H11966

NOAA FORM 76-35A

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

DESCRIPTIVE REPORT

Type of Survey HYDROGRAPHIC

Field No. M-L906-KR-08

Registry No. H11966

LOCALITY

State California

General Locality Pacific Ocean Northern California

Sublocality Vicinity of Point Arena Light

2009

CHIEF OF PARTY

DEAN MOYLES

LIBRARY & ARCHIVES

DATE

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

HYDROGRAPHIC TITLE SHEET

REGISTRY No

H11966

INSTRUCTIONS – The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.

FIELD No: **N/A**

State California

General Locality Pacific Ocean – Northern California

Sub-Locality Vicinity of Point Arena Light

Scale N/A **Date of Survey** 08/09/09 – 10/19/09

Instructions dated 7/7/2008 **Project No.** M-L906-KR-08

Vessel F/V PACIFIC STAR (556510), R/V R2 (623241), R/V D2 (647782)

Chief of party DEAN MOYLES

Surveyed by MOYLES, BRIGGS, FARLEY, REYNOLDS, CAIN, LYDON, ROKYTA, GOODALL, LOPEZ, TIXIER, et al.

Soundings by RESON SEABAT 7125 & 8125 ECHOSOUNDERS HULL MOUNTED

SAR by Fernando Ortiz Compilation by Fernando Ortiz

Soundings compiled in Fathoms

REMARKS: All times are UTC. UTM Projection 10

The purpose of this survey is to provide contemporary surveys to update National Ocean Service (NOS) nautical charts. All separates are filed with the hydrographic data. Revisions and end notes in red were generated during office processing. Page numbering may be interrupted or non sequential.

A. AREA SURVEYED

H11966 (Sheet AV) is located near in the Vicinity of Point Arena Light. It is bound by the coordinates listed in **Table 1**. [1]

This data was collected by Fugro Pelagos, Inc. for NOAA and the State of California's Coastal Conservancy. While the State of California's interest in this data is primarily for fisheries habitat mapping, the necessary steps to meet NOAA specifications and make the data suitable to OCS for nautical charting purposes have been taken, as detailed in the 2008 Specifications and Deliverables and described in this and accompanying reports.

Hydrographic data collection began on August 9, 2009 and ended on October 19, 2009.

Table 1 – Sheet Bounds

Point	Latitude (North)	Longitude (West)
1	39-07-20	123-48-49
2	39-07-20	123-41-26
3	38-56-37	123-41-26
4	38-56-37	123-48-49
5	39-07-20	123-48-49

Note: The northern bounds were modified slightly (shifted farther north) from originally planned to include additional survey area.[2]

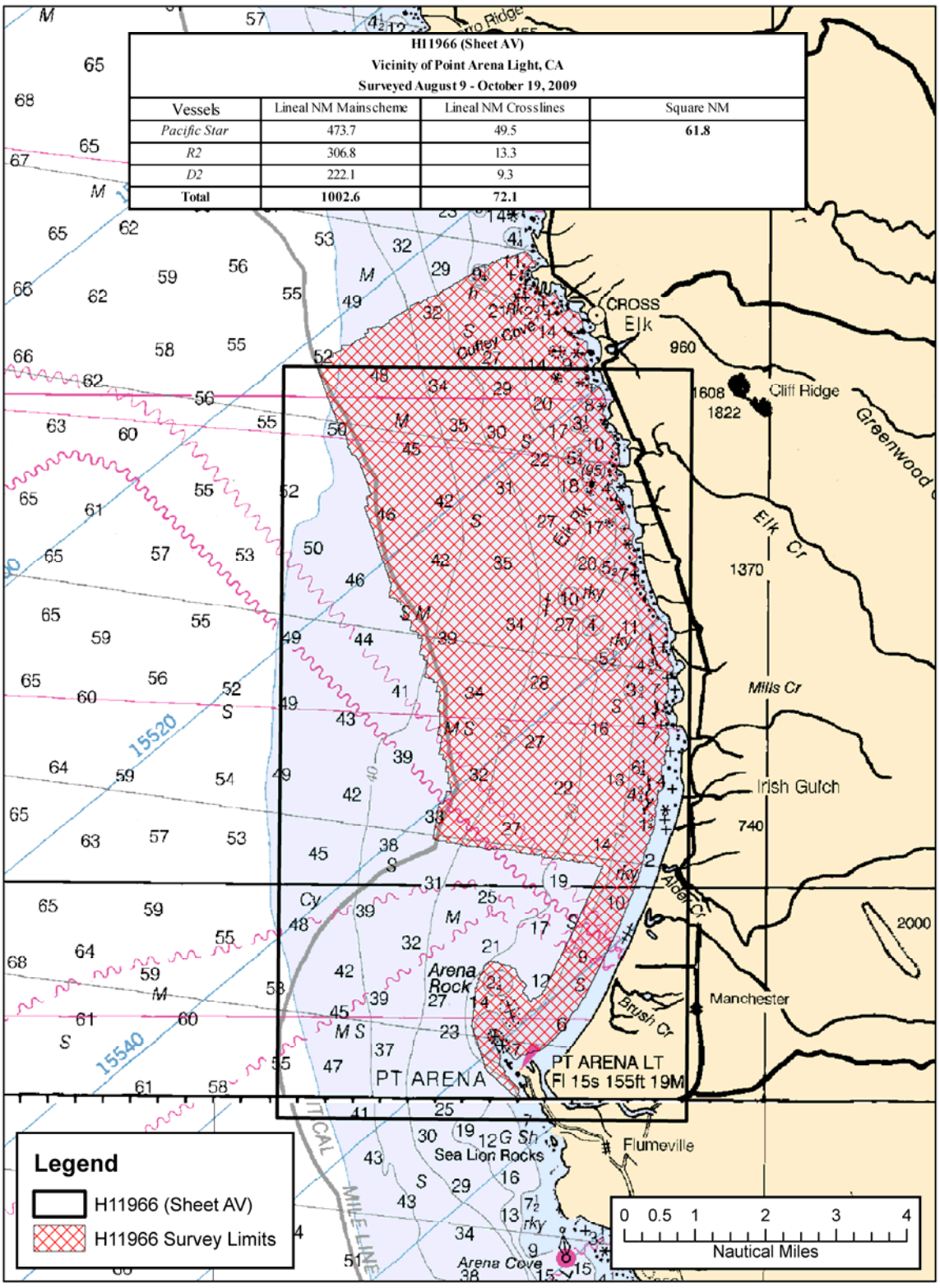

Figure 1 H11966 Area Surveyed

B. DATA ACQUISITION AND PROCESSING

Refer to the M-L906-KR-08 Data Acquisition and Processing Report[3] 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 R/Vs R2 and D2 and F/Vs Pacific Star acquired all sounding data for H11966.

The Pacific Star, 162 feet in length with a draft of 16 feet, was equipped with both a Reson Seabat 7125 (400/200 kHz dual frequency) sonar, and a Reson Seabat 8111 sonar for multibeam data acquisition. The 7125 multibeam data files were logged in the S7K format, and the Reson 8111 files logged in the XTF format. All multibeam data files were logged using WinFrog Multibeam v 3.08.44.04. The vessel was also equipped with two AML sound velocity and pressure sensors (SV&P), and a Brooks Ocean Moving Vessel Profiler (MVP), for sound velocity profiles. Vessel attitude and position were measured using an Applanix Position and Orientation System for Marine Vessels (POS MV) 320 V4.

Vessel D2, a Pacific Star launch, is 29 feet in length with a draft of 3 feet. It was equipped with a Reson Seabat 8125 (455 kHz frequency) multibeam sonar system, two AML SV&P probes, and an Applanix (POS MV) 320 V4. Multibeam data files were logged in the XTF format using WinFrog Multibeam v 3.08.44.04.

Vessel R2, with the same specifications as D2, was similarly equipped, except that it was fitted with a Reson 7125 system (400/200 kHz dual frequency).

