U.S. Department of Commerce National Oceanic and Atmospheric Administration National Ocean Service		
	DESCRIPTIVE REPORT	
Type of Survey:	Navigable Area	
Registry Number:	H13275	
	LOCALITY	
State(s):	Hawaii	
General Locality:	Hawaiian Islands and Vicinity	
Sub-locality:	Kaunakakai Harbor to Kamalo Harbor	
-	2019	
	CHIEF OF PARTY Benjamin K. Evans, CAPT/NOAA	
	LIBRARY & ARCHIVES	
Date:		

U.S. DEPARTMENT OF COMMERCE REGISTRY NUMBER: NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION			
HYDROGRAPHIC TITLE SHEETH13275			
INSTRUCTIONS: The Hydrog	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(s):	Hawaii		
General Locality:	Hawaiian Islands and Vicinity		
Sub-Locality:	Kaunakakai Harbor to Kamalo Harbor		
Scale:	40000		
Dates of Survey:	08/20/2019 to 08/26/2019		
Instructions Dated:	06/28/2019		
Project Number:	OPR-T383-RA-19		
Field Unit:	NOAA Ship Rainier (S221)		
Chief of Party: Benjamin K. Evans, CAPT/NOAA			
Soundings by:	Multibeam Echo Sounder		
Imagery by:	Multibeam Echo Sounder Backscatter		
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/.

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Descriptive Report to Accompany Survey H13275

Project: OPR-T383-RA-19 Locality: Hawaiian Islands and Vicinity Sublocality: Kaunakakai Harbor to Kamalo Harbor Scale: 1:40000 August 2019 - August 2019

NOAA Ship Rainier

Chief of Party: Benjamin K. Evans, CAPT/NOAA

A. Area Surveyed

The survey area is referred to as H13275, "Kaunakakai Harbor to Kamalo Harbor" (sheet 5) within the Project Instructions. The area encompasses approximately 10 square nautical miles on the southern coast of Molokai Island, Hawai'i.

A.1 Survey Limits

Data were acquired within the following survey limits:

Northwest Limit	Southeast Limit
21° 5' 0.89" N	21° 1' 28.49" N
157° 4' 20.67" W	156° 57' 15.89" W

Table 1: Survey Limits



Figure 1: H13275 assigned survey area (Charts 19347 and 19351).

Data were acquired within the assigned survey limits as required in the Project Instructions and HSSD unless otherwise noted in this report.

A.2 Survey Purpose

The area encompassing survey H13275 is exposed to wind and heavy seas from the east and south. Kaunakakai Harbor, Molokai's main harbor, is used for cargo, recreational, and commercial vessels. It is shared by the Department of Transportation (DOT) and the Department of Land and Natural Resources' Division of Boating and Ocean Recreation (DOBOR). Kaunakakai Harbor and its surrounding waters were surveyed several times during the 1900s with leadline, sounding poles, fathometers, echo sounders, and aerial LIDAR data. The most recent survey of this area was completed in 2016 by the Army Corps of Engineers and encompassed only the extents Kaunakakai Harbor and its channel. The multibeam data from this survey will provide crucial updates to nautical charts, enhancing navigational safety in Kaunakakai Harbor and its approaches.

A.3 Survey Quality

The entire survey is adequate to supersede previous data.

Pydro QC Tools Grid QA was used to analyze H13275 multibeam echosounder (MBES) data density. The submitted H13275 variable-resolution (VR) surface met HSSD density requirements as shown in the histogram below.



Figure 2: Pydro derived plot showing HSSD density compliance of H13275 finalized complete coverage variable-resolution MBES data.

A.4 Survey Coverage

The following table lists the coverage requirements for this survey as assigned in the project instructions:

Water Depth	Coverage Required
All waters in survey area	Complete Coverage (Refer to HSSD Section 5.2.2.3)

Table 2: Survey Coverage

Because of time constraints, full coverage of the survey area could not be attained. The field unit prioritized the most navigationally significant areas, which were Kaunakakai Harbor and its approaches up to the Navigable Area Limit Line.

