

W00341

NOAA Form 76-35A

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Ocean Survey

DESCRIPTIVE REPORT

Type of Survey: Navigable Area

Registry Number: W00341

LOCALITY

State: California

General Locality: Channel Islands

Sub-locality: N/A

2016

CHIEF OF PARTY
Andrew Armstrong

LIBRARY & ARCHIVES

Date:

HYDROGRAPHIC TITLE SHEET

W00341

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

State: **California**

General Locality: **Channel Islands**

Sub-Locality: **N/A**

Scale: **1: 10,000**

Dates of Survey: **07/04/2016 to 07/20/2016**

Instructions Dated:

Project Number: **OPR-PHB-17**

Field Unit: **E/V Nautilus**

Chief of Party: **Andrew Armstrong**

Soundings by: **Multibeam Echo Sounder**

Imagery by:

Verification by: **Pacific Hydrographic Branch**

Soundings Acquired in: **meters at Mean Lower Low Water**

Remarks:

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. Any revisions to the Descriptive Report (DR) generated during office processing are shown in bold red italic text. The processing branch maintains the DR as a field unit product, therefore, all information and recommendations within the body of the DR are considered preliminary unless otherwise noted. The final disposition of surveyed features is represented in the OCS nautical chart update products. All pertinent records for this survey, including the DR, are archived at the National Centers for Environmental Information (NCEI) and can be retrieved via <http://www.ncei.noaa.gov/>.

DR SUMMARY TEMPLATE

Descriptive Report Summary to Accompany W00341	
Project	OSD-PHB-17
Survey	W00341
State	California
Locality	Channel Islands
Sub Locality	N/A
Scale of Survey	1:10,000
Sonars Used	EM302
Horizontal Datum	North American Datum of 1983 (NAD83)
Vertical Datum	Mean Lower Low Water (MLLW)
Vertical Datum Correction	Verified Observed Tides
Projection	Latitude-Longitude (NAD83) - UTM Zone 10N /11N
Field Unit	E/V <i>Nautilus</i>
Survey Dates	07/04/2016 – 07/20/2016
Chief of Party / Data Originator	Ocean Exploration Trust http://www.oceanexplorationtrust.org

The submitted data was projected in WGS 84, not NAD83 as indicated above.

A. Area Surveyed

This hydrographic survey was acquired by the Ocean Exploration Trust (OET) on the E/V *Nautilus* in the vicinity of the Channel Islands, off the coast of Santa Barbara, California. The area was surveyed with a Kongsberg EM302 between July 4th 2016 and July 20th 2016. The NOAA Hydrographic Specification and Deliveries Manual and the NOAA Field Procedures Manual were not requirements of this cruise.

Data was acquired within the following survey limits:

Northwest Limit	Southeast Limit
34.50 N	33.34 N
121.22 W	118.88 W

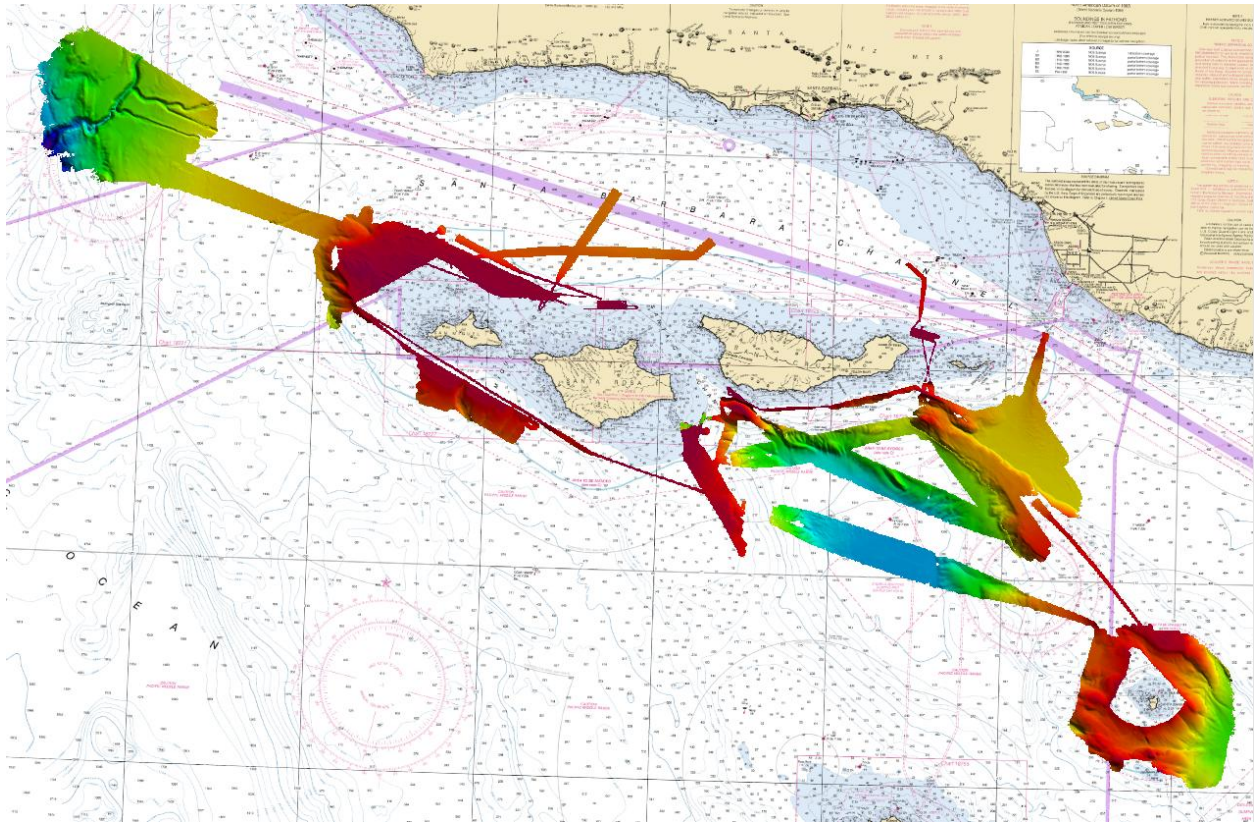


Figure 1 W00341 survey coverage. Depth Range 30 m – 2,497 m. Background chart 18720 1:232,188.

