. num tube. An acoustic bouy line with two hard float 18 fathoms long. A 150' 0.183 0.68396 2.12 Yes NGWLMS 10 seconds edrock outcrop below the tid reighted with lead weights a					
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Backup DCP	PowerAnchor / RiggingAnchor / RiggingInstalledSensorData LoggerAprox. DepthModem AddressPowerAnchor / RiggingPowerAnchor / RiggingData LoggerGOES RadioGOES RadioGOES AddressIntervalPowerOrifice MountOrifice MountDate4/27/2009NAVD88 Level TieComments	SBE 26-plus has d-ce The 1000 pound steel modem and external p and one small trailing ground line runs south 4/28/2009 Seabird 26-plus combined in 26-plus 10 Fathoms (18m) Link Quest 1 SBE 26-plus has d-ce The 1000 pound steel modem and external p and one small trailing ground line runs south 4/27/2009 DAA H350XL DAA H350XL DAA H350XL DAA H350XL DAA H222 9070B6CE 1 hour Two batteries with a 2 The Orifice is mounter house. Orifice was dry concrete wedge anch This gauge installed a Recovered 2 Order This gauge installed a Recovered C No NAVD88 marks wi Level run included Ga	anchor is roughly for over source for the is bouy made of hard for along the bottom from Removed Serial No. Averaging Interval Latitude Wake Up Period Il batteries inside and anchor is roughly for over source for the is bouy made of hard for along the bottom from Removed Serial No. Averaging Interval Serial No. Channel Offset Owatt solar panel with d with a clamp to a set y at install, roughly a ors. s a partial tide check Established 3 Type Optical thin 1.6km (1 mi). auge 1 orifice "0"	In feet across with the S modem are mounted to oam are attached to the om anchor to a 150 lb. s I 1131 180 seconds N 54° 23' 27.42" 120sec Link Quest Modem has ur feet across with the S modem are mounted to oam are attached to the om anchor to a 150 lb. s I 1051 181 seconds I 1051 181 seconds I 170 0:02:10 n solar controller. ection of Uni-Strut that is -1.4' low tide. Tubing wa for the primary offshore 9462808 TIDAL 2, 9462808 TIDAL 2,	Seabird mounted in an alumin exterior of tube. A surface h end of the buoyline which is teel weight. Slope Constant Firmware Longitude Serial No. s external battery pack on an Seabird mounted in an alumin exterior of tube. A surface h end of the buoyline which is teel weight. Level Point to orifice "0" Slope Constant in Gauge Firmware GPS timing Format Transmit Window s boltted to an area of the be as joined to 1/4" cable and w a gauges. Designations 9462808 TIDAL 4, 9462808 Bench Marks Connect 9462808 TIDAL 4, 9462808	num tube. An acoustic bouy line with two hard float 18 fathoms long. A 150' 0.00000 6.1 d W 164° 43' 10.44" 010215 nchor. num tube. An acoustic bouy line with two hard float 18 fathoms long. A 150' 0.183 0.68396 2.12 Yes NGWLMS 10 seconds edrock outcrop below the tid reighted with lead weights an A, 9462808 B, 9462808 C ed A, 9462808 B, 9462808 C					

