

H10910

NOAA FORM 76-35A

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

DESCRIPTIVE REPORT

Type of Survey Hydrographic

Field No. RA-20-07-99

Registry No. H-10910

LOCALITY

State Alaska

General Locality Cook Inlet, Navigation Corridors

Sublocality 6 NM Northwest of Cape Kasilof

1999

CHIEF OF PARTY

Commander Daniel R. Herlihy, NOAA

LIBRARY & ARCHIVES

DATE

NOV 8 2000

HYDROGRAPHIC TITLE SHEET

H-10910

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.

RA-20-07-99

State Alaska

General locality Cook Inlet (Navigation Corridors)

Locality 6 NM Northwest of Cape Kasilof

Scale 1:20,000 Date of survey 7/21/99 - 8/19/99

Instructions dated June 8, 1999 * Project No. OPR-P342-RA

Vessel (RAINIER) RA-1(2121), RA-3(2123), RA-5(2125), RA-6(2126)

Chief of party Commander Daniel R. Herlihy, NOAA

Surveyed by RAINIER Personnel

Soundings taken by echo sounder, ~~and lead line~~ Knudsen 320M, RESON 8101MB

Graphic record scaled by RAINIER Personnel

Graphic record checked by RAINIER Personnel

Evaluation by: I. Almacen Automated plot by HP Design Jet 750C

Verification by E. Domingo, R. Davies, G. Nelson, R. Mayor, D. Doles

Soundings in fathoms ~~XXXX~~ at ~~MLW~~ MLLW and tenths (data collected in meters)

REMARKS: All times are UTC, revisions and marginal notes in black were generated during office processing. All separates are filed with the hydrographic data, as a result page numbering may be interrupted or non-sequential.
All depths listed in this report are referenced to mean lower low water unless otherwise noted.
* Change #1 - July 26, 1999

AWJ/S/SURE 10-18-00 by MBH

PROGRESS SKETCH

OPR-P342-RA
COOK INLET
ALASKA

Navigable Area
Corridor
(2 Mile Wide Swath)
July 1999

Chart 16662

NOAA Ship RAINIER
CDR Daniel R. Hertlhy
Commanding

NOAA'S HYDROGRAPHIC SURVEYING PROGRAM IS A JOINT EFFORT OF THE U.S. NAVY AND THE U.S. COAST AND GEODETIC SURVEY. THE U.S. NAVY'S CONTRIBUTION IS PROVIDED BY THE NAVAL HYDROGRAPHIC OFFICE, WASHINGTON, D.C. THE U.S. COAST AND GEODETIC SURVEY'S CONTRIBUTION IS PROVIDED BY THE CHIEF OF NAVAL OPERATIONS, WASHINGTON, D.C.

Downtime Type	July	August
Weather - Hr	0	0
Mechanical -Hr	0	0
Electronic -Hr	0	0

Accomplished	July	August
LNH Hydro	0	0
LNH SSS	0	0
SQ NM	56.29	0.9
AWOIS Invest.	1	0
Other Invest.	0	0
LNH Multibeam	1950.92	86.78
Days at Sea	23	2

Sheet	Reg_No	Started	Percent	Completed	Submitted	SQNM
H	H10908	7/16/99	100	8/19/99		11.86
I	H10909	7/16/99	100	8/19/99		19.66
J	H10810	7/16/99	100	8/19/99		25.67

