

1739

NOAA FORM 76-35A	
U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION NATIONAL OCEAN SERVICE	
<b>DESCRIPTIVE REPORT</b>	
<i>Type of Survey</i> HYDROGRAPHIC	
<i>Field No.</i>	
<i>Registry No.</i> H11739	
<b>LOCALITY</b>	
<i>State</i> CALIFORNIA	
<i>General Locality</i> Northern California Coast	
<i>Sublocality</i> Drakes Bay to Bolinas Bay	
<hr/> <b>2007</b> <hr/>	
<b>CHIEF OF PARTY</b>	
<i>Andrew Orthmann, Fugro-Pelagos, Inc.</i>	
<b>LIBRARY &amp; ARCHIVES</b>	
<b>DATE</b>	

## HYDROGRAPHIC TITLE SHEET

H11739

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.

State CALIFORNIAGeneral Locality Northern California CoastSublocality Drakes Bay to Bolinas BayScale N/A Dates of Survey 02/12/2007 - 04/04/2007Instructions Date 6/26/2007 Project No. OPR-M-M924-KR-07Vessel F/V PACIFIC STAR (556510)Chief of Party Andrew OrthmannSurveyed by Orthmann, Moyles, Reynolds, Briggs, Gill, Mount, Farley, Lapointe, et al.Soundings taken by echo sounders: Reson Seabat 8101 (Hull Mounted) echosounderGraphic record scaled by Fugro Pelagos, Inc. personnelGraphic record checked by Fugro Pelagos, Inc. personnelEvaluation by G. Froelich Automated plot by N/AVerification by G. Froelich, K. ReserSoundings in Feet at MLLWREMARKS: Time in UTC. UTM Projection Zone 10

Revisions and annotations appearing as endnotes were

generated during office processing.

As a result, page numbering may be interrupted or non-sequential

All separates are filed with the hydrographic data.

## A. AREA SURVEYED

H11739 (Sheet H) encompasses the area from Drakes Bay to Bolinas Bay, California. It is bound by the coordinates listed in Table 1.

This data was originally collected by Fugro Pelagos, Inc. for the Seafloor Mapping Lab at California State University Monterey Bay (CSUMB) for the purpose of fisheries habitat mapping. CSUMB refers to this data set as “Northern Central California Coast State Waters Mapping Project Phase II”. After submission to CSUMB in June 2007, an agreement with NOAA was reached to reprocess and QC the data to produce deliverables that meet NOAA specifications and are suitable to OCS for nautical charting purposes.<sup>1</sup> This report and accompanying data represent those deliverables.

Hydrographic data collection began on February 12, 2007 and ended on April 4, 2007.

**Table 1 – Sheet Bounds**

<b>Point</b>	<b>Latitude (North)</b>	<b>Longitude (West)</b>
1	38-01-15	122-53-00
2	38-01-15	122-39-31
3	37-47-44	122-39-31
4	37-47-44	122-53-00
5	38-01-15	122-53-00