		946-2808 S	Site Rep cotch Cap,	oort Unimak Island	, AK					
Site Visit	Purpose of Visit	Installation	Team Leader	Nathan Wardwell JOA		9/4/2009 - 9/5/2009				
Tertiary Station	Installation	April 28, 2009	Removal	September 5, 2009	Number of Days	131				
Project	OCS	OPR-P188-TE-09			JOA	141				
Position (NAD83)	Latitude (N)	54° 23' 37.1"	Longitude (W)	164° 44' 44.6"	Time Meridian	0° (UTC)				
ocal Values	Gravity (milligals)	981562	GOES Angles	Elev 22.9°/ Az 147.1°	Magnetic Declination	11.5° E, +0° 8' W/year				
Contractor		Prime TerraSond Ltd. couth Industrial Way, S Palmer, AK 99645 (907) 745-7215 XTTN: Kathleen Mildor			Tide Consultant John Oswald & Associates 2000 E. Dowling Rd, Suit Anchorage, AK 9950 (907) 561-0136 phon ATTN: John Oswald	e 10 7				
Owner	United States Coast ( Sector Anchorage 510 L Street Suite 10 Anchorage, Alaska 9 (907) 271-6700	ie ie 100								
Location	then east 47 nautical unmanned Coast Gua and on the next rock	miles past Akun Islan ard light and ruins of tl outcrop down the bea	d and across Unimal ne Scotch Cap Light ch to the east. The s	Pass to the southwesten house. The bench marks	y boat northeast 30 nautica orn shore of Unimak Island 3 are located on the rock ou are located to the east in ar	SSE of Scotch Cap to the tcrop below the lighthouse				
Tide House	gauge runs through a that the orifice is bolte	hole in the SE facing ad on. The orifice line	concrete wall of the is weighted down wit	lighthouse, down the hill	on the ground and down a	e orifice line for the bubbler short cliff to the rock outcrop as as well as the solar panel				
Primary DCP	Installed	4/28/2009	Removed							
	Sensor	Seabird 26-plus	Serial No.	1155	Slope Constant	0.00000				
	Data Logger	combined in 26-plus	Averaging Interval	180 seconds	Firmware	6.1 d				
	Aprox. Depth	10 Fathoms (18m)	Latitude	N 54° 23' 30.66"	Longitude	W 164° 43' 43.38"				
	Modem	Link Quest	Wake Up Period	120sec	Serial No.	10589				
	Modem Address	3	Wake op i enou	120300	Cenarivo.	10303				
	Power		ll battorios insido an	d Link Quest Medem ha	s oxtornal battory pack on r	nchor				
	Anchor / Rigging	The 1000 pound stee modem and external floats and one small t	SBE 26-plus has d-cell batteries inside and Link Quest Modem has external battery pack on anchor. The 1000 pound steel anchor is roughly four feet across with the Seabird mounted in an aluminum tube. A modem and external power source for the modem are mounted to exterior of tube. A surface bouy line with loats and one small trailing bouy made of hard foam are attached to the end of the buoyline which is 18 fai 150' ground line runs south along the bottom from anchor to a 150 lb. steel weight.							
Secondary DCP	Installed	4/28/2009	Removed							
	Sensor	Seabird 26-plus	Serial No.	1156	Slope Constant	0.00000				
	Data Logger	combined in 26-plus	Averaging Interval	180 seconds	Firmware	6.1 d				
	Aprox. Depth	11 Fathoms (20m)	Latitude	N 54° 23' 31.44"	Longitude	W 164° 43' 26.64"				
	Modem	Link Quest	Wake Up Period	120sec	Serial No.	009869				
	Modem Address	2								
Tation: DCD	Power Anchor / Rigging	The 1000 pound stee modem and external floats and one small t 150' ground line runs	I anchor is roughly for power source for the railing bouy made of south along the bott	our feet across with the S modem are mounted to		inum tube. An acoustic				
Tertiary DCP	Installed	4/28/2009	Removed	4404	Class Constant	0.00000				
	Sensor	Seabird 26-plus	Serial No.	1131 100 seconds	Slope Constant	0.00000				
	Data Logger	combined in 26-plus	Averaging Interval	180 seconds	Firmware	6.1 d				
	Aprox. Depth	10 Fathoms (18m) Link Quest	Latitude	N 54° 23' 27.42" 120sec	Longitude Serial No.	W 164° 43' 10.44" 010215				
	Modem Modem Address	1	Wake Up Period	120500	Senai NO.	010215				
	Power		ell batteries inside an	d Link Quest Modem ha	s external battery pack on a	anchor				
Deskur DCP	Anchor / Rigging	The 1000 pound stee modem and external floats and one small t	I anchor is roughly for power source for the railing bouy made of	our feet across with the S modem are mounted to	eabird mounted in an alum exterior of tube. A surface to the end of the buoyline	inum tube. An acoustic				
Backup DCP	Installed	4/27/2009 DAA H350XL	Serial No.	1051	Level Point to orifice "0"	0.183				
	Sensor									
	Sensor	Brittilooonie				0.68396				
	Sensor	577771000712	Averaging Interval	181 seconds	Slope Constant in Gauge					
	Sensor Data Logger	DAA H350XL								
					Slope Constant in Gauge	0.68396				
	Data Logger	DAA H350XL	Averaging Interval		Slope Constant in Gauge Firmware	0.68396				
	Data Logger GOES Radio	DAA H350XL DAA H222	Averaging Interval Serial No.	181 seconds	Slope Constant in Gauge Firmware GPS timing	0.68396 2.12 Yes				
	Data Logger GOES Radio GOES Address	DAA H350XL DAA H222 9070B6CE	Averaging Interval Serial No. Channel Offset	181 seconds 170 0:02:10	Slope Constant in Gauge Firmware GPS timing Format	0.68396 2.12 Yes NGWLMS				
	Data Logger GOES Radio GOES Address Interval Power Orifice Mount	DAA H350XL DAA H222 9070B6CE 1 hour Two batteries with a 2 The Orifice is mounte tide house. Orifice wa weights and concrete	Averaging Interval Serial No. Channel Offset Owatt solar panel wiid d with a clamp to a s s dry at install, rougt wedge anchors.	181 seconds 170 0:02:10 h solar controller. ection of Uni-Strut that is ly a -1.4' low tide. Tubin	Slope Constant in Gauge Firmware GPS timing Format Transmit Window s boltted to an area of the b g was joined to 1/4" cable a	0.68396 2.12 Yes NGWLMS 10 seconds edrock outcrop below the				
	Data Logger GOES Radio GOES Address Interval Power	DAA H350XL DAA H222 9070B6CE 1 hour Two batteries with a 2 The Orifice is mounte tide house. Orifice wa weights and concrete	Averaging Interval Serial No. Channel Offset Owatt solar panel wiid d with a clamp to a s s dry at install, rougt wedge anchors.	181 seconds 170 0:02:10 h solar controller. ection of Uni-Strut that is	Slope Constant in Gauge Firmware GPS timing Format Transmit Window s boltted to an area of the b g was joined to 1/4" cable a	0.68396 2.12 Yes NGWLMS 10 seconds edrock outcrop below the				
Fidal Bench Marks	Data Logger GOES Radio GOES Address Interval Power Orifice Mount	DAA H350XL DAA H222 9070B6CE 1 hour Two batteries with a 2 The Orifice is mounte tide house. Orifice wa weights and concrete	Averaging Interval Serial No. Channel Offset Owatt solar panel wiid d with a clamp to a s s dry at install, rougt wedge anchors.	181 seconds 170 0:02:10 h solar controller. ection of Uni-Strut that is ly a -1.4' low tide. Tubin	Slope Constant in Gauge Firmware GPS timing Format Transmit Window s boltted to an area of the b g was joined to 1/4" cable a	0.68396 2.12 Yes NGWLMS 10 seconds edrock outcrop below the				
Fidal Bench Marks	Data Logger GOES Radio GOES Address Interval Power Orifice Mount Comments	DAA H350XL DAA H222 9070B6CE 1 hour Two batteries with a 2 The Orifice is mounte tide house. Orifice wa weights and concrete This gauge installed a	Averaging Interval Serial No. Channel Offset Owatt solar panel with d with a clamp to a s s dry at install, rough wedge anchors. Is a partial tide check	181 seconds 170 0:02:10 h solar controller. ection of Uni-Strut that is ly a -1.4' low tide. Tubin (for the primary offshore	Slope Constant in Gauge Firmware GPS timing Format Transmit Window s boltted to an area of the b g was joined to 1/4" cable a gauges.	0.68396 2.12 Yes NGWLMS 10 seconds edrock outcrop below the nd weighted with lead				
	Data Logger GOES Radio GOES Address Interval Power Orifice Mount Comments Primary	DAA H350XL DAA H222 9070B6CE 1 hour Two batteries with a 2 The Orifice is mounte tide house. Orifice wa weights and concrete This gauge installed a Recovered	Averaging Interval Serial No. Channel Offset Owatt solar panel wiri d with a clamp to a s s dry at install, rough wedge anchors. Is a partial tide check Established	181 seconds 170 0:02:10 h solar controller. ection of Uni-Strut that is ly a -1.4' low tide. Tubin (for the primary offshore	Slope Constant in Gauge Firmware GPS timing Format Transmit Window s boltted to an area of the b g was joined to 1/4" cable a e gauges. Designations	0.68396 2.12 Yes NGWLMS 10 seconds edrock outcrop below the nd weighted with lead A, 9462808 B, 9462808 C				
	Data Logger GOES Radio GOES Address Interval Power Orifice Mount Comments Primary 9462808 Tidal 2	DAA H350XL DAA H222 9070B6CE 1 hour Two batteries with a 2 The Orifice is mounte tide house. Orifice wa weights and concrete This gauge installed a Recovered 2	Averaging Interval Serial No. Channel Offset Owatt solar panel wild d with a clamp to a s s dry at install, rough wedge anchors. is a partial tide check Established 3	181 seconds 170 0:02:10 h solar controller. ection of Uni-Strut that is ly a -1.4' low tide. Tubin ( for the primary offshore 9462808 TIDAL 2, 9	Slope Constant in Gauge Firmware GPS timing Format Transmit Window s boltted to an area of the b g was joined to 1/4" cable a gauges. Designations 462808 TIDAL 4, 9462808	0.68396 2.12 Yes NGWLMS 10 seconds edrock outcrop below the nd weighted with lead A, 9462808 B, 9462808 C				
	Data Logger GOES Radio GOES Address Interval Power Orifice Mount Comments Primary 9462808 Tidal 2 Date	DAA H350XL DAA H222 9070B6CE 1 hour Two batteries with a 2 The Orifice is mounte tide house. Orifice wa weights and concrete This gauge installed a Recovered 2 Order	Averaging Interval Serial No. Channel Offset Owatt solar panel wild d with a clamp to a s s dry at install, rougt wedge anchors. is a partial tide check Established 3 Type	181 seconds 170 0:02:10 h solar controller. ection of Uni-Strut that is ily a -1.4' low tide. Tubin for the primary offshore 9462808 TIDAL 2, 9 9462808 TIDAL 2, 9	Slope Constant in Gauge Firmware GPS timing Format Transmit Window boltted to an area of the b g was joined to 1/4° cable a gauges. Designations 462808 TIDAL 4, 9462808 Bench Marks Connector	0.68396 2.12 Yes NGWLMS 10 seconds edrock outcrop below the ind weighted with lead A, 9462808 B, 9462808 C ad A, 9462808 B, 9462808 C				
	Data Logger GOES Radio GOES Address Interval Power Orifice Mount Comments Primary 9462808 Tidal 2 Date 4/27/2009 9/4/2009	DAA H350XL DAA H222 9070B6CE 1 hour Two batteries with a 2 The Orifice is mounte tide house. Orifice wa weights and concrete This gauge installed a Recovered 2 Order Third	Averaging Interval Serial No. Channel Offset Owatt solar panel wit d with a clamp to a s s dry at install, rough wedge anchors. is a partial tide check Established 3 Type Optical Optical	181 seconds 170 0:02:10 h solar controller. ection of Uni-Strut that is ily a -1.4' low tide. Tubin for the primary offshore 9462808 TIDAL 2, 9 9462808 TIDAL 2, 9	Slope Constant in Gauge Firmware GPS timing Format Transmit Window a boltted to an area of the b g was joined to 1/4° cable a b gauges. Designations 462808 TIDAL 4, 9462808 Bench Marks Connect 462808 TIDAL 4, 9462808	0.68396 2.12 Yes NGWLMS 10 seconds edrock outcrop below the ind weighted with lead A, 9462808 B, 9462808 C ad A, 9462808 B, 9462808 C				
Fidal Bench Marks Leveling	Data Logger GOES Radio GOES Address Interval Power Orifice Mount Comments Primary 9462808 Tidal 2 Date 4/27/2009 9/4/2009	DAA H350XL DAA H222 9070B6CE 1 hour Two batteries with a 2 The Orifice is mounte tide house. Orifice wa weights and concrete This gauge installed a Recovered 2 Order Third Third	Averaging Interval Serial No. Channel Offset Owatt solar panel wit d with a clamp to a s s dry at install, rough wedge anchors. as a partial tide check Established 3 Type Optical Optical Optical ithin 1.6km (1 mi).	181 seconds 170 0:02:10 h solar controller. ection of Uni-Strut that is ily a -1.4' low tide. Tubin- for the primary offshore 9462808 TIDAL 2, 9 9462808 TIDAL 2, 9 9462808 TIDAL 2, 9	Slope Constant in Gauge Firmware GPS timing Format Transmit Window a boltted to an area of the b g was joined to 1/4° cable a b gauges. Designations 462808 TIDAL 4, 9462808 Bench Marks Connect 462808 TIDAL 4, 9462808	0.68396 2.12 Yes NGWLMS 10 seconds edrock outcrop below the ind weighted with lead A, 9462808 B, 9462808 C ad A, 9462808 B, 9462808 C				
	Data Logger GOES Radio GOES Address Interval Power Orifice Mount Comments Primary 9462808 Tidal 2 Date 4/27/2009 9/4/2009 NAVD88 Level Tie	DAA H350XL DAA H222 9070B6CE 1 hour Two batteries with a 2 The Orifice is mounte tide house. Orifice wa weights and concrete This gauge installed a Recovered 2 Order Third Third Third No NAVD88 marks w	Averaging Interval Serial No. Channel Offset Owatt solar panel wit d with a clamp to a s s dry at install, rough wedge anchors. as a partial tide check Established 3 Type Optical Optical Optical ithin 1.6km (1 mi).	181 seconds 170 0:02:10 h solar controller. ection of Uni-Strut that is ily a -1.4' low tide. Tubin- for the primary offshore 9462808 TIDAL 2, 9 9462808 TIDAL 2, 9 9462808 TIDAL 2, 9	Slope Constant in Gauge Firmware GPS timing Format Transmit Window a boltted to an area of the b g was joined to 1/4° cable a b gauges. Designations 462808 TIDAL 4, 9462808 Bench Marks Connect 462808 TIDAL 4, 9462808	0.68396 2.12 Yes NGWLMS 10 seconds edrock outcrop below the ind weighted with lead A, 9462808 B, 9462808 C ad A, 9462808 B, 9462808 C				
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## Site Report 945-9968 Sanak Harbor, Sanak Island, AK

