H11965

NOAA FORM 76-35A

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

DESCRIPTIVE REPORT

Type of Survey Hydrographic Survey

Field No. N/A

Registry No. H11965

LOCALITY

State California

General Locality Pacific Ocean - Northern California

Sublocality Farallon Islands

2009

CHIEF OF PARTY

Dean Moyles

LIBRARY & ARCHIVES

DATE

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

HYDROGRAPHIC TITLE SHEET

REGISTRY No

H11965

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 **Farallon Islands**

Scale **N/A** Date of Survey **August 3 to August 9, 2009**

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

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

Chief of party **Dean Moyles**

Surveyed by **Moyles, Briggs, Farley, Reynolds, Cain, Lydon, Rokyta, Goodall, Lopez, Tixier, et al.**

Soundings by **RESON SEABAT 7125 HULL MOUNTED**

SAR by **Keith Toepfer** Compilation by **Keith Toepfer**

Soundings compiled in **Fathoms**

REMARKS: **All times are UTC. UTM Projection 10N**

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

H11965 (Sheet AU) is located near the Farallon Islands, California. It is bound by the coordinates listed in **Table 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 3, 2009 and ended on August 9, 2009.

Table 1 – Sheet Bounds

Point	Latitude (North)	Longitude (West)
1	37-49-59	123-11-19
2	37-49-59	122-55-42
3	37-37-42	122-55-42
4	37-37-42	123-11-19
5	37-49-59	123-11-19