B. Survey Purpose

In partnership with the NOAA Channel Islands National Marine Sanctuaries (CINMS), the Ocean Exploration Trust acquired exploratory mapping data of geological and geophysical aspects of the region, while covering areas not recently acquired with modern day survey techniques, in an effort to fill in gaps identified by the Southern California Seafloor Mapping Initiative. The CINMS and NOAA National Center for Coastal and Ocean Science (NCOSS) started the Southern California Seafloor Mapping Initiative (<http://sanctuaries.noaa.gov/science/conservation/pdfs/seafloor-mapping-initiative.pdf>) to identify areas that need to be mapped with modern hydrographic methods and organize resources to coordinate closing those gaps. Accurate, full coverage data is critical for informing marine management decision-making. The Office of Coast Survey is contributing to this initiative by post processing the Ocean Exploration Trust data for application to the chart and for use by NCCOSS and the CINMS.

C. Intended Use of Survey

Data is adequate to supersede prior data and is intended for chart compilation, pending results of comparison with NOAA Ship *Rainier* data, as discussed in Section G.

D. Data Acquisition and Processing

The Joint Hydrographic Center Integrated Ocean and Coastal Mapping Group received raw and processed data from the Ocean Exploration Trust and various reports including: instrument lists and calibration reports, equipment wiring diagrams, vessel survey report, and the most recent Multibeam Advisory Committee (MAC) System Review report from 2015. These reports have been included in the data submission.

The following equipment was used during the survey.

Task	Equipment
Sonar	Kongsberg EM302 (30 kHz)
Positioning Sensor	Kongsberg SeaPath 330+ GNSS Antennae
Motion Sensor	MRU 5+
Surface Sound Speed Sensor	AML Oceanographic Micro-X
Sound Speed Sensor	Sippican Expendable Bathythermograph (XBT)
Acquisition Software	Kongsberg Seafloor Information System (SIS)
Processing Software	Qimera

Qimera version 1.2 was used by OET to process the data and exported GSFs were included in the data submission. The GSF files were unreadable by Caris and Qimera, therefore the raw data were used to process the grids submitted to the Coast Survey's Hydrographic Surveys Division in Caris Hips and Sips 9.1.7 and 10.2. The unreadable Qimera GSF exports error has been fixed in Qimera 1.2.5.

Sound speed data was collected and applied during acquisition. Sound speed data are stored in the raw .ALL files. No major sound speed errors were found in the dataset.

No crosslines were collected as part of the data set, however transit lines were recorded and included in the submission and provide some areas for perpendicular line comparison. Transit lines were included to maximize data potential and provide more opportunity for overlap with other surveys for depth validation.

The E/V *Nautilus* logged turn data between lines as separate files, which were included in the data submission. These files were omitted from the final grids, but are retained with the data.

E. Uncertainty

The EM302 is a deep water multibeam with a reported depth range of 10 to 7,000m. A portion of the data within the survey area falls within the lower range of the survey system. In these areas the data artifacts, "Eric's horns," appear where noise presents itself in the transition between phase detections and amplitude detections. This noise was cleaned out where it was represented in the CUBE surface.

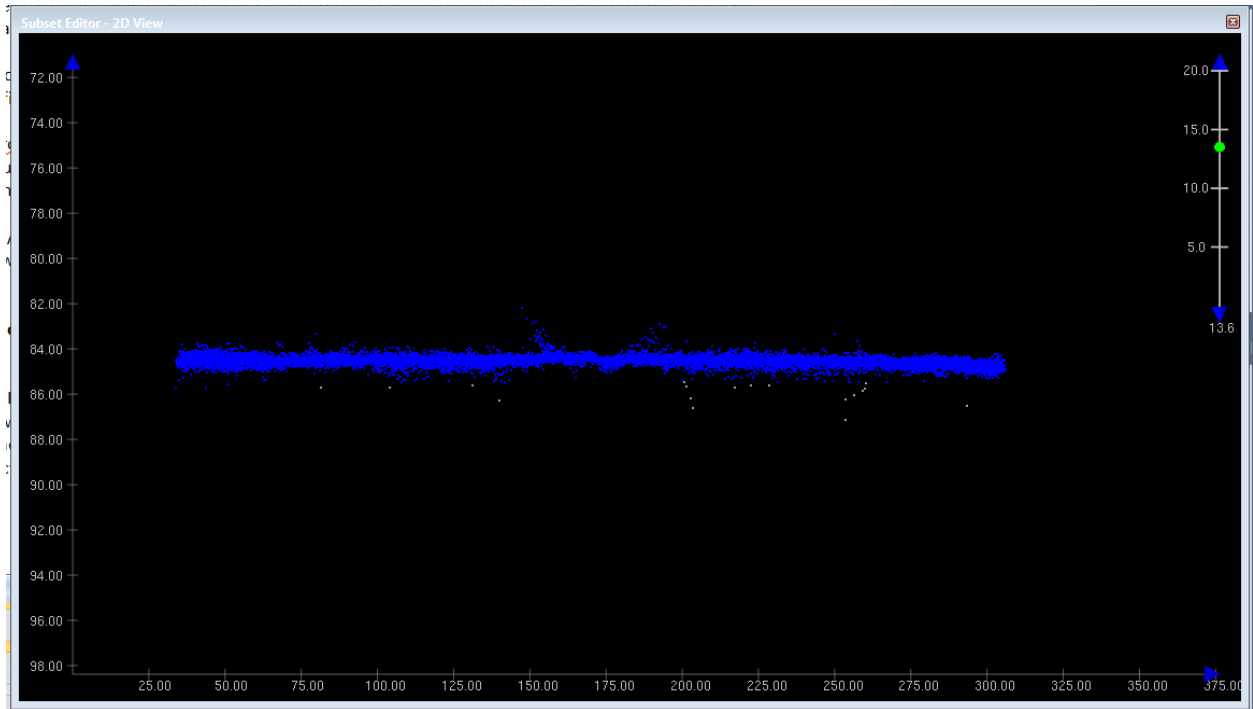


Figure 2 A swath profile in 84 m of water with the Eric's horns artifact between amplitude and phase detections.