Tertiary Station		Installation	Team Leader	Nathan Wardwell (JC	DA) Date of Visit	4/29 - 4/30/2009		
Duciest	Installation	April 29, 2009	Removal		Number of Days			
Project	OCS	OPR-P188-TE-09			JOA	141		
Position (NAD83)	Latitude (N)	54° 28' 48.6"	Longitude (W)	162° 48' 50.1"	Time Meridian	0° (UTC)		
ocal Values	Gravity (milligals)	981577	GOES Angles	NA	Magnetic Declination	12° 46' E, +0° 9' W/yea		
Contractor		Prime			Tide Consultan	t		
	1617	TerraSond, Ltd South Industrial Way Palmer, AK 99645 (907) 745-7215 ATTN: Kathleen Mild	5	JOA Surveys, LLC 2000 E. Dowling Rd, Suite 10 Anchorage, AK 99507 (907) 561-0136 phone ATTN: John Oswald				
Dwner	Sanak Corporation 1 Main St Sand Point, AK 996 (907) 383-2106	< 9961						
_ocation	pass between Unal Akun islands, then	aska and Akutan Islar proceed East 187km (	nds, then proceed EN	E for 46km (25nm)	eed by boat NE 27km (15n to the entrance to Akutan F or, then proceed south 1km			
lide House	Not Applicable beca	ause the pressure ser	nsor deployed at this s	ite is used for tidal	zoning purposes only.			
	Installer	5/12/2008	Domourd					
Primary DCP	Installed	5/13/2008	Removed	4457	Vert Velue ()	0.000		
	Pressure Sensor	SBE 26+ (100 psi)	Serial No.	1157	Vent Value (m)	0.000		
			Averaging Interval	180 seconds				
	Data Logger	combined in SBE 26		NA				
	Acoustic Modem	LinkQuest UWM	Serial No.	010218				
	Power for modem	LinkQuest	Serial No.	009851				
	Power	. ,	teries for the seabird a	• •		de) by 50cm (long) by 20cm		
	Anchor	The anchor is 1.2m (tall). Inside each lead blue polyline that is a orange. A trailing bu	in diameter and as thi g are four 60 lbs lengt approximately 78' long loy is attached to the i	ee legs equally spa hs of railroad rail. A g. There are two buy nain buoy line with	ced. Each leg is 50cm (wid t the end of each leg is a h oys used as surface expre- a separate piece of floating	andle. The buoy line is 3/4 ssions: one white and one g line.		
	Anchor Comments	The anchor is 1.2m (tall). Inside each leg blue polyline that is a orange. A trailing bu A 100' dragline is att out in a South orient	in diameter and as thi g are four 60 lbs lengt approximately 78' long loy is attached to the tached to the anchor. lation from the anchor	ee legs equally spa hs of railroad rail. A g. There are two buy nain buoy line with At the other end of	ced. Each leg is 50cm (wid t the end of each leg is a h oys used as surface expre- a separate piece of floating	andle. The buoy line is 3/4 ssions: one white and one g line.		
econdary DCP	Anchor Comments Installed	The anchor is 1.2m (tall). Inside each leo blue polyline that is orange. A trailing bu A 100' dragline is att out in a South orient NA	in diameter and as thi g are four 60 lbs lengt approximately 78' long loy is attached to the tached to the anchor. lation from the anchor Removed	ee legs equally spa hs of railroad rail. A g. There are two buy nain buoy line with At the other end of	iced. Each leg is 50cm (with t the end of each leg is a h bys used as surface expres a separate piece of floating the dragline is a 150 lb we	andle. The buoy line is 3/4 ssions: one white and one g line. ight. The dragline is strech		
econdary DCP	Anchor Comments	The anchor is 1.2m (tall). Inside each leo blue polyline that is orange. A trailing bu A 100' dragline is att out in a South orient NA NA	in diameter and as thi g are four 60 lbs lengt approximately 78' long loy is attached to the tached to the anchor. lation from the anchor	ee legs equally spa hs of railroad rail. A g. There are two bun nain buoy line with At the other end of NA NA	ced. Each leg is 50cm (wid t the end of each leg is a h oys used as surface expre- a separate piece of floating	andle. The buoy line is 3/4 ssions: one white and one g line.		
econdary DCP	Anchor Comments Installed	The anchor is 1.2m (tall). Inside each leo blue polyline that is orange. A trailing bu A 100' dragline is att out in a South orient NA	in diameter and as the g are four 60 lbs lengt approximately 78' long toy is attached to the tached to the anchor. tation from the anchor Removed Serial No. Averaging Interval Firmware	ee legs equally spa hs of railroad rail. A g. There are two bun nain buoy line with At the other end of NA	iced. Each leg is 50cm (with t the end of each leg is a h bys used as surface expres a separate piece of floating the dragline is a 150 lb we	andle. The buoy line is 3/4 ssions: one white and one g line. ight. The dragline is strech		
econdary DCP	Anchor Comments Installed Pressure Sensor	The anchor is 1.2m (tall). Inside each leo blue polyline that is orange. A trailing bu A 100' dragline is att out in a South orient NA NA	in diameter and as thi g are four 60 lbs lengt approximately 78' long toy is attached to the tached to the anchor. tation from the anchor <b>Removed</b> Serial No. Averaging Interval	ee legs equally spa hs of railroad rail. A g. There are two bun nain buoy line with At the other end of NA NA	iced. Each leg is 50cm (with t the end of each leg is a h bys used as surface expres a separate piece of floating the dragline is a 150 lb we	andle. The buoy line is 3/4 ssions: one white and one g line. ight. The dragline is strech		
Secondary DCP	Anchor Comments Installed Pressure Sensor Data Logger	The anchor is 1.2m (tall). Inside each leg blue polyline that is a orange. A trailing bu A 100' dragline is att out in a South orient NA NA NA	in diameter and as the g are four 60 lbs lengt approximately 78' long toy is attached to the tached to the anchor. tation from the anchor Removed Serial No. Averaging Interval Firmware	ee legs equally spa hs of railroad rail. A J. There are two buu nain buoy line with At the other end of NA NA NA	iced. Each leg is 50cm (with t the end of each leg is a h bys used as surface expres a separate piece of floating the dragline is a 150 lb we	andle. The buoy line is 3/4 ssions: one white and one g line. ight. The dragline is strech		
Secondary DCP	Anchor Comments Installed Pressure Sensor Data Logger Acoustic Modem	The anchor is 1.2m (tall). Inside each leg blue polyline that is a orange. A trailing bu A 100' dragline is att out in a South orient NA NA NA	in diameter and as thi g are four 60 lbs lengt approximately 78' long toy is attached to the tached to the anchor. tation from the anchor <b>Removed</b> Serial No. Averaging Interval Firmware Serial No.	ee legs equally spa hs of railroad rail. A g. There are two bun nain buoy line with At the other end of NA NA NA NA	iced. Each leg is 50cm (with t the end of each leg is a h bys used as surface expres a separate piece of floating the dragline is a 150 lb we	andle. The buoy line is 3/4 ssions: one white and one g line. ight. The dragline is strech		
econdary DCP	Anchor Comments Installed Pressure Sensor Data Logger Acoustic Modem Power for modem Power Anchor	The anchor is 1.2m (tall). Inside each leg blue polyline that is a orange. A trailing bu A 100' dragline is att out in a South orient NA NA NA NA NA	in diameter and as thi g are four 60 lbs lengt approximately 78' long toy is attached to the tached to the anchor. tation from the anchor <b>Removed</b> Serial No. Averaging Interval Firmware Serial No.	ee legs equally spa hs of railroad rail. A g. There are two bun nain buoy line with At the other end of NA NA NA NA	iced. Each leg is 50cm (with t the end of each leg is a h bys used as surface expres a separate piece of floating the dragline is a 150 lb we	g line. ight. The dragline is strech		
	Anchor Comments Installed Pressure Sensor Data Logger Acoustic Modem Power for modem Power Anchor Comments	The anchor is 1.2m (tall). Inside each leg blue polyline that is a orange. A trailing bu A 100' dragline is att out in a South orient NA NA NA NA NA NA	in diameter and as thi g are four 60 lbs lengt approximately 78' long toy is attached to the tached to the anchor. tation from the anchor <b>Removed</b> Serial No. Averaging Interval Firmware Serial No.	ee legs equally spa hs of railroad rail. A g. There are two bun nain buoy line with At the other end of NA NA NA NA	iced. Each leg is 50cm (with t the end of each leg is a h bys used as surface expres a separate piece of floating the dragline is a 150 lb we	andle. The buoy line is 3/4 ssions: one white and one g line. ight. The dragline is strech		
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ide Staff	Anchor         Comments         Installed         Pressure Sensor         Data Logger         Acoustic Modem         Power for modem         Power         Anchor         Comments         NA         Primary	The anchor is 1.2m (tall). Inside each leo blue polyline that is a orange. A trailing bu A 100' dragline is atto out in a South orient NA NA NA NA NA NA NA NA NA RA NA RA	in diameter and as thi g are four 60 lbs lengt approximately 78' long ioy is attached to the tached to the anchor. tation from the anchor Removed Serial No. Averaging Interval Firmware Serial No. Serial No. Serial No.	ee legs equally spa hs of railroad rail. A g. There are two burnain buoy line with At the other end of NA NA NA NA NA NA	Ceed. Each leg is 50cm (with the end of each leg is a horse surface express a separate piece of floating the dragline is a 150 lb we vent Value (m)	2, 9459968 TIDAL 3		
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ide Staff idal Bench Marks eveling	Anchor         Comments         Installed         Pressure Sensor         Data Logger         Acoustic Modem         Power for modem         Power for modem         Power         Anchor         Comments         NA         Primary         NA         Date         4/29/2009         NAVD88 Level Tie         Comments         Bench Mark         NA	The anchor is 1.2m (tall). Inside each leg blue polyline that is a orange. A trailing bu A 100' dragline is attout in a South orient NA SA Single vire levels ru Date	in diameter and as the g are four 60 lbs lengt approximately 78' long toy is attached to the tached to the anchor. attorn from the anchor Removed Serial No. Averaging Interval Firmware Serial No. Serial No.	ee legs equally spa hs of railroad rail. A g. There are two burnain buoy line with At the other end of NA NA NA NA NA NA NA SA SA SA SA SA SA SA SA SA SA SA SA SA	Ced. Each leg is 50cm (with the end of each leg is a host surface express a separate piece of floating the dragline is a 150 lb we vent Value (m) Vent Value (m) Designations TIDAL 1, 9459968 TIDAL Bench Marks Connect TIDAL 1, 9459968 TIDAL	2, 9459968 TIDAL 3 ected		
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#### APPENDIX V Supplemental Survey Records and Correspondence

