H12111

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. OPR-L430-KR-09

Registry No. H12111

LOCALITY

State California

General Locality Gulf of the Farallones

Sublocality Vicinity of Bolinas Bay

2010

CHIEF OF PARTY

DAVID D BRIGGS

LIBRARY & ARCHIVES

DATE

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

HYDROGRAPHIC TITLE SHEET

REGISTRY No

H12111

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 Gulf of the Farallones

Sub-Locality Vicinity of Bolinas Bay

Scale 1:10,000 **Date of Survey** 06/14/09 – 08/04/09

Instructions dated December 2008 **Project No.** OPR-L430-KR-09

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

Chief of party DAVID D. BRIGGS

Surveyed by REYNOLDS, MOYLES, FARLEY, ROKYTA, LYDON, LOPEZ, BARROW, TIXIER, et al.

Soundings by PACIFIC STAR & R2, RESON SEABAT 7125, D2 RESON SEABAT 8125

SAR by Adam Argento Compilation by Martha Herzog

Soundings compiled in Feet

REMARKS: All times are UTC. UTM Zone 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.

All pertinent records for this survey, including the Descriptive Report, are archived at the National Geophysical Data Center (NGDC) and can be retrieved via http://www.ngdc.noaa.gov/.

A. AREA SURVEYED

H12111 (Sheet C) is located in the vicinity of Bolinas Bay. It is bound by the coordinates listed in **Table 1** and shown in **Figure 1.**

Hydrographic data collection began on June 14, 2009 and ended on August 4, 2009.

Table 1 – Sheet Bounds

Point	Latitude (North)	Longitude (West)
1	37-53-11	122-43-18
2	37-46-47	122-38-48
3	37-49-40	122-32-05
4	37-56-07	122-36-38

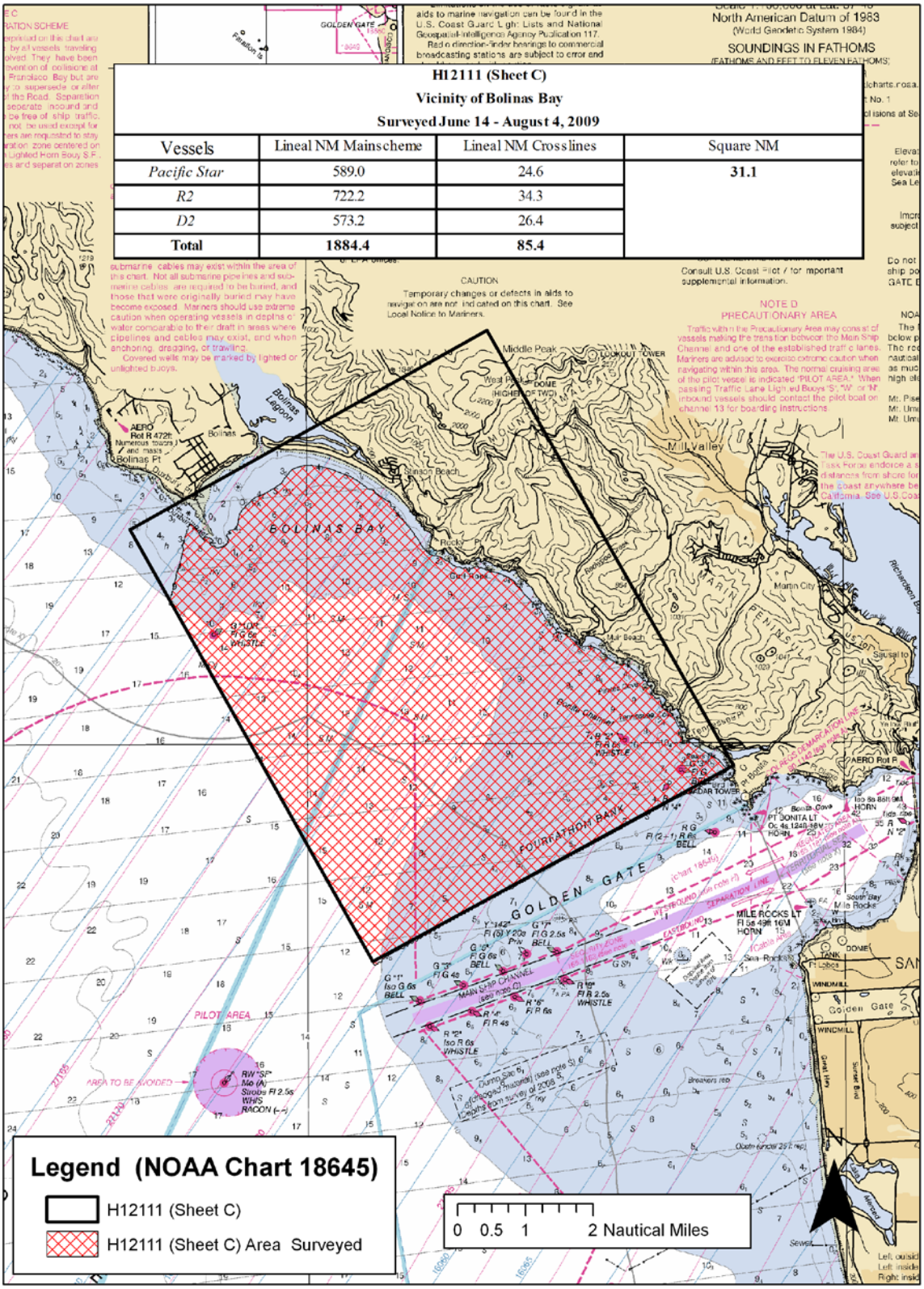

Figure 1 H12111 Area Surveyed

B. DATA ACQUISITION AND PROCESSING

Refer to the OPR-L430-KR-09 Data Acquisition and Processing Report 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 (with launches R2 and D2) acquired all sounding data for H12111.

F/V Pacific Star, 162 feet in length with a draft of 16 feet, was equipped with a hull mounted Reson SeaBat 7125 dual-frequency multibeam echosounder system for the OPR-L430-KR-09 survey. All 7125 multibeam data files were logged in the S7K format using WinFrog Multibeam v 3.08.44.04. The vessel was 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.

R/V R2, a Pacific Star launch, is 29 feet in length with a draft of 3 feet. For this survey, R2 was equipped with a hull mounted Reson SeaBat 7125 dual-frequency multibeam echosounder system. All 7125 multibeam data files were logged in the S7K format using WinFrog Multibeam v 3.08.44.04. R2 was equipped with two AML sound velocity and pressure sensors (SV&P) for sound velocity profiles, and vessel attitude and position were measured using an Applanix Position and Orientation System for Marine Vessels (POS MV) 320 V4.

R/V D2, a Pacific Star launch, is 29 feet in length with a draft of 3 feet. D2 is outfitted and configured in a manner similar to R/V R2. For this survey, D2 was equipped with a Reson Seabat 8125 (455 kHz frequency) multibeam echosounder system. Multibeam data files were logged in the XTF format using WinFrog Multibeam v 3.08.44.04. D2 was equipped with two AML sound velocity and pressure sensors (SV&P) for sound velocity profiles, and vessel attitude and position were measured using an Applanix Position and Orientation System for Marine Vessels (POS MV) 320 V4.

Refer to OPR-L430-KR-09 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 85.4 nautical miles or 4.5 percent of the total main scheme line length. Each crossline was compared to a 2m CUBE, using the CARIS HIPS QC report routine and all beams passed at 95 percent confidence level or better with the exception of line5C01-TIE007.[1] Results are located in Separate IV.

Line 5C01-TIE007 was logged in an area of steep slopes and significant rock ledges. The line was compared to a 1 m surface, but due to the dynamic topography of the bottom, the line still fell just below the desired 95% confidence level. Good conformity was still seen between the main scheme lines and crossline **(Figure 2)**.[2]

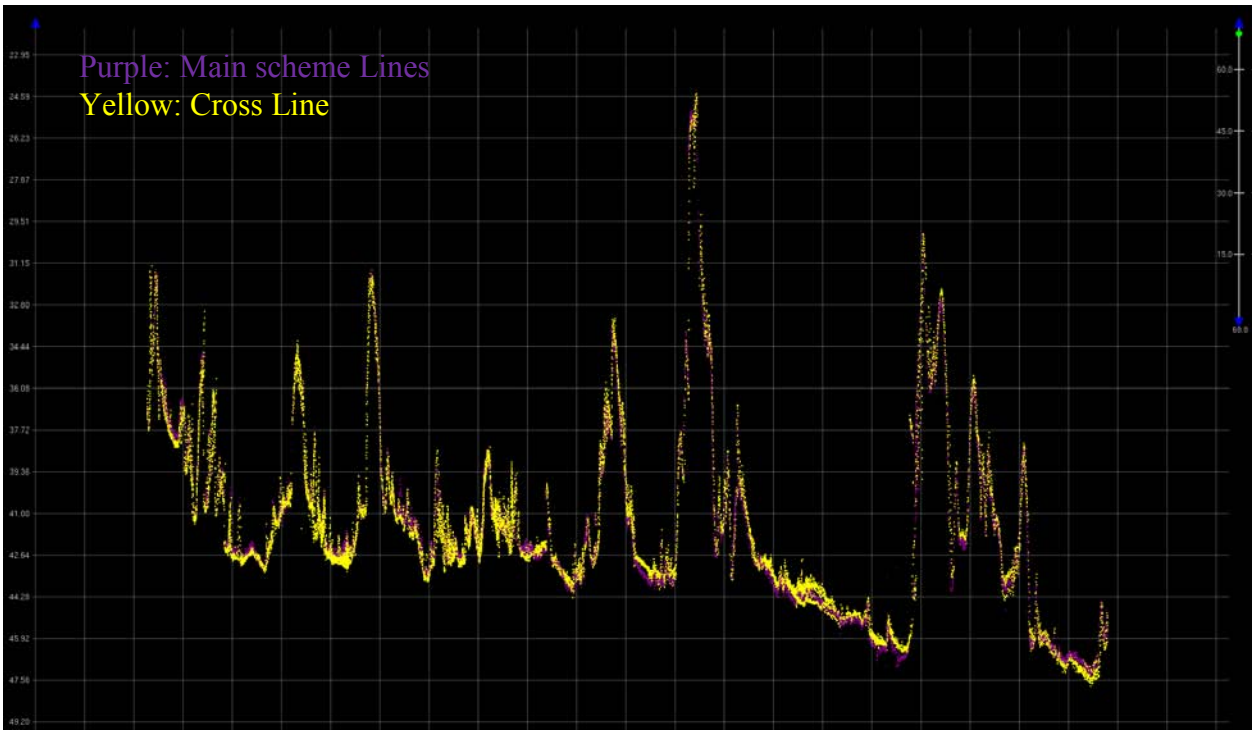

Figure 2 5C01-TIE007

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

Where, a=0.5 and b=0.013, d=depth

Uncertainty Values

The majority of H12111 had uncertainty values of 0.31 m to 0.38 m, which met project specifications (**Figure 3**).[3]

As seen in the uncertainty surface graphic, uncertainty values are generally lowest near the sonar nadir beams and increase toward the outside of each swath. This is expected and primarily a result of sound velocity error and higher bottom detection uncertainty.