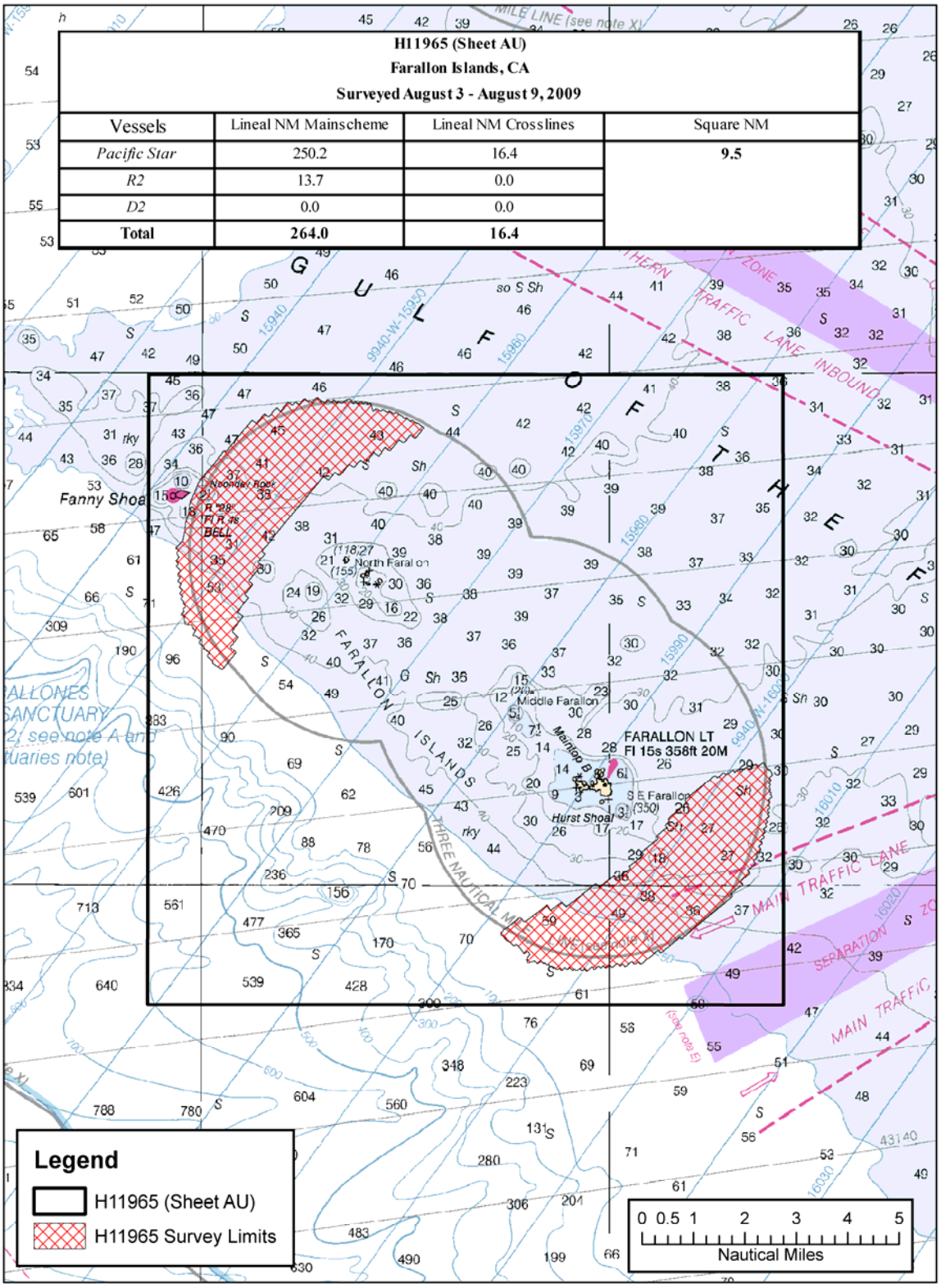

Figure 1 H11965 Area Surveyed

B. DATA ACQUISITION AND PROCESSING

Refer to the M-L906-KR-08 Data Acquisition and Processing Report[1] 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/V R2 and F/V Pacific Star acquired all sounding data for H11965.

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 R2, a Pacific Star launch, is 29 feet in length with a draft of 3 feet. R2 was equipped with a Reson Seabat 7125 (400/200 kHz dual frequency) multibeam sonar for the H11965 project. The vessel was also equipped with two AML sound velocity and pressure sensors (SV&P) for sound velocity profiles, and an Applanix (POS MV) 320 V4 for vessel attitude and position. All 7125 multibeam data files were logged in the S7K format using WinFrog Multibeam v 3.08.44.04.

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 16.4 nautical miles or 6.2 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. 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.[2] 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.[3] **Figure 2** (below) provides an example. Note: Main scheme lines shown in green and crosslines in yellow.

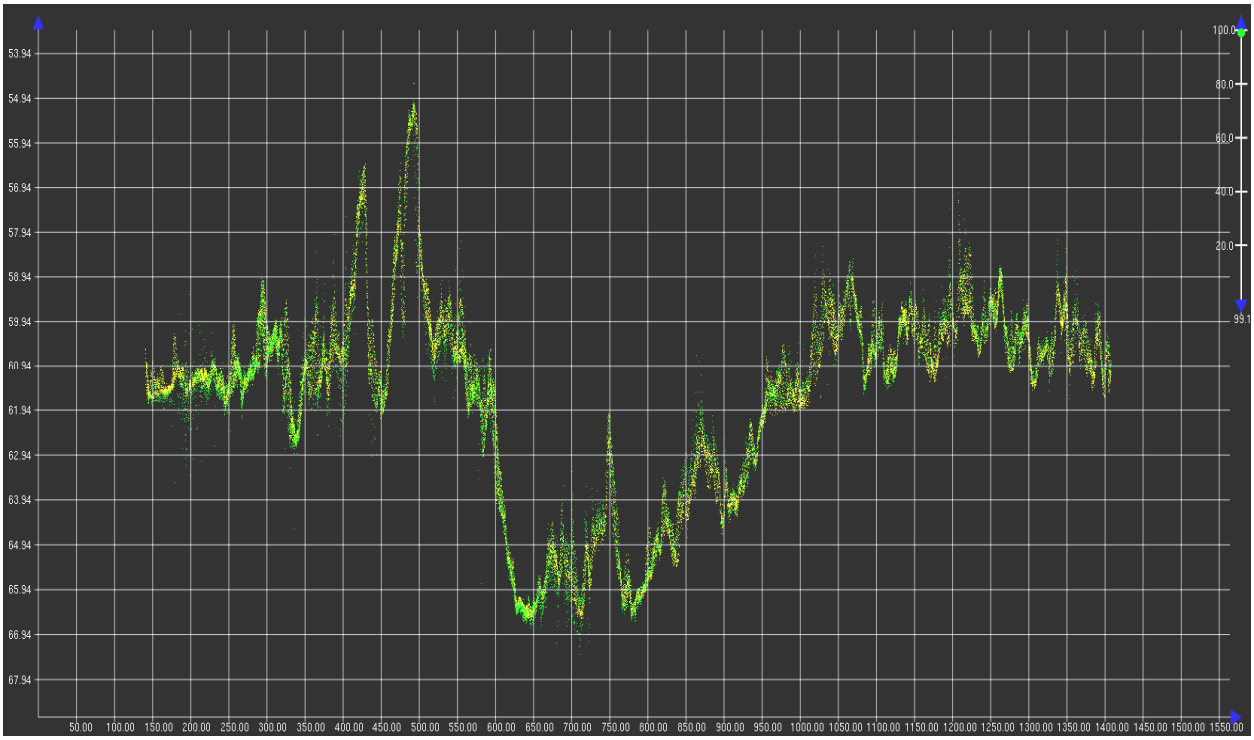

Figure 2 Profile of 2AU01-TIE04

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 H11965 had uncertainty values of 0.35 m to 0.60 m, which met project specifications.[4]

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.