### **Bottom Samples**

121 bottom samples were collected in support of the 2009 survey. The samples were distributed geographically to obtain a full representation of the bottom characteristics as specified in NOAA Hydrographic Surveys Specifications and Deliverables, Section 7.1.

Bottom Sample Number	Julian Day Number	Time (UTC)	Depth (m)	Latitude	Longitude	Surface Description	Color	Nature of Surface
EBS005	2009-231	20:24	99.2	54° 11' 51.51" N	163° 49' 19.97" W	hard	n/a	n/a
EBS007	2009-234	11:56	74	54° 15' 3.37" N	163° 45' 37.75" W	fine, medium	black, black	sand, pebbles
EBS008	2009-234	11:10	71	54° 15' 2.89" N	163° 43' 48.12" W	medium	black	gravel
EBS009	2009-234	10:26	74	54° 15' 1.84" N	163° 41' 54.07" W	coarse, fine	black, black	pebbles, sand
EBS010	2009-234	9:49	87	54° 15' 0.64" N	163° 40' 5.38" W	medium	black	sand
EBS012	2009-234	13:31	76.5	54° 13' 57.95" N	163° 45' 42.38" W	medium	black	sand
EBS013	2009-234	10:56	73	54° 13' 58.21" N	163° 43' 45.92" W	medium, medium	black, black	pebbles, sand
EBS014	2009-234	10:42	72.5	54° 13' 58.354" N	163° 41' 59.79" W	medium, fine, n/a	black, black, black	pebbles, sand, cobble
EBS015	2009-234	9:34	71.5	54° 13' 56.25" N	163° 40' 8.34" W	medium, coarse	black, black	pebbles, gravel

Bottom Sample Number	Julian Day Number	Time (UTC)	Depth (m)	Latitude	Longitude	Surface Description	Color	Nature of Surface
EBS017	2009-233	22:52	77.5	54° 12' 54.07" N	163° 45' 42.73" W	fine	black	sand
EBS018	2009-233	23:05	75.4	54° 12' 51.55" N	163° 43' 53.28" W	coarse	black	silt
EBS019	2009-233	23:18	75.2	54° 12' 52.29" N	163° 42' 1.61" W	coarse, fine	black, black	sand, gravel
EBS020	2009-233	23:31	74.4	54° 12' 50.72" N	163° 40' 11.17" W	fine, coarse	black, black	sand, silt
EBS021	2009-231	20:06	95.5	54° 11' 48.9" N	163° 47' 37.6" W	hard	n/a	n/a
EBS022	2009-231	21:47	77.5	54° 11' 49.8" N	163° 45' 43.95" W	coarse, broken	black, white	gravel, shells
EBS023	2009-231	22:03	76.1	54° 11' 48.03" N	163° 43' 55" W	coarse	black	gravel
EBS024	2009-231	22:32	75.9	54° 11' 46.13" N	163° 42' 2.64" W	hard	n/a	n/a
EBS025	2009-231	22:45	76.5	54° 11' 47.92" N	163° 40' 14.25" W	fine	black	sand
EBS026	2009-233	20:08	86	54° 10' 45.49" N	163° 47' 35.32" W	coarse	black	silt
EBS027	2009-233	19:53	77	54° 10' 45.76" N	163° 45' 43.26" W	fine	black	sand
EBS028	2009-233	19:39	75	54° 10' 42.41" N	163° 43' 55.44" W	fine, coarse	black, black	sand, pebbles
EBS029	2009-233	19:26	72	54° 10' 43.69" N	163° 42' 3.59" W	fine	black	sand
EBS030	2009-233	19:12	76.9	54° 10' 41.66" N	163° 40' 16.04" W	fine	black	sand
EBS031	2009-234	8:54	93.5	54° 14' 58.55" N	163° 38' 19.03" W	coarse, medium	black, black	silt, sand
EBS032	2009-234	8:11	96	54° 14' 57.69" N	163° 36' 24.65" W	fine	black	silt