Refer to M-L906-KR-08 Data Acquisition and Processing Report for a complete listing of equipment and vessel descriptions.

B.2 Quality Control

Crosslines

Crosslines were planned and well distributed throughout the survey to ensure adequate quality control. Total crossline length surveyed was 72.1 nautical miles or 7.2 percent of the total main scheme line length. Each crossline was compared to the entire main scheme line plan and CUBE surface it intersected, using the CARIS HIPS QC report routine.

The majority of QC Reports fall well within the required accuracy specifications.[4] However, beams that fall below the 95 percent confidence level in the QC report are associated with areas and conditions illustrated below. It should be noted that these locations are in agreement with the surrounding adjacent lines and are considered well within the required specifications. Results are located in Separate IV. Note: QC reports were conducted line by line with GPS derived tides, and by vessel with verified tides applied.

The majority of beams that fall below the 95 percent confidence level are located in areas having extremely steep slopes and/or rocks. **Figures 2** and **3** below provide examples. Note: Main scheme lines are shown in yellow and crosslines in purple.

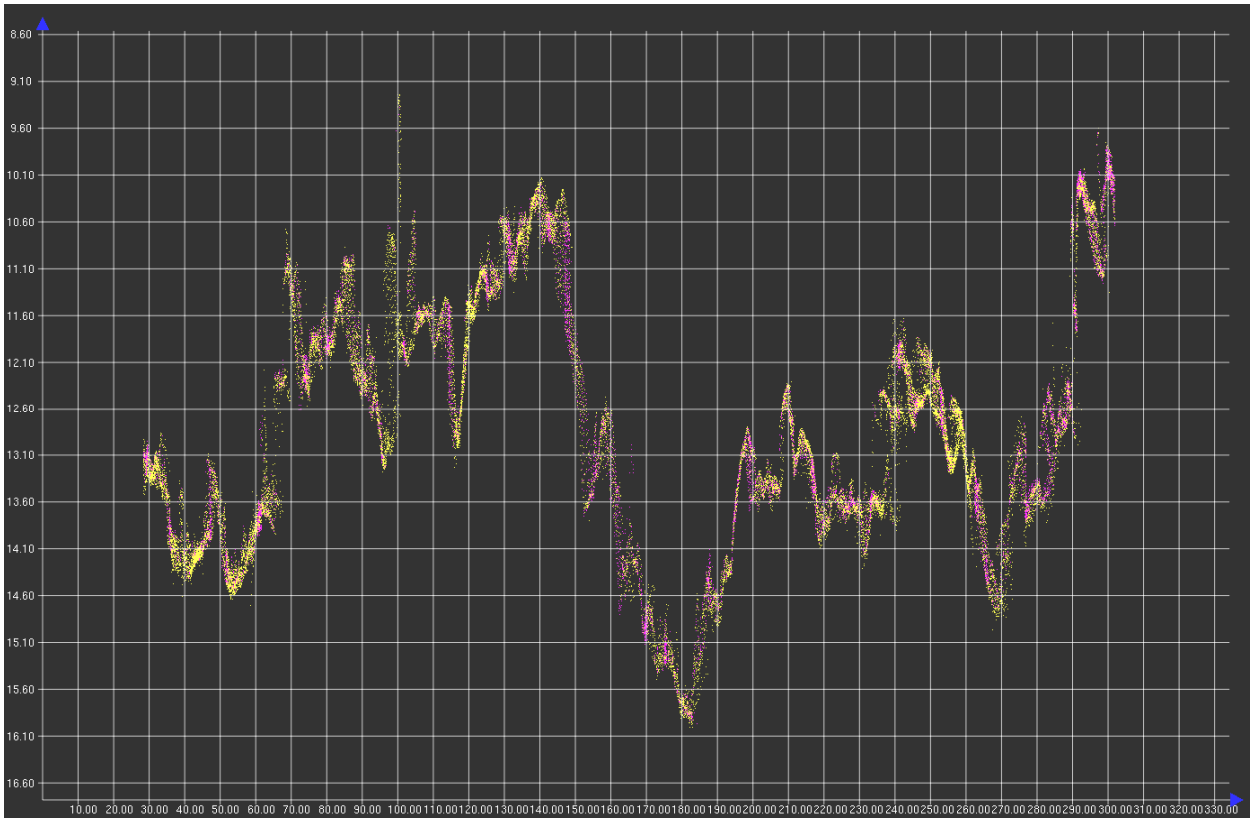

Figure 2 Profile of 4AV01-TIE10

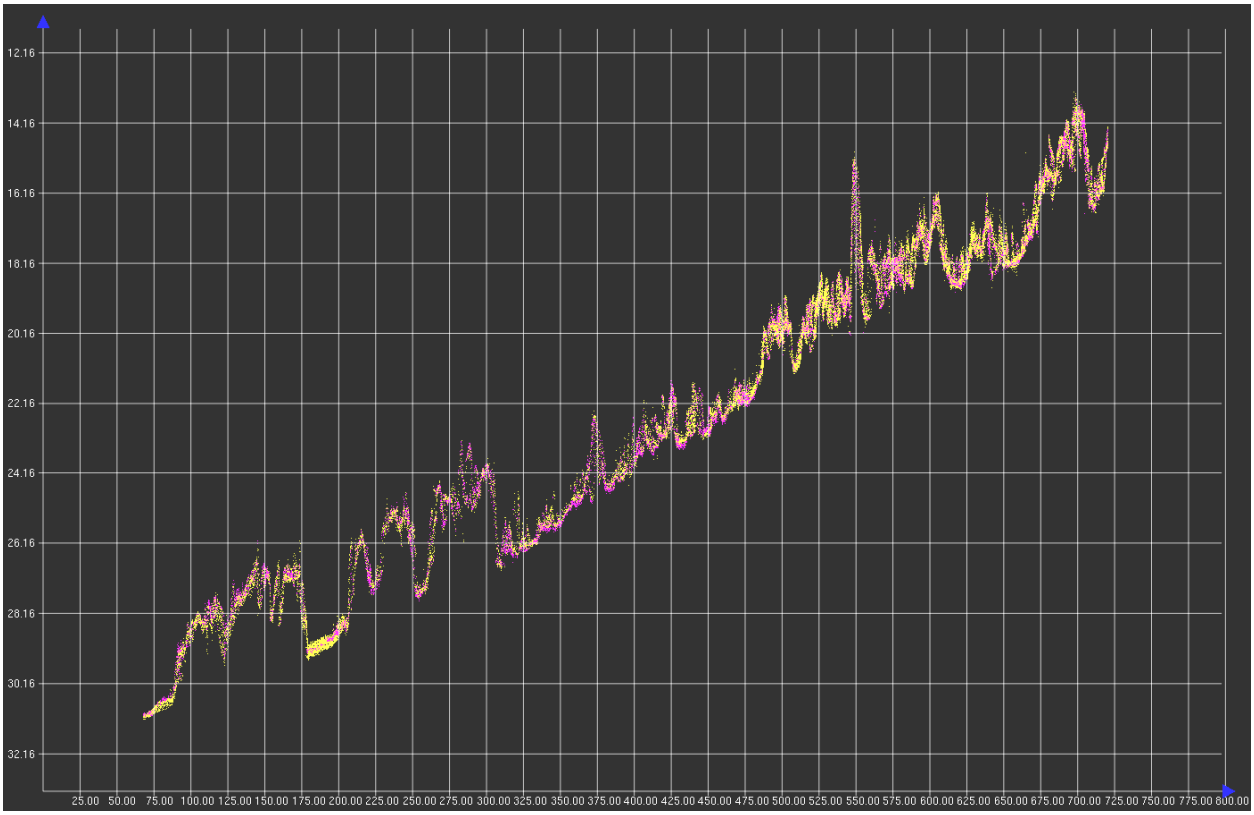

Figure 3 Profile of 5AV02-TIE16

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

$$+/- \sqrt{(a^2 + (b * d)^2)} \text{ where } a = 0.2, b = 0.01, \text{ and } d = \text{depth.}$$

Uncertainty Values

The majority of H11966 had uncertainty values of 0.30 m to 0.60 m, which met project specifications.

