

H12068

NOAA FORM 76-35A	
U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION NATIONAL OCEAN SURVEY	
DESCRIPTIVE REPORT	
Type of Survey:	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	
DATE	LIBRARY & ARCHIVES

NOAA FORM 77-28 (11-72) <div style="text-align: center; margin-top: 10px;">           U.S. DEPARTMENT OF COMMERCE            NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION         </div> <div style="text-align: center; margin-top: 20px; font-weight: bold; font-size: 1.2em;">           HYDROGRAPHIC TITLE SHEET         </div>	REGISTRY No  <div style="text-align: center; font-weight: bold; font-size: 1.5em; margin-top: 10px;">           OPR-P188-TE09         </div>
INSTRUCTIONS - The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.	FIELD No. <span style="float: right; font-weight: bold; font-size: 1.2em;">H12068</span>

State Alaska

General Locality Southwest Peninsula

Sub-Locality 26 NM SW of Sanak Island

Scale 1:40,000      Date of Survey 6/22/2009 – 8/22/2009

Instructions dated March 30, 2009      Project No. OPR-P188-TE-09

Vessel M/V Bluefin

Chief of party Marta Krynytzky

Surveyed by TerraSond Ltd

Soundings by echo sounder, lead line, pole Echo Sounder

Graphic record scaled by N/A

Graphic record checked by N/A      Automated Plot N/A

Verification by Kathleen Mildon ***Atlantic Hydrographic Branch Personnel***

Soundings in fathoms feet at MLW MLLW MLLW ***Acquired in meters, compiled in fathoms.***

**REMARKS:** Contract No.: DG133C-08-CQ-0005

Contractor: TerraSond Ltd. All times recorded in UTC

1617 South Industrial Way, Suite 3

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***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**

## TABLE OF CONTENTS

A. Area Surveyed.....	4
B. Data Acquisition And Processing .....	5
B.1. Equipment .....	5
B.2. Quality Control.....	6
B.2.1. Crosslines .....	6
B.2.2. Uncertainty Values.....	6
B.2.3. Contemporary Survey Junctions .....	7
B.2.4. Sonar System Quality Control Checks .....	8
B.2.5. Unusual Conditions Encountered .....	8
B.2.6. Sound Speed.....	9
B.2.7. Requirements for Object Detection and Coverage .....	9
B.3. Corrections to Echo Soundings .....	9
B.4. Data Processing .....	10
C. Vertical And Horizontal Control .....	11
D. Results And Recommendations .....	12
D.1. Chart Comparison .....	12
D.1.1. New Features .....	13
D.1.2. Charted Features .....	13
D.1.3. Soundings.....	13
D.1.4. Trends and Changeable Areas .....	14
D.1.5. AWOIS Items Summary .....	15
D.1.6. Features Labeled PA, ED, PD, or Rep.....	15
D.1.7. Danger to Navigation Reports. ....	15
D.2. Additional Results .....	15
D.2.1. Shoreline Verification .....	15
D.2.2. Aids to Navigation .....	15
D.2.3. Drilling Structures.....	15
D.2.4. Comparison with Prior Surveys .....	15
D.2.5. Bottom Samples .....	15
D.2.6. Bridges and Overhead Cables .....	15
D.2.7. Submarine Cables and Pipelines .....	16
LETTER OF APPROVAL .....	17

## FIGURES

Traffic in survey area H12066 .....	1
Figure 1– Overlay of H12066 on Chart 16520, 23rd Edition, August, 2008. Soundings in fathoms. ....	4
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.....	7
Figure 3 – Sheet limits of H12066 shown on chart 16520.....	13
Figure 4 – Contours from H12066 (green) overlaid on chart 16520 .....	14

## TABLES

Table 1 - Data Acquisition Summary .....	5
Table 2 - Specific Dates of Data Acquisition .....	5
Table 3 - Major systems used aboard the M/V Bluefin. ....	6
Table 4 - Contemporary survey junctions with H12066.....	7
Table 5 - Sound speed application method exceptions .....	9
Table 6 – Survey lines which do not have true heave applied.....	10
Table 7 - BASE surface resolution vs. survey depth. ....	10
Table 8 – Survey lines which do not have PPK navigation applied. ....	11
Table 9 – Charts used during chart comparisons. ....	12
Table 10 – Sounding discrepancies.....	14

## 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.

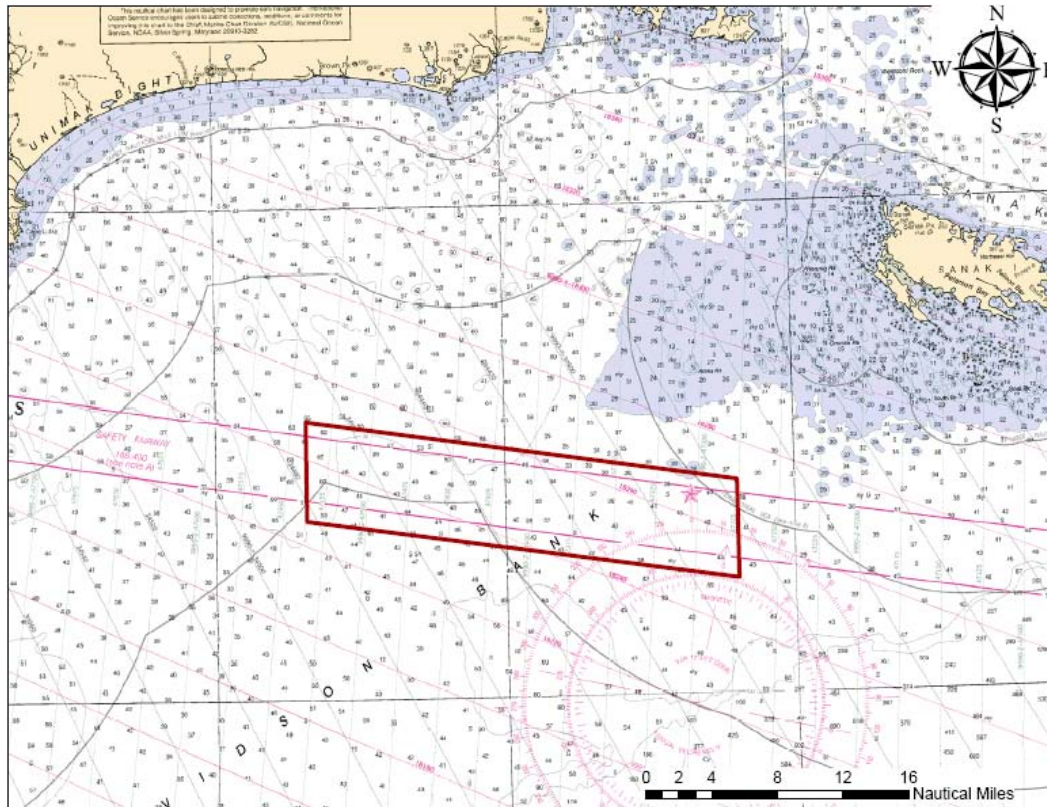


Figure 1– Overlay of H12066 on Chart 16520, 23rd Edition, August, 2008. Soundings in fathoms.