Bottom Sample Number	Julian Day Number	Time (UTC)	Depth (m)	Latitude	Longitude	Surface Description	Color	Nature of Surface
EBS036	2009-234	9:09	80	54° 13' 54.81" N	163° 38' 16.11" W	coarse, medium	black, black	sand, sand
EBS037	2009-234	7:00	89	54° 13' 52.63" N	163° 36' 23.08" W	fine	black	silt
EBS038	2009-234	7:32	92.3	54° 13' 51.53" N	163° 34' 35.89" W	fine,	black, black	silt, clay
EBS039	2009-234	7:03	91	54° 13' 50.79" N	163° 32' 45" W	fine	black	cobbles
EBS040	2009-234	6:48	84.7	54° 13' 47.55" N	163° 30' 56.63" W	fine, fine	black, black	sand, pebbles
EBS041	2009-233	23:44	78.1	54° 12' 50.1" N	163° 38' 23.19" W	coarse	black	sand
EBS042	2009-233	23:56	88.1	54° 12' 50.21" N	163° 36' 21.27" W	fine	black	silt
EBS043	2009-234	0:09	92	54° 12' 48.95" N	163° 34' 39.29" W	fine	black	silt
EBS044	2009-234	0:23	91.3	54° 12' 46.79" N	163° 32' 48.49" W	fine, fine	black, brown	sand, clay
EBS045	2009-234	0:37	89.6	54° 12' 45.55" N	163° 30' 57.62" W	fine	black	silt
EBS046	2009-231	22:59	82.2	54° 11' 43.87" N	163° 38' 22.07" W	medium, broken	black	sand, shells
EBS047	2009-231	23:15	87.6	54° 11' 45.97" N	163° 36' 28.95" W	fine, fine	black, black	sand, silt
EBS048	2009-231	23:29	89.9	54° 11' 42.85" N	163° 34' 39.33" W	coarse	brown, n/a	silt
EBS049	2009-231	23:43	88.4	54° 11' 40.72" N	163° 32' 49.28" W	fine	black	silt
EBS050	2009-231	23:59	86.9	54° 11' 37.22" N	163° 30' 58.58" W	medium	black	sand

Bottom Sample Number	Julian Day Number	Time (UTC)	Depth (m)	Latitude	Longitude	Surface Description	Color	Nature of Surface
EBS051	2009-233	18:59	79.1	54° 10' 40.08" N	163° 38' 23.56" W	fine, medium	black, black	sand, pebbles
EBS052	2009-233	18:44	82	54° 10' 37.71" N	163° 36' 34.19" W	medium, fine	black, black	sand, pebbles
EBS053	2009-233	18:30	83	54° 10' 37.13" N	163° 34' 43.87" W	fine	black	sand
EBS054	2009-233	18:15	83	54° 10' 36.26" N	163° 32' 54.08" W	medium	black	sand
EBS055	2009-233	18:00	78	54° 10' 34.63" N	163° 31' 2.43" W	broken	white	shells
EBS056	2009-234	6:35	88.6	54° 13' 46.78" N	163° 29' 5.73" W	fine	black	silt
EBS057	2009-234	5:56	74.2	54° 13' 44.4" N	163° 27' 15.87" W	medium	black	sand
EBS058	2009-234	5:43	64.7	54° 13' 43.74" N	163° 25' 27.17" W	medium, broken	black, white	sand, shells
EBS059	2009-234	5:31	62.2	54° 13' 42.29" N	163° 23' 35.45" W	medium	black	sand
EBS060	2009-234	5:19	63.9	54° 13' 40.44" N	163° 21' 43.85" W	medium	black	sand
EBS061	2009-234	1:07	87	54° 12' 42.23" N	163° 29' 8.43" W	fine	black	silt
EBS062	2009-234	1:20	76.4	54° 12' 43.17" N	163° 27' 12.7" W	fine	black	sand
EBS063	2009-234	1:32	65.6	54° 12' 40.05" N	163° 25' 30.43" W	medium, broken	brown, n/a	pebbles, shells
EBS064	2009-234	1:45	65.9	54° 12' 40.2" N	163° 23' 37.35" W	fine	black	sand
EBS065	2009-234	1:58	65.2	54° 12' 37.42" N	163° 21' 46.36" W	coarse, broken	black, white	silt, shells
EBS066	2009-232	0:14	82.4	54° 11' 38.52" N	163° 29' 12.51" W	medium	black	sand

Bottom Sample Number	Julian Day Number	Time (UTC)	Depth (m)	Latitude	Longitude	Surface Description	Color	Nature of Surface
EBS067	2009-232	0:29	76.5	54° 11' 36.72" N	163° 27' 21.66" W	medium	black	silt
EBS068	2009-232	0:43	69.7	54° 11' 35.11" N	136° 25' 31.98" W	hard	n/a	rock
EBS069	2009-232	0:57	69.9	54° 11' 36.16" N	163° 23' 40.76" W	fine	black	sand
EBS070	2009-232	1:25	69.8	54° 11' 31.17" N	163° 21' 44.67" W	hard	n/a	n/a
EBS071	2009-233	16:43	75	54° 10' 32.84" N	163° 29' 15.75" W	medium, broken	black, white	gravel, shells
EBS072	2009-233	16:28	73.5	54° 10' 32.87" N	163° 27' 24.43" W	medium, medium, broken	black, black, white	gravel, sand, shells
EBS073	2009-233	15:21	70	54° 10' 29.74" N	163° 25' 28.53" W	medium	black	sand
EBS074	2009-233	15:01	75	54° 10' 29.5" N	163° 23' 37.18" W	medium	black	sand
EBS075	2009-233	14:13	73.5	54° 10' 28.27" N	163° 21' 52.1" W	medium	black	sand
EBS076	2009-233	17:10	75	54° 9' 28.28" N	163° 29' 18.01" W	medium	black	sand
EBS077	2009-233	16:10	70	54° 9' 23.38" N	163° 27' 21.59" W	broken	white	shells
EBS078	2009-233	15:34	74.5	54° 9' 26.343" N	163° 25' 30.83" W	medium	black	sand
EBS079	2009-233	14:42	77	54° 9' 25.65" N	163° 23' 42.8" W	medium	black	sand
EBS080	2009-233	14:25	75	54° 9' 22.96" N	163° 21' 55.64" W	fine	black	sand
EBS081	2009-234	5:08	65.5	54° 13' 38.97" N	163° 19' 54.28" W	medium	black	sand
EBS082	2009-234	4:56	66	54° 13' 38.91" N	163° 18' 3.49" W	fine	black	sand
EBS083	2009-234	4:44	66.6	54° 13' 36.69" N	163° 16' 12.51" W	medium	black	sand