Areas of higher uncertainty include sound velocity error and static draft busts. Other areas of higher uncertainty include irregular bottom topography and rock outcrops.

Oscillations found in the along-track and across-track uncertainty values are a result of vessel pitch and roll and are more pronounced during times of heavy weather.

A slight difference in uncertainty values between survey platforms is apparent in the uncertainty surface.

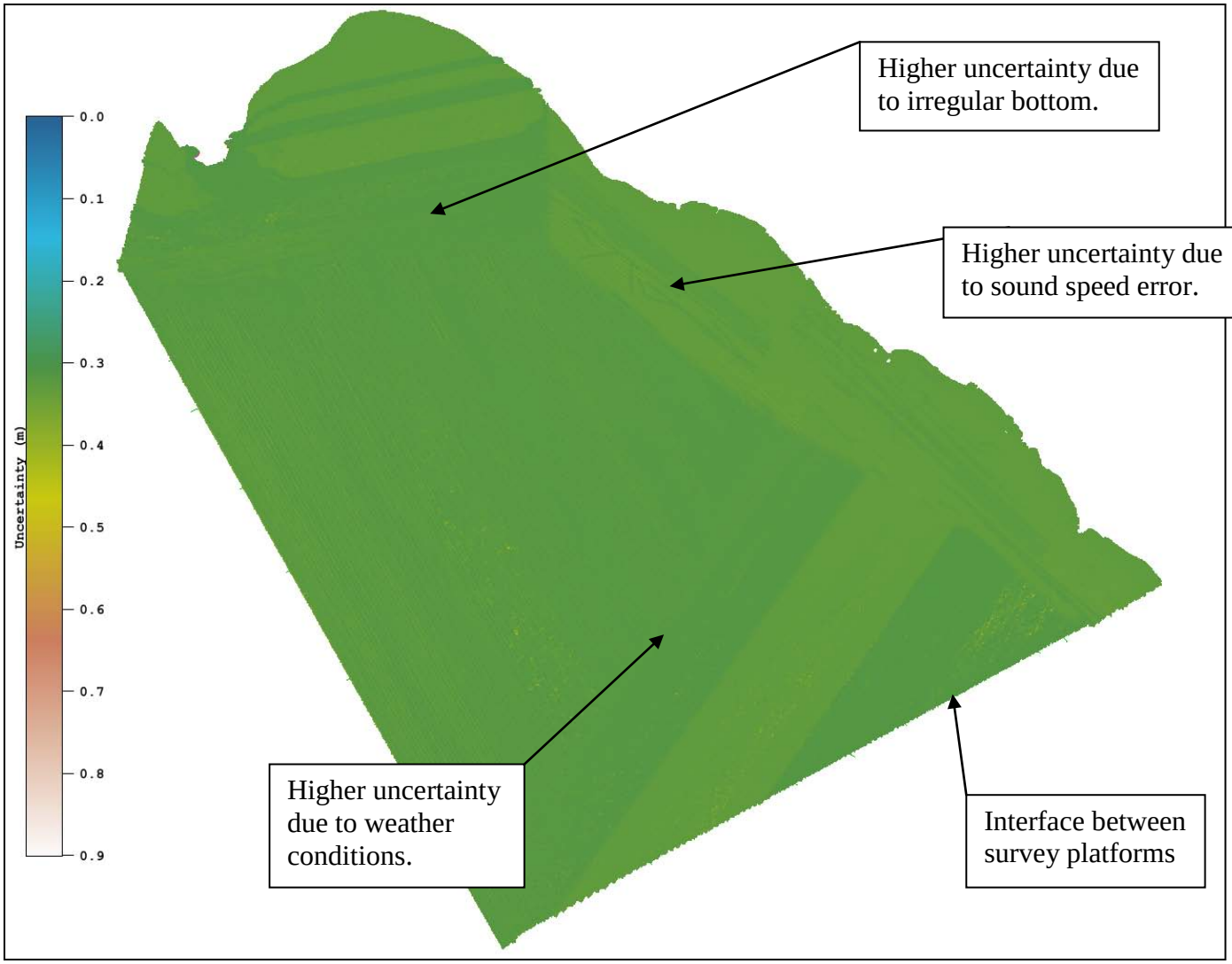

Figure 3 Uncertainty DTM

Survey Junctions

H12111 (Sheet C) junctions with:
See (**Figure 4**).

Registry #	Date	Junction Side
H12109	2009	West
H12112	2009	South

The surveys agree along their common borders. The agreement was noted in the field by comparing the CUBE surfaces during subset cleaning. This conformity is also apparent in the final combined BASE surfaces.[4]

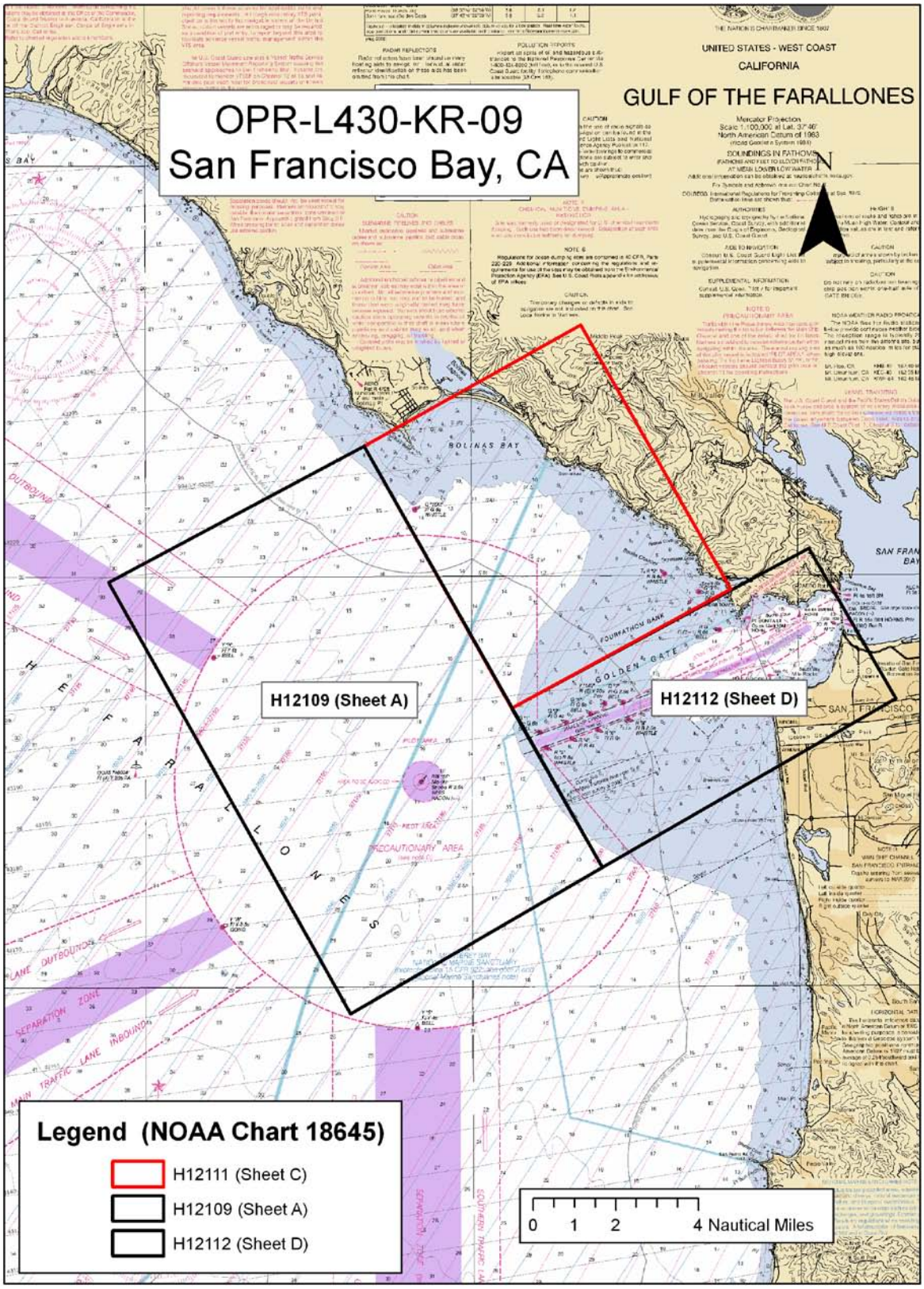

Figure 4 H12111 Survey Junctions

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 which were monitored throughout the survey to ensure that 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 comparable sound velocity data for all vessels. This was accomplished by having all sound velocity profiling equipment (MVP and SVPs) perform an SVP cast concurrently, with all vessels in close proximity to each other.