Another artifact presented itself in the data as raised along track bumps at nadir on downward slopes, as seen in Figure 3. These artifacts have been manually cleaned from the data, which in many areas resulted in holidays, particularly on transit lines with no other overlapping coverage. These holidays are not a concern considering the deep depths of the survey. This artifact was most likely caused by the sonar tracking a side lobe at nadir due to the penetration filter set too high.

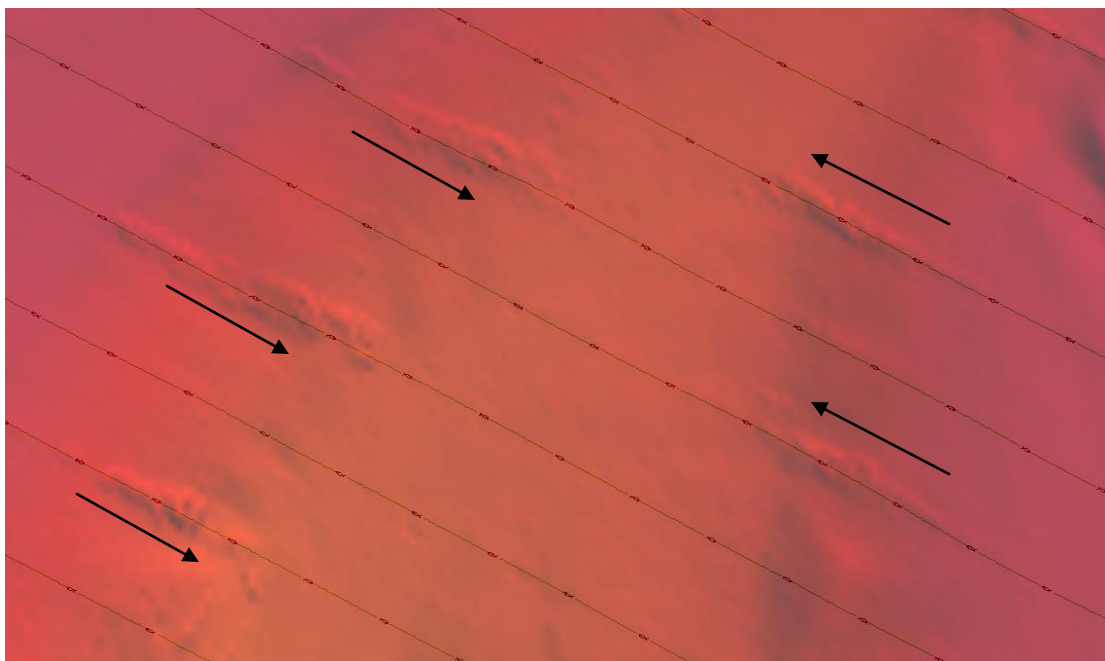


Figure 3 Data artifact as seen in surface before being cleaned from data. It appears at nadir on downward slopes.

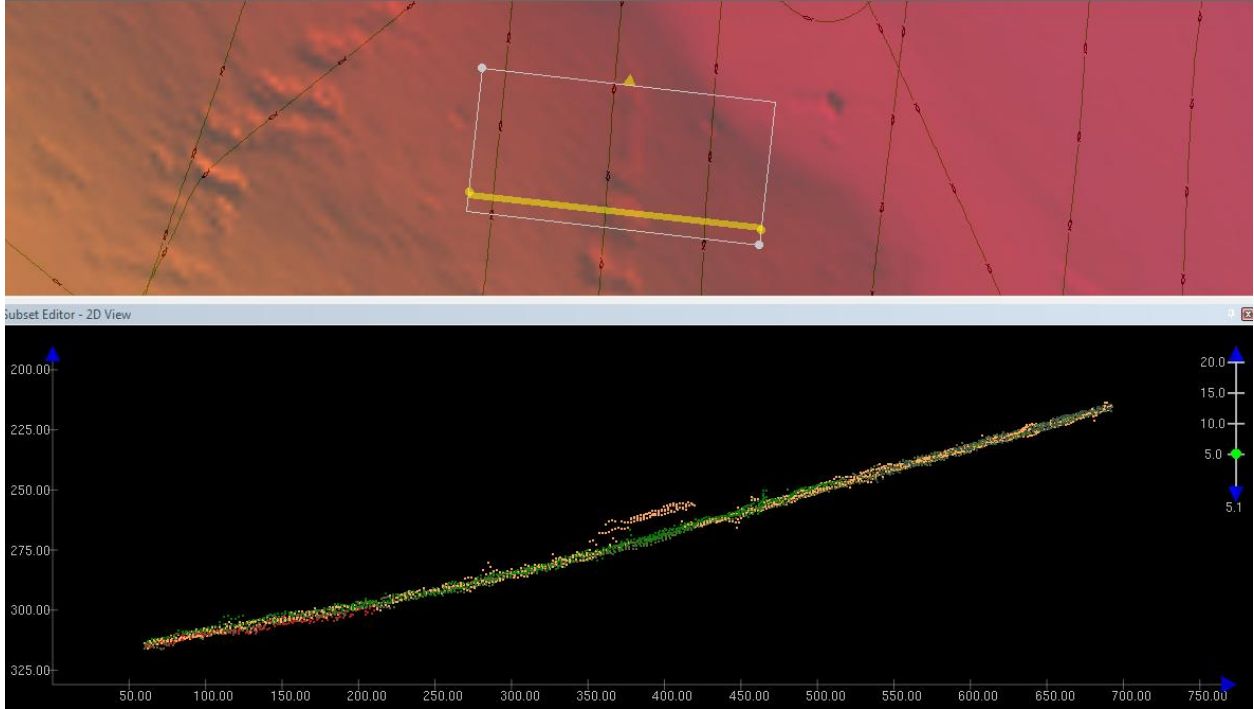


Figure 4 Nadir data artifact as seen in the swath profile cross section in Caris, appearing in one line and not the others, as raised data points disconnected from the bottom.