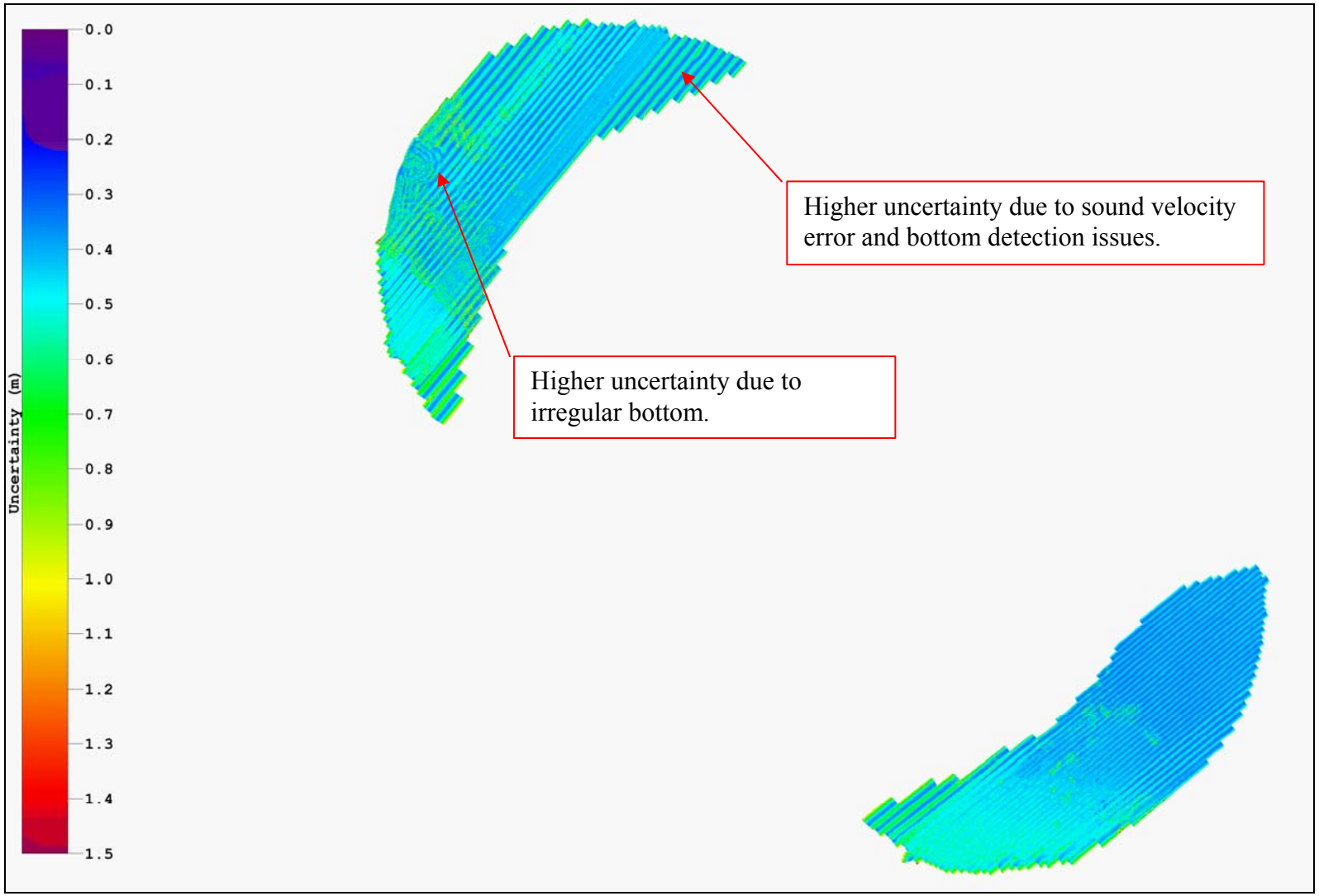

Figure 3 Uncertainty DTM

Survey Junctions

H11965 (Sheet AU) does not junction with any other surveys.[5]