As seen in the uncertainty surface, uncertainty is generally lowest near the sonar nadir beams and increases toward the outside of each swath. This is expected and primarily a result of sound velocity error uncertainty.

Other areas of higher uncertainty include rock outcrops and irregular bottom topography.

Oscillations along track and port to starboard in the uncertainty surface are due to higher uncertainty computed due to vessel roll, again prevalent mostly in the outer beams.

High uncertainty was found with line 5AV02-SH043 as a result of higher than normal positioning error. All data still falls within required accuracy specifications.[5]

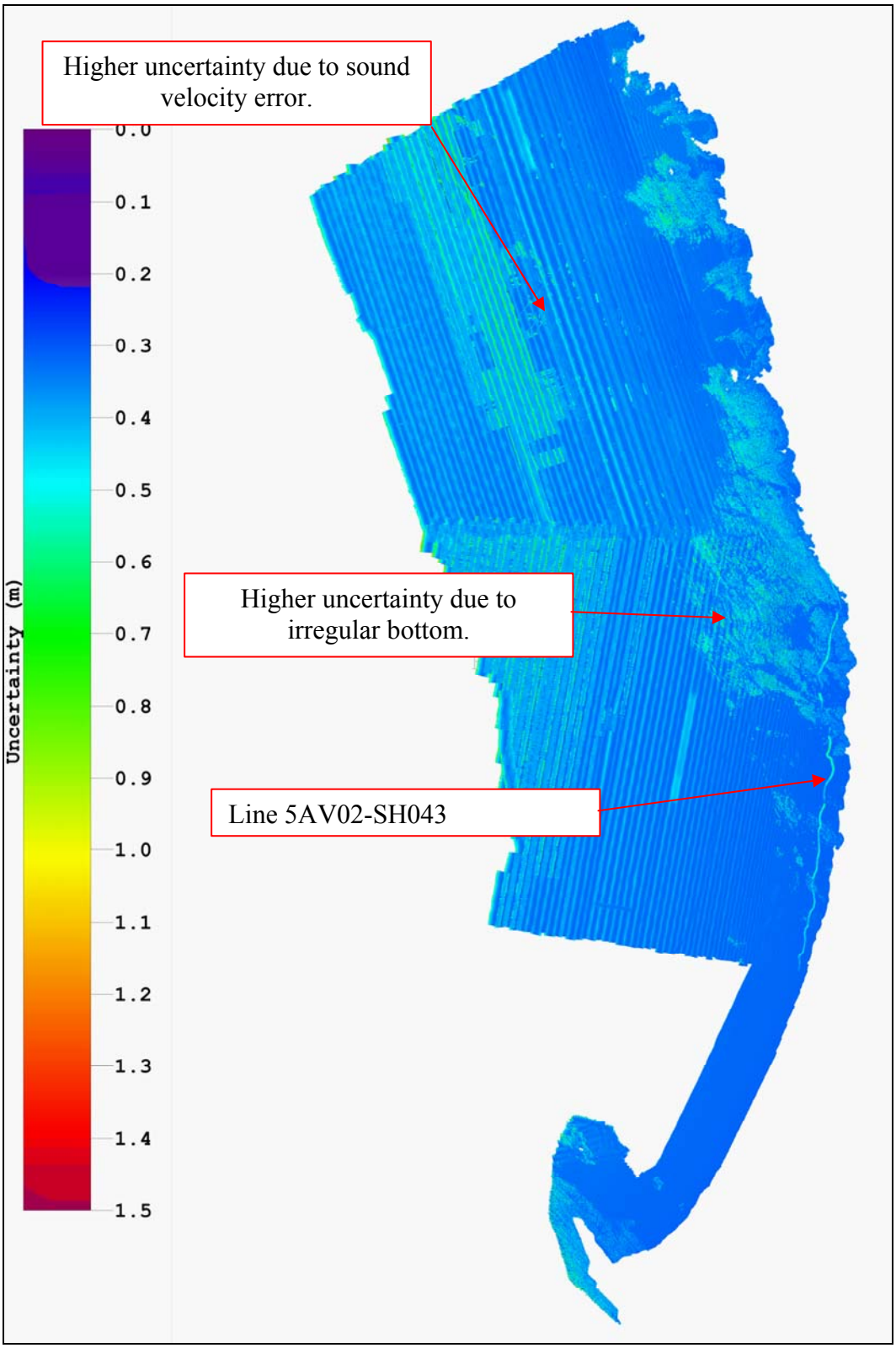

Figure 4 Uncertainty DTM

Survey Junctions

H11966 (Sheet AV) junctions with:

Registry #	Date	Junction Side
H11967	2009	North

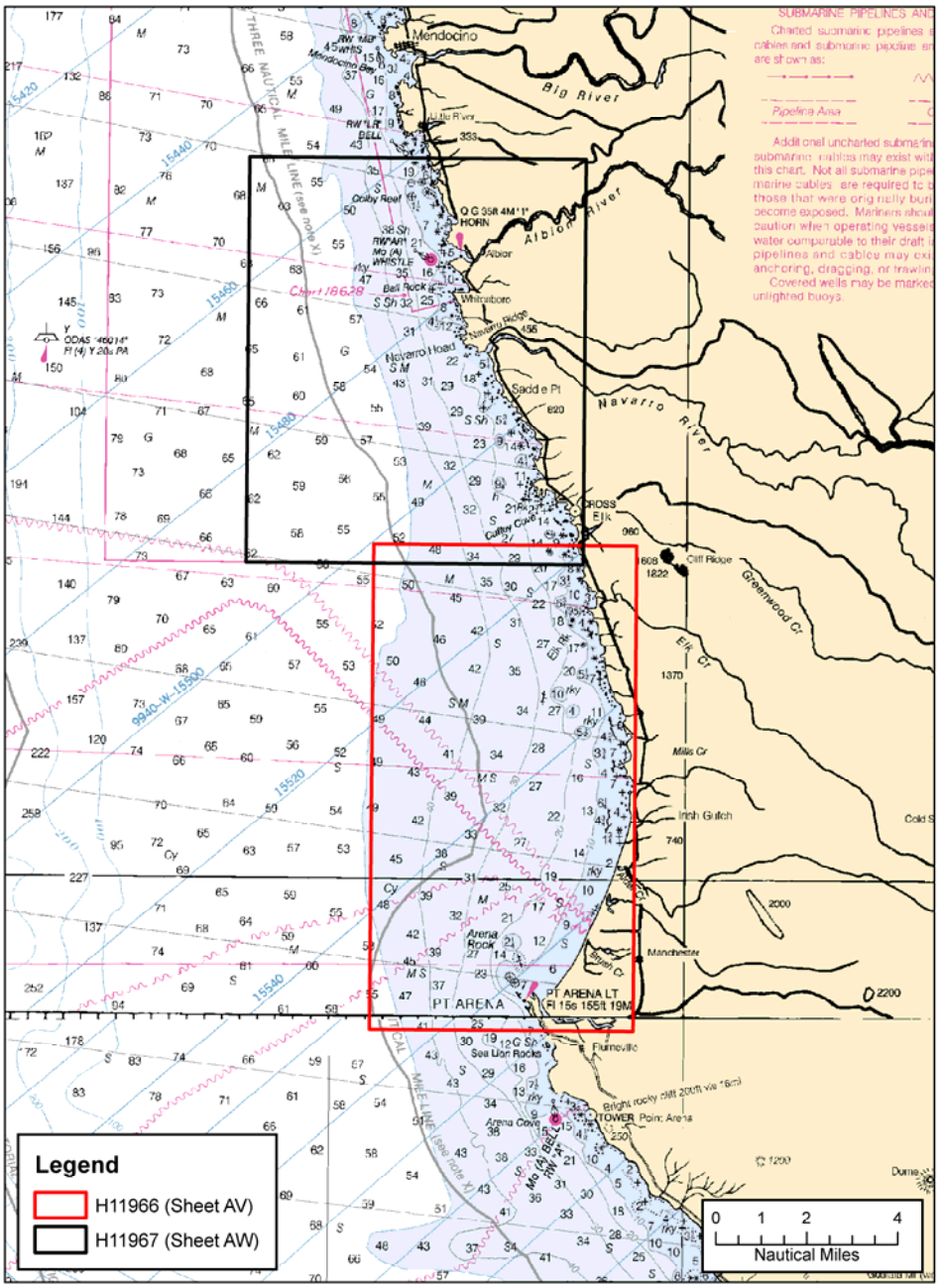

Figure 5 H11966 Survey Junctions

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.[6]

Quality Control Checks

Positioning system confidence checks were conducted on a daily basis using the (POS MV) 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 suspended.