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 Data Acquisition and Processing Report (DAPR)\*, *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 Hydrographic Surveys Specifications and Deliverables (HSSD), *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



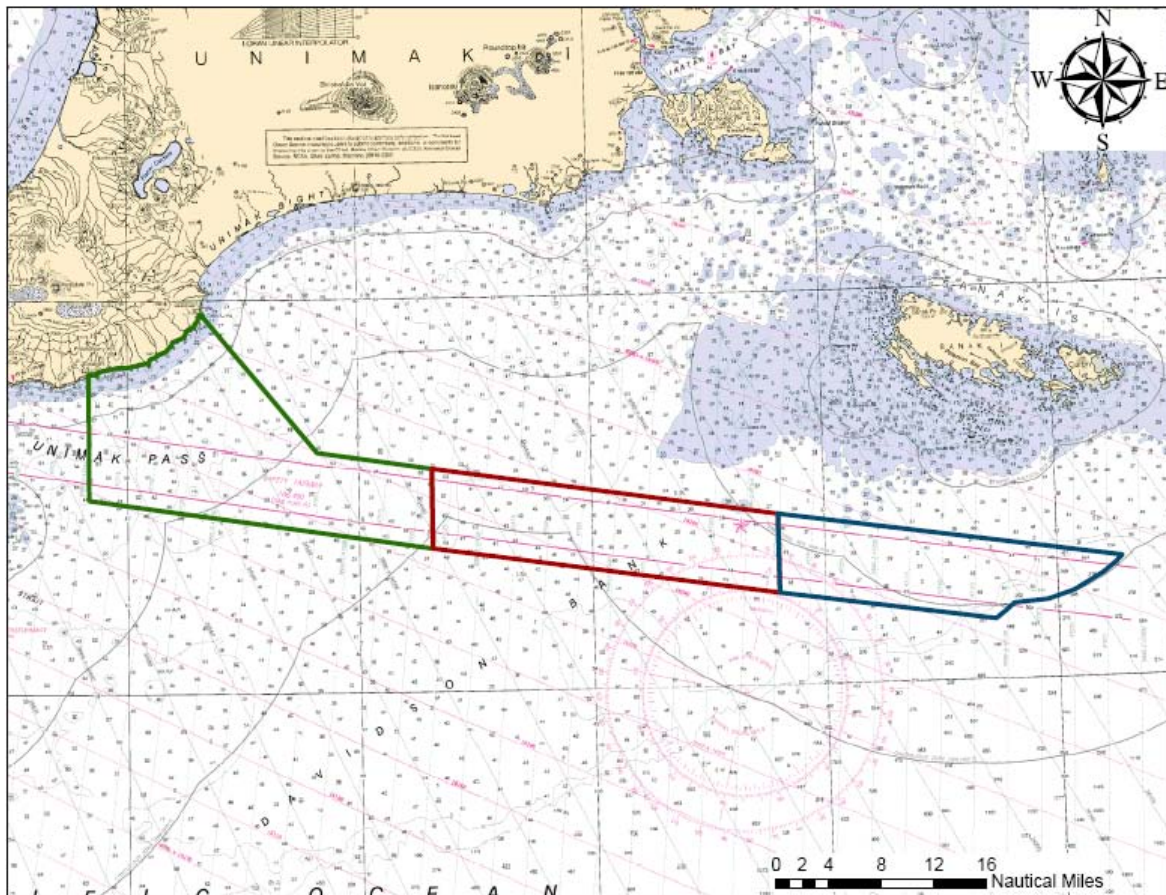
uncertainty exceed IHO levels as described in HSSD section 5.1.2 and 5.2.2 . However, there are isolated areas of elevated uncertainty which are typically relegated to outer beams presenting sound velocity (refraction) artifacts, areas of dynamic seabed morphology and areas of steep/changeable terrain.

### 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 DAPR, 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 DAPR, *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
1051_-_E	<i>M/V Bluefin</i>	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 DAPR.\*

### 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 DAPR\*.

***\*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-E	<i>M/V Bluefin</i>	True Heave Not Available
0923-E	<i>M/V Bluefin</i>	True Heave Not Available
0929-E	<i>M/V Bluefin</i>	True Heave Not Available
0977-E	<i>M/V Bluefin</i>	True Heave Not Available
1032-E	<i>M/V Bluefin</i>	True Heave Not Available
1279-E	<i>M/V Bluefin</i>	True Heave Not Available
1335-E	<i>M/V Bluefin</i>	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 Vertical and Horizontal Control Report (VHCR)\* 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 H12004~~66~~ 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 DAPR, *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 DAPR Section B: Quality Control\*. PPK navigation data was applied to the sounding data with the exception of the following:

CARIS line name	Vessel	Comment
0922_-_E	M/V Bluefin	SBET Not Available
0923_-_E	M/V Bluefin	SBET Not Available
0977_-_E	M/V Bluefin	SBET Not Available
1155_-_E_XL	M/V Bluefin	SBET Not Available
1279_-_E	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.

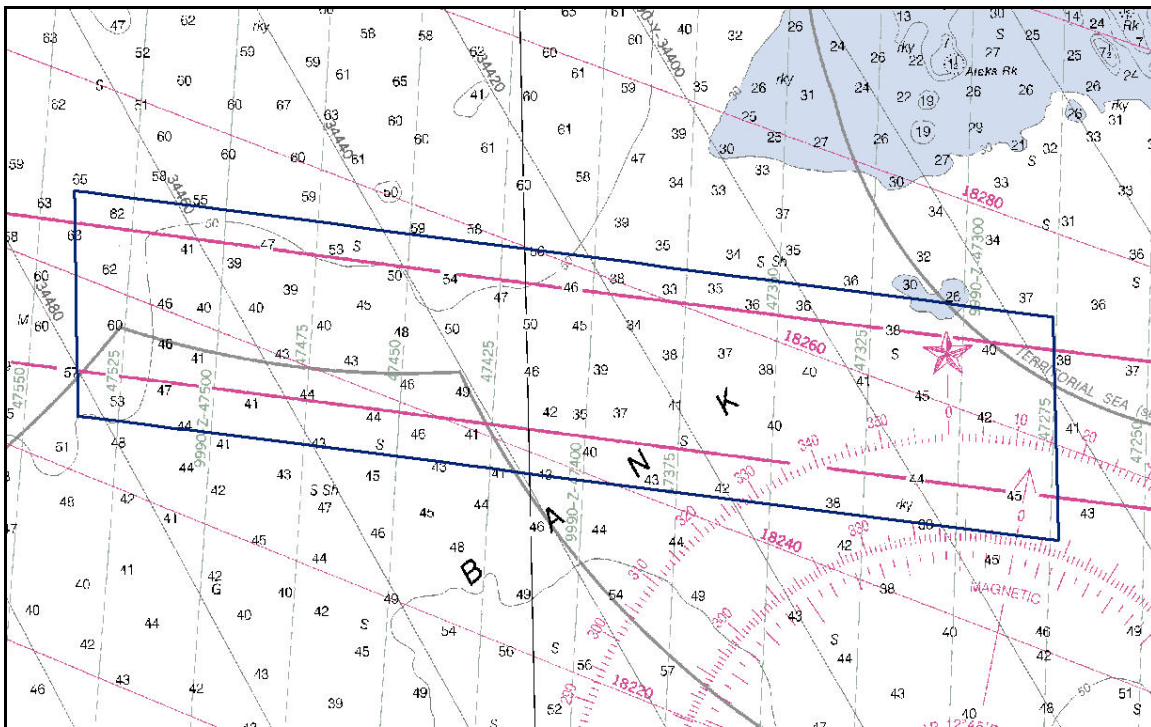
All survey data were compared to the data published in the RNCs and ENCs listed in Table 9.

Chart	Type	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 than  $\pm 10\%$  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

#### D.1.4. Trends and Changeable Areas

Contours were created in CARIS Bathymetry 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.