Variable resolution grids were generated from the data in Caris Hips and Sips 10.2, as described in section F. Chart Comparison. The data density of those grids meets Office of Coast Survey’s data density requirements of 95% of nodes having five soundings for more.

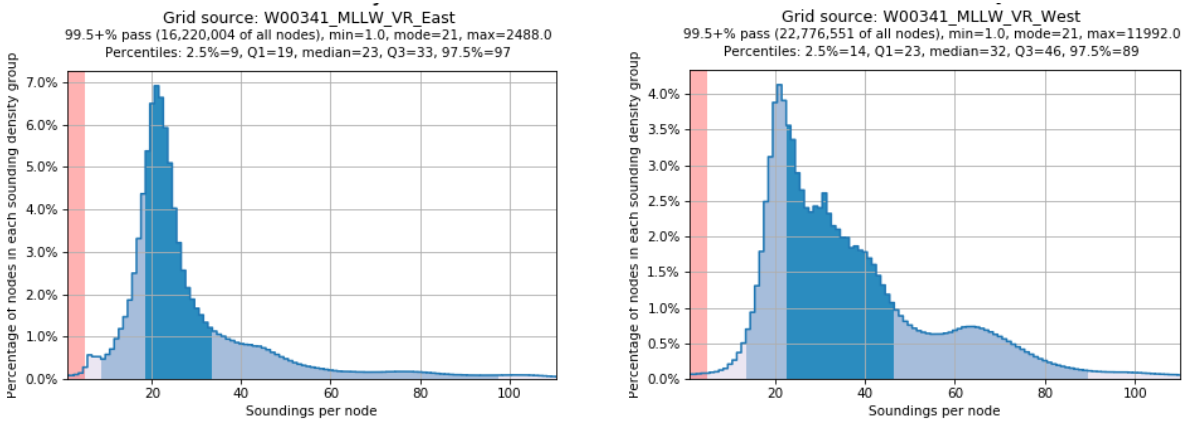


Figure 5 Histograms generated by QC Tools show that 99% of nodes have five soundings or more for east (left) and west (right) grids.

The data meets IHO Order 1b accuracy standards.

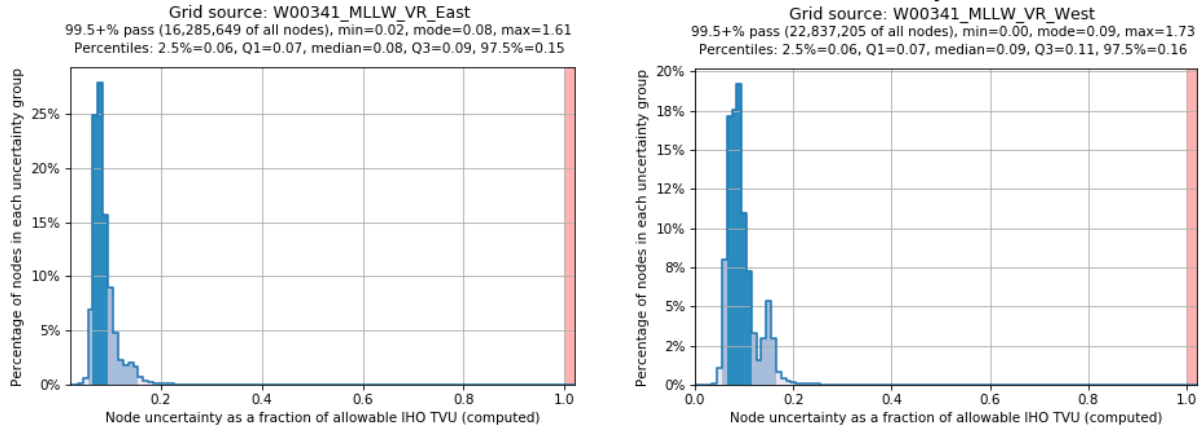


Figure 6 Histograms generated from QC Tools show that 99.5% of nodes meet IHO Order 1b uncertainty standards. One new gridded surface was created during office review and has comparable results to those shown above; 99% of all nodes meet density requirements and 98% of all nodes meet IHO Uncertainty standards.

F. Chart Comparison

The following are the largest scale Electronic Navigational Charts (ENC) and Raster Navigational Charts (RNC), which cover the survey area:

ENC	Scale	Edition	Update Application Date	Issue Date
US3CA69M	1:232,188	21.4	2/1/2017	6/21/2017
US4CA68M	1:100,000	10	6/19/2017	6/19/2017
US5CA65M	1:50,000	42.4	7/27/2017	6/21/2017
US5CA64M	1:40,000	9	10/6/2017	10/6/2016
US5CA66M	1:40,000	3.1	10/6/2017	10/6/2016
US5CA67M	1:40,000	3.1	9/22/2016	9/22/2016
US5CA58M	1:20,000	9.2	12/8/2016	5/17/2017
US5CA75M	1:20,000	7	1/7/2016	1/7/2016