Sonar system confidence checks were performed weekly by comparing post processed depth information collected by multiple vessels surveying over a common area. In addition, bar checks were performed to maintain a high confidence level. Sound Velocity Probe confidence checks were conducted weekly by producing comparative sound velocity data between all vessels. This was conducted by having all sound velocity profiling equipment (MVP and SVPs) perform a cast in close proximity to each other in a near simultaneous time period.

Comparison of PPK-GPSTide and Zoned Verified Tides

Tidal corrections for this survey were done using PPK-GPS derived altitudes which were reduced to MLLW using VDatum grids and the CARIS HIPS GPSTide function. Since conventional tidal data and zones were available, gross error and reality check comparisons were done between data corrected using both methods. The following tests were performed:

1. For a snapshot of general agreement throughout the survey area, a copy of the crossline data was corrected using zoned, verified smoothed tides, with dynamic draft correctors applied. QC reports were then generated in HIPS for these "tidal" crosslines versus the BASE surfaces (GPSTide method) in the same manner described in the crossline comparison section above.

   Results: All "tidal" beams passed at 95% or better as compared to the BASE surfaces with exception of beams which did not pass for normal crossline comparisons as previously discussed in the Crossline section of the report. Results are available in Separate IV.

2. In order to identify and quantify any static offsets between the two processing methods, a difference surface was created in Caris Bathy DataBASE 2.3 using a CUBE surface created from the crosslines and a CUBE surface created from the same crosslines corrected using zoned, verified smooth tides. Difference surface = (tidal surface minus GPSTide surface). Both surfaces were created at a 4m resolution.

Results (see **Figure** 6): Average difference was -0.222 m; median difference was -0.230 m, with a standard deviation of 0.133 m. Therefore, the GPSTide surface was about 22 cm deeper on average. No significant trends were apparent, but a portion of the difference can be attributed to the high uncertainty or inability to measure the waterline (static draft) value on the Pacific Star in less than ideal sea states.

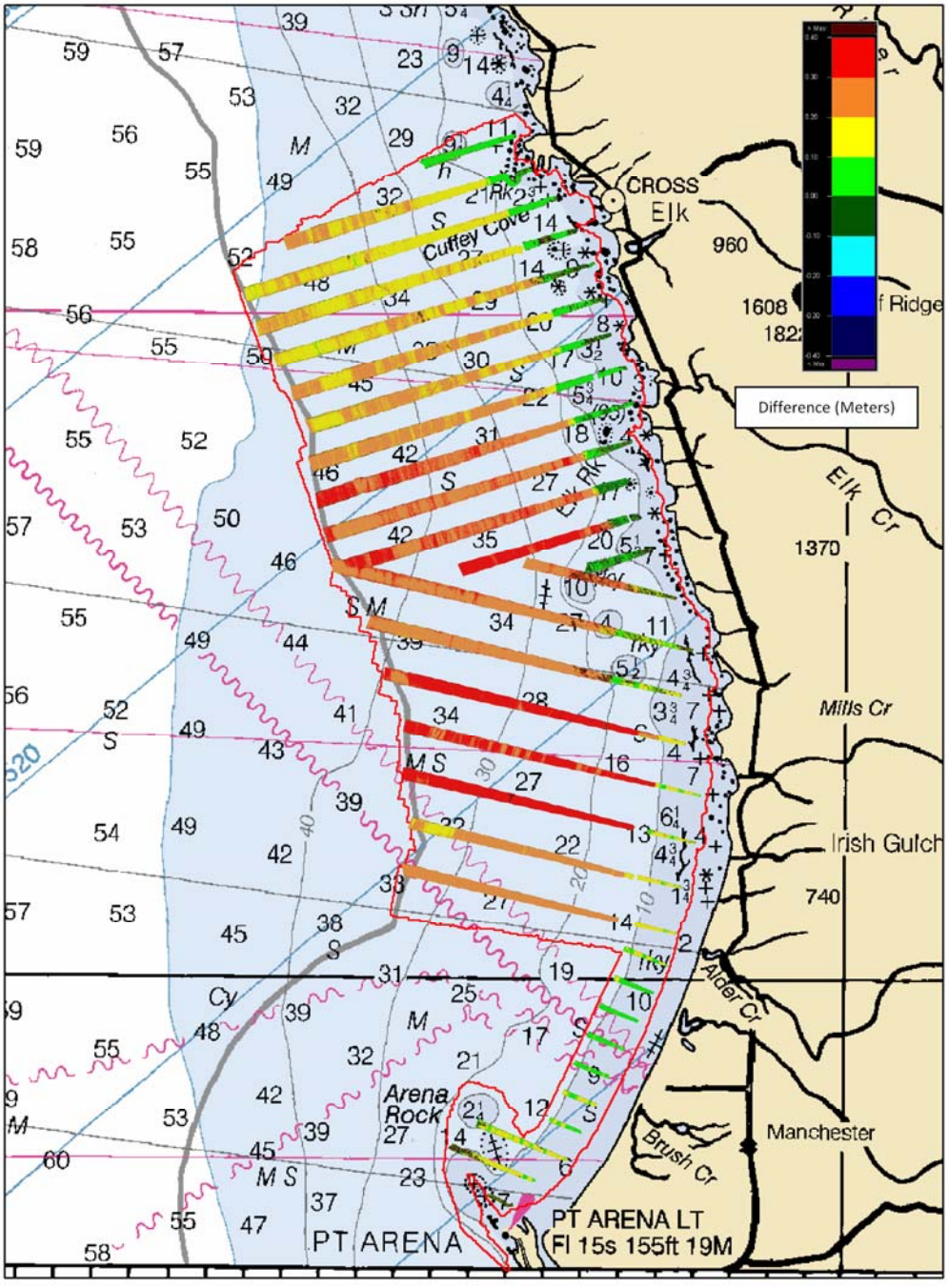

Figure 6 H11966 Difference Surface (Tidal minus GPSTide)

In conclusion, absolute correctness of one source of tidal correction over the other cannot be determined by direct comparisons between the two data sets. However, data corrected using both methods statistically compares very well to each other, and qualitatively the matchup between adjacent lines is good using both methods. Therefore, for this survey, the GPSTide method of tidal correction meets specification and is an acceptable alternative to the standard tidal method.[7]

Data Quality

In general, the multibeam data quality for H11966 was good. Three notable problems follow:

1. A general downward and/or upward cupping is noticeable in the across track sounding profiles for certain areas. This is possibly due to a high volume of thermal layering and strong undercurrents 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 in the data, it is within required specifications.[8]

R2 and D2 collected sound velocity profiles every two hours (or less) to compensate for velocity changes over time. Profiles were collected on alternate ends of lines, or often in the middle of lines, to minimize the spatial aspect of sound velocity changes.

The MVP system on the Pacific Star was also used at an interval of every two hours, except that the system was used to collect as many as five profiles along the course of a single line. Two hours later, another set of profiles would be collected, with the net result being the creation of a grid of sound velocity profiles that kept differences in time and distance to a minimum between the survey data and the in-use sound velocity profile.