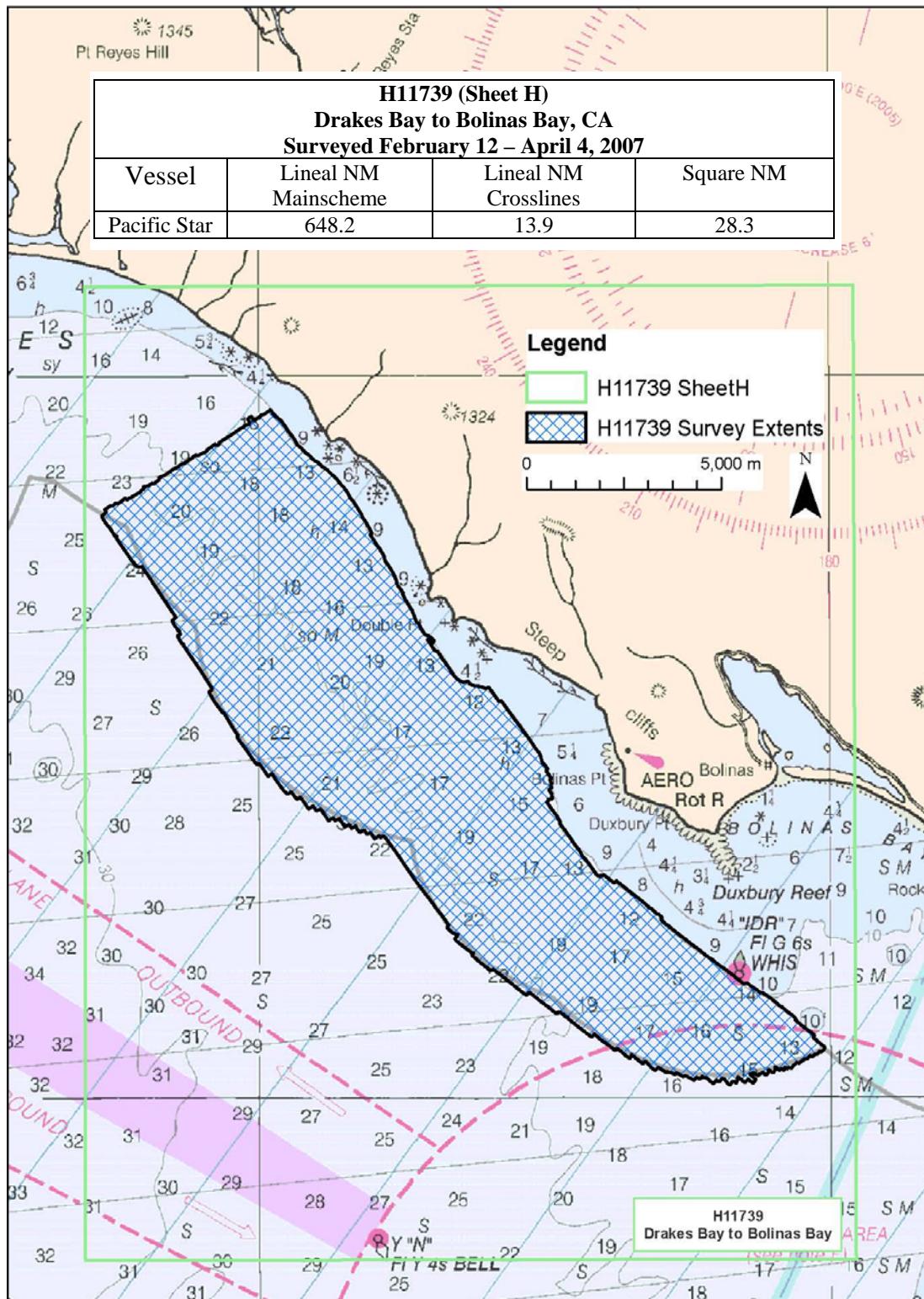


Figure 1 H11739 Area Surveyed

## B. DATA ACQUISITION AND PROCESSING

Refer to the OPR-M-M924-KR-07 Data Acquisition and Processing Report<sup>2</sup> for a detailed description of all equipment, survey vessels, processing procedures and quality control features. Items specific to this survey and any deviations from the Data Acquisition and Processing Report are discussed in the following sections.

### B.1 Equipment & Vessels

The F/V Pacific Star acquired all sounding data for H11739. The Pacific Star, which is 162 feet in length with a draft of 14 feet, was equipped with a Reson 8101 with option 033 (pseudo Side Scan) for multibeam data acquisition. The vessel was also equipped with two AML sound velocity and pressure sensors (SV&P) for sound velocity profiles. Vessel attitude and position were measured using an Applanix Position and Orientation System for Marine Vessel (POSMV 320 V4) with XTF files logged in Triton ISIS v7.1.428.53.

Refer to OPR-M-M924-KR-07 Data Acquisition and Processing Report for a complete listing of equipment and vessel descriptions.

### B.2 Quality Control

#### Crosslines

Quality control crosslines were planned so that all main scheme lines would intersect with at least one crossline. This resulted in at least one crossline for each block of mainlines. Total crossline length surveyed was 13.9 nautical miles or 2.2 percent of the total main scheme nautical miles (5 % was not required). Conducted crosslines were distributed throughout the sheet to ensure adequate crossline distribution. All crosslines were compared to the mainline CUBE surface, using the CARIS HIPS QC report routine and all beams passed at 95 percent confidence level or better. Results are located in Separate IV.<sup>3</sup>

Note: The QC reports were generated based on the given accuracy specification of:

$$\pm \sqrt{[a^2 + (b * d)^2]}$$

where, a = 0.5, b = 0.013 and d = depth.