# **TERRAS**

Bottom Sample Number	Julian Day Number	Time (UTC)	Depth (m)	Latitude	Longitude	Surface Description	Color	Nature of Surface
EBS084	2009-234	4:33	62.1	54° 13' 36.46" N	163° 14' 25.44" W	calcareous	amber	coral
EBS085	2009-234	4:09	51.3	54° 13' 32.29" N	163° 12' 33.11" W	fine, broken	black, white	pebbles, shells
EBS086	2009-234	2:10	67.1	54° 12' 35.32" N	163° 19' 56.05" W	hard, broken	brown, white	rock, shells
EBS087	2009-234	2:23	67.5	54° 12' 34.1" N	163° 18' 5.06" W	medium, broken	black, white	sand, shells
EBS088	2009-234	2:36	69.4	54° 12' 31.96" N	163° 16' 14.9" W	fine	black	sand
EBS089	2009-234	2:49	72.1	54° 12' 30.97" N	163° 14' 27.21" W	fine, coarse	black, black	sand, silt
EBS090	2009-234	3:02	73.6	54° 12' 28.52" N	163° 12' 36.66" W	fine, medium	black, black	pebbles, pebbles
EBS091	2009-232	1:58	70	54° 11' 30.05" N	136° 19' 52.21" W	fine	black	sand
EBS092	2009-232	2:14	70.2	54° 11' 30.67" N	136° 18' 9.5" W	hard, fine	n/a, black	rock, sand
EBS093	2009-232	2:29	71.8	54° 11' 29.44" N	163° 16' 19.17" W	fine	black	sand
EBS094	2009-232	2:47	72.9	54° 11' 24.94" N	163° 14' 25.03" W	medium	black	sand
EBS095	2009-232	3:06	76.5	54° 11' 24.99" N	163° 12' 32.56" W	coarse	black	silt
EBS096	2009-233	13:44	72	54° 10' 25.92" N	163° 20' 0.29" W	medium, broken	black, white	sand, shells
EBS097	2009-233	13:27	72	54° 10' 21.41" N	163° 18' 11.52" W	medium	black	sand
EBS098	2009-233	13:07	74	54° 10' 23.34" N	163° 16' 19.42" W	medium	black	sand

# **TERRAS**

Bottom Sample Number	Julian Day Number	Time (UTC)	Depth (m)	Latitude	Longitude	Surface Description	Color	Nature of Surface
EBS099	2009-233	12:50	75	54° 10' 21.14" N	163° 14' 29.49" W	medium	black	sand
EBS100	2009-233	12:32	77	54° 10' 20.1" N	163° 12' 36.79" W	medium, broken	black, white	sand, shells
EBS101	2009-233	9:10	71	54° 9' 22.67" N	163° 20' 2.27" W	broken	white	shells
EBS102	2009-233	9:26	76	54° 9' 20.12" N	163° 18' 10.22" W	medium, broken	black, white	sand, shells
EBS103	2009-233	9:44	76	54° 9' 17.57" N	163° 16' 19.95" W	medium, medium	black, black	sand, pebbles
EBS104	2009-233	10:00	75	54° 9' 16.12" N	163° 14' 31.61" W	fine, broken	black, white	sand, shells
EBS105	2009-233	10:15	76	54° 9' 14.23" N	163° 12' 43.85" W	medium	black	pebbles
EBS106	2009-234	3:15	72.4	54° 12' 27.61" N	163° 10' 48.44" W	fine	black	sand
EBS107	2009-234	3:28	69.5	54° 12' 26.7" N	163° 8' 55.396" W	coarse	black	silt
EBS108	2009-234	3:43	66.9	54° 12' 23.26" N	163° 7' 3.76" W	fine	black	silt
EBS109	2009-232	3:28	75.3	54° 11' 23.5" N	163° 10' 47.85" W	medium	black	silt
EBS110	2009-232	3:42	72.6	54° 11' 20.58" N	163° 8' 57.89" W	fine	black	sand
EBS111	2009-232	3:55	70.4	54° 11' 18.46" N	163° 7' 11" W	fine	black	sand
EBS112	2009-233	12:10	78	54° 10' 17.48" N	163° 10' 51.61" W	medium	black	sand
EBS113	2009-233	11:55	77.5	54° 10' 15.33" N	163° 8' 55" W	hard	n/a	n/a
EBS114	2009-233	11:27	75	54° 10' 12.83" N	163° 7' 10.05" W	medium, broken	black, white	sand, shells

# **TERRAS**

Bottom Sample Number	Julian Day Number	Time (UTC)	Depth (m)	Latitude	Longitude	Surface Description	Color	Nature of Surface
EBS115	2009-233	10:29	80	54° 9' 11.72" N	163° 10' 51.6" W	medium	black	sand
EBS116	2009-233	10:45	80	54° 9' 10.44" N	163° 9' 1.67" W	medium	black	sand
EBS117	2009-233	11:05	78.5	54° 9' 8.61" N	163° 7' 11.15" W	medium	black	sand
EBS118	2009-233	7:30	77.9	54° 8' 8.02" N	163° 10' 58.79" W	fine	black	sand
EBS119	2009-233	7:10	79.8	54° 8' 7.4" N	163° 9' 8.93" W	fine	black	sand
EBS120	2009-233	6:53	79.2	54° 8' 6.08" N	163° 7' 18.42" W	fine	black	sand
EBS121	2009-233	7:50	68.9	54° 8' 9.77" N	163° 12' 48.44" W	medium	brown	cobbles
EBS122	2009-233	8:07	70	54° 8' 10.18" N	163° 14' 32.43" W	medium, broken	black, white	sand, shells
EBS123	2009-233	8:34	70	54° 8' 13.47" N	163° 16' 22.87" W	medium, medium, broken	black, black, white	sand, pebbles, shells
EBS124	2009-233	8:50	74	54° 8' 16.41" N	163° 18' 16.02" W	medium, broken	black, white	sand, shells
EBS125	2009-234	6:08	83.6	54° 14' 51.24" N	163° 27' 11.6" W	calcareous	pink	shells
EBS126	2009-234	6:22	98.4	54° 14' 51.08" N	163° 29' 3.08" W	fine	black	silt
EBS127	2009-233	17:27	76	54° 9' 29.75" N	163° 31' 8.87" W	medium, medium	black, black	gravel, pebbles
EBS128	2009-233	17:38	75	54° 9' 30.96" N	163° 33' 0.64" W	medium	black	pebbles
EBS129	2009-234	10:06	98.5	54° 16' 6.1" N	163° 41' 51.86" W	coarse	black	silt
EBS131	2009-234	11:25	94	54° 16' 7.64" N	163° 43' 43.73" W	fine	black	sand



Bottom Sample Number	Julian Day Number	Time (UTC)	Depth (m)	Latitude	Longitude	Surface Description	Color	Nature of Surface
EBS134	2009-233	6:35	80	54° 7' 9.35" N	163° 6' 25.8" W	fine	black	sand

Table 1 – Bottom samples obtained in conjunction with survey H12066 (2009).

#### Correspondence

Item 1: RE: Coverage 2008 Specs Item 2: RE: AWOIS Items

#### Item 1:

From: Mark.T.Lathrop [mailto:Mark.T.Lathrop@noaa.gov] Sent: Tuesday, June 23, 2009 9:25 AM To: Kathleen Mildon Cc: Castle.E.Parker; Brian Busey; Thomas Newman; Jeffrey.Ferguson@noaa.gov Subject: Re: Coverage follow up

### Kathleen,

You are authorized to survey to the 2008 Specifications and Deliverables, Section 5.1.2.2 for all work this year. Mark



Kathleen Mildon wrote:

Gene,

This email is in summary of our conversation yesterday morning, Monday June 22, on the 2009 Specifications and Deliverables section 5.1.2.2 concerning Unimak Pass. TerraSond is trying to meet the specification of the third bullet point in that section in particular. It states that:

"• Grid resolution shall be 1m in waters less than 20m deep, and approximately 5% of the water depth in waters 20m and deeper. Coarser resolutions may be warranted in certain areas due to bottom topography ("steep and deep"), or if side scan data is also collected, or other project specific reasons. However, there is rarely a circumstance where the depths encountered are deep enough to warrant the use of grid resolutions greater than 10m. The coarsest resolution shall be 8m for areas with depths up to 350m and a 16m resolution for areas with depths greater than 350m. At least 95% of all nodes on the surface shall be populated, with at least 5 soundings."