To ensure appropriate data density for safety to navigation in Kaunakakai Harbor, all data within the harbor were collected using a 400 kHz frequency and "SHORT" continuous wave ping mode. All waters outside the harbor were collected using a 300 kHz frequency and "AUTO" ping mode.



Figure 3: H13275 MBES coverage and assigned survey limits (Charts 19347 and 19351).



Figure 4: Example of Navigable Area Limit Line (NALL) determination; the blue dashed line indicates assigned sheet limits. The inshore limit for areas outside of the harbor is 10 meters water depth in the Project Instructions. Time constraints prevented full coverage of the NALL.



Figure 5: Example of Navigable Area Limit Line (NALL) determination; the blue dashed line indicates assigned sheet limits. The inshore limit for areas inside the harbor is 3.5 meters water depth in the Project Instructions. Time constraints prevented full coverage of the NALL.

A.6 Survey Statistics

The following table lists the mainscheme and crossline acquisition mileage for this survey:

	HULL ID	2801	2803	Total
	SBES Mainscheme	0	0	0
	MBES Mainscheme	79.01	67.73	146.74
	Lidar Mainscheme	0	0	0
	SSS Mainscheme	0	0	0
	SBES/SSS Mainscheme	0	0	0
	MBES/SSS Mainscheme	0	0	0
	SBES/MBES Crosslines	6.11	6.02	12.13
	Lidar Crosslines	0	0	0
Numb Botton	er of n Samples			0
Numb Bound Investi	er Maritime lary Points igated			0
Numb	er of DPs			1
Numb Invest Dive C	er of Items igated by Dps			0
Total S	SNM			10.28

Table 3: Hydrographic Survey Statistics

The following table lists the specific dates of data acquisition for this survey:

Survey Dates	Day of the Year
08/20/2019	232
08/21/2019	233

Survey Dates	Day of the Year
08/22/2019	234
08/23/2019	235
08/24/2019	236
08/26/2019	238

Table 4: Dates of Hydrography

B. Data Acquisition and Processing

B.1 Equipment and Vessels

Refer to the Data Acquisition and Processing Report (DAPR) for a complete description of data acquisition and processing systems, survey vessels, quality control procedures and data processing methods. Additional information to supplement sounding and survey data, and any deviations from the DAPR are discussed in the following sections.

B.1.1 Vessels

The following vessels were used for data acquisition during this survey:

Hull ID	2801	2803
LOA	8.8 meters	8.8 meters
Draft	1.1 meters	1.1 meters

Table 5: Vessels Used



Figure 6: RAINIER Launch 2801 (RA-4).

All multibeam data for H13275 were acquired by NOAA Ship RAINIER survey launches 2801 (RA-4) and 2803 (RA-3). These vessels acquired depth soundings, backscatter, and sound speed profiles.

B.1.2 Equipment

The following major systems were used for data acquisition during this survey:

Manufacturer	Model	Туре
Applanix	POS MV 320 v5	Positioning and Attitude System
Kongsberg Maritime	EM 2040	MBES
Teledyne RESON	SVP 70	Sound Speed System
Sea-Bird Scientific	SBE 19plus V2	Conductivity, Temperature, and Depth Sensor

Table 6: Major Systems Used

B.2 Quality Control

B.2.1 Crosslines

Multibeam/single beam echo sounder/side scan sonar crosslines acquired for this survey totaled 8.27% of mainscheme acquisition.

RAINIER launches 2801 (RA-4) and 2803 (RA-3) acquired 12.13 nautical miles of multibeam crosslines. Crosslines could not be acquired inside the harbor because of time constraints. H13275 crossline data is adequate for verifying and evaluating the internal consistency of survey data. The Compare Grids function in Pydro Explorer analyzed finalized VR surfaces of H13275 crossline-only data and mainscheme-only data. In the difference surface, 99.5% of nodes met IHO allowable Total Vertical Uncertainty (TVU) standards. Figures 7-9 provide additional results.



Figure 7: H13275 crossline surface overlaid on mainscheme tracklines.



Comparison Distribution

Figure 8: Pydro derived showing percentage-pass value of H13275 complete coverage mainscheme to crossline data.



Figure 9: Pydro derived plot showing absolute difference statistics of H13275 complete coverage mainscheme to crossline data.