RNC	Scale	Edition	Edition Date	LNM Date	NM Date
18720	1:232,188	34	7/1/2013	8/15/2017	7/22/2017
18721	1:100,000	12	12/1/2009	8/15/2017	7/22/2017
18724	1:20,000	3	6/1/2013	8/15/2017	7/22/2017
18725	1:50,000	30	6/1/2013	8/15/2017	7/22/2017
18727	1:40,000	12	7/1/2004	8/15/2017	7/22/2017
18728	1:40,000	9	11/1/2004	8/15/2017	7/22/2017
18729	1:40,000	13	10/1/2005	8/15/2017	7/22/2017
18740	1:234,270	45	1/1/2017	8/15/2017	8/19/2017
18755	1:40,000	10	2/12/2000	8/15/2017	7/22/2017

The boundary between UTM zones 10N and 11N runs between the middle of the survey area, along the 120°W meridian, on the east side of Santa Rosa Island. Grids for the survey region were separated, east and west along this UTM boundary. The following Caris CSAR grids have been generated for the survey area in the corresponding projected UTM zone.

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter
W00341_MB_MLLW_VR_East	CSAR	4 to 32 m	44 - 2034	CUBE
W00341_MB_MLLW_VR_West	CSAR	4 to 32 m	30 - 2497	CUBE

The two variable resolution surfaces were submitted using CARIS Density and CUBE parameters. During review, one large variable resolution surface was created (W00341_MB_MLLW_VR) to encompass both areas ("East" and "West") and projected in 10N. Calder-Rice Density and CUBE processing parameters were used as outlined in the Hydrographic Technical Directive 2017-2 CARIS VR Grids. This surface has comparable depths to those shown above.

The survey covers an area of predominantly sparse chart soundings, collected before 1939 with partial bottom coverage. High variability is observed between charted soundings and survey soundings, with some flat areas agreeing well and some areas different by 50 -100m, due to the highly irregular nature of the seabed in the area. Figure 7 presents an example from ENC US5CA75M (scale of 1:20,000) around Santa Barbara Island. The data presently supporting the ENC was collected in 1932 and 1937 with hand lead, machine soundings, wire frame and fathometer, as documented in the H05305, H05306, H06259 and H06260 Descriptive Reports. Large discrepancies throughout the survey exist between charted and W00341 survey depths.

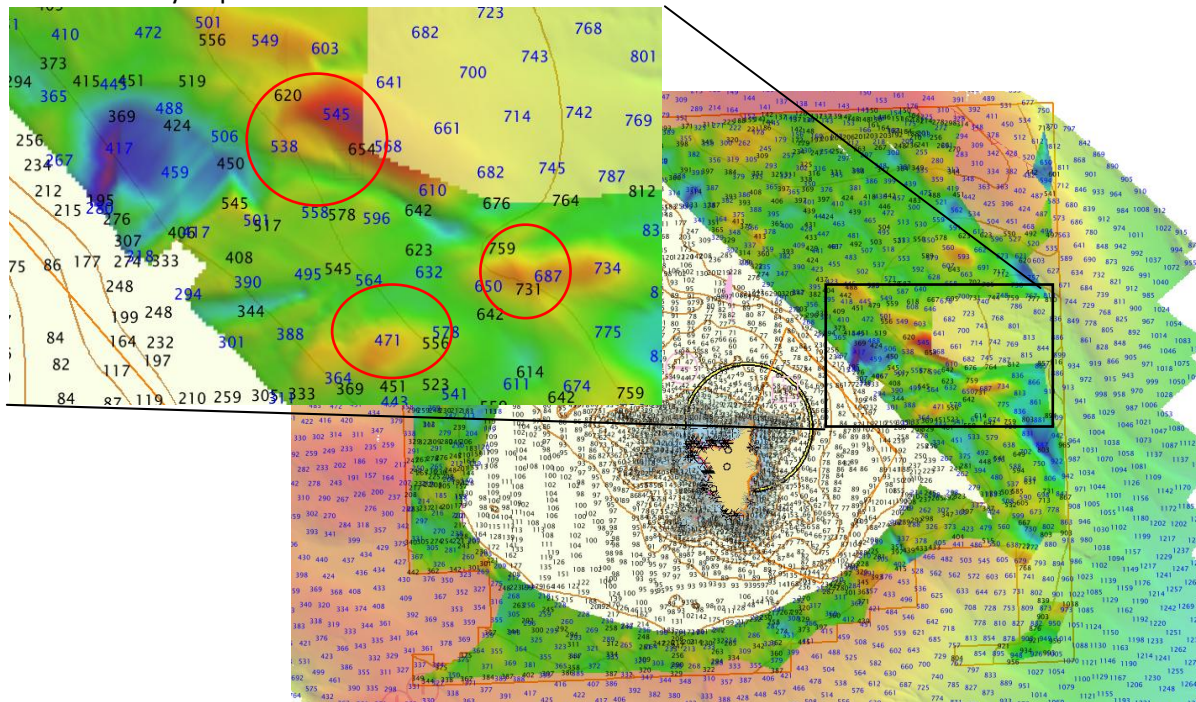


Figure 7 The ENC soundings (black) were used to generate a TIN, which was used to perform a surface difference with the survey grid. The surface difference layer brings attention to areas of high variability between chart depths (black) and survey depths (blue). The focus area highlights several survey soundings (blue) that are significantly shallower than chart soundings (black). Sounding depth in meters.