2. Some small holidays exist in the data. These are due to insufficient along or across track data density due to the irregular bottom topography. The holidays are small, in relatively deep water, and no shoaling is evident along their edges.[9]

3. Some tide busts occur sporadically between adjacent lines. This was due to lower post-processed GPS accuracy than normal on certain lines. Though the busts are apparent in subset edit mode, they are relatively small (less than 0.10 m) and within specifications.[10]

Object detection requirements were met by minimizing vessel speed when necessary, 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 WinFrog QC and coverage displays. The office-based processing crew provided feedback after preliminary processing and coverage creation in CARIS HIPS, and reported re-runs or in-fills as necessary to the acquisition crew.

Refer to the M-L906-KR-08 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 M-L906-KR-08 Data Acquisition and Processing Report for a detailed description of all corrections to echo soundings. No deviations from the report occurred.

B.4 Data Processing

Refer to the M-L906-KR-08 Data Acquisition and Processing Report for a detailed description of the processing flow.

The final fieldsheet for H11966 is called "H11966_(Sheet_AV)" and it contains four BASE surfaces. The following parameters were used:

0-33 meters: 1 m resolution, name "H11966_1m_Final"
30-45 meters: 1.5 m resolution, name "H11966_1_5m_Final"
40-84 meters: 2 m resolution, name "H11966_2m_Final"
80-100 meters: 4 m resolution, name "H11966_4m_Final"

Notes:

- Maximum depth was approximately 100 m; therefore resolutions coarser than 4 m were not computed.
- Due to the quantity of data, final CUBE BASE surfaces were created with CARIS v 7.0 in the CARIS Spatial Archive (CSAR) format. These surfaces are located under the "H11966\CARIS\Fieldsheets\" directory.

The final S57 file for this project is called "H11966_S57_Features.000". This file contains the object and metadata S57 objects as required in the Specifications and Deliverables.

C. VERTICAL AND HORIZONTAL CONTROL

Refer to the M-L906-KR-08 Horizontal and Vertical Control Report[11] 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).

For real-time DGPS corrections, a CSI MBX-3 unit was tuned to the Cape Mendocino, CA. USCG DGPS site. The unit output differentially corrected positions at 1 Hz to the (POS MV) 320 V4 where it was integrated with inertial data; and a position for the top-center of the IMU was generated. This position was logged concurrently with the bathymetry from WinFrog and the POS file by WinFrog PosMvLogger. It was later corrected for offsets to the multibeam echosounder (MBES) by CARIS HIPS in processing.

Final positioning, however, was done using post-processed kinematic (PPK) methods. Applanix POSPac software was used in conjunction with the POS files and local base station data to generate a higher accuracy position which was applied in processing, replacing the real-time position records.

See M-L906-KR-08 Horizontal and Vertical Control Report for a more detailed description of PPK positioning methods used.

Vertical Control

All sounding data were initially reduced to mean lower low water (MLLW) using preliminary tidal data. It should be noted that preliminary tides were used in the field for the initial stage of processing only.

Table 2 – Tide Gauge

Gauge	Location	Latitude	Longitude
9418767	North Spit, CA	40° 46.0' N	124° 13.0' W
9416841	Arena Cove, CA	38° 54.8' N	123° 42.4' W
9415020	Point Reyes, CA	37° 59.7' N	122° 58.6' W

Final tidal corrections were generated using PPK processing methods in conjunction with NOAA's VDATUM model and the CARIS GPSTide routine. Applanix POSPac software produced a smoothed best estimate of trajectory (SBET) file that, along with other data, contained GPS altitudes based on the NAD83 ellipsoid (GRS 80). The SBET altitudes were loaded into every line in CARIS HIPS, and HIPS' GPSTide routine was run to compute a GPS-based tide. The GPSTide routine used a VDatum NAD83 to MLLW offset grid to produce MLLW tide correctors. This grid is an XYZ text file and is included with the CARIS data under the tide directory.

See M-L906-KR-08 Horizontal and Vertical Control Report for a more detailed description of the GPSTide methods.

D. RESULTS AND RECOMMENDATIONS

D.1 Chart Comparison[12]

H11966 survey was compared with charts shown in Table 3.

Table 3 – Chart Comparisons

Chart Number	Type	Cell Name	Scale	Edition	Edition Date
18010	Raster	n/a	1:811,980	21	Jan-07
18620	Raster	n/a	1:196,948	23	Jun-02
18640	Raster	n/a	1:207,840	25	Aug-05
18645	Raster	n/a	1:40,000	26	Sep-08
18622	Raster	n/a	1:25,000	54	Apr-10
18623	Raster	n/a	1:40,000	11	Aug-01
18626	Raster	n/a	1:40,000	15	Sep-00
18628	Raster	n/a	1:10,000	8	Nov-99
18640	ENC	US3CA14M	n/a	9	Jul-09
18620	ENC	US3CA15M	n/a	9	May-09
18007	ENC	US2WC12M	n/a	6	Jun-09
501	ENC	US1WC01M	n/a	23	Oct-09

Comparison of Soundings

A comparison of soundings was accomplished by overlaying the latest edition of NOAA charts and ENCs onto the final BASE surfaces in CARIS HIPS & SIPS. The general agreement between the charted soundings and H11966 soundings is noted. A more detailed comparison was undertaken for any charted shoals or other dangerous features.

Agreement between the H11966 BASE surface depths and the charted soundings for all applicable ENC and Raster charts was within +/- 1 to 2 fathoms.[13] Since the survey area was ensonified with 100% multibeam coverage, shoaler depths were discovered between the charted soundings. In these areas, when necessary, the sounding was designated to insure its inclusion in the finalized BASE surface. Exceptions follow:

1. Some discrepancy exists at the exact position of charted soundings on steep slopes, likely due to the charted soundings being slightly out of position, making a large difference in depths apparent.

2. Charted rocks and islets on ENCs US3CA15M, US2WC12M fall within the multibeam coverage and should be modified to agree with the H11966 survey.[14]

The Hydrographer recommends that soundings within the survey limits of H11966 supersede all prior survey and charted depths.[15]

Automated Wreck and Observation Information System

There were no AWOIS items assigned to H11966. [16]

Charted Features [17]

There were no charted features labeled ED, PD, or PA within the limits of H11966, but two notable charted features follow.

1. The wreck charted at 39-03-58N 123-44-00W on chart 18620 (and US3CA15M) was not found during the H11966 survey.[18] This area was surveyed with 100% multibeam coverage and contains numerous rock outcrops, making it difficult to identify a wreck if one did exist. Refer to **Figures 7** and **8** for detailed views.