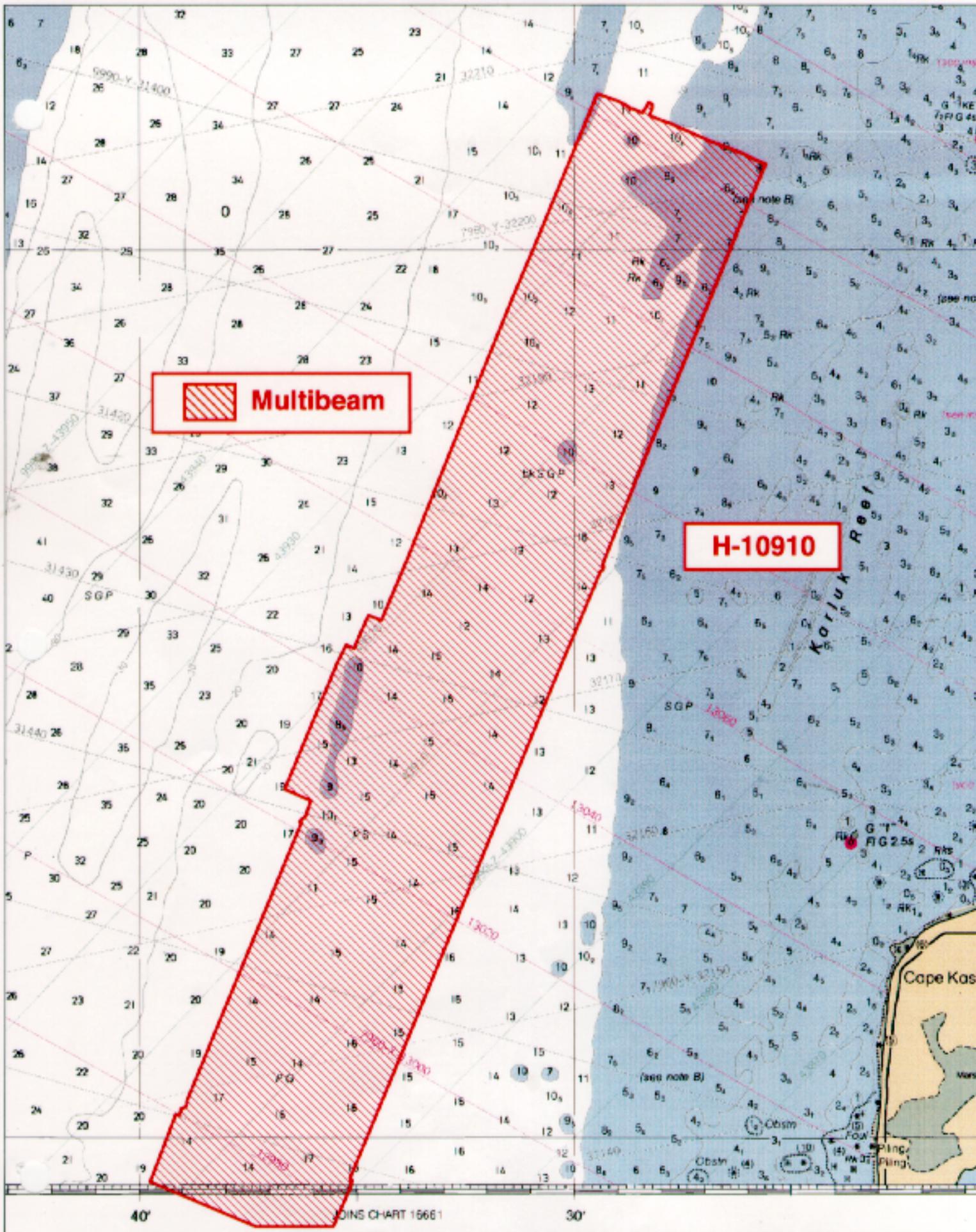
Sheet "H"
Area of Hydrography
11.86 SNM

Sheet "I"
Area of Hydrography
19.66 SNM

Sheet "J"
Area of Hydrography
25.67 SNM

U.S. GOVERNMENT PRINTING OFFICE: 1999 O-488-000

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 **Multibeam**

H-10910

40'

JOINS CHART 16661

30'

Descriptive Report to Accompany Hydrographic Survey H10910

Field Number RA-20-07-99

Scale 1:20,000

July-August 1999

NOAA Ship RAINIER

Chief of Party: Commander Daniel R. Herlihy, NOAA

A. PROJECT ✓

This navigable area survey was completed as specified by the Draft Standing Project Instructions dated April 6, 1999 and Hydrographic Survey Letter Instructions OPR-P342-RA dated June 08, 1999, amended July 26, 1999 (change number 1). Survey H10910 corresponds to Sheet J as defined in the sheet layout.

This project is being conducted in response to requests from the Southwest Alaska Pilot's Association for full bottom coverage hydrographic surveys of a navigation corridor in Cook Inlet and specifically the approaches to Nikiski. Heavy marine traffic including deep draft tankers, liquid nitrogen gas (LNG) tankers, ammonia tankers, bulk vessels, container vessels, and barges transit this area. With the use of shallow water multibeam systems, it is the intent of this survey to provide modern and accurate full-coverage hydrographic survey data to supersede prior surveys performed from 1967 through 1976 in an effort to update NOS Charts of the area.