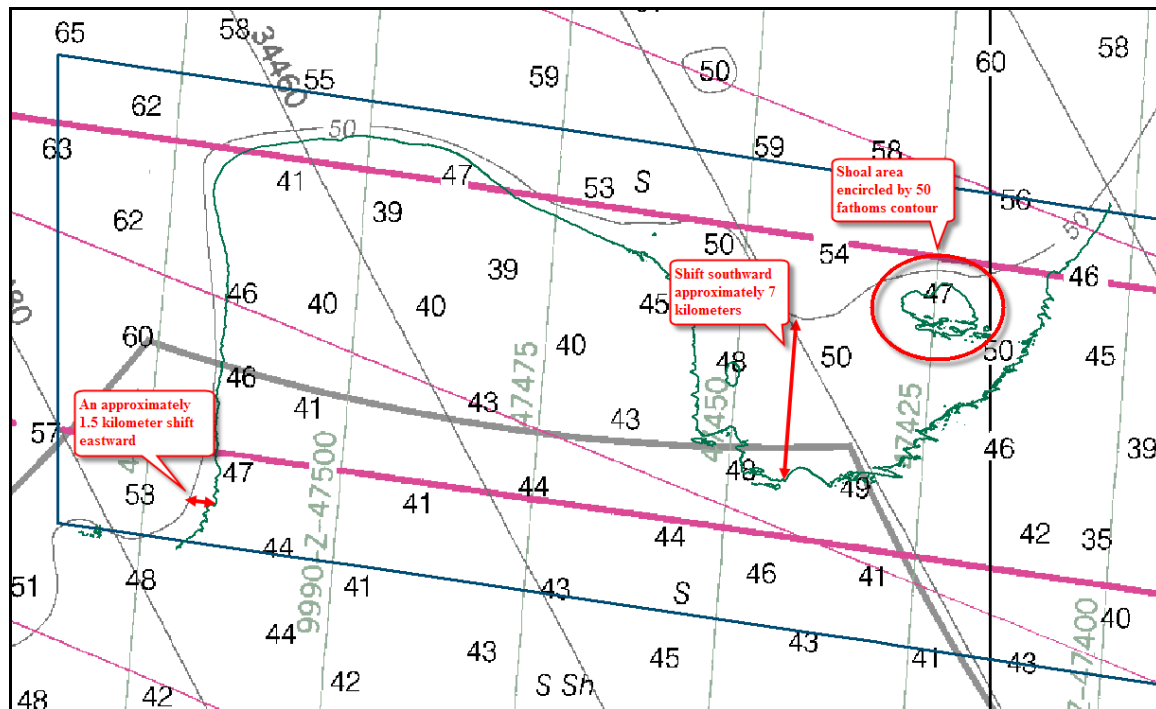


Figure 4 – Contours from H12066 (green) overlaid on chart 16520

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 HSSD, *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 Data Acquisition and Processing Report and the Vertical and Horizontal Control Report.

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

**Marta Krynytzky**

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

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**Marta Krynytzky, Lead Hydrographer**  
TerraSond Ltd.

Date \_\_\_\_\_ January 14, 2010 \_\_\_\_\_

**APPENDIX I**  
**Danger to Navigation Reports**

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There were no Dangers to Navigation Reported for this survey.

# APPENDIX II FEATURES REPORT

**Registry Number:**

**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)  
**TPU ( $\pm 1.96\sigma$ ):** **THU (TPEh)**  $\pm 2.094$  m ; **TVU (TPEv)**  $\pm 0.784$  m  
**Timestamp:** 2009-229.23:30:30.704 (08/17/2009)  
**Survey Line:** sheet\_e / bluefin / 2009-229 / 1335\_-\_e  
**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/2009-229/1335_-_e	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)

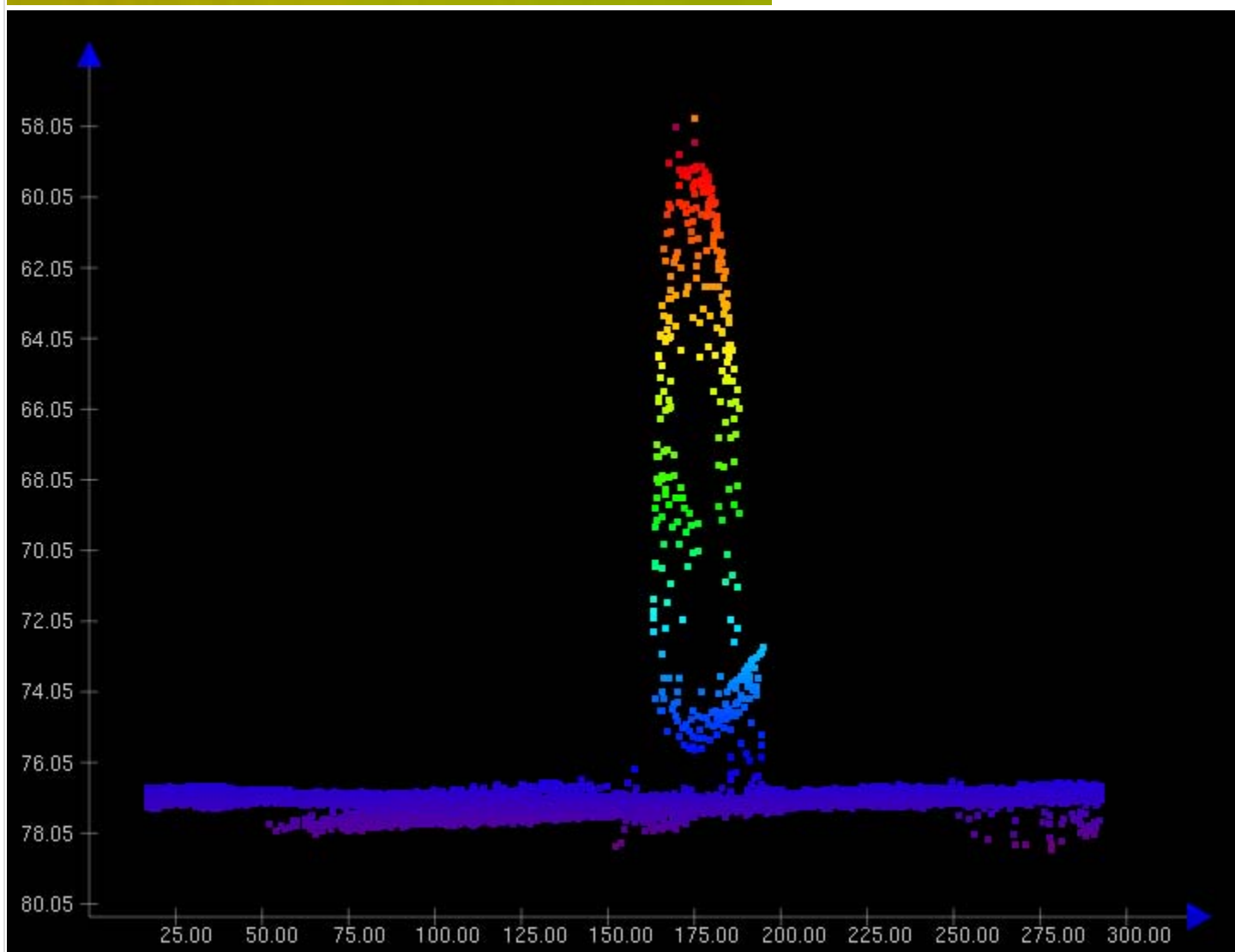
### S-57 Data

**Geo object 1:** Underwater rock / awash rock (UWTROC)  
**Attributes:** QUASOU - 6:least depth known  
 SORDAT - 20090822  
 SORIND - US,US,graph,H12066  
 TECSOU - 3:found by multi-beam  
 VALSOU - 57.698 m  
 WATLEV - 3:always under water/submerged



## Office Notes

Concur - Add 31 fm Rk.