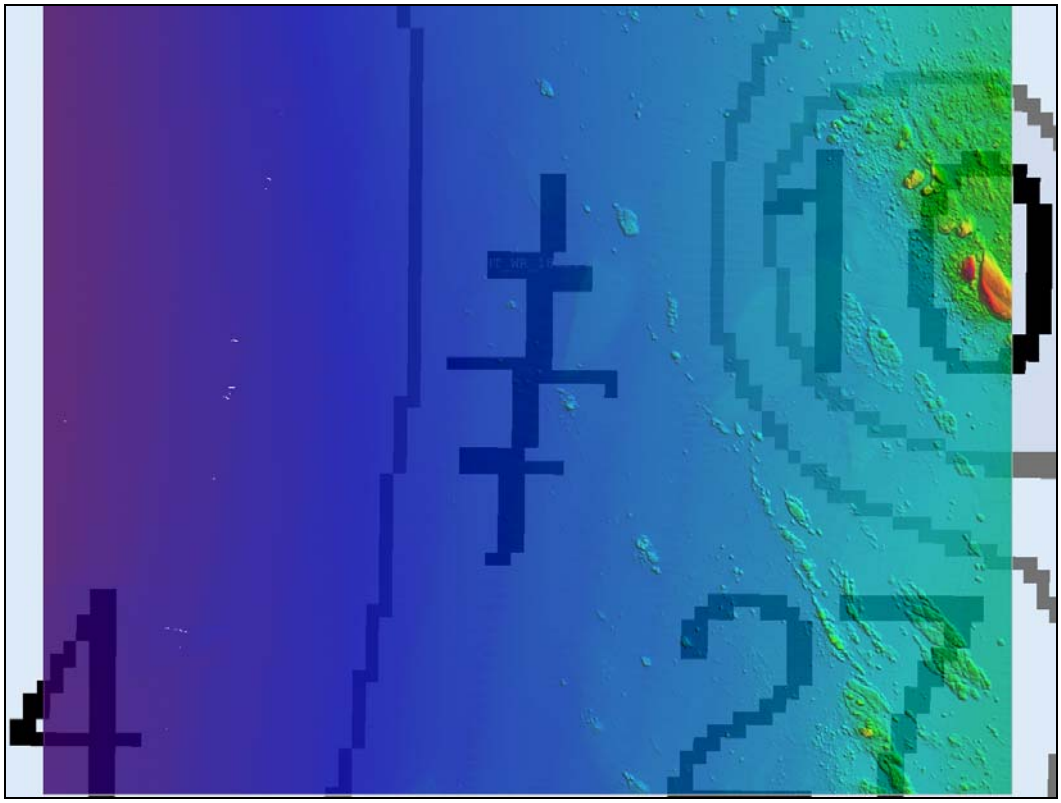

Figure 7 Charted Wreck (colored DTM)

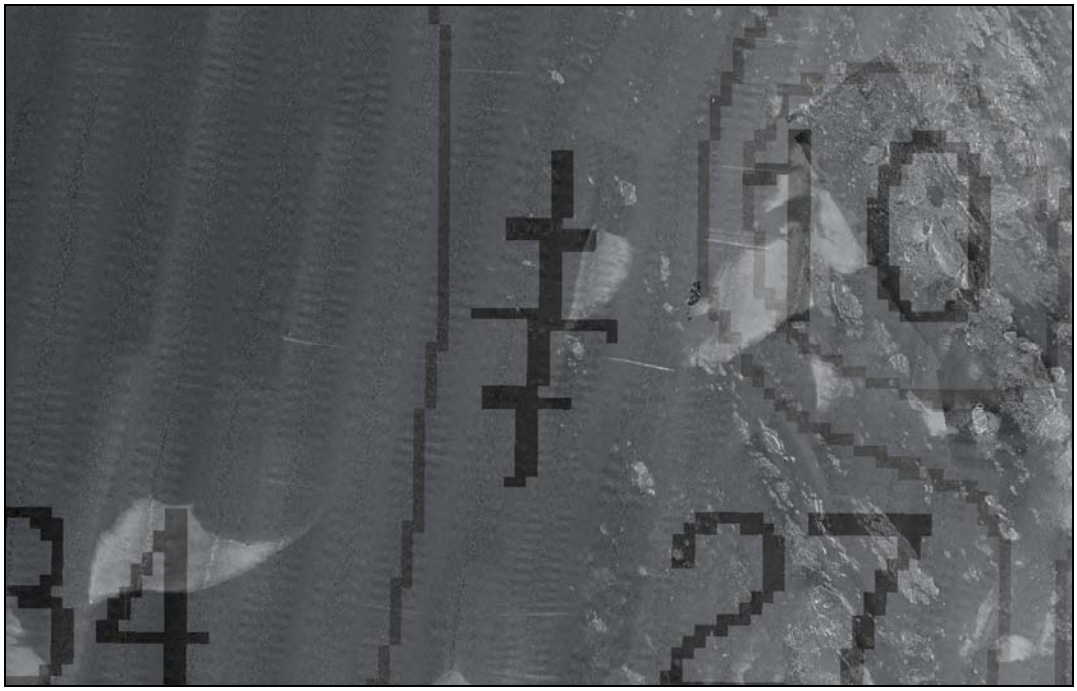

Figure 8 Charted Wreck (Backscatter)

2. The wreck charted at 38-58-12N 123-44-39W on charts 18620 and 18640 (and US3CA14M) was not found during the H11966 survey[19]. This area was surveyed with 100% multibeam coverage and contains numerous rock outcrops; making it difficult to identify a wreck if one did exist. Refer to **Figures 9** and **10** for detailed views.

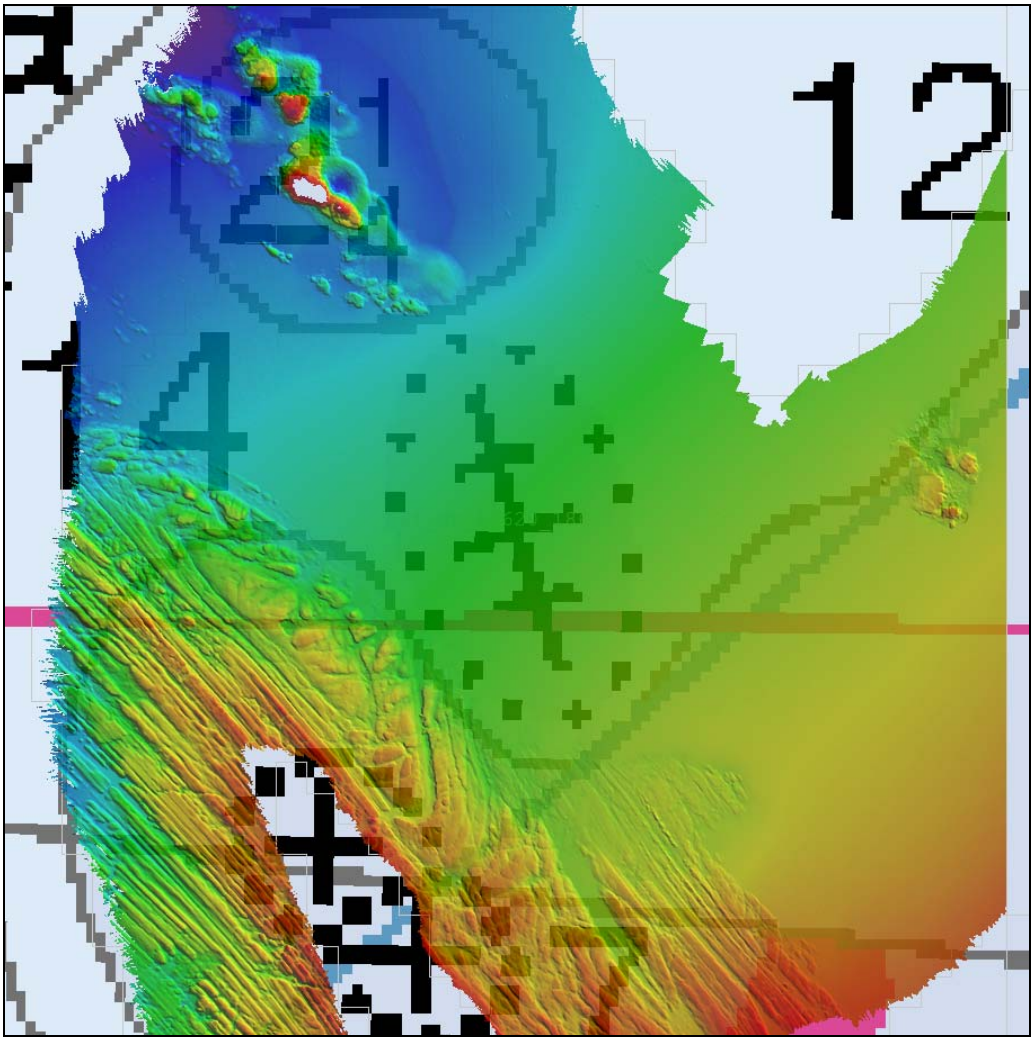

Figure 9 Charted Wreck (colored DTM)