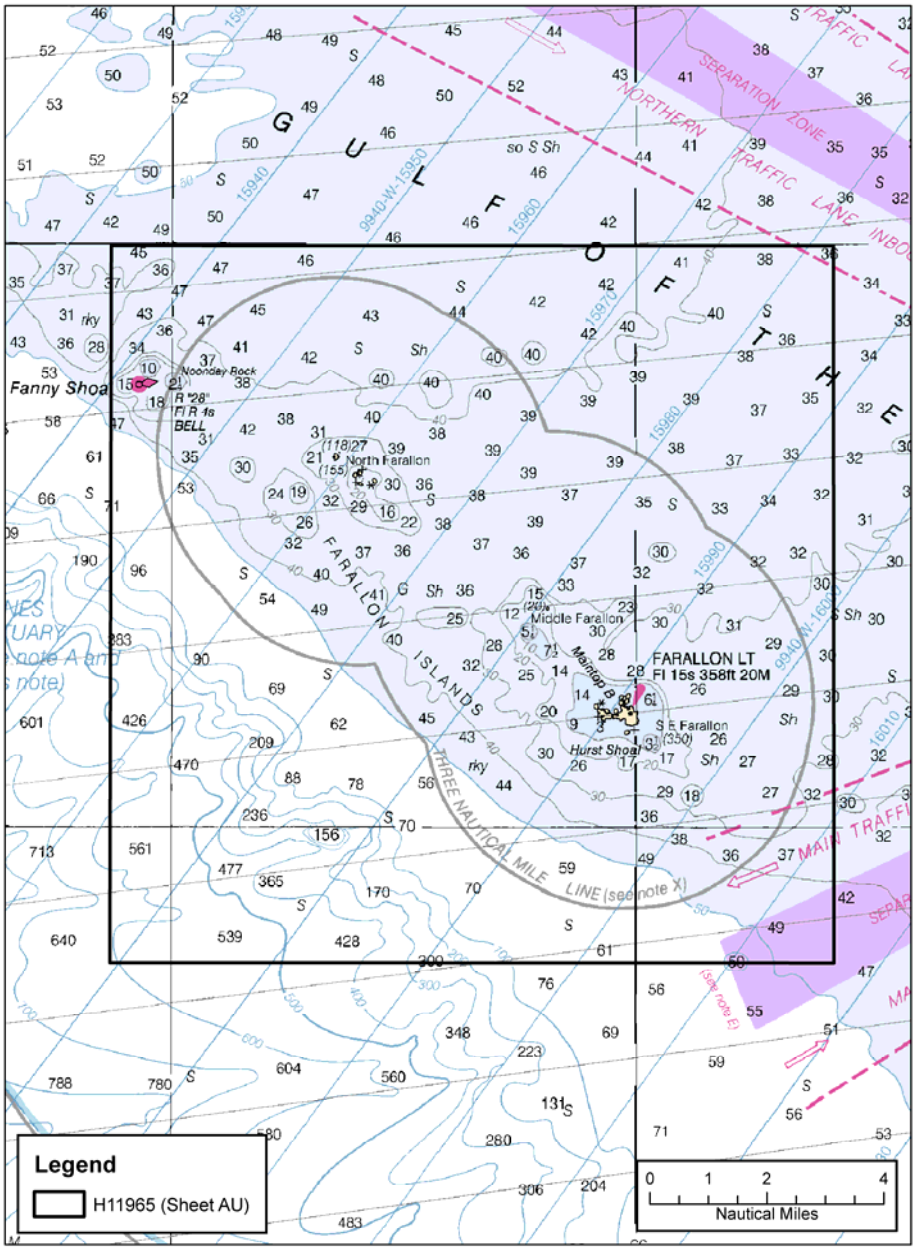

Figure 4 H11965 Survey Junctions

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 5** below). Average difference was -0.252 m; median difference was -0.26 m, with a standard deviation of 0.052 m. Therefore, the GPSTide surface was about 25 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.