Data Quality

In general, the multibeam data quality for H12111 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 most likely due to a high volume of thermal layering and to strong undercurrents in the water column. To address this problem, full water column sound speed measurements were conducted more frequently. Even though this SVP error is noticeable in the data, it is within required specifications.[5]

The MVP system on the Pacific Star was deployed at an interval of once every two hours, where 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 was collected, with the result being the creation of a grid of sound velocity profiles. This method kept differences in time and distance to a minimum between the survey data and the applied sound velocity profile.

2. During routine processing, areas were found which contained excessive sound speed error. Although this data was valid and within IHO Order 1, the outer beam data were marked rejected during subset cleaning to allow a stronger hypothesis for near nadir beams in adjacent lines. Data density requirement of 5 pings per node were met prior to subset cleaning, refer to **Figure 5,** and were adhered to during data acquisition. It's apparent in the final surface that after the subset cleaning process, some areas fell outside the data the density requirement, refer to **Figure 6**.[6]

Figure 5 is a snippet of data from H12111 prior to subset cleaning that show grid nodes (in red) having less than 5 hits. It is evident from the graphic that only a few areas, excluding the border region, fell outside the requirement.

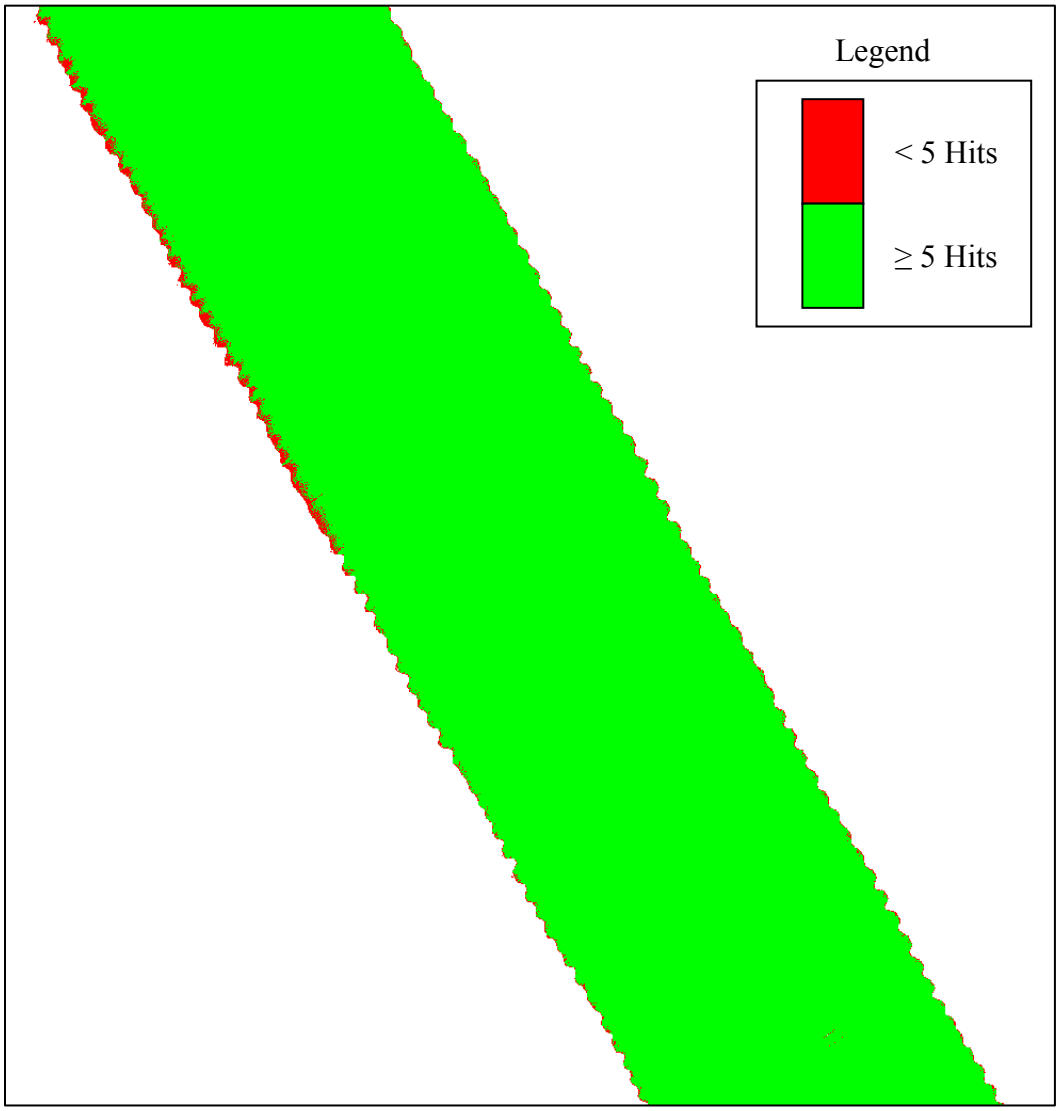

Figure 5 Data prior to Subset Editor cleaning

Figure 6 is the same snippet of data, but displays the data set after the cleaning process outlined above, from the graphic there numerous grid nodes (in red) that now fall outside of the data density requirement.

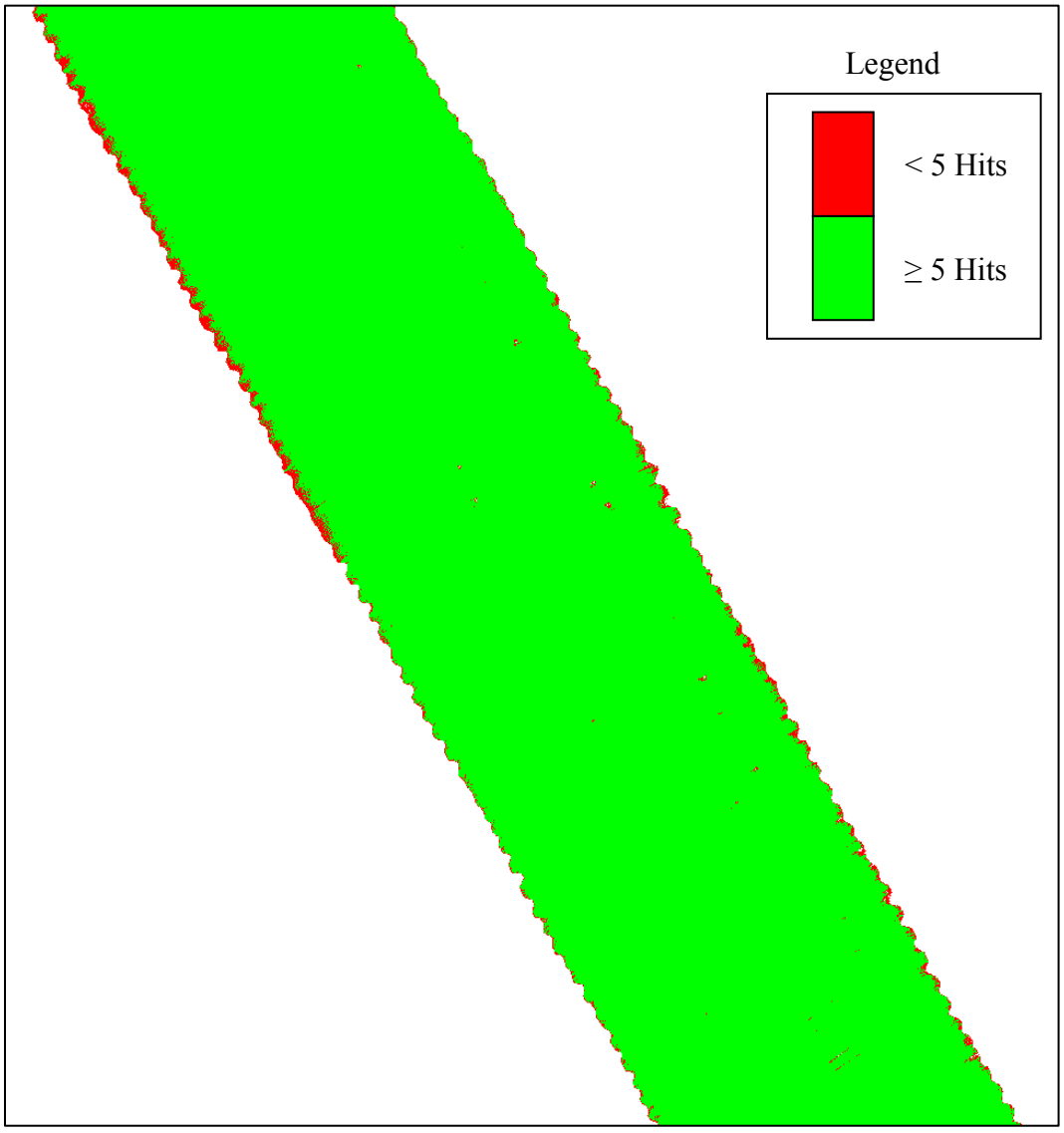

Figure 6 Data after Subset Editor cleaning

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.

3. Several inaccurate waterline measurements were logged on the Pacific Star as a result of significant wave action combined with considerable vessel roll. An effort was made to record waterline values at 12-hour intervals and vessel ballasting was avoided, but significant variance was still found in these values. Waterline values were evaluated using Post Processed Kinematic GPS Altitude and erroneous values were removed from the CARIS Vessel Configuration File. Some lines still exhibit vertical busts of up to 15cm as a result of higher than normal uncertainty in waterline measurements.[7]

Refer to the OPR-L430-KR-09 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 Soundings

Refer to the OPR-L430-KR-09 Data Acquisition and Processing Report for a detailed description of all corrections to soundings. No deviations from the report occurred.