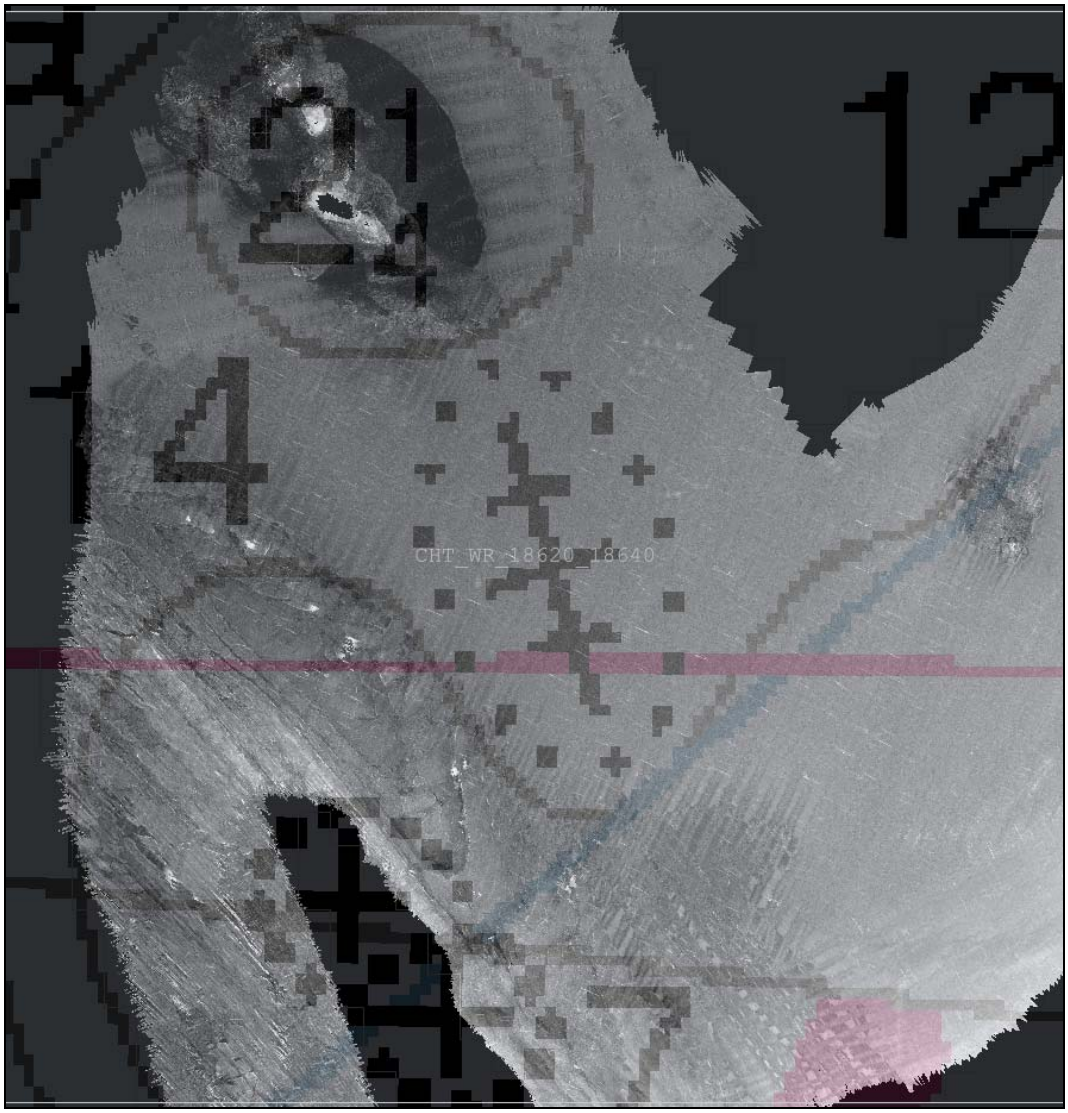

Figure 10 Charted Wreck (Backscatter)

Dangers to Navigation

No dangers to navigation were found and reported for this survey. [20]

D.2 Additional Results

None to note.

Bottom Samples

None were assigned for this sheet.[21]

Aids to Navigation [22]

No charted aids to navigation existed in the survey area.

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

E. APPROVAL SHEET

Approval Sheet

For

H11966

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

M-L906-KR-08 Statement of Work
NOS Hydrographic Surveys Specifications and Deliverables, April 2008 Edition
Fugro Pelagos, Inc. Acquisition Procedures (2009-MBES_Acquisition_Procedures_R0);
Fugro Pelagos, Inc. Processing Procedures (2009-MBES_Processing_Procedures_R0)

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

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,

David D Briggs,
Lead Hydrographer
Fugro Pelagos, Inc.
April, 13, 2010

4/13/2010

X 

David D Briggs
Lead Hydrographer

Revisions compiled during office processing and certification

[1] Concur.
[2] Concur and the Northern boundary was modified to Latitude 39-08-58.667 N Longitude 123-44-28.417W
[3] Filed with project records.
[4] Concur.
[5] Concur.
[6] Concur.
[7] Concur.
[8] Concur.
[9] Concur.
[10] Concur.
[11] Filed with project records
[12] Concur with clarification. Survey area was compared with the following charts: 18620_1 Ed., 23rd , 06/2002, 18626_1 and 18626_3 Ed., 15th ,09/2000
[13] Concur.
[14] Concur with clarification. Chart as shown in the Hcell.
[15] Concur.
[16] Concur.
[17] The string of islets located from North end Lat. 39-04-51.315N, Long. -123-42-40.279W to South end Lat. 39-03-46.015N to Long. -123-41-51.379W appears to be incorrectly charted on ENC US3CA15M. The evaluator believes the string of islets is actually a foul line with islets inside the foul line. Prior survey H0456 does not show islets in this area but does show numerous kelp symbols. The evaluator believes the area should be charted with a foul line encompassing the kelp. The evaluator recommends MCD investigate prior chart editions to verify the correct cartographic representation.
[18] Concur. It is recommended to remove 1 charted wreck from the charts at the following location 38-58-12N, 123-44-39W. Survey H11966 included 100% multibeam coverage over the wreck. For the wreck located at 39-03-58N, 123-44-00W it is recommended to retain the wreck symbol because backscatter reflects something that could be a wreck.
[19] Concur. See endnote 18.
[20] Concur.
[21] No bottom samples were collected during this survey. 8 bottom samples were imported to the Hcell from ENCs to be retained (US3CA14M and US3CA15M)
[22] Concur.

H11966 HCell Report

Fernando Ortiz, Hydrographic Contractor
Pacific Hydrographic Branch

Introduction

The primary purpose of the HCell is to provide new survey information in International Hydrographic Organization (IHO) format S-57 to update the largest scale ENCs and RNCs in the region: NOAA RNCs, 18626_3 (1:10,000), 18626_1 (1:40,000) and 18620_1 (1:200,000) corresponding NOAA ENCs, US3CA14M and US3CA15M.

HCell compilation of survey H11966 utilized Office of Coast Survey DRAFT HCell Specifications Version 4.0. For additional information on the standards and protocols used for HCell Compilation, see the DRAFT A/PHB HCell Reference Guide, version 2.0, March 17, 2010.

1. Compilation Scale

Depths and features for HCell H11966 were compiled to the largest scale chart in the region, 18626_1 (1:40,000.)

2. Soundings

A survey-scale sounding (SOUNDG) feature object layer was built from the 4-meter final surface, **H11966_Final_combined.csar** in CARIS BASE editor. A shoal-biased selection was made at 1:10,000 survey scale using a Radius Table file with values shown in the table, below. The resultant sounding layer contains depths ranging from 0.2 to 96.2 meters.

Shoal Limit (m)	Deep Limit (m)	Radius (mm)
0	10	2
10	20	3
20	50	3.5
50	500	4

In CARIS BASE Editor Soundings were manually selected from the high density sounding layers and imported into a new layer created to accommodate chart density depths. Manual selection was used to accomplish a density and distribution that closely represents the seafloor morphology.

3. Depth Contours

Depth contours at the intervals on the largest scale chart are included in the H11966_SS HCell for MCD raster charting division to use for guidance in creating chart contours. The metric and fathom equivalent contour values are shown in the table below.