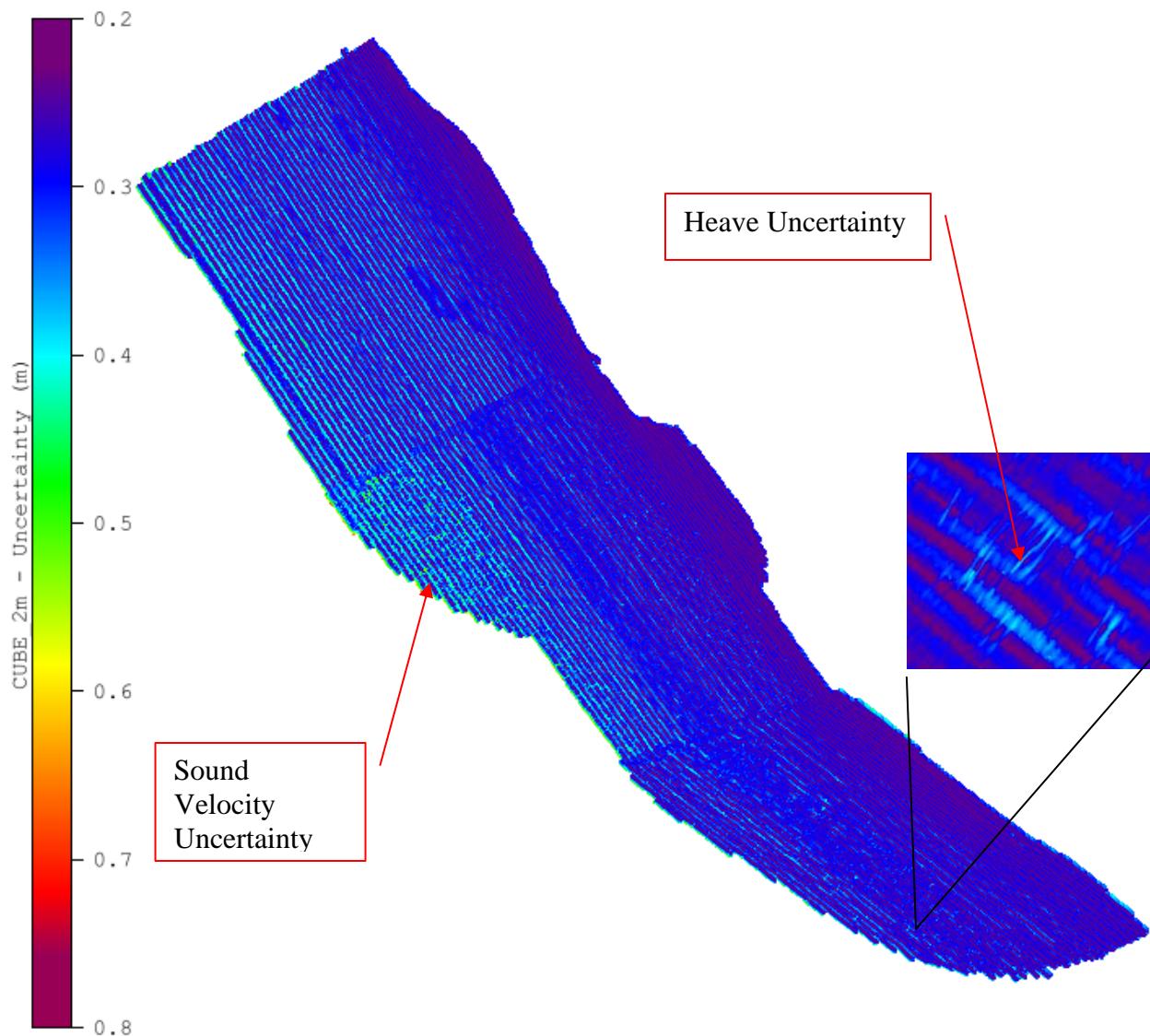
However, since a variance of a difference, rather than a variance from a mean is being used, the a and b values were defined in the user defined option within the CARIS HIPS QC Report routine:

$$a = 0.5 * \sqrt{2} = 0.707$$

$$b = 0.013 * \sqrt{2} = 0.018$$

### Uncertainty Values

The majority of H11739 had uncertainty values of 0.30 m to 0.40 m, with extremes of 0.23 m and 0.76 m. The effects of sound speed uncertainty are very apparent in the graphic below. No uncertainty values exceeded IHO Order 1.<sup>4</sup>