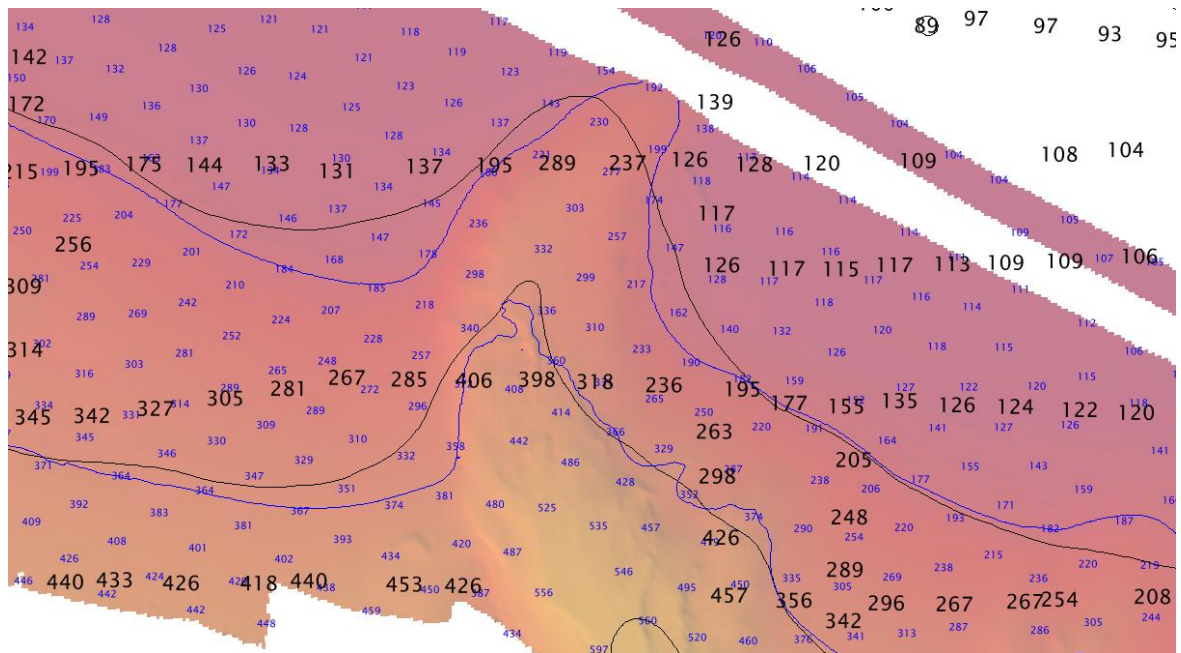


Figure 8 Survey W00341 provides more complete coverage in deep waters, compared to chart soundings and contours (black) from ENC US5CA64M, 1:40,000. The blue soundings and contours were generated from the survey grid. Sounding depth in meters.

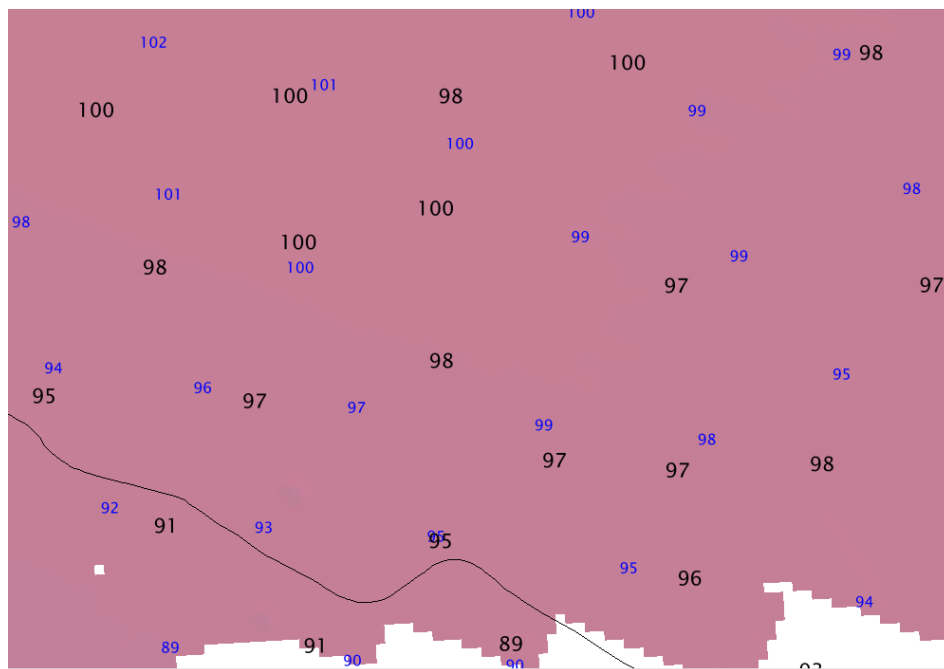


Figure 9 Soundings from ENC US5CA64M 1:40,000 (black) agree within 1-2 m with survey soundings (blue). Sounding depth in meters. Other areas of flat seafloor vary by 2-3 meters.

G. Comparison with Adjacent Surveys

Several modern multibeam surveys collected by other NOAA organizations, including the Office of Ocean Exploration and Research and the NCCOS Biogeography Branch, overlap W00341. These surveys are not NOAA charting hydrographic surveys, but have potential to be used for the chart based on the age and coverage of current chart data. Depth comparison was performed between W00341 and these surveys to assess vertical accuracy. The comparisons resulted in a variety of vertical offsets, with average differences ranging from -0.2 m to 5.7 m, discussed below. It was requested that the NOAA Ship *Rainier* collect chart quality data over these surveys as a Field Investigation to validate depths and clarify data quality issues. *Rainier* is scheduled to survey in the Channel Islands in the fall of 2017 under project number OPR-L397-RA-17. Any crosslines run will be under Field Investigation D00228.