The highlighted section is the portion is what we are having trouble meeting, that there be 5 soundings per resolution pixel on the surface.

In the 2008 and previous specifications it states that ". At least 95% of all nodes on the surface shall be populated." which we are meeting currently.

We are meeting currently the 2008 specifications with our along track coverage although this was also taken out of the 2009 specifications. In 2008 and previous this is the along track statement in section 5.1.1.2 :

"To ensure proper along track coverage, the hydrographer shall ensure that vessel speed is adjusted so that no less than 3.2 beam footprints, center-to-center, fall within 3 m, or a distance equal to 10 percent of the depth, whichever is greater, in the along track direction."

To meet this new specification as we spoke about earlier today we have to slow considerably to around 4 knots in the deep areas over 100 m. This also happens in areas around 40-60 m where the resolution changes.

We had discussed that as long as we are meeting our along track ping rate, as well as having no holiday spanning 3 nodes in waters less than 30m and also that if we had our grid nodes populated that our survey would more than likely not be checked against the "95% of all nodes on the surface shall be populated, with at least 5soundings.".



OPR-P188-TE-09 Unimak Pass, Alaska H12066, Sheet E

I would just like to reiterate that we are currently meeting the 2008 specification of along track coverage as well as grid resolution that was changed in the 2009 specs.

Upon writing our Work Plan we had estimated our time based on the previous year's jobs. These jobs all ran to the 2008 or previous years specifications and deliverables. The 2009 Specifications and Deliverables was not out until April which was after our work plan had been accepted.

TerraSond is requesting a relaxation of the specifications to abide by the 2008 specifications or a review and amendment of the 2009 specifications to alleviate this issue.

Thank you for your time,

Katie

Katie Mildon Charting Program Manager TerraSond Ltd Terrestrial and Sea Floor Mapping 1617 South Industrial Way Suite 3, Palmer, Alaska 99645 (907) 745-7215 Office (907) 745-7273 FAX (907) 715-1825 Cell kmildon@terrasond.com www.terrasond.com

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Subject: [Fwd: Re: Unimak Pass grid resolution] From: "Mark.T.Lathrop" <Mark.T.Lathrop@noaa.gov> Date: Wed, 06 Oct 2010 13:46:05 -0400 To: gene\_parker <Castle.E.Parker@noaa.gov>

Gene,

Here's the appropriate e-mail. Now I remember this issue was cropping up in all the deep-water surveys,; both KR and NOAA platforms. Don't know why they didn't include this in their DR. Mark

Subject: Re: Unimak Pass grid resolution From: "Mark.T.Lathrop" <Mark.T.Lathrop@noaa.gov> Date: Mon, 14 Dec 2009 14:07:00 -0500 To: Kathleen Mildon <kmildon@terrasond.com> CC: James DePasquale <jdepasquale@terrasond.com>, Andrew Orthmann <aorthmann@terrasond.com>

Katie,

Your proposal is fine. We authorized the use of the 2008 Specs for 5.1.2.2 and that should logically carry over to the CUBE parameters as well.

Mark

Kathleen Mildon wrote:

Mark,

I am forwarding along a concern that Andy Orthmann discovered during our data processing. Please see below.

Mark,

We would like to deviate from the specs concerning depth range resolution requirements for H12004 (Unimak sheet C). Specifically we propose:

1. Adjusting the 4 meter resolution surface to terminate at 80 meters depth (therefore 4m from 46 to 80 instead of 46 to 115 meters)

2. Starting the 8 meter resolution surface at 72 meters depth (therefore 8m from 72 to 350 instead of 103 to 350 meters)

3. The remaining surfaces (1m and 2m) would be unchanged from the specs

We are seeing excessive holidays between adjacent lines in the 4-meter surface in depths of 80 to 115 meters in this sheet. Though we haven't quantified it, it is likely to cause the 95 % requirement for node population outlined in the specs to not be met unless the resolution is adjusted.

The data meets the complete multibeam requirements in sections 5.1.2.2 of 2008 Specs and Deliverables (we were exempted from adhering to the 2009 specs for that section). However, we are using CUBE parameters that meet the more stringent 2009 specs requirements because we have good results in the other sheets. But in this sheet on this particular surface the results are not good due to wider line spacing used early in the project.

We would prefer adjusting the resolution range for H12004 as outlined above over using different CUBE parameters specific to this sheet in order to keep the CUBE parameters consistent project wide.

Thank you, Katie

Katie Mildon Charting Program Manager

# **TerraSond Ltd**

Terrestrial and Sea Floor Mapping 1617 South Industrial Way Suite 3, Palmer, Alaska 99645 (907) 745-7215 Office (907) 745-7273 FAX (907) 715-1825 Cell kmildon@terrasond.com www.terrasond.com

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Re: Unimak Pass grid resolution.eml	<b>Content-Type:</b>	message/rfc822
Re: Ommak rass grid resolution.em	<b>Content-Encoding:</b>	7bit



Please consider the environment before printing this email.

This email was scanned and found virus free by GFI on 23/6/2009.

#### **Item 2:**

- From: Mark.T.Lathrop [Mark.T.Lathrop@noaa.gov]
- Sent: Friday, August 21, 2009 10:03 AM
- To: Kathleen Mildon
- Subject: awois

Katie,

You are correct, there are no AWOIS items assigned for Unimak Pass.

Mark

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

# H12066 COMPILATION LOG

	eneral Survey Information	
REGISTRY No.	H12066	
PROJECT No.	<i>OPR-P188-TE-09</i>	
FIELD UNIT	TERRASOND LTD.	
DATE OF SURVEY	June 2, 2009 to August 22, 2009	
LARGEST SCALE CHART	16250, 23 <sup>rd.</sup> Edition, 20080801	
SOUNDING UNITS	Fathoms	
COMPILER	Norris Wike	
Source Grids	File Name	
	🖾 1_of_2_4m_Final.hns 563,703 KB HNS File	
	2_of_2_2m_Final.hns 19,940 KB HNS File	
	2_of_2_4m_Final.hns 429,152 KB HNS File	
Surfaces	File Name	
Combined	H12066_4M_Combined.csar	
Interpolated TIN	H12066_8M_InterpTIN.csar	
Shifted Interpolated TIN	H12066_8M_InterpTIN_shifted.csar	
Final HOBs	File Name	
Survey Scale Soundings	H12066_SS.hob,	
Chart Scale Soundings	H12066_CS.hob	
Contour Layer	H12066_Contours.hob	
Feature Layer	H12066_Features.hob	
Meta-Objects Layer	H12066_MetaLayers.hob	
Blue Notes	H12066 BlueNotes.hob	
Bottom Samples	H12066_BottomSamples.hob	
Meta-Objects Attribution		
Acronym	Value	
M_COVR		
CATCOV	1	
SORDAT	20090822	
SORIND	US,US,graph,H12066	
M_QUAL		
CATZOC	6	
CATZOC INFORM	M/V Bluefin	
CATZOC INFORM POSACC	M/V Bluefin       10	
CATZOC INFORM POSACC SORDAT	M/V Bluefin           10           20090822	
CATZOC INFORM POSACC SORDAT SORIND	M/V Bluefin           10           20090822           US,US,graph,H12066	
CATZOC INFORM POSACC SORDAT SORIND SUREND	M/V Bluefin           10           20090822           US,US,graph,H12066           20090822	
CATZOC INFORM POSACC SORDAT SORIND SUREND SURSTA	M/V Bluefin           10           20090822           US,US,graph,H12066	
CATZOC INFORM POSACC SORDAT SORIND SUREND SURSTA DEPARE	M/V Bluefin         10         20090822         US,US,graph,H12066         20090822         20090602	
CATZOC INFORM POSACC SORDAT SORIND SUREND SUREND SURSTA DEPARE DRVALV 1	M/V Bluefin         10         20090822         US,US,graph,H12066         20090822         20090602         23.000 fm	
CATZOC INFORM POSACC SORDAT SORIND SUREND SUREND SURSTA DEPARE DRVALV 1 DRVALV 2	M/V Bluefin         10         20090822         US,US,graph,H12066         20090822         20090602         23.000 fm         63.000 fm	
CATZOC INFORM POSACC SORDAT SORIND SUREND SURSTA DEPARE DRVALV 1 DRVALV2 SORDAT	M/V Bluefin         10         20090822         US,US,graph,H12066         20090822         20090602         23.000 fm         63.000 fm         20090822	
CATZOC INFORM POSACC SORDAT SORIND SUREND SUREND SURSTA DEPARE DRVALV 1 DRVALV 2	M/V Bluefin         10         20090822         US,US,graph,H12066         20090822         20090602         23.000 fm         63.000 fm	
CATZOC INFORM POSACC SORDAT SORIND SUREND SURSTA DEPARE DRVALV 1 DRVALV2 SORDAT	M/V Bluefin         10         20090822         US,US,graph,H12066         20090822         20090602         23.000 fm         63.000 fm         20090822	
CATZOC INFORM POSACC SORDAT SORIND SUREND SURSTA DEPARE DRVALV 1 DRVALV2 SORDAT	M/V Bluefin         10         20090822         US,US,graph,H12066         20090822         20090602         23.000 fm         63.000 fm         20090822	