# APPENDIX III

## Final Progress Report

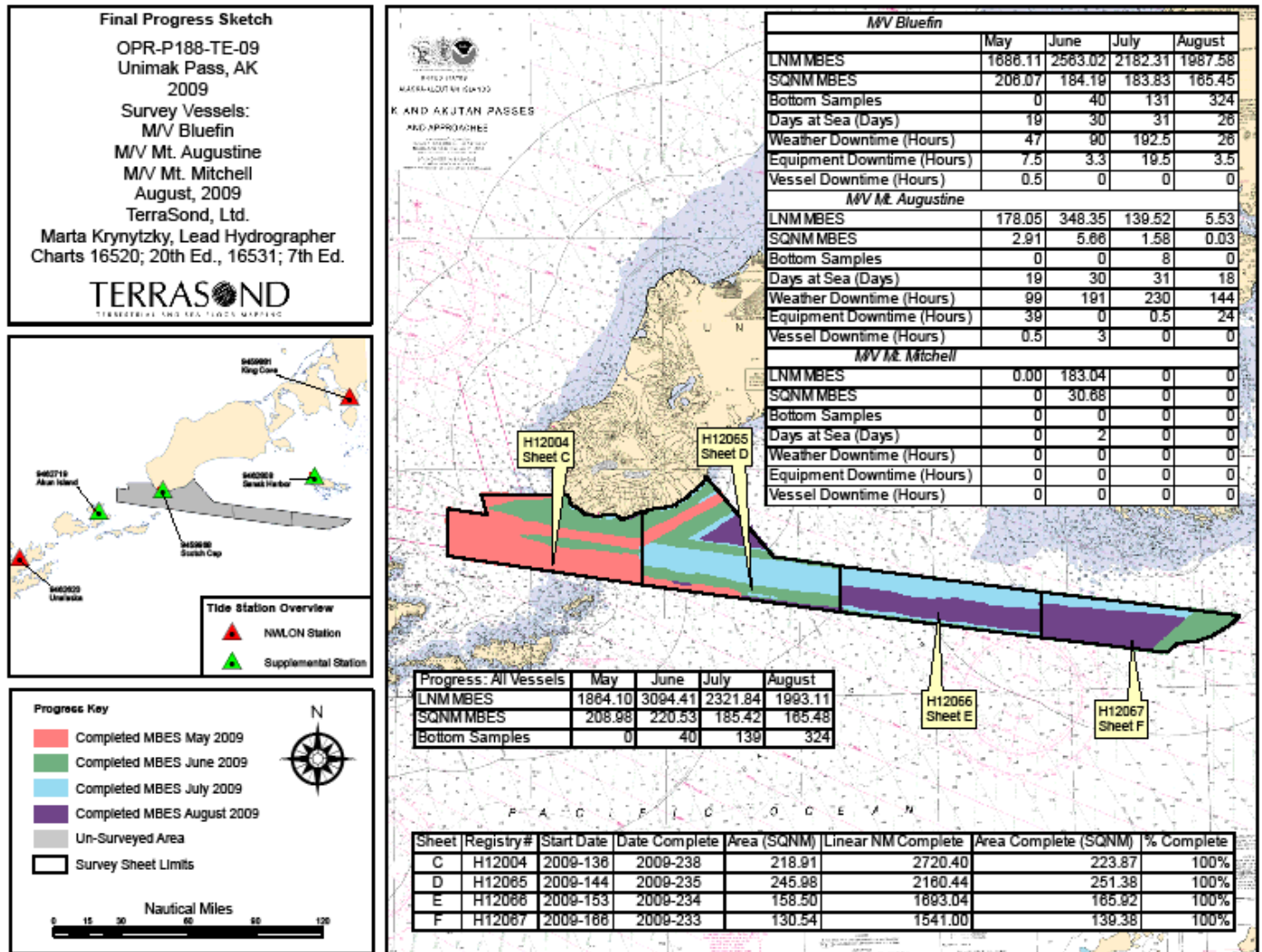


Figure 1 – Final Progress Sketch for OPR-P188-TE-09

**APPENDIX IV**  
**Tides and Water Levels**

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**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.

START		END	
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
Tertiary Station	Installation	April 10, 2009	Removal		Number of Days	
Project	OCS	OPR-P188-TE-09			JOA	141
Position (NAD83)	Latitude (N)	54° 14' 20"	Longitude (W)	165° 32' 28"	Time Meridian	0° (UTC)
Local Values	Gravity (milligals)	981539	GOES Angles	Elev 22°/ Az 144°	Magnetic Declination	11° E, +0° 8' W/year
Contractor	Prime TerraSond Ltd. 1617 South Industrial Way, Suite 3 Palmer, AK 99645 (907) 745-7215 ATTN: Kathleen Mildon			Tide Consultant JOA Surveys, LLC 2000 E. Dowling Rd, Suite 10 Anchorage, AK 99507 (907) 561-0136 phone ATTN: John Oswald		
Owner	Akutan Corporation PO Box 8 Akutan, AK 99553 (907) 698-2206					
Location	To reach the tidal bench marks from the Unalaska (Dutch Harbor) City Dock, proceed by boat NNE 26km (14nm) to the north side of Akutan Island, then proceed NE for 37km (20nm) to the entrance to Akutan Pass between Akutan and Akun islands, then proceed East 26km (14nm) to Billings Head at the NE point of Akun Island, then proceed 5km (3nm) South to Akun Bay, then proceed SW 6km (3nm) to Helianthus Cove. The bench marks are located on a rock ledge/bluff facing north.					
Tide House	The tide gauge electronics are housed in individual Pelican cases mounted inside a 4' (wide) by 3' (high) by 3' (deep) wooden shed anchored down with guide wires. There is barbed-wire fence surrounding the tide house and solar cells. A gate to the fence is located in the SW corner. The orifice line for the two bubbler gauges run outside to the grass edge then across the boulders on the beach. The orifice tubing is attached to 3/8" cable. There is a Duckbill anchor at the grass ledge and just outside the tide house that are used to anchor the orifice lines and cable. From the tide house to the barbed-wire fence the orifice tubing is covered with grass, then from outside the fence to the surf zone the tubing is covered with rocks to protect from fox and cattle. GPS and GOES antennas are mounted to the shed itself.					
Gauge 1	Installed	4/10/2009	Removed			
	Pressure Sensor	DAA H350XL	Serial No.	1354	Vent Value (m)	NA
			Averaging Interval	180 seconds	Slope Constant in Gauge	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 Optima batteries with a 70watt solar panel and solar controller.				
	Orifice	The bubbler orifice is attached to a 3/4" diameter galvanized pipe that is mounted vertically to a 1100 lbs anchor. The bubbler orifice is hose clamped to a 4"x3/4" pipe that is welded to the anchor. Between the orifice pipe and the pipe that is welded onto the anchor are plastic spacers. The length of the orifice tubing is approximately 550'.				
Anchors	The anchor is 1.2m in diameter. They have three legs equally spaced. Each leg is 50cm (wide) by 50cm (long) by 20cm (tall). Inside each leg are four 60 lbs lengths of railroad rail. At the end of each leg is a handle. The buoy line 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 line with a separate piece of floating line.					
Gauge 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 Optima batteries with a 70watt solar panel and solar controller.				
	Orifice	The bubbler orifice is attached to a 3/4" diameter galvanized pipe that is mounted vertically to the metal yoke for the 1100 lbs anchor. Hose are used to clamp the orifice to the yoke. Between the orifice pipe and the pipe that is welded onto the anchor are plastic spacers. The length of the orifice tubing is approximately 550'.				
Anchors	The anchor is 1.2m in diameter. They have three legs equally spaced. Each leg is 50cm (wide) by 50cm (long) by 20cm (tall). Inside each leg are four 60 lbs lengths of railroad rail. At the end of each leg is a handle. The buoy line 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 line with a separate piece of floating line.					
Gauge 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) batteries for the seabird and extra battery pack for the modem				
	Anchors	The anchor is 1.2m in diameter. They have three legs equally spaced. Each leg is 50cm (wide) by 50cm (long) by 20cm (tall). Inside each leg are four 60 lbs lengths of railroad rail. At the end of each leg is a handle. The buoy line is 3/4" blue polyline that is approximately 60' long. There are two buoys used as surface expressions: one large Green inflatable drag buoy and another small foam trailing buoy. The trailing buoy is attached to the main buoy line with a separate piece of floating line.				
Tidal Bench Marks	Primary	Recovered	Established	Designations		
	4		1	946 2719 TIDAL 1, 946 2719 TIDAL 2, 946 2719 TIDAL 3, 946 2719 TIDAL 4, 946 2719 A		
Leveling	Date	Order	Type	Bench Marks Connected		
	4/9/09 - 4/11/09	Third	Optical	946 2719 TIDAL 1, 946 2719 TIDAL 2, 946 2719 TIDAL 3, 946 2719 TIDAL 4, 946 2719 A		
	NAVD88 Level Tie	No NAVD88 marks within 1.6km (1 mi).				
GPS & OPUS	Bench Mark	Date	Session Length	Latitude (N)	Longitude (W)	Ellipsoid Height (m)
	9462719 A	4/9/2009	22.5 hrs	54° 14' 20.08925"	165° 32' 28.20926"	19.789
	NAVD88 GPS Tie	Not required per OCS hydro specifications until OPUS Projects is operational.				
	Comments	link to OPUS-DB datasheet <a href="http://beta.ngs.noaa.gov/OPUS/getDatasheet.jsp?PID=BBBH93&amp;style=modern">http://beta.ngs.noaa.gov/OPUS/getDatasheet.jsp?PID=BBBH93&amp;style=modern</a>				
Station History	4/7/09 - 4/11/09: The tide station was re-occupied with two bubblers and one seabird. Four historic marks were found and one new (SS rod) was established.					