B.4 Data Processing

Refer to the OPR-L430-KR-09 Data Acquisition and Processing Report for a detailed description of the processing flow.

In order to provide more accurate project wide TPU values, all full water column sound speed cast measurements were statistically analyzed in MBTools, via the SVP Statistics utility. This utility calculated a mean, variance, and standard deviation at a user specified depth interval. The standard deviation was then used to produce a TPU value of higher accuracy that was vessel and sheet specific.

The calculated Sound Velocity TPU values are as follows for H12111:

Vessel	Measured	Surface
3-Pacific Star	0.500	2.987
4-R2	0.500	1.796
5-D2	0.500	2.322

The final fieldsheet for H12111 is called "H12111_(Sheet_C)" and it contains two BASE surfaces. The following parameters were used:

0-23 meters: 1 m resolution, name "H12111_1m_Final"
20-52 meters: 2 m resolution, name "H12111_2m_Final"

Note:

- Maximum depth was approximately 30 m; therefore, resolutions coarser than 2m were not computed.

The final S57 file for this project is called "H12111_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 OPR-L430-KR-09 Horizontal and Vertical Control Report 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.

C.1 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 Pigeon Point, 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.[8]

See OPR-L430-KR-09 Horizontal and Vertical Control Report for a more detailed description of PPK positioning methods used.

C.2 Vertical Control

All sounding data were initially reduced to mean lower low water (MLLW) using preliminary tidal data for gauges 9414290 & 9415020, from the National Water Level Observation Program accessed through the NOAA tides and currents website (http://tidesandcurrents.noaa.gov/). A cumulative file for the gauges was updated daily by appending the new data. Preliminary tidal zoning provided by NOAA was used in conjunction with the preliminary tide data for initial data processing.

On September 14, 2009, JOA issued verified tidal data and final zoning for H12109, H12110, H12111, H12112, and H12113 of OPR-L430-KR-09. The tidal zoning was modified by JOA, providing a more elaborate zoning scheme from those zones issued in the Statement of Work. Verified tidal data had a light smoothing applied to alleviate high frequency noise.[9]

All sounding data were then re-merged using CARIS HIPS and SIPS tide routine. Verified tidal data from the San Francisco, CA (9414290) and Point Reyes, CA (9415020) tidal stations were used for the final Navigation Base Surfaces and S-57 Feature files.[10] Tidal Stations were owned and operated by NOAA's National Ocean Service through the National Water Level Observation Program.

Table 2 – Tide Gauge

Gauge	Location	Latitude	Longitude
9414290	San Francisco, CA	37° 48.4' N	122° 27.9' W
9415020	Point Reyes, CA	37° 59.7 N	122° 58.6 W

See OPR-L430-KR-09 Horizontal and Vertical Control Report for a more detailed description of final tidal zoning.

D. RESULTS AND RECOMMENDATIONS

D.1 Chart Comparison

H12111 survey was compared with charts shown in **Table 3**.[11]

Table 3 – Chart Comparisons

Chart Number	Type	Scale	Edition	Edition Date
18645	Raster	1:100,000	26	September, 2008
18649	Raster	1:40,000	67	December, 2009
18652	Raster	1:80,000	35	August, 2009
US4CA12M	ENC	n/a	11	March, 2010
US3CA14M	ENC	n/a	10	July 2010

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 H12111 soundings is noted. A more detailed comparison was undertaken for any charted shoals or other dangerous features.

Agreement between the H12111 BASE surface depths and the charted soundings for all applicable ENCs and Raster charts was within +/- 1 to 2 fathoms.[12] 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 ensure its inclusion in the finalized BASE surface. Exceptions follow.

- Numerous deep rocks, least depths ranging from 20ft to 35ft, were found seaward of the 36ft contour on chart 18649 extending from Tennessee Pt (37-50-04N 122-32-56W) to North of Muir Beach (37-51-51N 122-35-43W). Due to the extensive nature of the rocks, the Hydrographer recommends revising contours to include shoaler rocks.[13]

- A relatively isolated rock was found on the 36ft contour (chart 14649) with a least depth of 10.5ft at a position of 37-51-57.78N 122-35-48.76W. Hydrographer recommends charting the underwater rock as depicted in the S-57 feature file **(Figure 7).**[14]

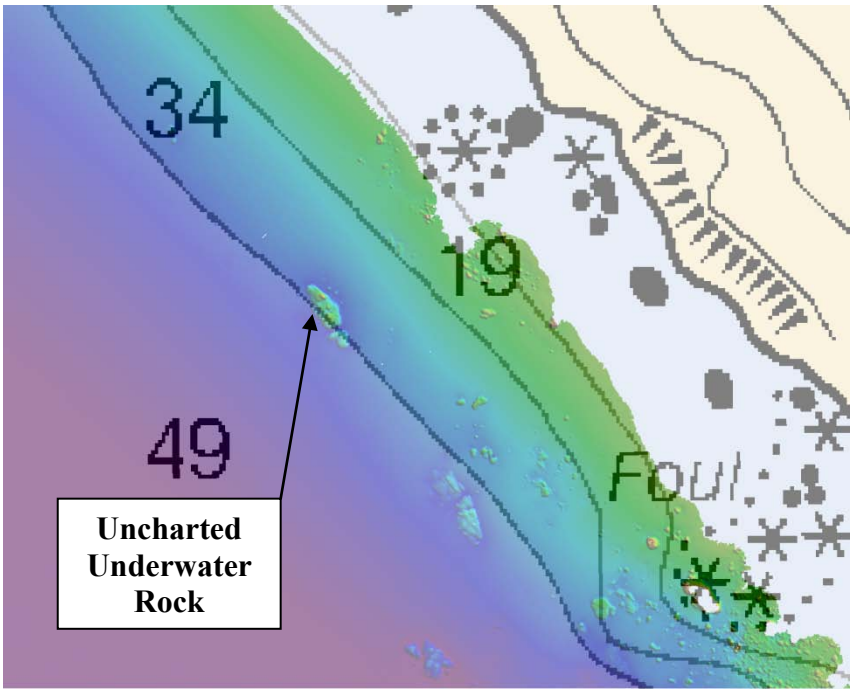

Figure 7 Uncharted Underwater Rock (Chart 18649)

- Two exposed rocks in the vicinity of Tennessee Cove were found to be incorrectly positioned based on the multibeam data **(Figure 8)**. The correction positions are 37-50-07.13N 122-33-04.61W & 37-50-47.57N 122-33-43.98W. No visual verification or leveling was performed on the features. Hydrographer recommends adjusting positions based on the MBES coverage.[15]

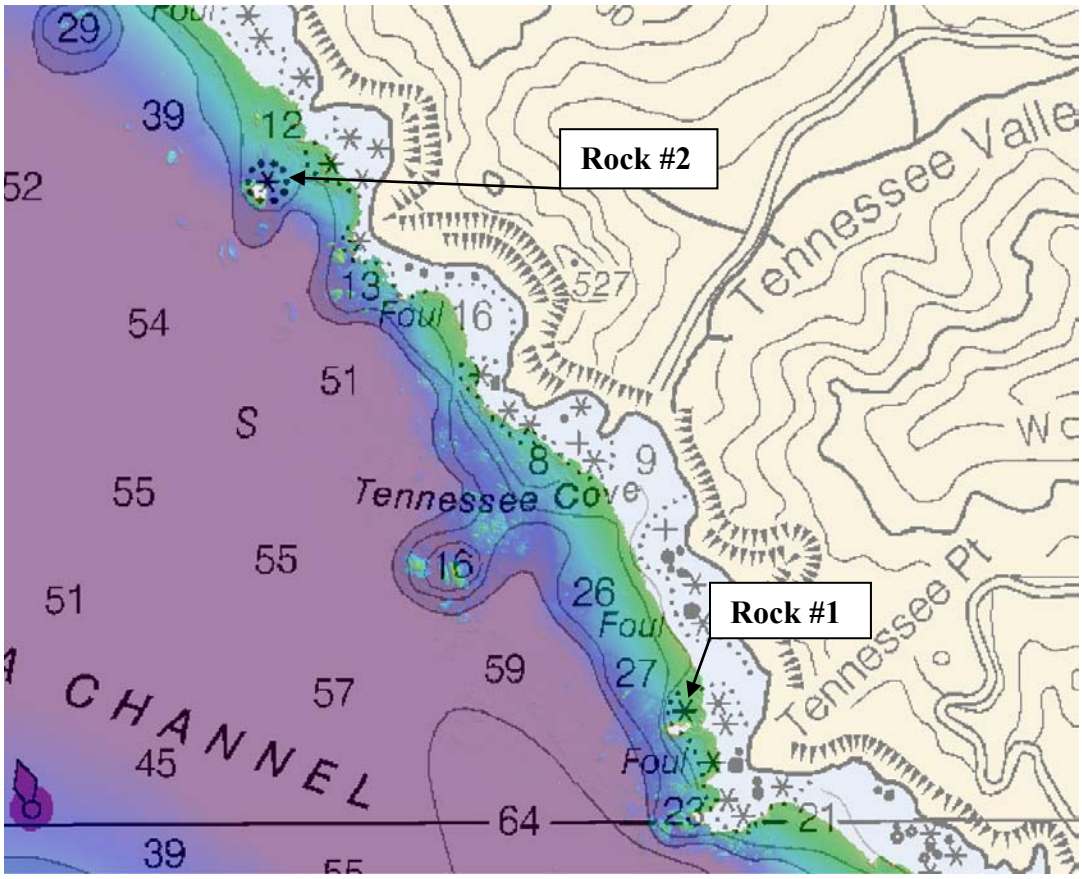

Figure 8 Incorrectly positioned Rocks (Chart 18649)