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

#### **SPECIFICATIONS:**

- I. COMBINED SURFACE:
  - a. Number of ESAR Final Grids: 3
  - b. Resolution of Combined (m): **4***M*
- II. SURVEY SCALE SOUNDINGS (SS):
  - a. <u>Radius</u>
  - b. Shoal biased
  - c. Use Single-Defined Radius (mm at Map Scale): 300000
    - i. Radius Value (m): 1
    - ii. Or use a Sounding Space Range Table (if applicable): NA
  - d. Queried Depth of All Soundings
    - i. Minimum: 24.2957 fm
    - ii. Maximum: 61.6326 fm
- III. INTERPOLATED TIN SURFACE: a. Resolution (m):
- **8M**

b. <u>Linear</u>

0171

- c. Shifted value:  $[-0.229m (feet), (\leq 10 fathoms)]$ [-1.372m (fathoms), (> 10 fathoms)]
- IV. Contours:
  - a. Use a Depth List: *H12066\_depth\_curves\_list.txt*b. Line Object: DEPCNT
  - c. Value Attribute: VALDCO
- V. FEATURES:
  - a. Total Number of Features: 1
  - b. Number of Insignificant Features: NA
- VI. CHART SURVEY SOUNDINGS (CS):
  - a. Number of ENC CS Soundings: 68
  - b. <u>Radius</u>
  - c. Shoal biased
  - d. Use Single-Defined Radius: m on the ground
    - i. Radius Value (m): 2500
    - ii. Or use a Sounding Space Range Table (if applicable): NA
  - e. Filter: <u>Interpolated != 1</u>
  - f. Number Survey CS Soundings: 81

```
VII. Notes:
```

#### ATLANTIC HYDROGRAPHIC BRANCH H-CELL REPORT to ACCOMPANY SURVEY H12066 (2009)

This H-Cell 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.2. QUALITY CONTROL**

## H-Cell

The AHB source depth grid for the survey's nautical chart update product were the field's original 2m and 4m grids. These grids were combined at 4 meter resolution. The survey scale soundings were created from the combined surface using the 1MM at map scale process. Refer to the Compilation Log above for exact values used for this process. A TIN was created from the survey scale soundings from which an interpolated surface was generated. The chart scale soundings were derived from only the non-interpolated nodes of this surface to preserve absolute continuity between the charted depths, the survey scale soundings, and the original source grid. The chart scale soundings were selected using the mm on the ground process. 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.

The interpolated TIN surface of 8m resolution was shifted by the NOAA sounding rounding value of -0.75 fathoms for depths greater than 10 fathoms. The shifted interpolated TIN was used to generate depth contours in fathoms. 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 compilation products (Final \*.HOB files) for this survey are detailed in the H12066 AHB Compilation Log contained within this document. The Final HOB files included depth areas (DEPARE), depth contours (DEPCNT), soundings (SOUNDG), meta-objects (M\_COVR, M\_QUAL), cartographic Blue Notes (\$CSYMB), and features (SBDARE, UWTROC).

As dictated by Hydrographic Technical Directive 2008-8, the Final HOB files were combined into two separate H-Cell files in S-57 format. Both S-57 files were exported from CARIS Bathy DataBASE in meters, and then converted from metric units into feet using CARIS HOM ENC 3.3. Quality assurance and topology checks were conducted using DKART Inspector 5.1 validation tests.

The final H-Cell products are two S-57 files, in Lat/Long NAD-83. The contents of these two H-Cell deliverables are listed in the table below:

	TABLE 1 -	Contents of H-Cel	ll Files
H1206	5_CS.000		Scale 1:300,000
Object Class Types	Geographic	Cartographic	Meta
	DEPARE	\$CSYMB	M_COVR
S-57 Object Acronyms	SBDARE		M_QUAL
	SOUNDG		
	UWTROC		
		· · ·	
H1206	5_SS.000		Scale 1:40,000
Object Class Types	Geographic		
S-57 Object Acronyms	DEPCNT		
	SOUNDG		

# **B.2.3** Junctions

Survey H12066 (2009) has a junction with surveys H12065 (2009) to the west and H12067 (2009) to the east. Present survey soundings compare within 1 foot with H12065 (2009) and H12067 (2009). Most present survey depths compare within 1 fathom of the charted hydrography to the north and south.

### **DATA PROCESSING**

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

CARIS HIPS/SIPS version 7.0 SP2, HF 2-7 CARIS Bathy DataBASE version 3.0 HF 1, 3, 5, 8, 9, 10 CARIS S-57 Composer version 2.1 HF 1-5 DKART INSPECTOR, version 5.1 CARIS HOM ENC 3.3 SP3 HF 1-8 PYDRO version 11.3 (r3347)

# C. <u>VERTICAL AND HORIZONTAL CONTROL</u>

The hydrographer makes adequate mention of horizontal and vertical control used for this survey in section C of the DR. The sounding datum for this survey is Mean Lower Low Water (MLLW), and the vertical datum is Mean High Water (MHW). Horizontal control used for this survey during data acquisition is based upon the North American Datum of 1983 (NAD83), UTM projection zone 3 North.

# D. <u>RESULTS AND RECOMMENDATIONS</u>

CHART COMPARISON	16520 (23 <sup>rd</sup> . Edition, Aug. /08)
	Unimak and Akutan Passes
	Corrected through NM 04/16/2011
	Corrected through LNM 04/12/2011
	Scale 1:300,000
ENC Comparison	US3AK61M
ENC Comparison	US3AK61M Unimak and Akutan Passes
ENC Comparison	
ENC Comparison	Unimak and Akutan Passes
ENC Comparison	Unimak and Akutan Passes Edition 16

## **Hydrography**

The charted hydrography originates with prior surveys and requires no further consideration. The hydrographer makes adequate chart comparisons in section D. and Appendix I and II of the Descriptive Report. Any charted features not specifically addressed either in the H-Cell files or the Blue Notes should be retained as charted.

The following should be noted:

An uncharted <u>*rock*</u> with a depth of <u>**31** fm</u> in Latitude 54°13'00.80"N, Longitude 163°39'22.30"W was located during office processing. Chart a <u>*rock*</u> with a depth of <u>**31** fm</u>.

A charted notation <u>*rky*</u> in the vicinity of Latitude  $54^{\circ}08'04.99"$ N, Longitude  $163^{\circ}12'55.45"$ W was disproved by the present survey. Seabed characteristics show the bottom to be sand. Delete the charted notation <u>*rky*</u>.

The field unit collected a total of 152 bottom samples. All charted seabed characteristics were superseded by the survey findings. Eleven seabed characteristics were used for charting and the remaining 141 seabed characteristics are filed with this report.

#### **MISCELLANEOUS**

Chart compilation was completed 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.

#### **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 section D. and Appendix I and II of the Descriptive Report for further recommendations by the hydrographer.

#### APPROVAL SHEET H12066 (2009)

#### **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.

> **Norris A. Wike** 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.

Approved: \_

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