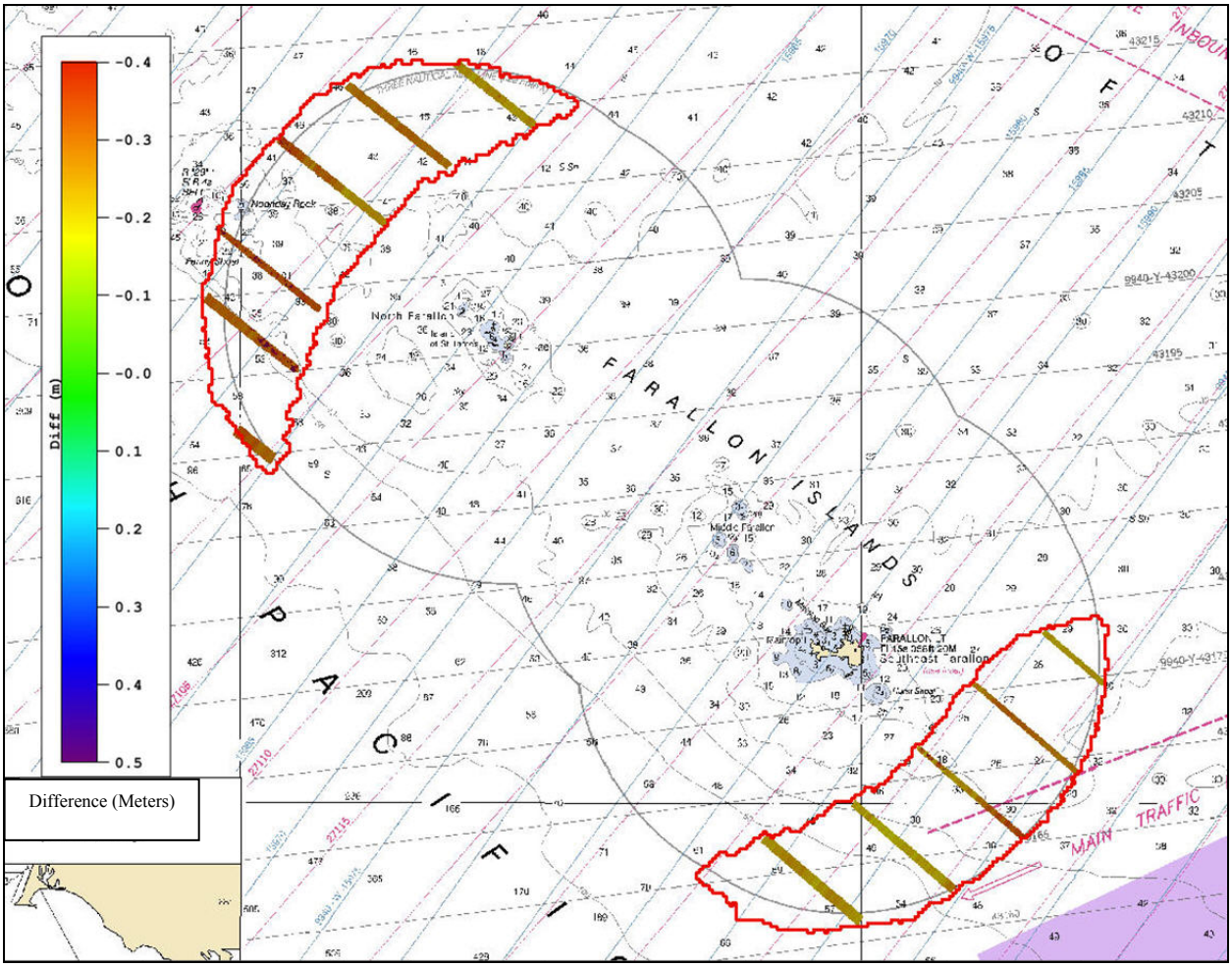

Figure 5 H11965 Difference Surface (Tidal minus GPSTide)

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.[6]

Data Quality

In general, the multibeam data quality for H11965 was good. Two 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.[7]

Vessel R2 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.[8]

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 by maximizing swath overlap. These variables were adjusted in real-time by the onboard 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 H11965 is called “H11965_(Sheet_AU)” and it contains five BASE surfaces. The following parameters[9] were used:

0-33 meters: 1 m resolution, name “H11965_1m_Final”
30-45 meters: 1.5 m resolution, name “H11965_1_5m_Final”
40-84 meters: 2 m resolution, name “H11965_2m_Final”

80-100 meters: 4 m resolution, name “H11965_4m_Final”
90-250 meters: 5 m resolution, name “H11965_5m_Final”

Notes:

- Maximum depth was approximately 120 m; therefore resolutions coarser than 5 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 “H11965\CARIS\Fieldsheets\” directory.