- The northern islet of a set of two islets (37-51-22.43N 122-34-53.07W) located off of Muir Beach was not found off of Muir Beach was not found in 100% multibeam coverage. No shoreline verification was performed to verify the existence of both islets but Google Earth Imagery does show the existence of two distinct features. Hydrographer recommends repositioning islets to conform to multibeam data.[16]

- An islet east of Gull Rk was found to be incorrectly positioned based on the multibeam data **(Figure 9)**. The correction position is 37-52-31.76N 122-36-36.55W. No visual verification or leveling was performed on the features. Hydrographer recommends adjusting positions based on the MBES coverage.[17]

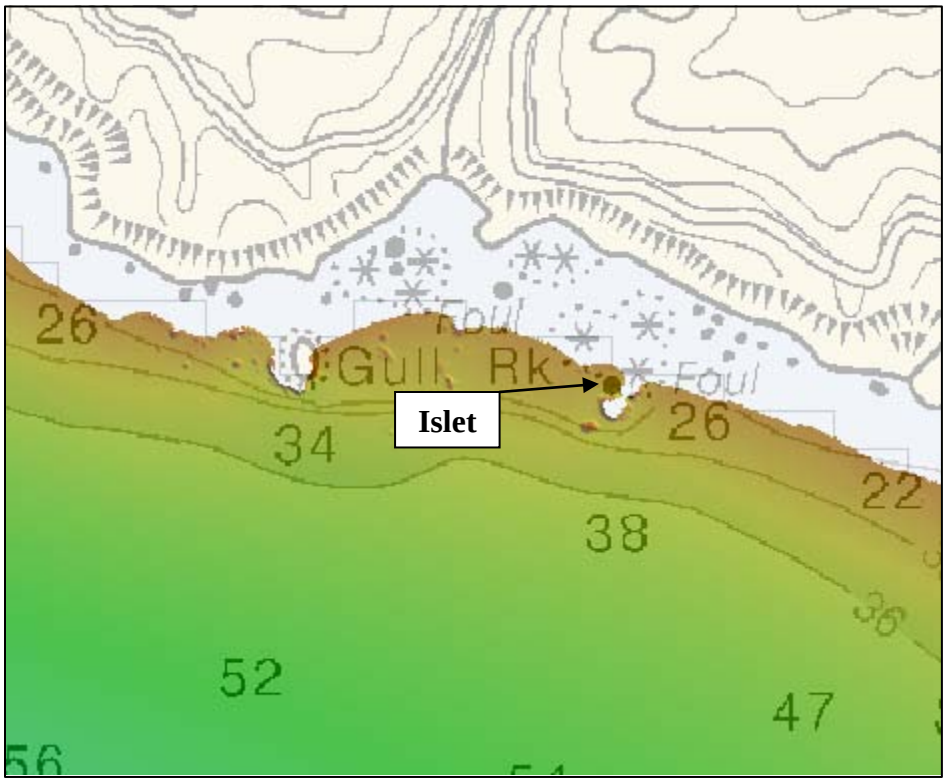

Figure 9 Incorrectly positioned Islet (Chart 18649)

- Submerged ledges and rocks in the vicinity of Duxbury Reef (37-53-00N 122-41-40W) were found to be far more extensive than previously charted. Significant deviations in charted contours were found to extend up to 3km south of Duxbury Reef. Due to the extensive nature of the ledges and rocks, the Hydrographer recommends revising contours to include shoaler rocks and ledges.[18]

- A 64ft sound on chart 18649, ENC US5CA12M, & ENC US3CA14M (10 fathom 4 ft sounding on chart 18645) at position 37-51-02N 122-40-14W was not found in the course of survey H12111. The area was found to be relatively flat with an approximate depth of 82ft at the position **(Figure 10)**. Hydrographer recommends revision of soundings to conform to H12111.[19]

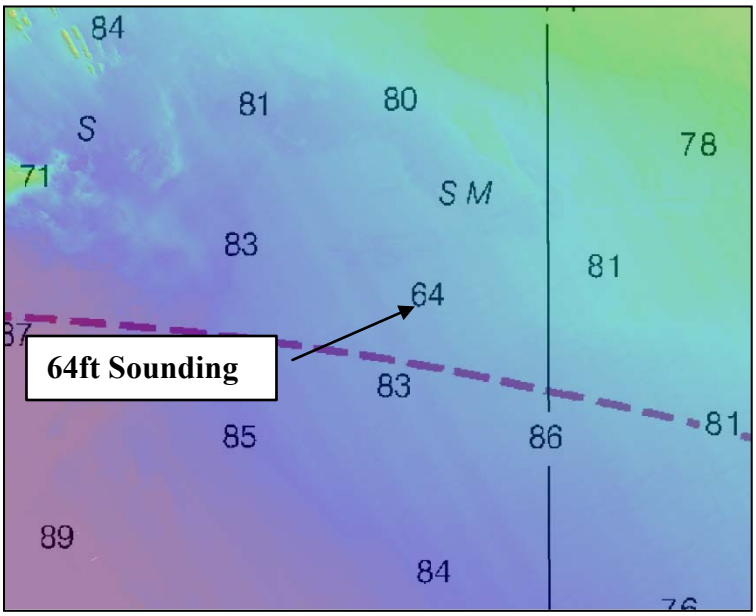

Figure 10 64ft Sounding (Chart 18649)

The Hydrographer recommends that soundings within the survey limits of H12111 supersede all prior survey and charted depths.[20]

Automated Wreck and Observation Information System (AWOIS)

There was one AWOIS items assigned to H12111, item 50099.[21] Refer to Appendix II for a detailed report.

Charted Features

There were no charted features labeled ED, PD, or PA within the limits of H12111.[22]

Dangers to Navigation

No dangers to navigation were found or reported for this survey.[23]

D.2 Additional Results

Shoreline verification was not a requirement for OPR-L430-KR-09.[24] In addition to providing NOAA with high-density multibeam data for charting purposes, an in depth VDatum analysis was conducted as a joint effort between Fugro Pelagos, Inc. and John Oswald & Associates. The results and findings can be found in the Horizontal & Vertical Control Report for the project.

Bottom Samples

The F/V Pacific Star and launches (R2 and D2) were fitted to obtain bottom samples as specified in the Statement of Work.

Samples were taken with a Van Veen grab sampler and positions were recorded with WinFrog Multibeam v 3.08.44.04. Samples retrieved were analyzed and then encoded with the appropriate S57 attributes. Positions and descriptions of all samples are found in the H12111_S57_Features file.[25]

Aids to Navigation

The following aid to navigation was examined during this survey:

1. Nun buoy R N ”4” at 37-49-23 N, 122-33-15 W (chart 18649) found to exist and to be serving its intended purpose.
2. Can buoy G ”3” Fl G 4s Bell at 37-49-36 N, 122-33-03 W (chart 18649) found to exist and to be serving its intended purpose.
3. Can buoy R ”2” Fl R 6s Whistle at 37-50-01 N, 122-34-06 W (chart 18649) found to exist and to be serving its intended purpose.
4. Can buoy G ”1DR” Fl R 6s Whistle at 37-51-37 N, 122-41-43 W (chart 18649) found to exist and to be serving its intended purpose.[26]

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

E. APPROVAL SHEET

Approval Sheet

For

H12111

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

OPR-L430-KR-09 Statement of Work
NOS Hydrographic Surveys Specifications and Deliverables, April 2009 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.
September 2, 2010

9/2/2010

X 

David D. Briggs
Lead Hydrographer

Revisions Compiled During Office Processing and Certification

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[1] Concur.
[2] Concur.
[3] Concur.
[4] Concur. H12109 and H12112 have not been compiled yet.
[5] Concur.
[6] Concur. The data is adequate to supersede charted data in the common area. Chart per H12111_CS.000.
[7] Concur. The data is adequate to supersede charted data in the common area. Chart per H12111_CS.000.
[8] Concur.
[9] Concur. The tide report is appended to this report.
[10] Concur.
[11] US4CA12M does not exist and probably is a typo intending to say US5CA12M. Chart 18647, 1:40,000 was not listed in the comparison but used in the HCell Compilation.
[12] Concur.
[13] Concur.
[14] Concur. Chart per H12111.000.
[15] Concur. Chart per H12111.000.
[16] Concur. Chart per H12111.000.
[17] Concur. Chart per H12111.000.
[18] Concur.
[19] Concur. Chart per H12111.000.
[20] Concur. Chart as depicted in H12111.000.
[21] AWOIS wreck not identified in the survey investigation. See the appended AWOIS Report. Chart as depicted in H12111.000.
[22] Concur.
[23] Two DTONs were found and submitted by PHB. Both have been applied to the chart.
[24] Concur.
[25] Concur. In addition to 28 surveyed bottom samples, 24 bottom samples were imported into the HCell from the ENC to be retained. Chart as depicted in H12111.000.
[26] Chart per latest ATONIS information.

H12111 Danger to Navigation Reprot

Registry Number: H12111

State: California

Locality: Gulf of the Farallones

Sub-locality: Vicinity of Bolinas Bay

Project Number: OPR-L430-KR-09

Survey Dates: 06/14/09 - 08/04/09

Charts Affected

Number	Edition	Date	Scale (RNC)	RNC Correction(s)*
18647	15th	09/01/2002	1:40,000 (18647_1)	[L]NTM: ?
18649	66th	02/01/2009	1:40,000 (18649_1)	[L]NTM: ?
18645	26th	09/01/2008	1:100,000 (18645_1)	[L]NTM: ?
18640	25th	08/01/2005	1:207,840 (18640_1)	[L]NTM: ?
18680	31st	06/01/2005	1:210,668 (18680_1)	[L]NTM: ?
18010	21st	03/01/2007	1:811,980 (18010_1)	[L]NTM: ?
18022	35th	08/01/2005	1:868,003 (18022_1)	[L]NTM: ?
18007	33rd	02/01/2009	1:1,200,000 (18007_1)	[L]NTM: ?
18020	38th	10/01/2007	1:1,444,000 (18020_1)	[L]NTM: ?
501	12th	11/01/2002	1:3,500,000 (501_1)	[L]NTM: ?
530	32nd	06/01/2007	1:4,860,700 (530_1)	[L]NTM: ?
50	6th	06/01/2003	1:10,000,000 (50_1)	[L]NTM: ?