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

Site Visit	Purpose of Visit	Removal	Team Leader	N. Wardwell, JOA	Date of Visit	9/5/09 - 9/7/09
Tertiary Station	Installation	April 10, 2009	Removal	September 7, 2009	Number of Days	151
Project	OCS	OPR-P188-TE-09			JOA	141
Position (NAD83)	Latitude (N)	54° 14' 20"	Longitude (W)	165° 32' 28"	Time Meridian	0° (UTC)
Local Values	Gravity (milligals)	981539	GOES Angles	Elev 22°/ Az 144°	Magnetic Declination	11° E, +0° 8' W/year
Contractor	Prime TerraSond Ltd. 1617 South Industrial Way, Suite 3 Palmer, AK 99645 (907) 745-7215 ATTN: Kathleen Mildon			Tide Consultant JOA Surveys, LLC 2000 E. Dowling Rd, Suite 10 Anchorage, AK 99507 (907) 561-0136 phone ATTN: Nathan Wardwell		
Owner	Akutan Corporation PO Box 8 Akutan, AK 99553 (907) 698-2206					
Location	To reach the tidal bench marks from the Unalaska (Dutch Harbor) City Dock, proceed by boat NNE 26km (14nm) to the north side of Akutan Island, then proceed NE for 37km (20nm) to the entrance to Akutan Pass between Akutan and Akun islands, then proceed East 26km (14nm) to Billings Head at the NE point of Akun Island, then proceed 5km (3nm) South to Akun Bay, then proceed SW 6km (3nm) to Helianthus Cove. The bench marks are located on a rock ledge/bluff facing north.					
Tide House	The tide gauge electronics are housed in individual Pelican cases mounted inside a 4' (wide) by 3' (high) by 3' (deep) wooden shed anchored down with guide wires. There is barbed-wire fence surrounding the tide house and solar cells. A gate to the fence is located in the SW corner. The orifice line for the two bubbler gauges run outside to the grass edge then across the boulders on the beach. The orifice tubing is attached to 3/8" cable. There is a Duckbill anchor at the grass ledge and just outside the tide house that are used to anchor the orifice lines and cable. From the tide house to the barbed-wire fence the orifice tubing is covered with grass, then from outside the fence to the surf zone the tubing is covered with rocks to protect from fox and cattle. GPS and GOES antennas are mounted to the shed itself.					
Gauge 1	Installed	4/10/2009	Removed	9/7/2009		
	Pressure Sensor	DAA H350XL	Serial No.	1354	Vent Value (m)	NA
			Averaging Interval	180 seconds	Slope Constant in Gauge	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 Optima batteries with a 70watt solar panel and solar controller.				
	Orifice	The bubbler orifice is attached to a 3/4" diameter galvanized pipe that is mounted vertically to a 1100 lbs anchor. The bubbler orifice is hose clamped to a 4"x3/4" pipe that is welded to the anchor. Between the orifice pipe and the pipe that is welded onto the anchor are plastic spacers. The length of the orifice tubing is approximately 550'.				
Anchors	The anchor is 1.2m in diameter. They have three legs equally spaced. Each leg is 50cm (wide) by 50cm (long) by 20cm (tall). Inside each leg are four 60 lbs lengths of railroad rail. At the end of each leg is a handle. The buoy line 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 line with a separate piece of floating line.					
Gauge 2	Installed	4/10/2009	Removed	9/7/2009		
	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 Optima batteries with a 70watt solar panel and solar controller.				
	Orifice	The bubbler orifice is attached to a 3/4" diameter galvanized pipe that is mounted vertically to the metal yoke for the 1100 lbs anchor. Hose are used to clamp the orifice to the yoke. Between the orifice pipe and the pipe that is welded				
Anchors	The anchor is 1.2m in diameter. They have three legs equally spaced. Each leg is 50cm (wide) by 50cm (long) by 20cm (tall). Inside each leg are four 60 lbs lengths of railroad rail. At the end of each leg is a handle. The buoy line 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 line with a separate piece of floating line.					
Gauge 3	Installed	4/10/2009	Removed	9/7/2009		
	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) batteries for the seabird and extra battery pack for the modem				
	Anchors	The anchor is 1.2m in diameter. They have three legs equally spaced. Each leg is 50cm (wide) by 50cm (long) by 20cm (tall). Inside each leg are four 60 lbs lengths of railroad rail. At the end of each leg is a handle. The buoy line is 3/4" blue polyline that is approximately 60' long. There are two buoys used as surface expressions: one large Green inflatable drag buoy and another small foam trailing buoy. The trailing buoy is attached to the main buoy line with a separate piece of floating line.				
Tidal Bench Marks	Primary	Recovered	Established	Designations		
	946 2719 TIDAL 1	4	1	946 2719 TIDAL 1, 946 2719 TIDAL 2, 946 2719 TIDAL 3, 946 2719 TIDAL 4, 946 2719 A		
Leveling	Date	Order	Type	Bench Marks Connected		
	4/9/09 - 4/11/09	Third	Optical	946 2719 TIDAL 1, 946 2719 TIDAL 2, 946 2719 TIDAL 3, 946 2719 TIDAL 4, 946 2719 A		
	9/5/2009	Third	Optical	946 2719 TIDAL 1, 946 2719 TIDAL 2, 946 2719 TIDAL 3, 946 2719 TIDAL 4, 946 2719 A		
	NAVD88 Level Tie	No NAVD88 marks within 1.6km (1 mi).				
GPS & OPUS	Bench Mark	Date	Session Length	Latitude (N)	Longitude (W)	Ellipsoid Height (m)
	9462719 A	4/9/2009	22.5 hrs	54° 14' 20.08925"	165° 32' 28.20926"	19.789
	NAVD88 GPS Tie					
	Comments	link to OPUS-DB datasheet <a href="http://beta.ngs.noaa.gov/OPUS/getDatasheet.jsp?PID=BBBH93&amp;style=modern">http://beta.ngs.noaa.gov/OPUS/getDatasheet.jsp?PID=BBBH93&amp;style=modern</a>				
Station History	4/7/09 - 4/11/09: The tide station was re-occupied with two bubblers and one seabird. Four historic marks were found and one new (Stainless steel deep rod rod) was established.					
	9/5/09 -9/7/09: The tide station was removed by N. Wardwell and G. Gray. Leveling was completed on 9/5/09, the staff shots were performed the following day, and the removal was completed on 9/7/09.					