B. AREA SURVEYED. (See SEAL RPT, Sec. B)

The survey area is located 6 nm northwest of Cape Kasilof in Cook Inlet, Alaska, and covers approximately 26 square nautical miles of a navigation corridor. The original survey limits were revised to include a shoal area to the west, and to increase the overlap area with H10904 (OPR-P385-KR) to the north. Survey limits are depicted below in Figure 1 on a detail of Chart 16660, with original survey limits shown in blue and revised limits shown in red. The survey's revised northern limit is latitude $60^{\circ}31'40''\text{N}$ and the southern limit is latitude $60^{\circ}19'27''\text{N}$. The survey's western limit is longitude $151^{\circ}39'31''\text{W}$ and the revised eastern limit is longitude $151^{\circ}25'42''\text{W}$. Data acquisition was conducted from July 21 to August 1, 1999 (DN 202 to 213), and August 19, 1999 (DN231).

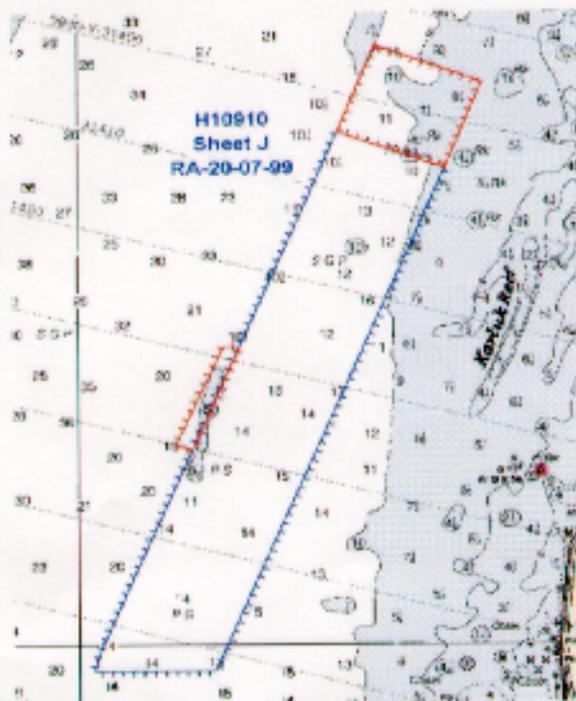
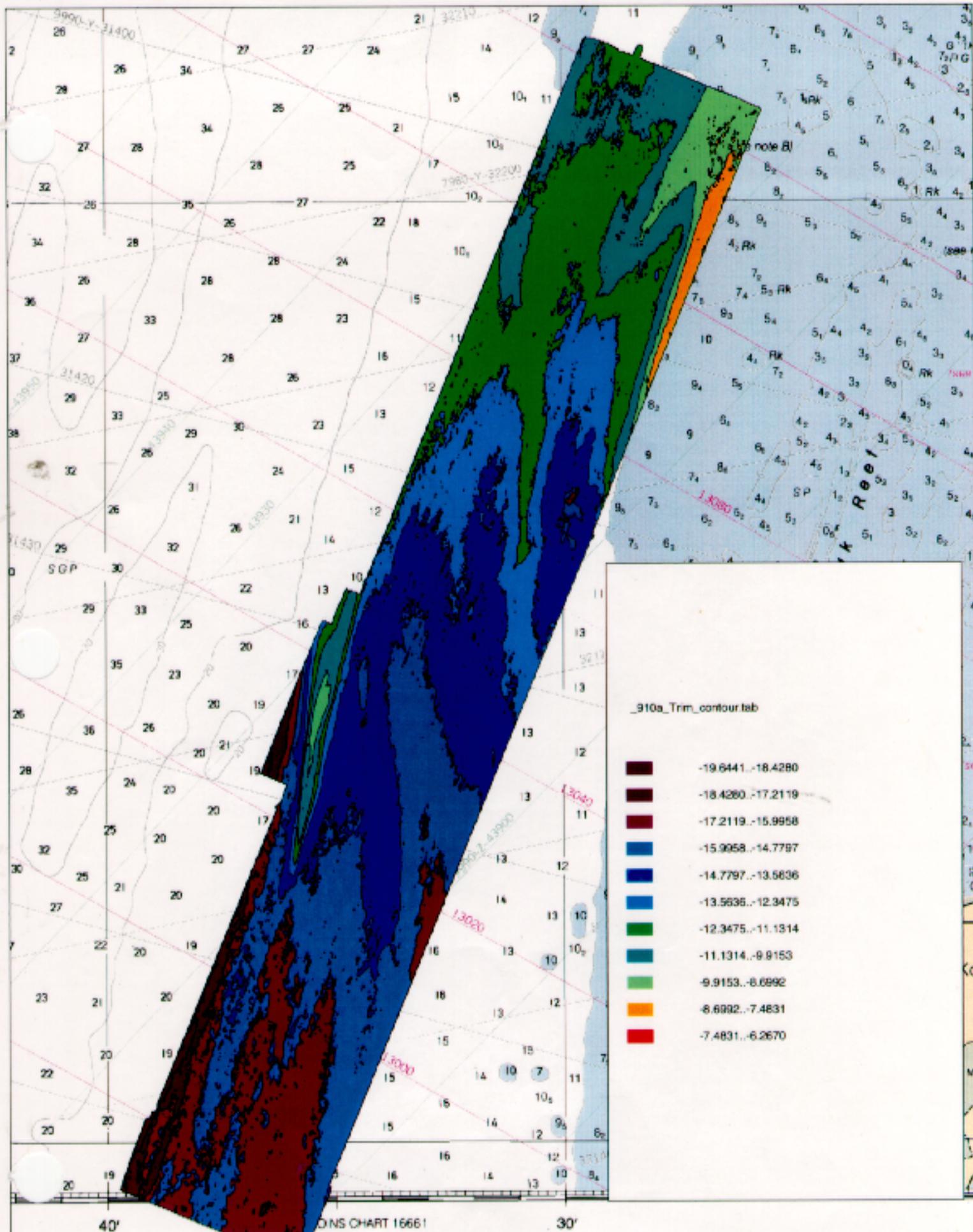