* Correction(s) - *source: last correction applied (last correction reviewed--"cleared date")*

Features

No.	Feature Type	Survey Depth	Survey Latitude	Survey Longitude	AWOIS Item
1.1	Rock	2.00 m	37° 52' 53.6" N	122° 41' 52.8" W	---
1.2	Rock	3.22 m	37° 51' 57.8" N	122° 35' 48.8" W	---

1 - Danger To Navigation

1.1) 2965/160

DANGER TO NAVIGATION

Survey Summary

Survey Position: 37° 52' 53.6" N, 122° 41' 52.8" W

Least Depth: 2.00 m (= 6.55 ft = 1.091 fm = 1 fm 0.55 ft)

TPU (±1.96σ): **THU (TPEh)** ±0.200 m ; **TVU (TPEv)** ±0.313 m

Timestamp: 2009-192.22:03:12.253 (07/11/2009)

Survey Line: sheet_c01 / 5-d2-8125 / 2009-192 / 5c01-sh041

Profile/Beam: 2965/160

Charts Affected: 18647_1, 18649_1, 18645_1, 18640_1, 18680_1, 18010_1, 18022_1, 18007_1, 18020_1, 501_1, 530_1, 50_1

Remarks:

[None]

Feature Correlation

Address	Feature	Range	Azimuth	Status
sheet_c01/5-d2-8125/2009-192/5c01-sh041	2965/160	0.00	000.0	Primary

Hydrographer Recommendations

[None]

Cartographically-Rounded Depth (Affected Charts):

6ft (18649_1)

1fm (18647_1, 18645_1, 18640_1, 18680_1, 18010_1, 18022_1, 18007_1, 18020_1, 530_1)

2.0m (501_1, 50_1)

S-57 Data

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

Attributes: QUASOU - 6:least depth known

SORDAT - 20090711

SORIND - US,US,graph,H12111

TECSOU - 3:found by multi-beam

VALSOU - 1.995 m

WATLEV - 3:always under water/submerged

1.2) 5721/10

DANGER TO NAVIGATION

Survey Summary

Survey Position: 37° 51' 57.8" N, 122° 35' 48.8" W

Least Depth: 3.22 m (= 10.55 ft = 1.759 fm = 1 fm 4.55 ft)

TPU (±1.96σ): **THU (TPEh)** ±0.203 m ; **TVU (TPEv)** ±0.328 m

Timestamp: 2009-173.00:06:22.070 (06/22/2009)

Survey Line: sheet_c02 / 4-r2-7125-400 / 2009-172 / 4c02-00900

Profile/Beam: 5721/10

Charts Affected: 18649_1, 18645_1, 18640_1, 18680_1, 18010_1, 18022_1, 18007_1, 18020_1, 501_1, 530_1, 50_1

Remarks:

[None]

Feature Correlation

Address	Feature	Range	Azimuth	Status
sheet_c02/4-r2-7125-400/2009-172/4c02-00900	5721/10	0.00	000.0	Primary

Hydrographer Recommendations

[None]

Cartographically-Rounded Depth (Affected Charts):

10ft (18649_1)

1 ¾fm (18645_1, 18640_1, 18680_1, 18010_1, 18022_1, 18007_1, 18020_1, 530_1)

3.2m (501_1, 50_1)

S-57 Data

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

Attributes: QUASOU - 6:least depth known

SORDAT - 20090621

SORIND - US,US,graph,H12111

TECSOU - 3:found by multi-beam

VALSOU - 3.217 m

WATLEV - 3:always under water/submerged

APPENDIX II – SURVEY FEATURE REPORT

There was one AWOIS items assigned to H12113, item 50099.

Item 50099:

AWOIS item 50099 (Elizabeth) sunk February 21, 1891 is located in Tennessee Bay at a position of 122°33'15.973"W, 37°50'23.769"N. (**Figure 1**). The search area was ensonified using 100% Multibeam Coverage Requirements and a 100m radius area was evaluated. No wreck shaped feature was found within the area. The area contains numerous rock outcrops, making it difficult to identify a wreck or other feature if one did exist (**Figure 2)**.