<div style="text-align: center;"> <b>Site Report</b>  <b>946-2808 Scotch Cap, Unimak Island, AK</b> </div>						
<b>Site Visit</b>	Purpose of Visit	Installation	Team Leader	Nathan Wardwell JOA	Date of Visit	4/26-4/28/2009
<b>Tertiary Station</b>	Installation	April 28, 2009	Removal		Number of Days	
<b>Project</b>	OCS	OPR-P188-TE-09			JOA	141
<b>Position (NAD83)</b>	Latitude (N)	54° 23' 37.1"	Longitude (W)	164° 44' 44.6"	Time Meridian	0° (UTC)
<b>Local Values</b>	Gravity (milligals)	981562	GOES Angles	Elev 22.9°/ Az 147.1°	Magnetic Declination	11.5° E, +0° 8' W/year
<b>Contractor</b>	<div style="text-align: center;"> <b>Prime</b>  TerraSond Ltd.  1617 South Industrial Way, Suite 3  Palmer, AK 99645  (907) 745-7215  ATTN: Kathleen Mildon </div>			<div style="text-align: center;"> <b>Tide Consultant</b>  John Oswald &amp; Associates, LLC  2000 E. Dowling Rd, Suite 10  Anchorage, AK 99507  (907) 561-0136 phone  ATTN: John Oswald </div>		
<b>Owner</b>	United States Coast Guard District 17 Sector Anchorage 510 L Street Suite 100 Anchorage, Alaska 99501 (907) 271-6700					
<b>Location</b>	To reach the tidal bench marks from the Unalaska (Dutch Harbor) City Dock, proceed by boat northeast 30 nautical miles past Akutan Island, then east 47 nautical miles past Akun Island and across Unimak Pass to the southwestern shore of Unimak Island SSE of Scotch Cap to the unmanned Coast Guard light and ruins of the Scotch Cap Lighthouse. The bench marks are located on the rock outcrop below the lighthouse and on the next rock outcrop down the beach to the east. The submersible tide gauges are located to the east in around 10 fathoms, the bubbler gauge is mounted in the ruins of the lighthouse destroyed by the 1946 tsunami.					
<b>Tide House</b>	The tide gauge electronics are housed in a Pelican case mounted inside of the concrete ruins of the lighthouse. The orifice line for the bubbler gauge runs through a hole in the SE facing concrete wall of the lighthouse, down the hill on the ground and down a short cliff to the rock outcrop that the orifice is bolted on. The orifice line is weighted down with large lead weights. The GPS and GOES antennas as well as the solar panel are mounted on the outside wall of the SE facign concrete wall of the lighthouse ruins.					
<b>Primary DCP</b>	<b>Installed</b>	4/28/2009	<b>Removed</b>			
	<b>Sensor</b>	Seabird 26-plus	Serial No.	1155	Slope Constant	0.00000
	<b>Data Logger</b>	combined in 26-plus	Averaging Interval	180 seconds	Firmware	6.1 d
	<b>Aprox. Depth</b>	10 Fathoms (18m)	Latitude	N 54° 23' 30.66"	Longitude	W 164° 43' 43.38"
	<b>Modem</b>	Link Quest	Wake Up Period	120sec	Serial No.	10589
	<b>Modem Address</b>	3				
	<b>Power</b>	SBE 26-plus has d-cell batteries inside and Link Quest Modem has external battery pack on anchor.				
	<b>Anchor / Rigging</b>	The 1000 pound steel anchor is roughly four feet across with the Seabird mounted in an aluminum tube. An acoustic modem and external power source for the modem are mounted to exterior of tube. A surface bouy line with two hard floats and one small trailing bouy made of hard foam are attached to the end of the buoyline which is 18 fathoms long. A 150' ground line runs south along the bottom from anchor to a 150 lb. steel weight.				
<b>Secondary DCP</b>	<b>Installed</b>	4/28/2009	<b>Removed</b>			
	<b>Sensor</b>	Seabird 26-plus	Serial No.	1156	Slope Constant	0.00000
	<b>Data Logger</b>	combined in 26-plus	Averaging Interval	180 seconds	Firmware	6.1 d
	<b>Aprox. Depth</b>	11 Fathoms (20m)	Latitude	N 54° 23' 31.44"	Longitude	W 164° 43' 26.64"
	<b>Modem</b>	Link Quest	Wake Up Period	120sec	Serial No.	009869
	<b>Modem Address</b>	2				
	<b>Power</b>	SBE 26-plus has d-cell batteries inside and Link Quest Modem has external battery pack on anchor.				
	<b>Anchor / Rigging</b>	The 1000 pound steel anchor is roughly four feet across with the Seabird mounted in an aluminum tube. An acoustic modem and external power source for the modem are mounted to exterior of tube. A surface bouy line with two hard floats and one small trailing bouy made of hard foam are attached to the end of the buoyline which is 18 fathoms long. A 150' ground line runs south along the bottom from anchor to a 150 lb. steel weight.				
<b>Tertiary DCP</b>	<b>Installed</b>	4/28/2009	<b>Removed</b>			
	<b>Sensor</b>	Seabird 26-plus	Serial No.	1131	Slope Constant	0.00000
	<b>Data Logger</b>	combined in 26-plus	Averaging Interval	180 seconds	Firmware	6.1 d
	<b>Aprox. Depth</b>	10 Fathoms (18m)	Latitude	N 54° 23' 27.42"	Longitude	W 164° 43' 10.44"
	<b>Modem</b>	Link Quest	Wake Up Period	120sec	Serial No.	010215
	<b>Modem Address</b>	1				
	<b>Power</b>	SBE 26-plus has d-cell batteries inside and Link Quest Modem has external battery pack on anchor.				
	<b>Anchor / Rigging</b>	The 1000 pound steel anchor is roughly four feet across with the Seabird mounted in an aluminum tube. An acoustic modem and external power source for the modem are mounted to exterior of tube. A surface bouy line with two hard floats and one small trailing bouy made of hard foam are attached to the end of the buoyline which is 18 fathoms long. A 150' ground line runs south along the bottom from anchor to a 150 lb. steel weight.				
<b>Backup DCP</b>	<b>Installed</b>	4/27/2009	<b>Removed</b>			
	<b>Sensor</b>	DAA H350XL	Serial No.	1051	Level Point to orifice "0"	0.183
			Averaging Interval	181 seconds	Slope Constant in Gauge	0.68396
	<b>Data Logger</b>	DAA H350XL			Firmware	2.12
	<b>GOES Radio</b>	DAA H222	Serial No.		GPS timing	Yes
	<b>GOES Address</b>	9070B6CE	Channel	170	Format	NGWLMS
	Interval	1 hour	Offset	0:02:10	Transmit Window	10 seconds
	<b>Power</b>	Two batteries with a 20watt solar panel with solar controller.				
	<b>Orifice Mount</b>	The Orifice is mounted with a clamp to a section of Uni-Strut that is boltted to an area of the bedrock outcrop below the tide house. Orifice was dry at install, roughly a -1.4' low tide. Tubing was joined to 1/4" cable and weighted with lead weights and concrete wedge anchors.				
	<b>Comments</b>	This gauge installed as a partial tide check for the primary offshore gauges.				
<b>Tidal Bench Marks</b>	<b>Primary</b>	<b>Recovered</b>	<b>Established</b>	<b>Designations</b>		
	9462808 Tidal 2	2	3	9462808 TIDAL 2, 9462808 TIDAL 4, 9462808 A, 9462808 B, 9462808 C		
<b>Leveling</b>	<b>Date</b>	<b>Order</b>	<b>Type</b>	<b>Bench Marks Connected</b>		
	4/27/2009	Third	Optical	9462808 TIDAL 2, 9462808 TIDAL 4, 9462808 A, 9462808 B, 9462808 C		
	NAVD88 Level Tie	No NAVD88 marks within 1.6km (1 mi).				
	Comments	Level run included Gauge 1 orifice "0"				
<b>GPS &amp; OPUS</b>	<b>Bench Mark</b>	<b>Date</b>	<b>Session Length</b>	<b>Latitude (N)</b>	<b>Longitude (W)</b>	<b>Ellipsoid Height (m)</b>
	9462808 Tidal 4	4/27/2009	4hours 59 min.	54° 23' 39.14616"	164° 44' 23.20766"	22.637
	Comments	<a href="http://beta.ngs.noaa.gov/OPUS/getDatashet.jsp?PID=BBBH99&amp;style=modern">Link to OPUS DB Datashet http://beta.ngs.noaa.gov/OPUS/getDatashet.jsp?PID=BBBH99&amp;style=modern</a>				
<b>Station History</b>						