B.2.2 Uncertainty

The following survey specific parameters were used for this survey:

Method	Measured	Zoning
ERS via ERTDM	0 meters	0.10 meters

Table 7: Survey Specific Tide TPU Values.

Hull ID	Measured - CTD	Measured - MVP	Measured - XBT	Surface
2801, 2803	3 meters/second	N/A meters/second	N/A meters/second	0.05 meters/second

Table 8: Survey Specific Sound Speed TPU Values.

Total Propagated Uncertainty (TPU) values for survey H13275 were derived from a combination of fixed values for equipment and vessel characteristics and field assigned values for sound speed uncertainties. A tidal zoning uncertainty of 0.10 meters was provided with NOAA's Ellipsoidal Referenced Tidal Datum Model (ERTDM) for this project. See the 2019 DAPR for further information.

In addition to these uncertainty estimates, some real-time and post-processed uncertainty sources were also incorporated into the depth estimates of this survey. Real-time uncertainties from Applanix POS MV position, navigation, attitude, and vessel motion data were applied during acquisition and initially in post-processing. However, the SBET and RMS files, which were generated using POSPac MMS software and applied in CARIS HIPS to supersede POS MV data, have post-processed uncertainties associated with corrected GPS position, attitude, and inertial measurements.

Uncertainty values of the submitted finalized grid were calculated in CARIS using "Greater of the Two" of uncertainty and standard deviation (scaled to 95%). Grid QA v5 within Pydro QC Tools was used to analyze H13275 TVU compliance. The submitted H13275 variable-resolution (VR) surface met TVU requirements as shown in Figure 10.



complete coverage finalized variable-resolution MBES data.

B.2.3 Junctions

There are no junctions required for this survey.

There are no contemporary surveys that junction with this survey.

B.2.4 Sonar QC Checks

Sonar system quality control checks were conducted as detailed in the quality control section of the DAPR.

B.2.5 Equipment Effectiveness

There were no conditions or deficiencies that affected equipment operational effectiveness.

B.2.6 Factors Affecting Soundings

Sea State

Excessive noise from rolling was caused by heavy swell and wind waves. This is especially noticeable in crosslines, which were driven in the trough. Frequent swells also occasionally caused blowouts. These were cleaned out of the data but no holidays were created as a result.

Vertical Offset

Launch 2801 (RA-4) displays a vertical offset from surrounding data on day number 234 in lines 0018 and 0019. The SBET for this boat day displayed a satellite drop out during the collection of the two multibeam lines. A new SBET was created using SmartBase solution instead of Trimble PP-RTX. The SBET was only applied to lines 0018 and 0019 and resulted in improved data quality (Figure 11). The SmartBase SBET is saved with the original SBET file for launch 2801, DN 234. See Section C.2 Horizontal Control for more information.



Figure 11: Comparison of surfaces produced with PP-RTX SBET and SmartBase SBET (no vertical exaggeration).

B.2.7 Sound Speed Methods

Sound Speed Cast Frequency: Launches took casts at least once every four hours (before MBES acquisition, middle of the day, and near the end of the day).

A total of 25 sound speed casts were taken on H13275. Additional casts were taken when significant changes to surface sound speed were observed or when operating in a new area. Sound speed profiles were acquired using a Sea-Bird 19plus V2 SEACAT Profiler. All casts were concatenated into a master file and applied to MBES data in CARIS HIPS using the "Nearest in distance within time (4 hours)" profile selection method.



Figure 12: H13275 sound speed cast locations.

B.2.8 Coverage Equipment and Methods

All equipment and survey methods were used as detailed in the DAPR.

B.2.9 Detect Fliers

Pydro QC Tools Flier Finder v8 was used to find fliers in the finalized variable resolution surface. Flier Finder settings: Checks included #2: Gaussian Curvature, #3: Adjacent Cells, #4: Edge Slivers, and #5: Isolated Nodes; Filters were defined as Distance ≤ 1.0 nodes and Delta Z ≤ 0.01 meters. "Features from

S57 File" and "Designated (SR BAG only)" were not used. Flier height was not restricted. Obvious noise was rejected by the hydrographer in CARIS subset editor. After data cleaning, Flier Finder was run again and found 0 fliers in the surface.