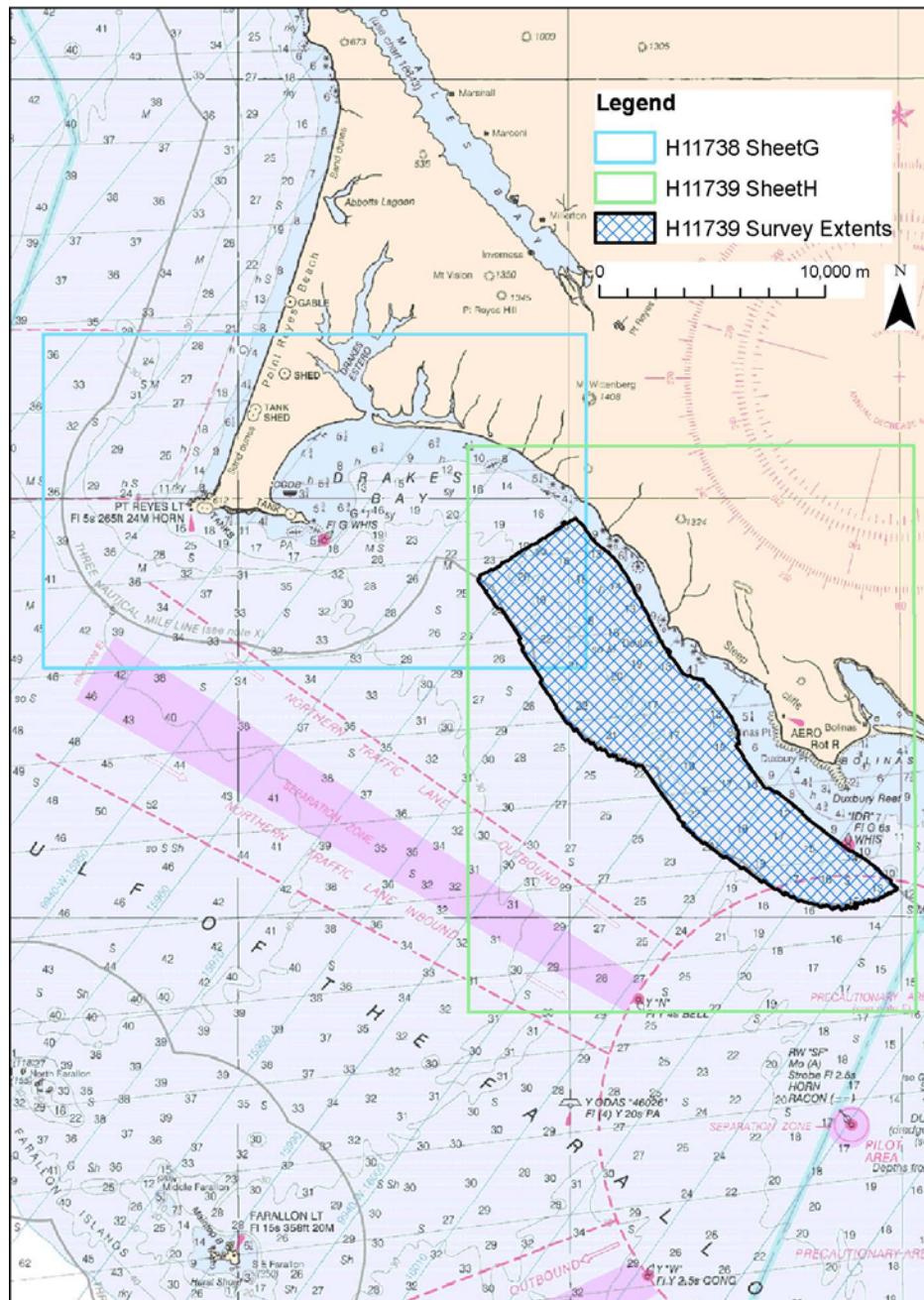


**Figure 2 Uncertainty DTM**

## Survey Junctions

### H11739 (Sheet H) junctions with:

Registry #	Date	Junction Side
H11738	2007	North



### Figure 3 H11739 Survey Junctions

The surveys are in agreement along their common borders. The agreement was noted in the field using the CUBE surfaces during subset cleaning. The conformity is also apparent in the Final Combined BASE Surfaces.<sup>5</sup>

### Quality Control Checks

Positioning system confidence checks were conducted on a daily basis using the POSMV controller software. The controller software had numerous real-time displays that were monitored throughout the survey to ensure the positional accuracies, specified in the NOS Hydrographic Surveys Specifications and Deliverables were achieved. These include, but are not limited to the following: GPS Status, Position Accuracy, Receiver Status (which included HDOP) and Satellite Status. During periods of high HDOP and/or low number of available satellites survey operations were stopped.