Site Report						
946-2808 Scotch Cap, Unimak Island, AK						
Site Visit	Purpose of Visit	Installation	Team Leader	Nathan Wardwell JOA	Date of Visit	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)
Local 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. 1617 South Industrial Way, Suite 3 Palmer, AK 99645 (907) 745-7215 ATTN: Kathleen Mildon			Tide Consultant John Oswald & Associates, LLC 2000 E. Dowling Rd, Suite 10 Anchorage, AK 99507 (907) 561-0136 phone ATTN: John Oswald		
Owner	United States Coast Guard District 17 Sector Anchorage 510 L Street Suite 100 Anchorage, Alaska 99501 (907) 271-6700					
Location	To reach the tidal bench marks from the Unalaska (Dutch Harbor) City Dock, proceed by boat northeast 30 nautical miles past Akutan Island, then east 47 nautical miles past Akun Island and across Unimak Pass to the southwestern shore of Unimak Island SSE of Scotch Cap to the unmanned Coast Guard light and ruins of the Scotch Cap Lighthouse. The bench marks are located on the rock outcrop below the lighthouse and on the next rock outcrop down the beach to the east. The submersible tide gauges are located to the east in around 10 fathoms, the bubbler gauge is mounted in the ruins of the lighthouse destroyed by the 1946 tsunami.					
Tide House	The tide gauge electronics are housed in a Pelican case mounted inside of the concrete ruins of the lighthouse. The orifice line for the bubbler gauge runs through a hole in the SE facing concrete wall of the lighthouse, down the hill on the ground and down a short cliff to the rock outcrop that the orifice is bolted on. The orifice line is weighted down with large lead weights. The GPS and GOES antennas as well as the solar panel are mounted on the outside wall of the SE facing concrete wall of the lighthouse ruins.					
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				
	Power	SBE 26-plus has d-cell batteries inside and Link Quest Modem has external battery pack on anchor.				
	Anchor / Rigging	The 1000 pound steel anchor is roughly four feet across with the Seabird mounted in an aluminum tube. An acoustic modem and external power source for the modem are mounted to exterior of tube. A surface buoy line with two hard floats and one small trailing buoy made of hard foam are attached to the end of the buoyline which is 18 fathoms long. A 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				
	Power	SBE 26-plus has d-cell batteries inside and Link Quest Modem has external battery pack on anchor.				
	Anchor / Rigging	The 1000 pound steel anchor is roughly four feet across with the Seabird mounted in an aluminum tube. An acoustic modem and external power source for the modem are mounted to exterior of tube. A surface buoy line with two hard floats and one small trailing buoy made of hard foam are attached to the end of the buoyline which is 18 fathoms long. A 150' ground line runs south along the bottom from anchor to a 150 lb. steel weight.				
Tertiary DCP	Installed	4/28/2009	Removed			
	Sensor	Seabird 26-plus	Serial No.	1131	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' 27.42"	Longitude	W 164° 43' 10.44"
	Modem	Link Quest	Wake Up Period	120sec	Serial No.	010215
	Modem Address	1				
	Power	SBE 26-plus has d-cell batteries inside and Link Quest Modem has external battery pack on anchor.				
	Anchor / Rigging	The 1000 pound steel anchor is roughly four feet across with the Seabird mounted in an aluminum tube. An acoustic modem and external power source for the modem are mounted to exterior of tube. A surface buoy line with two hard floats and one small trailing buoy made of hard foam are attached to the end of the buoyline which is 18 fathoms long. A 150' ground line runs south along the bottom from anchor to a 150 lb. steel weight.				
Backup DCP	Installed	4/27/2009	Removed			
	Sensor	DAA H350XL	Serial No.	1051	Level Point to orifice "0"	0.183
			Averaging Interval	181 seconds	Slope Constant in Gauge	0.68396
	Data Logger	DAA H350XL			Firmware	2.12
	GOES Radio	DAA H222	Serial No.		GPS timing	Yes
	GOES Address	9070B6CE	Channel	170	Format	NGWLMS
	Interval	1 hour	Offset	0:02:10	Transmit Window	10 seconds
	Power	Two batteries with a 20watt solar panel with solar controller.				
	Orifice Mount	The Orifice is mounted with a clamp to a section of Uni-Strut that is bolted to an area of the bedrock outcrop below the tide house. Orifice was dry at install, roughly a -1.4' low tide. Tubing was joined to 1/4" cable and weighted with lead weights and concrete wedge anchors.				
	Comments	This gauge installed as a partial tide check for the primary offshore gauges.				
Tidal Bench Marks	Primary	Recovered	Established	Designations		
	9462808 Tidal 2	2	3	9462808 TIDAL 2, 9462808 TIDAL 4, 9462808 A, 9462808 B, 9462808 C		
Leveling	Date	Order	Type	Bench Marks Connected		
	4/27/2009	Third	Optical	9462808 TIDAL 2, 9462808 TIDAL 4, 9462808 A, 9462808 B, 9462808 C		
	9/4/2009	Third	Optical	9462808 TIDAL 2, 9462808 TIDAL 4, 9462808 A, 9462808 B, 9462808 C		
	NAVD88 Level Tie	No NAVD88 marks within 1.6km (1 mi).				
	Comments	Install level run included Gauge 4 orifice "0".				
GPS & OPUS	Bench Mark	Date	Session Length	Latitude (N)	Longitude (W)	Ellipsoid Height (m)
	9462808 Tidal 4	4/27/2009	4hours 59 min.	54° 23' 39.14616"	164° 44' 23.20766"	22.637
	Comments	<a href="http://beta.ngs.noaa.gov/OPUS/getDdatasheet.asp?PID=BBBH99&amp;style=modern">Link to OPUS DB Datasheet http://beta.ngs.noaa.gov/OPUS/getDdatasheet.asp?PID=BBBH99&amp;style=modern</a>				
Station History	See the '9462719 Tide Note.pdf' document.					