Figure 1. Original (blue) and Revised (red) Survey Limits for H10910



40'

ONS CHART 16661

30'

C. SURVEY VESSELS ✓

Data was acquired by RAINIER survey launches (vessel numbers 2121, 2123, 2125 and 2126) as noted in the Survey Information Summary included with this report. These vessels were used exclusively for acquisition of shallow water multibeam data, bottom samples, and sound velocity profiles. See Project Related Data for OPR-P342-RA for vessel descriptions. No unusual vessel configurations or problems were encountered during this survey.

D. AUTOMATED DATA ACQUISITION AND PROCESSING ✓

Coastal Oceanographic's HYPACK version 8.9 was utilized for vessel navigation and line tracking during acquisition of shallow water multibeam (SWMB) data. ✓

Shallow water multibeam (SWMB) echosounder data were acquired using the Reson SeaBat 8101 with Triton Elics ISIS version 4.32 and processed using CARIS HIPS software version 4.3. ✓

Reson 8101 depth data were reviewed with CARIS Hydrographic Data Cleaning System (HDCS). Depth fliers were identified and manually flagged as "rejected". Vessel positioning and attitude data from each system were similarly displayed and manually cleaned. Additionally, instantaneous speed as computed from the positioning data was checked for speed jumps exceeding 3 knots as an indication of potential position fliers.

After review and cleaning, Reson 8101 depth, position and attitude data were merged with sound velocity, verified tide and dynamic draft correctors to compute the corrected depth and position of each sounding. These processed data were extracted into a CARIS Workfile using "line-by-line" shoal-biased binning at a density of 5 meters x 5 meters. Digital Terrain Models (DTM's) at this resolution were used to determine coverage and served as a data quality assurance tool. Processed soundings were then exported into the Hydrographic Processing System (HPS) through HPTools. Soundings were corrected using verified tides fully adjusted using HP Tools for the MapInfo tidal zoning scheme provided with the project files. Processed soundings were excessed using a 3mm character size, and plotted at a 2mm character size to produce the final sounding plot. Final selected soundings were saved and plotted in MapInfo. Raster images registered in MapInfo facilitated chart and prior survey comparisons. ✓

During survey H10910, SWMB soundings beyond a maximum angle of 60° off nadir were rejected in an attempt to reduce noise in the outer beams, with one exception. In the southern portion of the sheet, soundings between 60° and 70° were retained after close inspection revealed consistent, quality sounding data from 60° to 70° off nadir. The purpose of retaining this data was to fill in small holidays between adjacent swaths. Data retained from these outer beams were inspected closely for any indication of shoaling. ✓

Survey H10910 is defined as sheet 03 in HPS. The CARIS workfile name is defined as cook_j, and the project name is identified as P342_SheetJ in HDCS.