The final S57 file for this project is called “H11965_S57_Features.000”.[10] 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 the 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

H11965 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 H11965 soundings is noted. A more detailed comparison was undertaken for any charted shoals or other dangerous features.

Agreement between the H11965 BASE surface depths and the charted soundings for all applicable ENC and Raster charts was within +/- 1 to 2 fathoms. 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.

The Hydrographer recommends that soundings within the survey limits of H11965 supersede all prior survey and charted depths.[12]

A feature strongly resembling a wreck is apparent in the BASE surface at 37-40-11.69N, 122-56-39.75W in approximately 56.5 meters of water. The 51-meter long and 5m high feature appears to have the overall shape of a ship. This feature is not charted. Recommend charting wreck as depicted in the S-57 Feature File.[13]

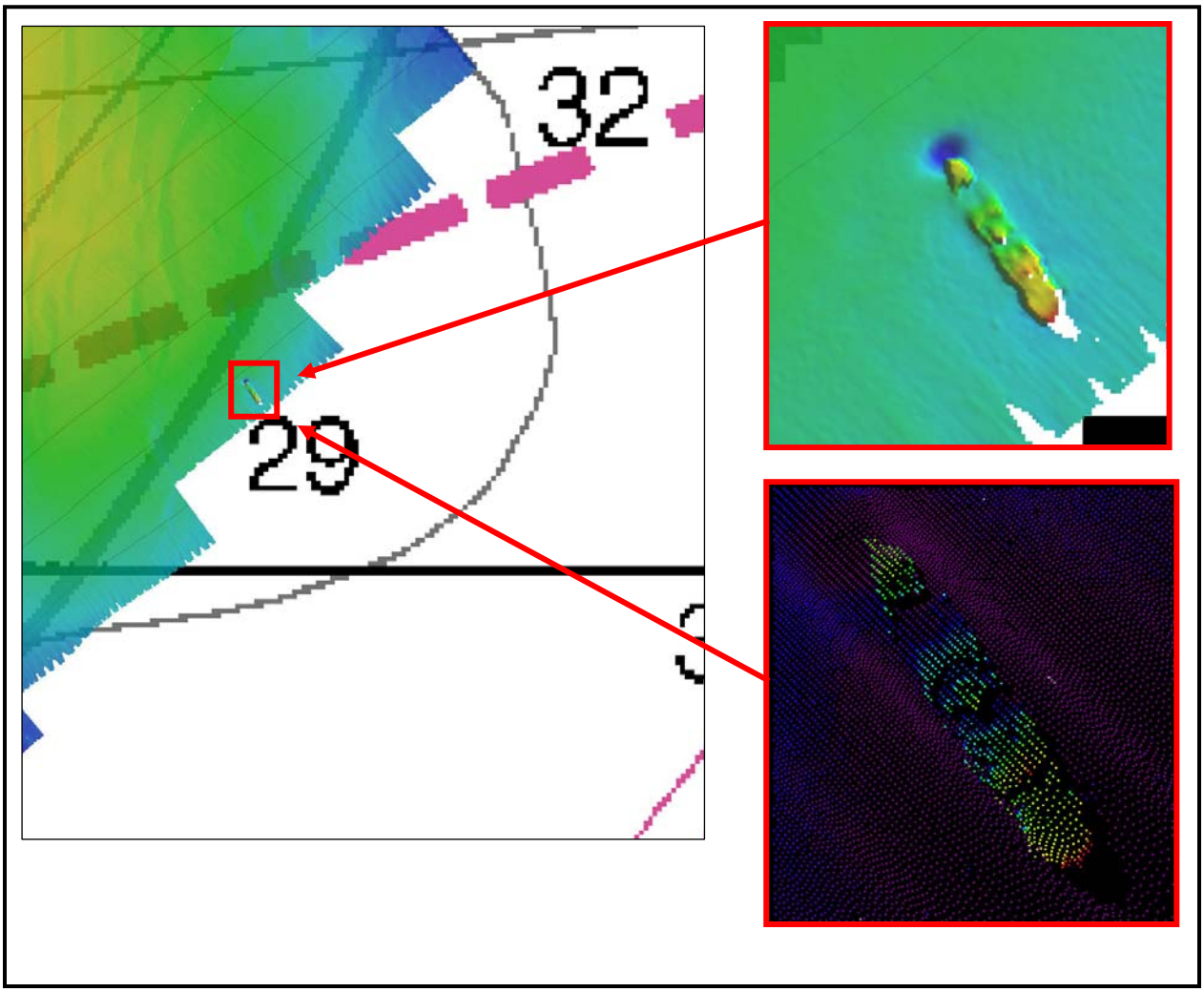

Figure 6: 1 m resolution multibeam surface of uncharted wreck.