B.3 Echo Sounding Corrections

B.3.1 Corrections to Echo Soundings

All data reduction procedures conform to those detailed in the DAPR.

B.3.2 Calibrations

All sounding systems were calibrated as detailed in the DAPR.

B.4 Backscatter

Raw backscatter data were acquired as .ALL files logged during MBES operations and processed by the field unit. The .GSF files created during processing and one backscatter mosaic per vessel per frequency has been delivered with this report. Backscatter processing procedures are described in the DAPR.



Figure 13: Overview of H13275 backscatter mosaics (Charts 19347 and 19351).

B.5 Data Processing

B.5.1 Primary Data Processing Software

The following software program was the primary program used for bathymetric data processing:

Manufacturer	Name	Version
CARIS	HIPS and SIPS	11.1

Table 9: Primary bathymetric data processing software

The following software program was the primary program used for imagery data processing:

Manufacturer	Name	Version
QPS	Fledermaus Geocoder Tool Box (FMGT)	7.8.1

Table 10: Primary imagery data processing software

The following Feature Object Catalog was used: NOAA Profile 2019 v2.

B.5.2 Surfaces

The following surfaces and/or BAGs were submitted to the Processing Branch:

Surface Name	Surface Type	Resolution	Depth Range	Surface Parameter	Purpose
H13275_MB_VR_MLLW	CARIS VR Surface (CUBE)	Variable Resolution	1.3 meters - 160.3 meters	NOAA_VR	Complete MBES
H13275_MB_VR_MLLW_Final CARIS VI (CUBE)		Variable Resolution	1.3 meters - 160.3 meters	NOAA_VR	Complete MBES

Table 11: Submitted Surfaces

Submitted Surfaces were generated using the NOAA recommended parameters for depth-based (Ranges) CARIS variable-resolution bathymetric grids as specified in 2019 HSSD.

C. Vertical and Horizontal Control

Additional information discussing the vertical or horizontal control for this survey can be found in the accompanying 2019 DAPR.

C.1 Vertical Control

The vertical datum for this project is Mean Lower Low Water.

ERS Datum Transformation

The following ellipsoid-to-chart vertical datum transformation was used:

MethodEllipsoid to Chart Datum Separation File	
ERS via ERTDM	OPR-T383- RA-19_ERTDM_NAD83(2011)_MLLW_Extended2 OPR-T383- RA-19_ERTDM_NAD83(2011)_MHW_Extended2.csar

Table 12: ERS method and SEP file

C.2 Horizontal Control

The horizontal datum for this project is North American Datum of 1983 (NAD 83).

The projection used for this project is Universal Transverse Mercator (UTM) Zone 4.

The following PPK methods were used for horizontal control:

- Smart Base
- RTX

The following base stations were selected by POSPac MMS 8.3 to produce a SmartBase SBET specifically for multibeam tracklines 0018 and 0019 from 2801 (RA-4) on day 234.

HVCR Site ID	Base Station ID	
MAUI	Haleakala Maui	
ZHN1	Honolulu WAAS 1	
UPO6	Upolu Point 6	
MLO1	Mauna Loa Observatory	
KOKV	Kokee Park, Waimea	
КОКВ	Kokee Park Geophysical Observatory	

The following CORS Stations were used for horizontal control:

Table 13: CORS Base Stations

WAAS

The Wide Area Augmentation System (WAAS) was used for real-time horizontal control during data acquisition. Post Processed-Real-Time Extended (PP-RTX) processing methods were used in Applanix POSPac MMS 8.3 software to produce SBETs for post-processed horizontal and vertical corrections.

D. Results and Recommendations

D.1 Chart Comparison

H13275 survey data was compared to Electronic Navigation Charts (ENC) US4HA30M and US5HA31M using a variable resolution CUBE surface, selected soundings, and contours created in CARIS. Throughout the survey, multibeam contours generally agreed with their charted depth curves. See images and discussions below for more information.