### Data Quality

In general, the multibeam data quality for H11739 was good. Three notable problems follow:

- During data acquisition and routine processing, a general downward and/or upward cupping was noticed in the across track sounding profiles for certain areas. This is possibly due to a high volume of thermal layering and strong under currents in the water column. This problem was addressed by conducting SVP casts more frequently and reducing the line spacing interval. Even though this SVP error is noticeable on the uncertainty surface, the data is within required specifications.<sup>6</sup>
- During data acquisition and routine processing an across-track oscillation in the survey data was noted and attributed to heave error. Error was directly proportional to swell / wave height and varied from 0.05m to 0.15m. Though not apparent in the 1x depth DTMs the effect can be seen if greater vertical exaggerations are used. The problem could not be compensated for but was considered the best that could be expected from the heave compensation system in the long-period swell experienced on this survey (POSMV manufacture specs are heave at +/- 5 % of heave amplitude). Though the effect can be seen on the uncertainty surface, the data is within required specifications.<sup>7</sup>
- Dungeness crab fishery was ongoing while this survey was underway; many crab pots buoys were encountered while surveying in 15m to 30m water depths. This made navigation difficult as the survey vessel attempted to avoid them, sometimes leading to small holidays that could not be filled. They were especially prevalent inside Drakes Bay. Shoaling was not observed on the edges of these holidays.<sup>8</sup>

Sound velocity profiles were collected every two to three hours to compensate for velocity changes over time. Profiles were collected on alternate ends of lines to minimize the spatial aspect of sound velocity changes.

Object detection requirements were met by minimizing vessel speed, using sonar range scales appropriate to the water depth to maximize ping rates, and maximizing swath overlap. These variables were adjusted in real-time by the online acquisition crew based on the ISIS and DelphMap QC and coverage displays. Ship-board processing crew provided feedback in near real-time after preliminary processing and coverage creation in CARIS HIPS.

Refer to the OPR-M-M924-KR-07 Data Acquisition and Processing Report for a detailed description of the survey equipment and methodology used over the course of this survey.

#### B.3 Corrections to Echo Soundings

Refer to the OPR-M-M924-KR-07 Data Acquisition and Processing Report for a detailed description of all corrections to echo soundings and lead line measurements. No deviations from the report occurred.

#### B.4 Data Processing

Refer to the OPR-M-M924-KR-07 Data Acquisition and Processing Report for a detailed description of the processing flow.

The final fieldsheet for H11739 is called “H11739-Final” and it contains three BASE surfaces. The following parameters were used:

- 0-25 meters: 1 m resolution, name “H11739\_1m”.
- 22-35 meters: 1.5m resolution, name “H11739\_1\_5m”
- 31-50 meters (or max depth): 2 m resolution, name “H11739\_2m”.

Most of the surveyed area is deeper than 20m, therefore it does not support gridding at resolutions finer than 1m.<sup>9</sup>

The final S57 file for this project is called “H11739\_S57\_Features.000”.<sup>10</sup> This file contains the object and metadata S57 objects as required in the Specifications and Deliverables.

## **C. VERTICAL AND HORIZONTAL CONTROL**

Refer to the OPR-M-M924-KR-07 Horizontal and Vertical Control Report<sup>11</sup> for a detailed description of the horizontal and vertical control used on this survey. No deviations from the report occurred. A summary of the project’s horizontal and vertical control follows.

### Horizontal Control

The horizontal control datum for this survey was the North American Datum of 1983 (NAD83). All raw positions were originally collected in WGS84 (ITRF00) and transformed to NAD83 by CARIS HIPS.

A STARFIX XP unit was used for the primary source of DGPS corrections. The Starfix XP service has a rated accuracy of +/- 0.15m. The unit output differentially corrected positions at 1 Hz to the POSMV 320 V4 where it was integrated with inertial data and a position for the top-center of the IMU was generated. This position was then logged concurrently with the bathymetry by ISIS and logged to the POS file by the POS Controller software. It was later corrected for offsets to the MBES sonar by CARIS HIPS in processing.

### Vertical Control

All sounding data were initially reduced to MLLW using predicted tidal data from Ft. Ross and Pt. Reyes. Predicted tides were used only for preliminary data cleaning.

On October 12, 2007, John Oswald and Associates (JOA) issued a final tidal zoning scheme covering the project area. Verified tidal data was downloaded from the NOAA COOPS website ([http://tidesandcurrents.noaa.gov/station\\_retrieve.shtml?type=Historic+Tide+Data](http://tidesandcurrents.noaa.gov/station_retrieve.shtml?type=Historic+Tide+Data)). The data was then smoothed using a 5<sup>th</sup> order polynomial curve, and applied to the CARIS data on November 7, 2007. Verified tidal data were used for all final base surfaces. Refer to the Horizontal and Vertical Control Report for additional tidal information and station descriptions.