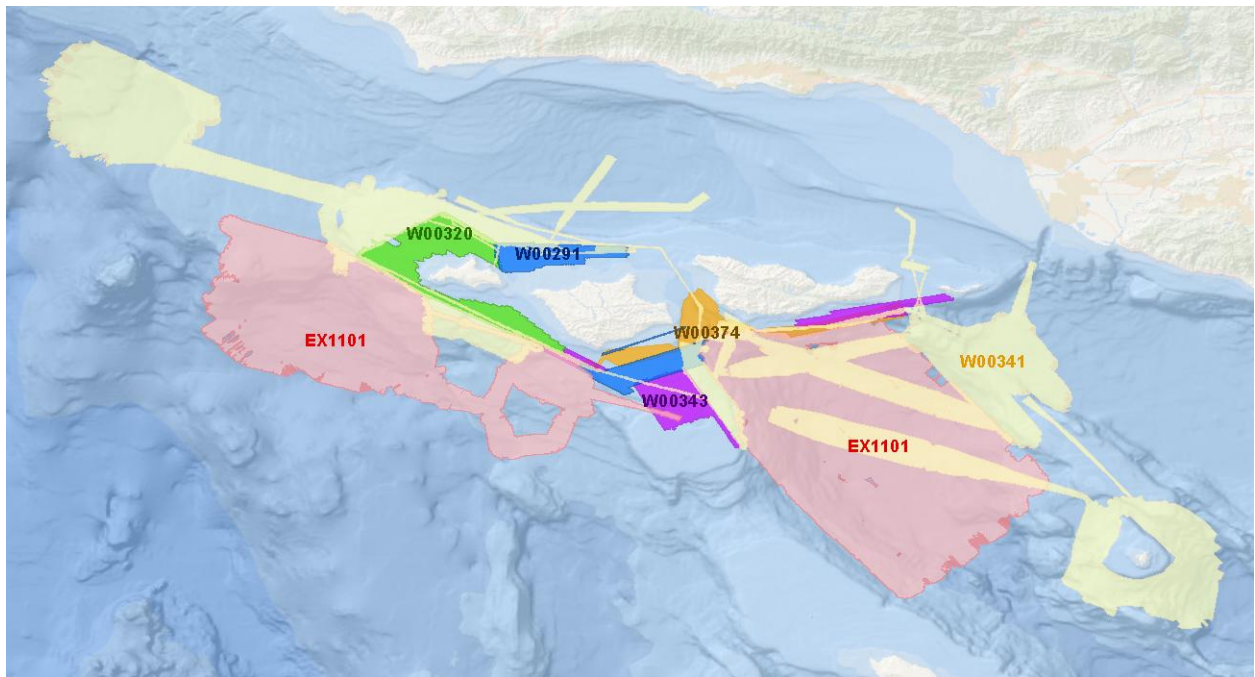


Figure 10 Recent multibeam surveys with regions of overlap with W00341 (yellow polygon) used for difference comparison.

The following was found when comparing W00341 with multibeam surveys in Figure 10. Unless otherwise noted, the resolutions of comparison grids were the same.

EX1101:

The 30 m EX1101 *Okeanos Explorer* grid (not corrected for tides) was compared with a 32 m W00341 *Nautilus* grid. Depth discrepancies were observed in areas of steep slopes, the outer beams due to refraction errors in the EX survey, and a surface artifact from the EX survey consistent with EX line direction. A total vertical uncertainty of greater than 10 m is allowed for the depth range of this comparison region, 950 – 2600 m.

<i>Okeanos</i> Grid	Resolution	Average Difference	Standard Deviation	Deeper
EX1101	30 m	0.6 m	5.1 m	<i>Nautilus</i>

W00343 (RL-16-06):

The NOAA NCCOS Biogeography Branch performed a survey with the Kongsberg ME70 aboard the NOAA Ship *Reuben Laskar*, which had been submitted to the Office of Coast Survey as outside source data W00343. Prior to this cruise a representative from Coast Survey's Hydrographic Systems and Technology Branch was aboard the *Laskar* to assist with Hypack system integration. The trip report from this visit has been included in the data submission. The following W00343 grids were compared with W00341.

<i>Laskar</i> Grid	Resolution	Average Difference	Standard Deviation	Deeper
1a	16 m	4.9 m	1.4 m	Nautilus
1b	8 m	5.7 m	0.6 m	Nautilus
3	16 m	4.8 m	2.9 m	Nautilus

W00291 (SH-15-03):

The NOAA NCCOS Biogeography Branch performed a survey with the Kongsberg ME70 aboard the NOAA Ship *Shimada*, which had been submitted to the Office of Coast Survey as outside source data W00291. This data has since been assessed for charting by the Atlantic Hydrographic Branch. A heave and roll artifact in the *Shimada* data was noticed during comparison.

<i>Shimada</i> Grid	Resolution	Average Difference	Standard Deviation	Deeper
W00291	8 m	-0.7 m	0.5 m	Shimada

W00320 (SH-16-06):

The NOAA NCCOS Biogeography Branch performed a survey with the Kongsberg ME70 aboard the NOAA Ship *Shimada*, which had been submitted to the Office of Coast Survey as outside source data W00320.

<i>Shimada</i> Grid	Resolution	Average Difference	Standard Deviation	Deeper
P1	16 m	4.4m	2.4 m	Nautilus
P1	8 m	4 m	1.6 m	Nautilus

W00374 (SH-17-05):

The NOAA NCCOS Biogeography Branch performed a survey with the Kongsberg ME70 aboard the NOAA Ship *Shimada*, which had been submitted to the Office of Coast Survey as outside source data W00374. Prior to this cruise a representative from Coast Survey's Hydrographic Systems and Technology Branch was aboard the *Shimada* to assist with Hypack system integration. The trip report from this visit has been included in the data submission. Areas of steep slopes were omitted from comparison. The *Shimada* grids were not final grids.

<i>Shimada</i> Grid	Resolution	Average Difference	Standard Deviation	Deeper
P1	16 m	0.6 m	4.3 m	Nautilus
P2	4 m	-0.2 m	0.4 m	Shimada
P3	8 m	-0.5 m	0.6 m	Shimada

The variability in offsets suggests that a waterline value may be applied incorrectly in some of the surveys. Based on the reports received from the Ocean Exploration Trust and the information found in the .ALL files, it appears the E/V *Nautilus* reference frame information and waterline was entered correctly. The values from these documents equate the distance from the sonar to the waterline as 4.501 m for the Nautilus. To be prudent it is recommended to compare W00341 with the *Rainier* data once it becomes available, prior to applying the data to the chart.