# Site Report

## 945-9968 Sanak Harbor, Sanak Island, AK

<b>Site Visit</b>	Purpose of Visit	Installation	Team Leader	Nathan Wardwell (JOA)	Date of Visit	4/29 - 4/30/2009			
<b>Tertiary Station</b>	Installation	April 29, 2009	Removal		Number of Days				
<b>Project</b>	OCS	OPR-P188-TE-09			JOA	141			
<b>Position (NAD83)</b>	Latitude (N)	54° 28' 48.6"	Longitude (W)	162° 48' 50.1"	Time Meridian	0° (UTC)			
<b>Local Values</b>	Gravity (milligals)	981577	GOES Angles	NA	Magnetic Declination	12° 46' E, +0° 9' W/year			
<b>Contractor</b>	<b>Prime</b> TerraSond, Ltd 1617 South Industrial Way, Suite 3 Palmer, AK 99645 (907) 745-7215 ATTN: Kathleen Mildon			<b>Tide Consultant</b> JOA Surveys, LLC 2000 E. Dowling Rd, Suite 10 Anchorage, AK 99507 (907) 561-0136 phone ATTN: John Oswald					
<b>Owner</b>	Sanak Corporation 1 Main St Sand Point, AK 9961 (907) 383-2106								
<b>Location</b>	To reach the tidal bench marks from the Unalaska (Dutch Harbor) City Dock, proceed by boat NE 27km (15nm) to the north side of the pass between Unalaska and Akutan Islands, then proceed ENE for 46km (25nm) to the entrance to Akutan Pass between Akutan and Akun islands, then proceed East 187km (101nm) to the entrance to Sanak Harbor, then proceed south 1km (0.6nm) to Sanak Harbor. The bench marks are located along the SE side of the Harbor.								
<b>Tide House</b>	Not Applicable because the pressure sensor deployed at this site is used for tidal zoning purposes only.								
<b>Primary DCP</b>	<b>Installed</b>	5/13/2008	<b>Removed</b>						
	<b>Pressure Sensor</b>	SBE 26+ (100 psi)	Serial No.	1157	Vent Value (m)	0.000			
			Averaging Interval	180 seconds					
	<b>Data Logger</b>	combined in SBE 26+	Firmware	NA					
	<b>Acoustic Modem</b>	LinkQuest UWM	Serial No.	010218					
	<b>Power for modem</b>	LinkQuest	Serial No.	009851					
	<b>Power</b>	12 D-Cell (1.5v) batteries for the seabird and extra battery pack for the modem							
	<b>Anchor</b>	The anchor is 1.2m in diameter and as three legs equally spaced. Each leg is 50cm (wide) by 50cm (long) by 20cm (tall). Inside each leg are four 60 lbs lengths of railroad rail. At the end of each leg is a handle. The buoy line is 3/4" blue polyline that is approximately 78' long. There are two buoys used as surface expressions: one white and one orange. A trailing buoy is attached to the main buoy line with a separate piece of floating line.							
<b>Secondary DCP</b>	<b>Comments</b>	A 100' dragline is attached to the anchor. At the other end of the dragline is a 150 lb weight. The dragline is stretched out in a South orientation from the anchor.							
	<b>Installed</b>	NA	<b>Removed</b>						
	<b>Pressure Sensor</b>	NA	Serial No.	NA	Vent Value (m)	0.000			
			Averaging Interval	NA					
	<b>Data Logger</b>	NA	Firmware	NA					
	<b>Acoustic Modem</b>	NA	Serial No.	NA					
	<b>Power for modem</b>	NA	Serial No.	NA					
	<b>Power</b>	NA							
<b>Tide Staff</b>	<b>Anchor</b>	NA							
	<b>Comments</b>								
<b>Tidal Bench Marks</b>	<b>Primary</b>	<b>Recovered</b>	<b>Established</b>	<b>Designations</b>					
	NA	3	0	9459968 TIDAL 1, 9459968 TIDAL 2, 9459968 TIDAL 3					
<b>Leveling</b>	<b>Date</b>	<b>Order</b>	<b>Type</b>	<b>Bench Marks Connected</b>					
	4/29/2009	Third	Optical	9459968 TIDAL 1, 9459968 TIDAL 2, 9459968 TIDAL 3					
	<b>NAVD88 Level Tie</b>	No NAVD88 marks within 1.6km (1 mi).							
	<b>Comments</b>	Single wire levels run between the three historic marks							
<b>GPS &amp; OPUS</b>	<b>Bench Mark</b>	<b>Date</b>	<b>Session Length</b>	<b>Latitude (N)</b>	<b>Longitude (W)</b>	<b>Ellipsoid Height (m)</b>			
	NA								
	<b>NAVD88 GPS Tie</b>	NA							
	<b>Comments</b>	No GPS was performed because the gauge deployed at this site is used only for tidal zoning.							
<b>Station History</b>	4/29 - 4/30/2009: N. Wardwell and C. Mayfield from JOA and M. Ewing from Terra deployed one zoning seabird.								

## APPENDIX V

### Supplemental Survey Records and Correspondence

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#### 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



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

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

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 5 soundings."

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@terra sond.com](mailto:kmildon@terra sond.com) [www.terra sond.com](http://www.terra sond.com)

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**Re: Unimak Pass grid resolution.eml**

**Content-Type:** message/rfc822

**Content-Encoding:** 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

## H12066 COMPILATION LOG

General Survey Information			
REGISTRY No.	<i>H12066</i>		
PROJECT No.	<i>OPR-P188-TE-09</i>		
FIELD UNIT	<i>TERRASOND LTD.</i>		
DATE OF SURVEY	<i>June 2, 2009 to August 22, 2009</i>		
LARGEST SCALE CHART	<i>16250, 23<sup>rd</sup> Edition, 20080801</i>		
SOUNDING UNITS	<i>Fathoms</i>		
COMPILER	<i>Norris Wike</i>		
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		
<i>Combined</i>	<i>H12066_4M_Combined.csar</i>		
<i>Interpolated TIN</i>	<i>H12066_8M_InterpTIN.csar</i>		
<i>Shifted Interpolated TIN</i>	<i>H12066_8M_InterpTIN_shifted.csar</i>		
Final HOBs	File Name		
<i>Survey Scale Soundings</i>	<i>H12066_SS.hob,</i>		
<i>Chart Scale Soundings</i>	<i>H12066_CS.hob</i>		
<i>Contour Layer</i>	<i>H12066_Contours.hob</i>		
<i>Feature Layer</i>	<i>H12066_Features.hob</i>		
<i>Meta-Objects Layer</i>	<i>H12066_MetaLayers.hob</i>		
<i>Blue Notes</i>	<i>H12066_BlueNotes.hob</i>		
<i>Bottom Samples</i>	<i>H12066_BottomSamples.hob</i>		
Meta-Objects Attribution			
Acronym	Value		
M_COVR			
CATCOV	<i>1</i>		
SORDAT	<i>20090822</i>		
SORIND	<i>US,US,graph,H12066</i>		
M_QUAL			
CATZOC	<i>6</i>		
INFORM	<i>M/V Bluefin</i>		
POSACC	<i>10</i>		
SORDAT	<i>20090822</i>		
SORIND	<i>US,US,graph,H12066</i>		
SUREND	<i>20090822</i>		
SURSTA	<i>20090602</i>		
DEPARE			
DRVALV 1	<i>23.000 fm</i>		
DRVALV2	<i>63.000 fm</i>		
SORDAT	<i>20090822</i>		
SORIND	<i>US,US,graph,H12066</i>		

SPECIFICATIONS:

- I. COMBINED SURFACE:
  - a. Number of ESAR Final Grids: **3**
  - b. Resolution of Combined (m): **4M**
  
- II. SURVEY SCALE SOUNDINGS (SS):
  - a. Radius
  - 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. Linear
  - 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. Radius
  - 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: Interpolated != 1
  - 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:

<b>TABLE 1 - Contents of H-Cell Files</b>			
<b>H12065_CS.000</b>		<b>Scale 1:300,000</b>	
<b>Object Class Types</b>	<b>Geographic</b>	<b>Cartographic</b>	<b>Meta</b>
	DEPARE	\$CSYMB	M_COVR
<b>S-57 Object Acronyms</b>	SBDARE		M_QUAL
	SOUNDG		
	UWTROC		
<b>H12065_SS.000</b>		<b>Scale 1:40,000</b>	
<b>Object Class Types</b>	<b>Geographic</b>		
<b>S-57 Object Acronyms</b>	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. VERTICAL AND HORIZONTAL CONTROL

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. RESULTS AND RECOMMENDATIONS

<u>CHART COMPARISON</u>	<u>16520 (23<sup>rd</sup>. Edition, Aug. /08)</u>
	Unimak and Akutan Passes
	Corrected through NM 04/16/2011
	Corrected through LNM 04/12/2011
	Scale 1:300,000
<u>ENC Comparison</u>	<u>US3AK61M</u>
	Unimak and Akutan Passes
	Edition 16
	Application Date 2011-01-12
	Issue Date 2011-01-12
	Chart 16520

#### 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 rock with a depth of 31 fm in Latitude 54°13'00.80"N, Longitude 163°39'22.30"W was located during office processing. Chart a rock. with a depth of 31 fm.

A charted notation rky in the vicinity of Latitude 54°08'04.99"N, Longitude 163°12'55.45"W was disproved by the present survey. Seabed characteristics show the bottom to be sand. Delete the charted notation rky.

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