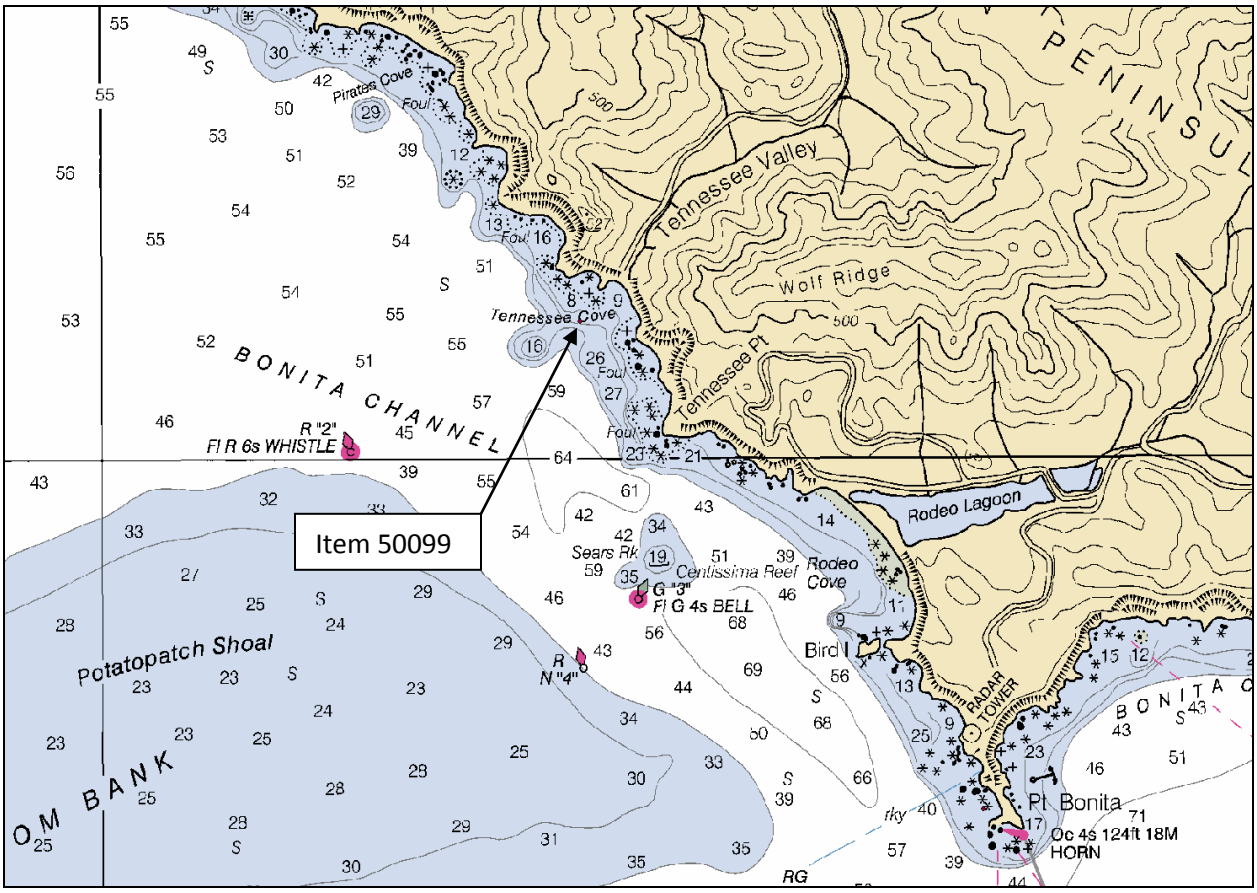

Figure 1 AWOIS Item 50099

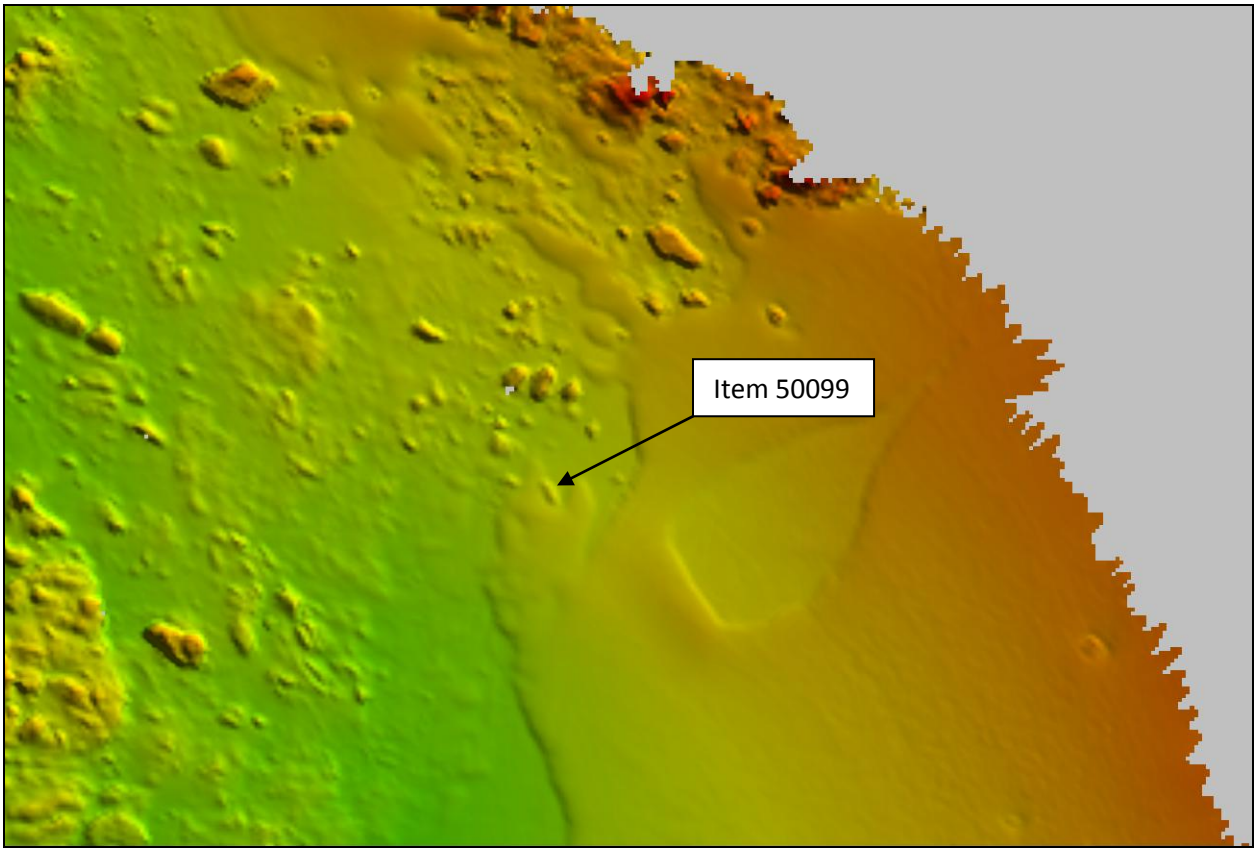

Figure 2 AWOIS Item 50099

Appendix I -Tides and Water Levels

Tidal Zoning: Approaches to San Francisco

Date: 8/17/2010

BY: Mike Zieserl
JOA Surveys, LLC

OVERVIEW

During the summer of 2009, Fugro-Pelagos performed a hydrographic survey for the Office of Coast Survey (OCS) covering the Approaches to San Francisco Bay under NOAA project OPR-L330-KR-2009. JOA Surveys (JOA) was the tides subcontractor to Fugro-Pelagos.

NOAA preliminary zoning was relative to the San Francisco NWLON. Both time and range change SW to NE, essentially towards San Francisco Bay. The maximum range of 1.21m is in the channel leading to the bay, while the smallest range of 1.17m is in the zone furthest offshore. The time offsets are -42 minutes to – 6minutes relative to San Francisco, for an overall change of 36 minutes. The Point Reyes NWLON tide arrives approximately 41 minutes earlier than San Francisco based upon the difference between their average High and Low Water Intervals (HWI, LWI). Translating these time offsets relative to the Point Reyes, they become -1 minute to +35 minutes.

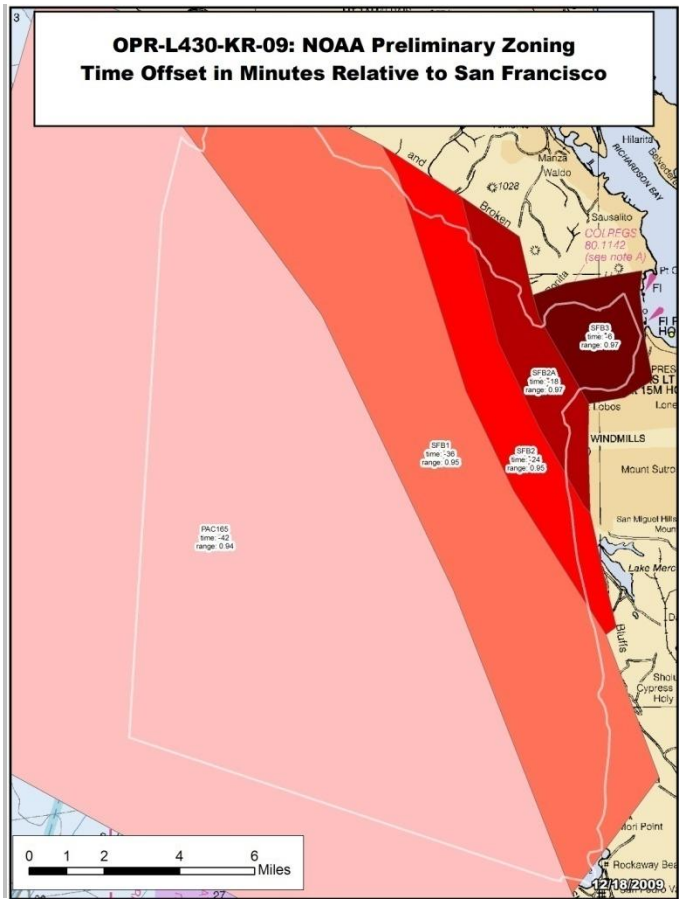

Figure 2. Preliminary NOAA Zoning Time Offsets

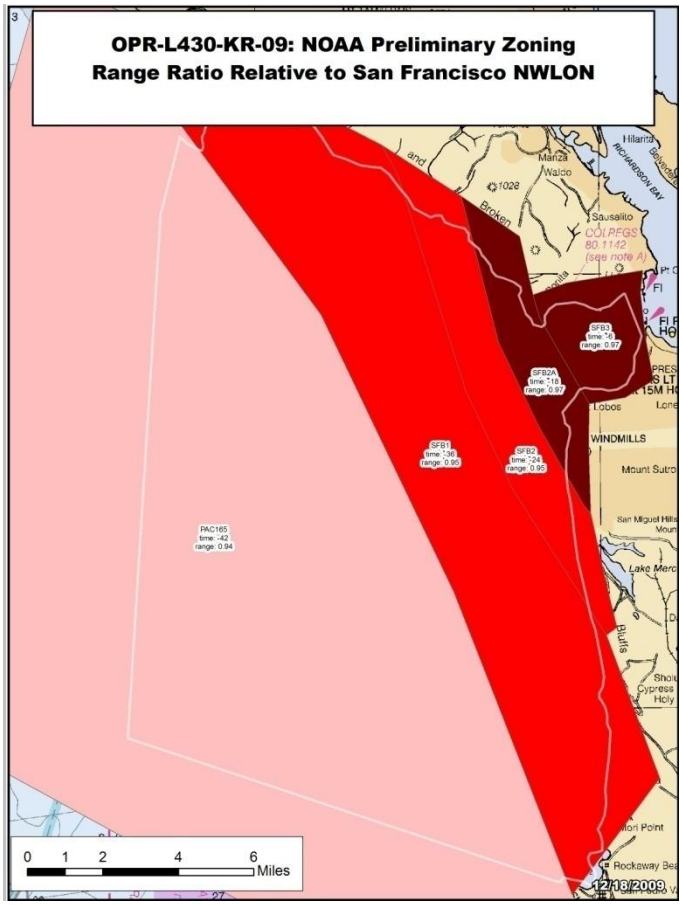

Figure 3. Preliminary NOAA Zoning Range Ratio

Revised Tidal Zoning based on Underwater Tide Gauge Data

JOA and Fugro-Pelagos deployed underwater tide gauges at six locations around the survey area to assist with conventional tidal zoning. The deployed tide gauges are a 200psi Seabird SBE26 and a 100psi Seabird SBE26+. Both Seabird tide gauges have ParoScientific sensors. The tide gauges were deployed from 7 to 14 days.

Zoning factors were computed from 941-5020 Point Reyes and 941-4290 San Francisco to each underwater tide gauge location. The time offsets and range ratios were determined by an iterative least squares fit of the control station data to the underwater tide gauge data. Location and zoning factors for each underwater tide gauge deployment are listed in the table at the end of this memo.

JOA revised the NOAA Preliminary zoning using the range ratio and time values computed using the underwater tide gauge data. The geometry of the NOAA Preliminary Zoning and JOA Version 1 Zoning is similar; in that both depict the tide progressing toward San Francisco Bay SW to NE, with the range increasing as the tide approaches the Bay.

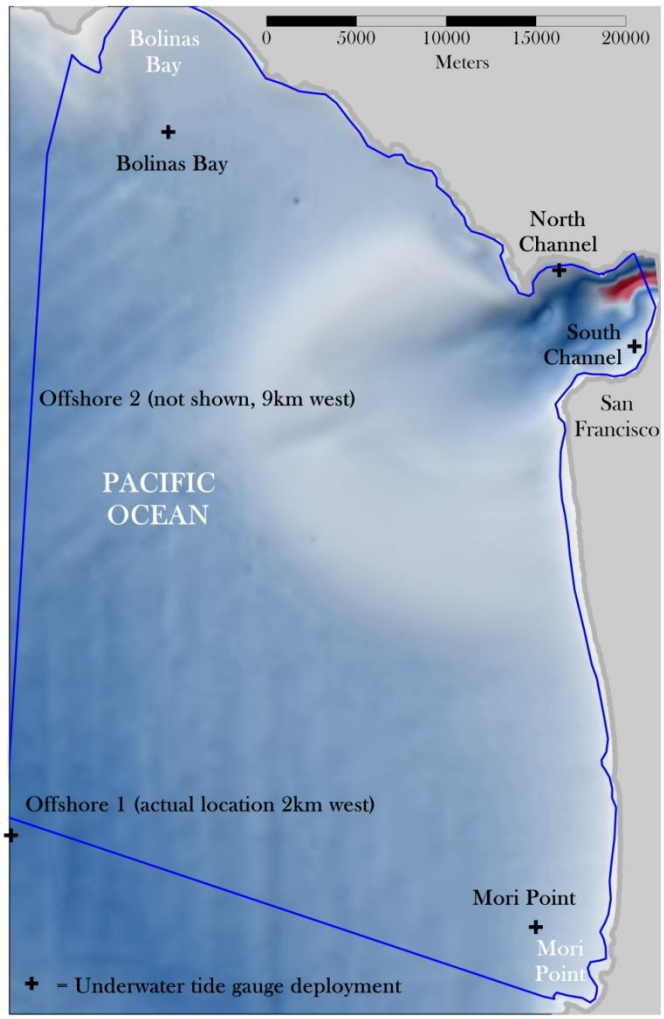

Figure 1. Underwater tide gauge deployments

The primary difference between the NOAA preliminary zoning and the JOA revised zoning is that the Point Reyes NWLON was assigned to zones offshore of the entrance channel to the bay, instead of the San Francisco NWLON. Data zoned from Point Reyes fit the data from the underwater tide gauges better than data from the San Francisco NWLON.