H. Vertical and Horizontal Control

The vertical datum for this project is Mean Lower Low Water. Discrete Tide Zoning from NOAA COOPS was applied in post processing by the IOCM center. The following National Water Level Observation Network (NWLON) stations served as datum control for this survey:

Station Name	Station ID
Santa Barbara, CA	9411340

This project was collected in horizontal datum WGS84 and reprojected in Caris Hips and Sips to NAD83 UTM 10N. Differential GPS (DGPS) was the sole method of positioning.

I. Additional Results

Backscatter was processed using QPS Fledermaus Geocoder Toolbox version 7.6.4. Raw files containing seafloor backscatter were combined with processed Caris HDCS data and TIFF mosaics were generated by day. Some data artifacts are visible in the mosaics and further cleaning of the processed data may result in improved mosaics.

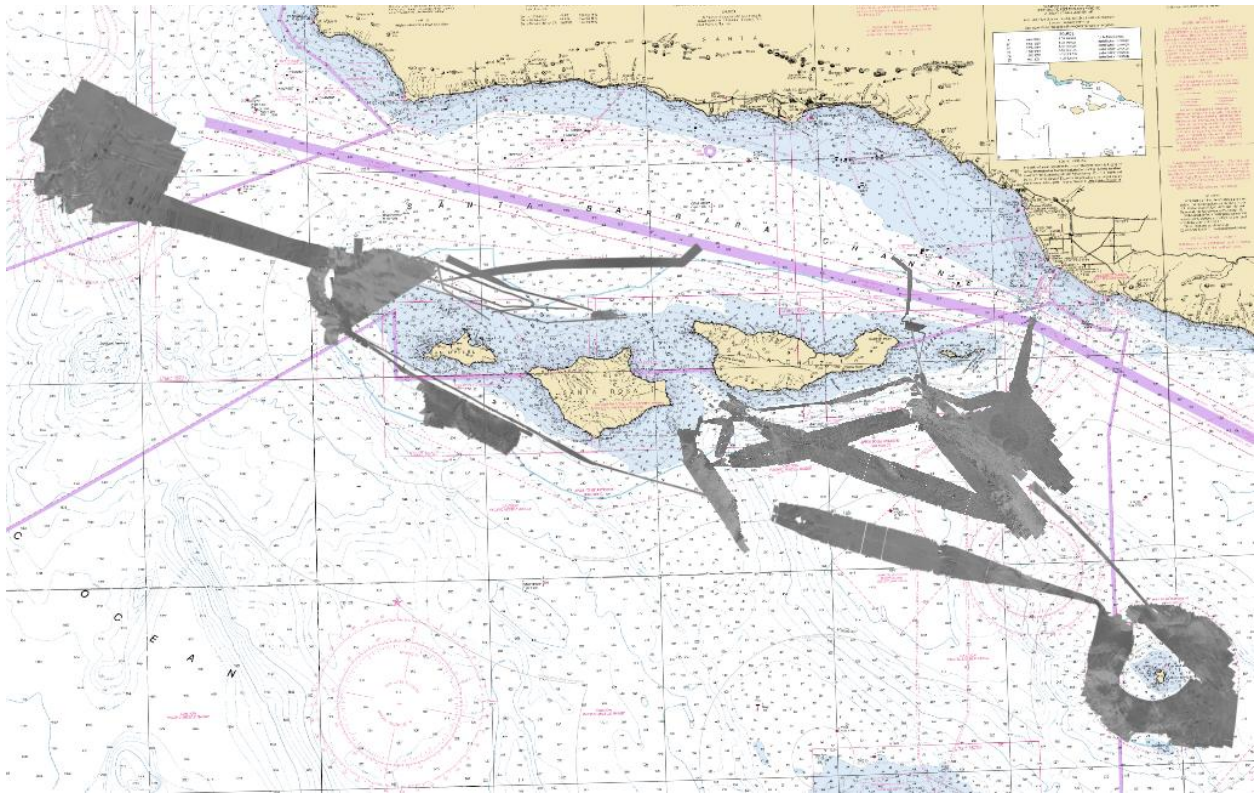



Figure 11 Backscatter mosaics generated for W00341. Greyscale color range 10 to -70 dB. Background chart 18720 1:232,188. Some of the submitted mosaics were too large for archival purposes so all new mosaics were re-created during office review.

J. Approval

The survey data meets or exceeds requirements as set forth in the NOS Hydrographic Surveys and Specifications Deliverables Manual, Field Procedures Manual, Standing and Letter Instructions, and all HSD Technical Directives. These data are adequate to supersede charted data in their common areas. This survey is complete and no additional work is required with the exception of deficiencies noted in the Survey Summary Report. All surfaces, this Survey Summary Report, and all accompanying records and data are approved. All records are forwarded for final review and processing to the Processing Branch.

Approver Name	Approver Title	Approval Date	Signature
Andrew A. Armstrong	Co-Director, JHC	22 September 2107	

APPROVAL PAGE

W00341

Data meet or exceed current specifications as certified by the OCS survey acceptance review process. Descriptive Report and survey data except where noted are adequate to supersede prior surveys and nautical charts in the common area.

The following products will be sent to NCEI for archive

- Descriptive Report
- Collection of Bathymetric Attributed Grids (BAGs)
- Collection of backscatter mosaics
- Processed survey data and records
- GeoPDF of survey product

The survey evaluation and verification has been conducted according current OCS Specifications, and the survey has been approved for dissemination and usage of updating NOAA's suite of nautical charts.

Approved: _____

Commander Olivia Hauser, NOAA
Chief, Pacific Hydrographic Branch