Automated Wreck and Obstruction Information System

There were no AWOIS items assigned to H11965.[14]

Charted Features

There were no charted features labeled ED, PD, or PA within the limits of H11965.[15]

Dangers to Navigation

No dangers to navigation were found and reported for this survey.[16]

D.2 Additional Results

None to note.

Bottom Samples

None were assigned for this sheet.[17]

Aids to Navigation

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

H11965

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.[18]

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 16, 2010

X

David D Briggs
Lead Hydrographer

Revisions Compiled During Office Processing and Certification

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[1] Filed with the Project records.
[2] Concur.
[3] Concur.
[4] Concur.
[5] Concur.
[6] Concur with clarification. Submission of GPS tides using VDatum was coordinated in advance with the concurrence of PHB via an exchange of emails (not attached to this report).
[7] Concur.
[8] Concur.
[9] Concur with clarification. The selection of a finest BASE surface resolution of 1 meter was the result of coordination with, and concurrence by PHB via an exchange of emails (not attached to this report).
[10] Features included in H11965_S57_Features.000 were imported into H11965_CS.000.
[11] Filed with the Project records.
[12] Concur.
[13] Concur with clarification. The wreck should be charted and considered for inclusion in the AWOIS Database.
[14] Concur.
[15] Concur.
[16] Concur.
[17] Concur, with clarification. No bottom samples in the survey area are to be retained.
[18] Concur.

Andy Orthmann

From: Crescent Moegling [Crescent.Moegling@noaa.gov]
Sent: Tuesday, July 08, 2008 9:10 AM
To: Ed Saade
Cc: Andy Orthmann; Bob Richards; Jeffrey Ferguson
Subject: Re: data transfer

Ed,

To further clarify, Fugro will only send raw data to NGDC, no other products or data types such as processed data, BAGs, etc.

Crescent

Ed Saade wrote:
Andy;

Just a note to confirm that when I met with NOAA in late June, Jeff indicated we plan to only send the master copy of the NOAA portion of the California data set directly to NGDC. You will not need to duplicate this data to your regulasr channels at Sand Point.

Regards;

Ed

--
Crescent Moegling
NOAA Hydrographic Surveys Division
Branch Chief - Data Acquisition Control
301.713.2700 x111

Andy Orthmann

From: David.Scharff [David.Scharff@noaa.gov]
Sent: Tuesday, November 04, 2008 12:06 PM
To: Andy Orthmann
Subject: Re: svp calibrations f/ California
Attachments: David_Scharff.vcf

Andy,

I would recommend simply treating it as a single survey. You could always run a final calibration check towards the end of the project as a check, but you are correct this is technically one continuous survey.

Dave

Andy Orthmann wrote:
>
> Dave,
>
> We haven't had a continuous project quite as long as this one so the
> subject of sound velocity profiler calibrations has come up.
>
> The specs and deliverables say that all profilers shall be calibrated
> within six months prior to the start of survey operations, and
> re-calibrated at an interval no greater then 12 months until survey
> completion.
>
> For purposes of SVP calibration, will California be considered three
> separate surveys, or one single survey? We would argue that since ops
> have been continuous since survey operations began that it is
> effectively the same survey despite it being broken up for
> administrative purposes into three separate ops.
>
> Thanks a lot,
>
> Andy Orthmann
>
> Fugro Pelagos, Inc.
>

Dean Moyles

From: Crescent Moegling [Crescent.Moegling@noaa.gov]
Sent: Friday, November 13, 2009 11:34 AM
To: Dean Moyles
Subject: CARIS 7.0

Hi Dean,

Sorry I just missed your call. We can accept the CSAR format for future submissions to PHB.

--
Crescent Moegling
Hydrographic Team Lead
Pacific Hydrographic Branch
206.526.6840

Dean Moyles

From: Gary Nelson [Gary.Nelson@noaa.gov]
Sent: Tuesday, September 15, 2009 8:08 AM
To: Crescent.Moegling@noaa.gov; Dean Moyles
Subject: Re: Fugro question about a dynamic seafloor

Crescent,

We always try to capture the shoalest depths within the survey. These dynamic changes are common in the Columbia River and Cook Inlet.