According to the JOA revised zoning, the maximum range of 1.31m is in the channel leading to the bay, which is 10cm larger than the range in the NOAA preliminary zoning. The smallest range of 1.17m is in the zone furthest offshore, which is exactly the same as the NOAA preliminary zoning. The time offsets are -6 minutes to +24 minutes relative to Point Reyes, for an overall change of 30 minutes, which is about 5 minutes less (or faster) than the NOAA preliminary zoning. (The time offsets in the zoning file are different, because they are relative to Point Reyes and San Francisco; the times above are just to gain an understanding of the travel time of the tide).

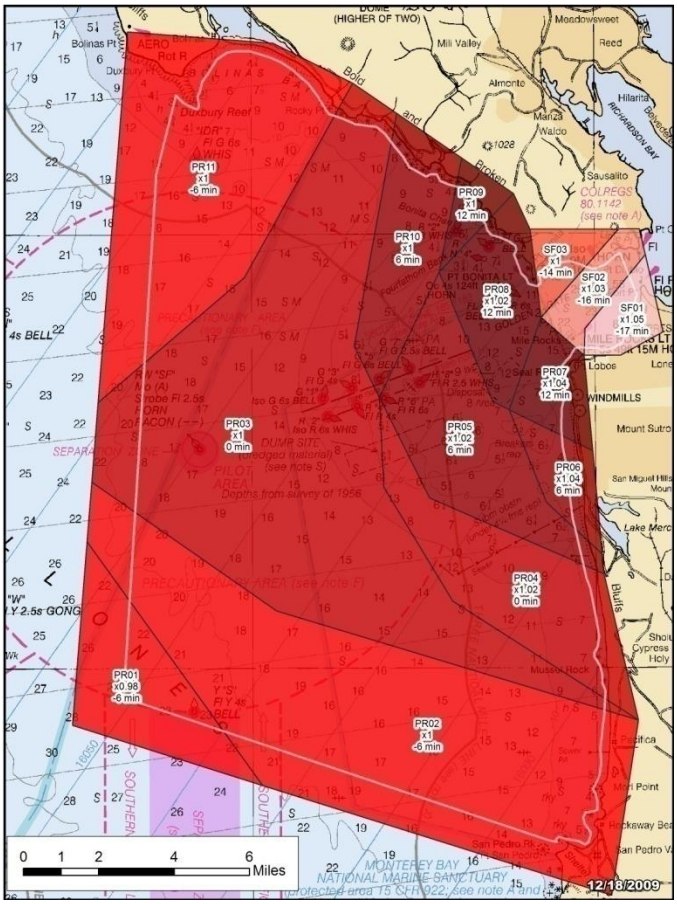

Figure 4. JOA Version 1 Tidal Zoning Time Offsets (based on underwater tide gauges)

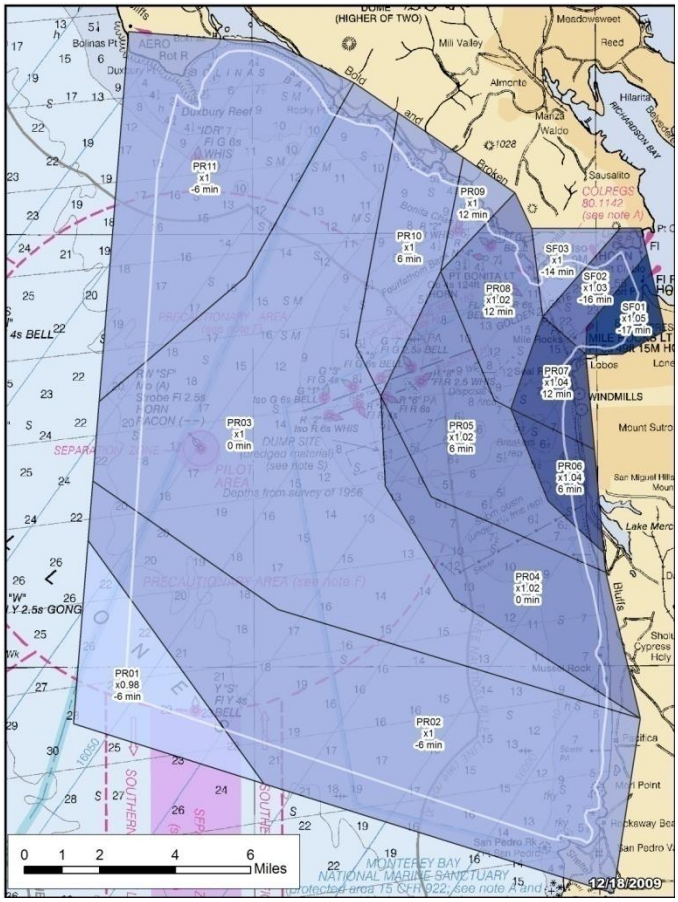

Figure 5. JOA Version 1 Tidal Zoning Range Ratios (based on underwater tide gauges)

Location Name	Number of Days	Latitude	Longitude	From San Francisco NWLON			From Point Reyes NWLON		
				Range Ratio	Time (minutes)	2 sigma fit	Range Ratio	Time (minutes)	2 sigma fit
North Channel	14	N37 49 16.5	W122 30 58.4	1.00	-14	0.068	1.015	19	0.068
South Channel	17	N37 47 53.2	W122 29 15.5	1.04	-17	0.061	1.068	16	0.127
Offshore 1	29	N37 39 02.8	W122 44 56.5	0.97	-39	0.091	0.985	-5	0.039
Bolinas Bay	15	N37 51 49.5	W122 39 57.5	0.97	-38	0.070	0.997	-7	0.035
Offshore 2	13	N37 46 32.9	W122 49 31.1	0.98	-37	0.096	0.991	-2	0.028
Mori Point	4	N37 37 18.5	W122 31 35.6	0.98	-42	0.070	0.997	-8	0.034

H12111 HCell Report

Martha Herzog, Physical Scientist
Pacific Hydrographic Branch

1. Specifications, Standards and Guidance Used in HCell Compilation

HCell compilation of survey H12111 used:

Office of Coast Survey HCell Specifications: Version: 4.0, 2 June, 2010.
HCell Re
ference Guide: Version 2.0, 2 June, 2010.

2. Compilation Scale

Depths and features for HCell H12111 were compiled to the largest scale raster charts shown below:

Chart	Scale	Edition	Edition Date	NTM Date
18649	1:40,000	67th	12/01/2009	01/29/2011
18647	1:40,000	16th	03/01/2009	01/29/2011

The following ENCs were also used during compilation:

Chart	Scale
US5CA12M	1:40,000
US4CA14M	1:100,000

3. Soundings

A survey-scale sounding (SOUNDG) feature object layer was built from the 2-meter Combined Surface 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.

Shoal Limit (m)	Deep Limit (m)	Radius (mm)
0	10	3
10	20	4
20	50	4.5
50	200	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 H12111_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 Feet from Chart 18649	Metric Equivalent to Chart Feet, Arithmetically Rounded	Metric Equivalent of Chart Feet, with NOAA Rounding Applied	Feet with NOAA Rounding Applied	Feet with NOAA Rounding Removed for Display on H12111_SS.000
6	1.8288	2.0574	6.75	6
12	3.6576	3.8862	12.75	12
18	5.4864	5.715	18.75	18
30	9.144	9.3726	30.75	30
36	10.9728	11.2014	36.75	36
60	18.288	18.5166	60.75	60

Contours have not been deconflicted against shoreline features, soundings and hydrography, as all other features in the H12111_CS file and soundings in the H12111_SS have been. This may result in conflicts between the H12111_SS file contours and HCell features at or near the survey limits. Conflicts with M_QUAL, COALNE and SBDARE objects should be expected. HCell features should be honored over H12111_SS.000 file contours in all cases where conflicts are found.

5. Meta Areas

The following Meta object areas are included in HCell H12111:

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. Spatial Framework

7.1 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.

7.2 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):	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.

8. Data Processing Notes

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

9. QA/QC and ENC Validation Checks

H12111 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.

10. Products

10.1 HSD, MCD and CGTP Deliverables

H12111_CS.000	Base Cell File, Chart Units, Soundings and features compiled to 1:40,000
H12111 _SS.000	Base Cell File, Chart Units, Soundings and Contours compiled to 1:10,000
H12111 _DR.pdf	Descriptive Report including end notes compiled during office processing and certification, the HCell Report, and supplemental items
H12111 _outline.gml	Survey outline
H12111 _outline.xsd	Survey outline

10.2 Software

CARIS HIPS Ver. 6.1	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.

11. Contacts

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

Martha Herzog
Physical Scientist
Pacific Hydrographic Branch
Seattle, WA
206-526-6841
Martha.herzog@noaa.gov

APPROVAL SHEET
H12111

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.

Digitally signed by Martha Herzog
Date: 2011.04.05 10:19:59 -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.

Kurt Brown
2011.04.05
13:27:26 -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.

Digitally signed by NELSON.GARY.C.1365885318
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=OTHER, cn=NELSON.GARY.C.1365885318
Date: 2011.04.06 09:08:25 -07'00'

David Scharff
2011.04.12 13:37:04
-04'00'