D.1.1 Electronic Navigational Charts

The following are the largest scale ENCs, which cover the survey area:

ENC	Scale	Edition	Update Application Date	Issue Date	Preliminary?
US4HA30M	1:80000	4	08/29/2017	08/29/2017	NO
US5HA31M	1:5000	11	08/01/2019	08/30/2019	NO

Table 14: Largest Scale ENCs

US4HA30M

Section A: 18.2 meter (10 ftm) contour is ~150 meters inshore of charted depth curve

Section B: 54.6 meter (30 ftm) contour is ~100 meters inshore of charted depth curve

Section C: Depths greater than 91.4 meter (50 ftm) found inshore of 50 fathom depth curve

Section D: No 18.2 meter (10 ftm) shoal seen in MBES data



Figure 14: Survey H13275 contours overlaid on ENC US4HA30M.

<u>US5HA31M</u>

Section A: 18.2 meter (10 ftm) contour is less dynamic than its charted depth curve

Section B: 9.1 meter (5 ftm) contour extends further inshore than charted

Section C: The 9.1 meter (5 ftm) contour inside the harbor is larger in area than its charted depth curve. MBES data also showed that the two 5 fathom depth curves charted in the harbor are connected, not separate.



Figure 15: Survey H13275 contours overlaid on ENC US5HA31M.

D.1.2 Maritime Boundary Points

No Maritime Boundary Points were assigned for this survey.

D.1.3 Charted Features

One PA for a wreck exists on the chart but could not be investigated. See Final Feature File for more information.

D.1.4 Uncharted Features

No uncharted features exist for this survey.

D.1.5 Shoal and Hazardous Features

Shoals and coral reefs surrounding the navigable waters in the harbor established the Navigable Area Limit Line as the inshore extent of safe navigation and prevented further nearshore investigation.

D.1.6 Channels

The channel leading into Kaunakakai Harbor is a federally-maintained channel that is periodically surveyed and dredged by the US Army Corps of Engineers. Please refer to the Supplemental Survey Records and Correspondence section of this report for more information regarding the USACE's 2016 survey of the harbor and its channel.

D.1.7 Bottom Samples

No bottom samples were required for this survey.

D.2 Additional Results

D.2.1 Shoreline

Limited shoreline verification was conducted in accordance with the applicable sections of NOAA HSSD and FPM using the Composite Source File (CSF) provided by NOAA HSD Operations Branch. In the field, all assigned features that were safe to approach were addressed as required with S-57 attribution and recorded in the H13275_FFF to best represent the features at chart scale. The file includes recommendations to update, retain, or delete assigned features.

D.2.2 Aids to Navigation

ATONs were visually verified and appear to be on station and serving their intended purposes. See Final Feature File for more information.

D.2.3 Overhead Features

No overhead features exist for this survey.

D.2.4 Submarine Features

Submarine features exist for this survey, but were not investigated.

D.2.5 Platforms

No platforms exist for this survey.

D.2.6 Ferry Routes and Terminals

There are no charted ferry routes or terminals. The Maui/Molokai Ferry between Lahaina and Kaunakakai Harbor was discontinued in October, 2016.

D.2.7 Abnormal Seafloor and/or Environmental Conditions

No abnormal seafloor and/or environmental conditions exist for this survey.

D.2.8 Construction and Dredging

No present or planned construction or dredging exist within the survey limits.

D.2.9 New Survey Recommendation

No new surveys or further investigations are recommended for this area.

D.2.10 Inset Recommendation

No new insets are recommended for this area.

E. Approval Sheet

As Chief of Party, field operations for this hydrographic survey were conducted under my direct supervision, with frequent personal checks of progress and adequacy. I have reviewed the attached survey data and reports.

All field sheets, this Descriptive Report, and all accompanying records and data are approved. All records are forwarded for final review and processing to the Processing Branch.

The survey data meets or exceeds requirements as set forth in the NOS Hydrographic Surveys Specifications and Deliverables, Field Procedures Manual, 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 Descriptive Report.