Chart Contour Intervals in Fathoms from Chart 18626_1,18626_3 18620_1	Metric Equivalent to Chart Fathoms, Arithmetically Rounded	Metric Equivalent of Chart Fathoms, with NOAA Rounding Applied	Fathoms with NOAA Rounding Applied	Fathoms with NOAA Rounding Removed for Display on H11966_SS.000
3	5.4864	5.715	3.125	3
10	18.288	18.517	10.125	10
20	36.576	37.948	20.750	20
30	54.864	56.236	30.750	30
40	73.152	74.524	40.750	40
50	91.44	92.8116	50.750	50

Contours in the H11966_SS file, have not been deconflicted against shoreline features, soundings and hydrography, as all other features in the H11966_CS file and soundings in the H11966_SS have been. This may result in conflicts between the H11966_SS file contours and HCell features at or near the survey limits. Conflicts with M_QUAL and SBDARE objects should be expected. HCell features should be honored over H11966_SS.000 file contours in all cases where conflicts are found.

4. Meta Areas

The following Meta object areas are included in HCell H11966:

M_QUAL
M_CSCL

Meta area objects were constructed on the basis of the limits of the hydrography.

5. Features

5.1 Generalization of Features to Chart Scale

Features addressed by the field unit are delivered to PHB where they are deconflicted against the hydrography and the largest scale chart. These features, as well as features to be retained from the chart and features digitized from the Base surface are included in the HCell. The geometry of these features is modified to emulate chart scale.

Feature generalization to emulate chart scale is accomplished primarily through reduction in the number of features included in the HCell, and in some cases generalizing area features to point objects. Some instances of reduction of area features to point objects are entrusted to the RNC division, for example rocky seabed areas that will display as point features on the RNC. Where line and area objects are included in the HCell, complexity of the lines and edges comprising the features have been smoothed to commensurate with chart scale.

5.2 Compilation of Features to the HCell

Shoreline features for H11966 were delivered from the field in one hob file defining new features, modification to charted features and disapprovals. These features were deconflicted against the chart and hydrography during office processing.

During office processing, one rock awash, two obstruction areas, and five rocky seabed areas were digitized from the high resolution BASE Surfaces.

The source of all features included in the H11966 HCell can be determined by the SORIND field.

6. S-57 Objects and Attributes

The *_CS HCell contains the following Objects:

$CSYMB	Blue Notes
M_QUAL	Data quality Meta object
M_CSCL	Compilation scale of the data
SBDARE	Rocky seabed areas and bottom samples
SOUNDG	Soundings at the chart scale density
UWTROC	Rock features

The *_SS HCell contains the following Objects:

DEPCNT	Generalized contours at chart scale intervals
SOUNDG	Soundings at the survey scale density

All S-57 Feature Objects in the H11966_CS Hcells have been attributed as fully as possible based on information provided by the Hydrographer and in accordance with current guidance and the OCS HCell Specifications.

7. Blue Notes

Notes to the RNC and ENC chart compilers are included in the HCell as $CSYMB features with the Blue Note information located in the NINFOM field.

8. Spatial Framework

8.1 Coordinate System

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

8.2 Horizontal and Vertical Units

DUNI, HUNI and PUNI are used to define units for depth, height and horizontal position in the chart units HCell, as shown below.

Chart Unit Base Cell Units:

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

During creation of the HCell in CARIS BASE Editor and CARIS S-57 Composer, all soundings and features are maintained in metric units with as high precision as possible. Depth units for

soundings measured with sonar maintain millimeter precision. Depths on rocks above MLLW and heights on islets above MHW are typically measured with range finder, so precision is less. Units and precision are shown below.

BASE Editor and S-57 Composer Units:

Sounding Units:	Meters rounded to the nearest millimeter
Spot Height Units:	Meters rounded to the nearest decimeter

Conversion to charting units and application of NOAA rounding is completed in the same step, at the end of the HCell compilation process.

Conversion to fathoms and feet charting units with NOAA rounding ensures that:

- All depths deeper or equal to 11 fathoms display as whole fathoms.
- All depth units between 0 fathoms (MLLW) and 11 fathoms display as fathoms and whole feet.
- All depth units above 0 fathoms (MLLW) to 2.0 feet above MHW display in feet for values that round to 5 feet or less, and in fathoms and feet above that. (This is a deviation from the traditional 'fathoms and feet' charting rule that requires that all depths above MLLW will be shown in feet. The display in fathoms and feet for depths between MLLW and 2 feet above MHW accommodates S-57 rules that require the same charting units to be used for all depth units (DUNI) in an ENC.)
- All height units (HUNI) which have been converted to charting units, and that are 2.00 feet above MHW and greater, are shown in feet.

In an ENC viewer fathoms and feet depth units (DUNI) display in the format X.YZZZ, where X is fathoms, Y is feet, and ZZZ is decimals of the foot. In an ENC viewer, heights (HUNI) display as whole feet.

9. Data Processing Notes

9.1 Junction with H11966

Survey H11966 junctions with H11967 to the North. A common junction was not made between H11967 as the survey has not completed the SAR process at this time. The northern extent of H11966 should supersede H11967 in the common area

10. QA/QC and ENC Validation Checks

H11966 was subjected to QA checks in S-57 Composer prior to exporting to the metric HCell base cell (000) file. The millimeter precision metric S-57 HCell was converted to chart units and NOAA rounding applied. dKart Inspector was then used to further check the data set for conformity with the S-58 ver. 2 standard (formerly Appendix B.1 Annex C of the S-57 standard). All tests were run and warnings and errors investigated and corrected unless they are MCD approved as inherent to and acceptable for HCells.

11. Products

11.1 HSD, MCD and CGTP Deliverables

H11966_CS.000	Base Cell File, Chart Units, Soundings and features compiled to 1:10,000
H11966_SS.000	Base Cell File, Chart Units, Soundings and Contours compiled to 1:10,000
H11966_DR.pdf	Descriptive Report including end notes compiled during office processing and certification, the HCell Report, and supplemental items
H11966.gml, xsd	Survey outline to populate SURDEX

11.3 Software

CARIS HIPS Ver. 7.0	Inspection of Combined BASE Surfaces
CARIS BASE Editor Ver. 2.3	Creation of soundings and bathy-derived features, meta area objects, and Blue Notes; Survey evaluation and verification; Initial HCell assembly.
CARIS S-57 Composer Ver. 2.1	Final compilation of the HCell, correct geometry and build topology, apply final attributes, export the HCell, and QA.
CARIS GIS 4.4a	Setting the sounding rounding variable for conversion of the metric HCell to NOAA charting units with NOAA rounding.
CARIS HOM Ver. 3.3	Perform conversion of the metric HCell to NOAA charting units with NOAA rounding.
HydroService AS, dKart Inspector Ver. 5. SP1	Validation of the base cell file.
Newport Systems, Inc., Fugawi View ENC Ver.1.0.0.3	Independent inspection of final HCells using a COTS viewer.

12. Contacts

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

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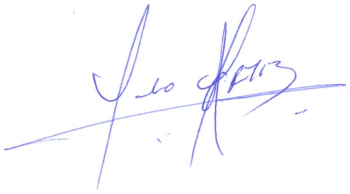
Seattle, WA
206-526-6883
Fernando.ortiz@noaa.gov

APPROVAL SHEET
H11966

Initial Approvals:

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



Fernando Ortiz
2010.07.06
09:54:23 -07'00'

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.

Digitally signed by Pete Holmberg
DN: cn=Pete Holmberg, o=NOAA, ou=PHB, email=peter.holmberg@noaa.gov, c=US
Date: 2010.07.06 13:17:55 -07'00'

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.

Gary C. Nelson
2010.07.06
09:58:16 -07'00'

Digitally signed by David Scharff
DN: cn=David Scharff, o=OCS, ou=NOAA, email=david.scharff@noaa.gov, c=US
Reason: AWOIS and Surf Check complete
Date: 2010.07.07 15:41:46 -04'00'