Gary
> Gary,
>
> Dean Moyles was inquiring about an area in their CA survey where the
> seafloor is quite dynamic and upon the return to a particular area it
> is much deeper than when previously surveyed. I know we've struggled
> with this on a recent Columbia River survey but it was the opposite
> where it was much shoaler than previously noted. Should Fugro submit
> the surfaces to be more conservative (shoaler) or go with the most
> current and accurate (deeper) depiction of the seafloor?
>
> Thanks for your guidance.
>

H11965 HCell Report

Keith H. Toepfer, Physical Scientist
Pacific Hydrographic Branch

1. Specifications, Standards and Guidance Used in HCell Compilation

HCell compilation of survey H11965 used:

Office of Coast Survey HCell Specifications: Draft, Version: 4.0, 17 March 2010.
HCell Reference Guide: Version 2.0, 30 June 2010.

2. Compilation Scale

Depths and features for HCell H11965 were compiled to the largest scale raster chart shown below:

Chart	Scale	Edition	Edition Date	NTM Date
18645	1:100,000	26th	09/01/2008	05/01/2010

The following ENC was also used during compilation:

Chart	Scale
US2WC12M	1:1,200,000

3. Soundings

A survey-scale sounding (SOUNDG) feature object layer was built from the 5-meter Combined Surface in CARIS BASE Editor. A shoal-biased selection was made at 1:20,000 survey scale using a Radius Table file with values shown in the table, below.

Shoal Limit (m)	Deep Limit (m)	Radius (mm)
0	10	3
10	20	4
20	50	4.5
50	500	5

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

4. Depth Contours

Depth contours at the intervals on the largest scale chart are included in the H11965_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 11965	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 H11965_SS.000
6	10.9728	11.2014	6.125	6
10	18.288	18.5166	10.750	10
20	36.576	37.9476	20.750	20
30	54.864	56.2356	30.750	30
40	73.152	74.5236	40.750	40
50	91.44	92.8116	50.750	50

5. Meta Areas

The following Meta object areas are included in HCell H11965:

M_QUAL

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

6. Features

Features addressed by the field units 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 may be modified to emulate chart scale per the HCell Reference Guide on compiling features to the chart scale HCell.

7. S-57 Objects and Attributes

The H11965_CS HCell contains the following Objects:

$CSYMB	Blue Notes-Notes to the MCD chart Compiler
M_QUAL	Data quality Meta object
SBDARE	Rocky seabed areas
SOUNDG	Soundings at the chart scale density
WRECKS	Wrecks
UWTROC	Underwater rocks

The H11965_SS HCell contains the following Objects:

DEPCNT	Contours at chart scale intervals
SOUNDG	Soundings at the survey scale density

8. Spatial Framework

8.1 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.

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

See the HCell Reference Guide for details of conversion from metric to charting units, and application of NOAA rounding.

9. Data Processing Notes

There were no significant deviations from the standards and protocols given in the HCell Specification and HCell Reference Guide.

10. QA/QC and ENC Validation Checks

H11965 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

H11965_CS.000	Base Cell File, Chart Units, Soundings and features compiled to 1:100,000
H11965 _SS.000	Base Cell File, Chart Units, Soundings and Contours compiled to 1:20,000
H11965 _DR.pdf	Descriptive Report including end notes compiled during office processing and certification, the HCell Report, and supplemental items
H11965 _outline.gml	Survey outline
H11965 _outline.xsd	Survey outline

11.2 Software

CARIS HIPS Ver. 6.2	Inspection of Combined BASE Surfaces
CARIS BASE Editor Ver. 2.3	Creation of soundings and bathy-derived features, creation of the depth area, 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. 5.1, SP 1	Validation of the base cell file.
Northport 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:

Keith H. Toepfer
Physical Scientist
Pacific Hydrographic Branch
Seattle, WA
206-526-6877
Keith.Toepfer@noaa.gov.

APPROVAL SHEET
H11965

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.

Keith H. Toepfer

Digitally signed by Keith H. Toepfer
DN: cn=Keith H. Toepfer, o=NOAA, ou=NOS/OCS/HSD/PHB, email=keith.toepfer@noaa.gov, c=US
Date: 2010.08.27 14:56:48 -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: 2010.08.31 10:52:24 -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
2010.08.31
10:38:34 -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: 2010.09.03 08:33:46 -04'00'