Approver Name	Approver Title	Approval Date	Signature
Samuel F. Greenaway, CDR/NOAA	Commanding Officer	12/11/2019	GREENAWAY.S Digitally signed by GREENAWAY.SAMUEL.F.12 AMUEL.F.12756 7563547 Date: 2019.12.11 12:41:45 -08'00'
Hadley A. Owen, LT/NOAA	Field Operations Officer	12/11/2019	Digitally signed by OWEN.HADLEY.ANNE.14 10967070 Date: 2019.12.11 10:14:46-08'00'
Audrey E. Jerauld	Senior Survey Technician/ACST	12/11/2019	JERAULD.AUDR Digitally signed by JERAULD.AUDREY.ELIZABE EY.ELIZABETH.1 TH.1170496260 170496260 Date: 2019.12.11 12:08:26 -08'00'
Amanda M. Finn	Sheet Manager	12/11/2019	FINN.AMANDA. Digitally signed by FINN.AMANDA.MARIA.1540 MARIA.1540474 474253 253 - Date: 2019.12.11 09:25:54 -08'00'

F. Table of Acronyms

Acronym	Definition
AHB	Atlantic Hydrographic Branch
AST	Assistant Survey Technician
ATON	Aid to Navigation
AWOIS	Automated Wreck and Obstruction Information System
BAG	Bathymetric Attributed Grid
BASE	Bathymetry Associated with Statistical Error
СО	Commanding Officer
CO-OPS	Center for Operational Products and Services
CORS	Continuously Operating Reference Station
CTD	Conductivity Temperature Depth
CEF	Chart Evaluation File
CSF	Composite Source File
CST	Chief Survey Technician
CUBE	Combined Uncertainty and Bathymetry Estimator
DAPR	Data Acquisition and Processing Report
DGPS	Differential Global Positioning System
DP	Detached Position
DR	Descriptive Report
DTON	Danger to Navigation
ENC	Electronic Navigational Chart
ERS	Ellipsoidal Referenced Survey
ERTDM	Ellipsoidally Referenced Tidal Datum Model
ERZT	Ellipsoidally Referenced Zoned Tides
FFF	Final Feature File
FOO	Field Operations Officer
FPM	Field Procedures Manual
GAMS	GPS Azimuth Measurement Subsystem
GC	Geographic Cell
GPS	Global Positioning System
HIPS	Hydrographic Information Processing System
HSD	Hydrographic Surveys Division

Acronym	Definition
HSSD	Hydrographic Survey Specifications and Deliverables
HSTB	Hydrographic Systems Technology Branch
HSX	Hypack Hysweep File Format
HTD	Hydrographic Surveys Technical Directive
HVCR	Horizontal and Vertical Control Report
HVF	HIPS Vessel File
IHO	International Hydrographic Organization
IMU	Inertial Motion Unit
ITRF	International Terrestrial Reference Frame
LNM	Linear Nautical Miles
MBAB	Multibeam Echosounder Acoustic Backscatter
MCD	Marine Chart Division
MHW	Mean High Water
MLLW	Mean Lower Low Water
NAD 83	North American Datum of 1983
NALL	Navigable Area Limit Line
NTM	Notice to Mariners
NMEA	National Marine Electronics Association
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NRT	Navigation Response Team
NSD	Navigation Services Division
OCS	Office of Coast Survey
OMAO	Office of Marine and Aviation Operations (NOAA)
OPS	Operations Branch
MBES	Multibeam Echosounder
NWLON	National Water Level Observation Network
PDBS	Phase Differencing Bathymetric Sonar
РНВ	Pacific Hydrographic Branch
POS/MV	Position and Orientation System for Marine Vessels
РРК	Post Processed Kinematic
PPP	Precise Point Positioning
PPS	Pulse per second

Acronym	Definition
PRF	Project Reference File
PS	Physical Scientist
RNC	Raster Navigational Chart
RTK	Real Time Kinematic
RTX	Real Time Extended
SBES	Singlebeam Echosounder
SBET	Smooth Best Estimate and Trajectory
SNM	Square Nautical Miles
SSS	Side Scan Sonar
SSSAB	Side Scan Sonar Acoustic Backscatter
ST	Survey Technician
SVP	Sound Velocity Profiler
TCARI	Tidal Constituent And Residual Interpolation
TPU	Total Propagated Uncertainty
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
UTM	Universal Transverse Mercator
XO	Executive Officer
ZDF	Zone Definition File

APPROVAL PAGE

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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 products

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