**Table 2 - Tide Gauges**

Gauge	Location	Latitude	Longitude
9415020	Point Reyes, CA	37° 59.8' N	122° 58.5' W
9416841	Arena Cove, CA	38° 54.8' N	123° 42.5' W

**Table 3 - Final Tide Zones**

Zone	Primary			
	Site	Number	Time Offset	Range Ratio
BB01	Point Reyes, CA	9415020	0	1.00
BB02	Point Reyes, CA	9415020	+6	1.01
BB03	Arena Cove, CA	9416841	0	1.00

## D. RESULTS AND RECOMMENDATIONS

### D.1 Chart Comparison

H11739 survey was compared with charts:

**Table 4 – Chart Comparisons**

Chart Number	Type	Cell Name	Scale	Edition	Edition Date as of Nov. 2007
OPR-M-M924-KR-07					
18647	Raster	N / A	1:40,000	15 <sup>th</sup>	Sept., 2002
18645	Raster	N / A	1:100,000	25 <sup>th</sup>	June 2005
18645	ENC	US4CA11M	N / A	7 <sup>th</sup>	Jan. 30, 2007
18640	Raster	N / A	1:207,840	25 <sup>th</sup>	Aug. 2005
18640	ENC	US3CA14M	N / A	6 <sup>th</sup>	Sept. 6, 2007
18680	Raster	N / A	1:210,668	31 <sup>st</sup>	June 2005

### Comparison of Soundings

A comparison of soundings was accomplished by generating shoal-biased soundings and contours in the CARIS Fieldsheet Editor and overlaying them on the latest edition NOAA charts. The general agreement between charted soundings and H11739 soundings was noted. A more detailed comparison was undertaken for any charted shoals or other dangerous features.

General agreement between this survey and all the above charts (Raster and ENC) is good. No significant differences were found.<sup>12</sup>

### Automated Wreck and Observation Information System

There were no AWOIS items assigned to H11739.<sup>13</sup>

### Charted Features

There were no charted features labeled PA, ED, PD, or Rep. within the limits of H11739.<sup>14</sup>

### Dangers to Navigation

No dangers to navigation were located during the hydrographic survey of H11739.<sup>15</sup>

#### D.2 Additional Results

None to note.

#### Bottom Samples

None were assigned for this sheet.<sup>16</sup>

#### Aids to Navigation

Charted aids to navigation existed within the survey extents but investigation was not required.<sup>17</sup>

No uncharted aids to navigation were found in the survey area.

## E. APPROVAL SHEET

### Approval Sheet

For

**H11739**

Standard field surveying and processing procedures were followed in producing this survey in accordance with the following documents:

OPR-M-M924-KR-07 Statement of Work

NOS Hydrographic Surveys Specifications and Deliverables, April 2007 Edition

Fugro Pelagos, Inc. Acquisition Procedures (2006- NOAAAcquisitionProcedures);

Fugro Pelagos, Inc. Processing Procedures (2006-NOAAProcessingProcedures);

Bodega Bay, CA QC and Zoning Report

The data were reviewed daily during acquisition and processing, and the survey is complete and adequate for its intended purpose.<sup>18</sup>

This report has been reviewed and approved. All records are forwarded for final review and processing to the Chief, Pacific Hydrographic Branch.

Approved and forwarded,



Andrew Orthmann, Fugro Pelagos, Inc.

Lead Hydrographer

Fugro Pelagos, Inc. Survey Party

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<sup>1</sup> Concur with clarification. Data meets specifications, verified during Survey Acceptance Review (SAR) performed at the Pacific Hydrographic Branch, PHB.

<sup>2</sup> Filed with project records.

<sup>3</sup> Separate IV filed with hydrographic records.

<sup>4</sup> Concur.

<sup>5</sup> Concur.

<sup>6</sup> Concur.

<sup>7</sup> Concur.

<sup>8</sup> Concur.

<sup>9</sup> Concur.

<sup>10</sup> The H11739\_S57\_Features.000 file only contained seabed area features was not included in the HCell. It was determined that the rocky seabed areas could be better delineated from the BASE surface by the compiler.

<sup>11</sup> Filed with project records

<sup>12</sup> Concur with clarification. There are places on Chart 18647 that have differences up to 2 fathoms.

<sup>13</sup> Concur with clarification. No AWOIS item exist within the limits of H11739.

<sup>14</sup> Concur.

<sup>15</sup> Concur.

<sup>16</sup> Concur with clarification. All ENC charted bottom samples, with the exception of one “rocky” notation, and additional bottom samples digitized from Chart 18647 were retained.

<sup>17</sup> Concur with clarification. Chart using the latest ATONIS information.

<sup>18</sup> Concur.

**H11739 HCell Report**  
Katie Reser, Physical Scientist  
Pacific Hydrographic Branch

## **Introduction**

The primary purpose of the HCell is to directly update NOAA ENCs with new survey information in International Hydrographic Organization (IHO) format S-57. HCell compilation of survey H11739 utilized Office of Coast Survey HCell Specifications Version 3.0, May 2008 and Hcell User Guide Version 1.1, June 2008. HCell H11739 will be used to update charts 18647, 1:40,000 (15th Ed.; September 02, NM 3/1/2008), 18649, 1:40,000 (65th Ed.; July 06, NM 5/31/2008), 18645, 1:100,000 (25th Ed.; June 05, NM 4/5/2008), 18640, 1:207,840 (25nd Ed.; August 05, NM 4/19/2008), 18680, 1:210,668 (31st Ed.; June 05, NM 3/1/2008), US5CA12M, US4CA11M and US3CA14M.

## **1. Compilation Scale**

The densities of soundings in the HCell are compiled as appropriate to emulate those soundings of Chart 18647, 1:40,000, Chart 18649, 1:40,000 and Chart 18645, 1:100,000.

## **2. Soundings**

### **2.1 Source Data**

A 2-meter resolution Combined BASE surface, **H11739\_Combined\_2m** was used as the basis for HCell production following Branch certification.

A survey-scale sounding (SOUNDG) feature object source layer was built from the **H11739\_Combined\_2m** surface in CARIS BASE Editor. A shoal-biased selection was made at 1:10,000 scale using a radius table with values shown in **Table 1**.

Upper limit (m)	Lower limit (m)	Radius (mm)
0	10	3
10	20	4
20	40	4.5
40	500	5

**Table 1**

## 2.2 Sounding Feature Objects

In CARIS BASE Editor soundings were manually selected from the high density sounding layer from H11739, and imported into a new layer created to accommodate chart density depths. Manual selection was used to accomplish a density and distribution that more closely represents the seafloor morphology and that emulates density and distribution of soundings on charts 18647, 18649 and 18645 than is possible using automated methods. See section 10.1, Data Processing Notes, for details about the use of manual sounding selection for H11739. The sounding feature object source layer was imported into the **H11739\_HCell\_Features.hob** file, which was used as a template to create the S-57 Composer product **H11739\_CS.prd**.

## 3. Depth Areas

### 3.1 Source Data

Using the BASE surface **H11739\_Combined\_2m** a single depth area was generated. No depth contours were delivered per OCS HCell Specifications ver.3.0 and Hcell User Guide ver. 1.1.

### 3.2 Depth Area Feature Objects

One all-encompassing depth range, 10 meters to 50 meters, was used for all depth area objects below MLLW.

## 4. Meta Areas

The following Meta objects areas are included in HCell 11739:

M_QUAL	M_CSCL
M_COVR	

Meta area objects were constructed on the basis of a perimeter line delineating the surveyed limits. This perimeter was first used to create the Skin of The Earth (SOTE) layer, then was duplicated to the Meta object layers and attributed per the HCell Specifications, ver. 3.0 and Hcell User Guide ver. 1.1.

## **5. Survey Features**

There are no DTONs in H11739.

There are no AWOIS items located within the limits of H11739.

No bottom samples were collected during H11739. All charted bottom samples, with the exception of one “rocky” notation, within the surveyed area were imported into the H11739 HCell. In the area where the “rocky” notation was removed, it was replaced by rocky seabed area features delineated from the BASE surface.

## **6. Shoreline / Tide Delineation**

One depth area (DEPARE) was created for the SOTE.

## **7. Attribution**

All S-57 Feature Objects have been attributed as fully as possible based on information provided by the Hydrographer and in accordance with OCS HCell Specifications, ver. 3.0 and Hcell User Guide ver. 1.1.

## **8. Layout**

### **8.1 CARIS S-57 Composer Scheme**

All features to be included in the HCell were imported into a single HOB file, **H11739\_HCell\_Features**, in BASE Editor. The HOB file was used as a template to create the S-57 Composer product file **H11739\_CS**. Once the features were in S-57 Composer, they were managed by using the function create layer by “Unique Feature Acronyms”. The following are the feature acronyms included in the product file:

SOUNDG	Chart scale soundings
DEPARE	Group 1 object (Skin of the Earth)
SBDARE	Bottom samples and rocky seabed areas
M_COVR	Data coverage meta object
M_QUAL	Data quality meta object
M_CSCL	Compilation scale meta object
\$CSYMB	Blue notes

### **8.2 Blue Notes**

Notes regarding data sources are in S-57 Composer as a \$CSYMB feature with the blue note located in the INFORM field and the survey registry number, chart number, chart edition and edition date located in the TXTDSC field. The blue notes are included in the HCell when it is exported to .000.

## 9. Spatial Framework

### 9.1 Coordinate System

All spatial map and base cell file deliverables are in an LLDG geographic coordinate system, with WGS84 horizontal, MHW vertical, and MLLW (1983-2001 NTDE) sounding datums.

### 9.2 Horizontal and Vertical Units

During creation of sounding sets in CARIS BASE Editor, and creation of the HCell in CARIS S-57 Composer, units are maintained as metric with millimeter resolution. NOAA rounding is applied at the same time that conversion to chart units is made to the metric HCell base cell file, at the end of the HCell compilation process.

A CARIS environment variable, uslXsounding\_round, controls the depth at which rounding occurs. Setting this variable to NOAA feet displays all soundings as whole units.

In an ENC viewer feet display in whole feet. Soundings round to the deeper foot if the decimals of the foot are 0.75000 or greater.

#### Chart Unit Base Cell Units

Depth Units (DUNI):	Feet
Height Units (HUNI):	Feet
Positional Units (PUNI):	Meters

## 10. QA/QC

### 10.1 Data Processing Notes

Manual chart scale sounding selections were made for this survey. Experience has shown that in areas where bathymetry varied, automated sounding selection is impractical.

None of the default sounding suppression options offered in CARIS BASE Editor, S-57 Composer or HOM yields an acceptable density and distribution of depths, generally bunching soundings nearshore with too sparse coverage seaward. While the customized options are more practical for this type of terrain, an inordinate amount of time must be spent in experimentation with variations on the algebraic terms in order to devise the most suitable formula, and manual adjustments are still required to the resulting sounding set.

### 10.2 ENC Validation Checks

H11739 was subjected to QA and Validation checks in S-57 Composer prior to exporting the HCell base cell (000) file in chart units with NOAA rounding. dKart Inspector 5.0

(Service Pack 1) was then used to further check the data set for conformity using the S-58 ver. 2 standard (formerly Appendix B.1 Annex C of the S-57 standard). All tests were run and errors investigated and corrected where necessary.

## **11. Products**

### **11.1 HSD, MCD and CGTP Deliverables**

- H11739 Base Cell File, Chart Units, Soundings compiled to 1:40,000 and 1:100,000
- H11739 Base Cell File, Chart Units, Soundings compiled to 1:10,000
- H11739 Descriptive Report including end notes compiled during office processing and certification
- H11739 HCell Report

### **11.2 File Naming Conventions**

S-57 Composer Product prefix: H11739\_CS.prd and H11739\_SS.prd

MCD Chart units base cell file: US511739\_CS.000

MCD Chart units base cell file, survey scale soundings: US511739\_SS.000

### **11.3 Software**

BASE Editor 2.1:	Combination of Product Surfaces and initial creation of the S-57 bathymetry-derived features
HOM 3.3:	Assembly of the H-Cell, S-57 products unit conversion
S-57 Composer 2.0:	Assembly of the H-Cell, S-57 products export, QA
dKart Inspector 5.0:	Validation of the base cell file

## **12. Contacts**

Inquiries regarding this HCell content or construction should be directed to:

Katie Reser, Physical Scientist, PHB, Seattle, WA; 206-526-6864;  
Katie.Reser@noaa.gov.

APPROVAL SHEET  
H11739

Initial Approvals:

The survey evaluation and verification has been conducted according to branch processing procedures and the HCell compiled per the latest OCS H-Cell Specifications.

The survey and associated records have been inspected with regard to survey coverage, delineation of the depth curves, development of critical depths, S-57 classification and attribution of soundings and features, cartographic characterization, and verification or disproval of charted data within the survey limits. The survey records and digital data comply with OCS requirements except where noted in the Descriptive Report and are adequate to supersede prior surveys and nautical charts in the common area.

I have reviewed the HCell, accompanying data, and reports. This survey and accompanying digital data meet or exceed OCS requirements and standards for products in support of nautical charting except where noted in the Descriptive Report.