All final plots were created in MapInfo using UTM Zone 5 projection.

A complete listing of software is included in Appendix H. * Data flow diagrams are included in Appendix G. *

E. SONAR EQUIPMENT ✓

Side Scan Sonar (SSS) equipment was not used on this survey. ^{cancel.} However, it should be noted that the Reson SeaBat 8101 SWMB system provides a low-resolution digital SSS record of the SWMB swath. This SSS imagery is primarily used during final processing of SWMB depth data to aid in determining whether anomalous soundings are true features or noise.

* Filed with the hydrographic data.

F. SOUNDING EQUIPMENT ✓

One category of echosounder system was used to acquire and record sounding data and is described below.

Launch Shallow Water Multibeam (VN 2121, 2123, 2126) ✓

The shallow water multibeam (SWMB) system utilized for this survey was the Reson SeaBat 8101, which is a 240 kHz multibeam system that measures relative water depths across a wide swath perpendicular to the vessel's heading. The Reson 8101 sonifies the seafloor with a 150° swath, consisting of 101 individual 1.5° x 1.5° beams. A TSS POS/MV Position and Orientation Sensor was used to correct for the effects of vessel motion during survey operations. Serial numbers for the Reson 8101 and POS/MV are included in Appendix H. *

It should be noted that vertical beam echosounders (VBES) were utilized as a quality assurance tool for SWMB. Vessels 2121, 2123 and 2126 are equipped with the Knudsen 320M, which is a dual frequency (100 kHz, 24 kHz) digital recording echosounder with an analog paper trace. Sounding data acquired by this system were used for two purposes. First, VBES depth data were compared in real time to nadir beams of the shallow water multibeam. A digital comparison between the two is displayed within the ISIS interface. Second, during acquisition digital VBES data is sent to ISIS, which then focuses the shallow water multibeam on a variable "gate" determined from the VBES data. The latter is extremely helpful in areas of extreme relief, when the shallow water multibeam tends to lose bottom lock. VBES data were not recorded or used for final sounding plot compilation, and are not submitted with the digital data. VBES serial numbers are included in Appendix H. *

G. CORRECTIONS TO ECHO SOUNDINGS ✓**Water Level Correctors** ✓

Soundings were reduced to Mean Lower-Low Water (MLLW) using verified tide data for station Nikiski, AK (945-5760) obtained from the Center for Operational Oceanographic Products and Services (CO-OPS) web site. These data were used in creating HPS tide table #1 and were also used in CARIS. All tide correctors were fully adjusted for the MapInfo tidal zoning scheme supplied with the project files.

Listings of HPS tide tables used for H10910 and tidal correctors as provided in the Project Instructions for H10910 are contained in the Survey Information Summary included with this report.

The operating NWLON tide stations at Nikiski, Alaska (945-5760) and Anchorage, Alaska (945-5920) served as control for datum determination. RAINIER personnel installed a Sutron 8200 tide gauge at North Kalgin Island (945-5732) on July 15, 1999 and at Cape Kasilof (945-5711) on July 19, 1999. The North Kalgin Island gauge was removed on August 19, 1999. The NOAA contractor Terra Surveys, LLC removed the Cape Kasilof gauge during the week of August 30, 1999. Refer to the Field Tide Notes and supporting data in Appendix D for individual gauge performance and level closure information.

Raw water level data from these gauges were forwarded to N/OPS1 on September 2, 1999 in accordance with HSG 50 and FPM 4.7. The Pacific Hydrographic Branch will apply final approved (smooth) tides to the survey data during final processing. A request for delivery of final approved (smooth) tides to the Pacific Hydrographic Branch was forwarded to N/OPS1 on September 3, 1999 in accordance with FPM 4.8.

Approved Tide Note dated December 22, 1999 is attached.

Sound Velocity Correctors ✓

The velocity of sound through water was determined by a minimum of one cast every four hours of acquisition in accordance with the Draft Standing Project Instructions. Cast information is included in the Survey Information Summary and in Appendix I. *

** Filed with the hydrographic data.*

The sound velocity casts were acquired with SBE SEACAT Profilers (S/N 2543 and 2477), calibrated November 13, 1998. Calibration reports are included with the Project Related Data for OPR-P342-RA. ✓
 Velocity correctors were computed using the program VELOCWIN version 4 beta 2, which generates correction tables for both CARIS and HPS. Sound velocity correctors were applied in CARIS during post processing.

Settlement and Squat and Static Draft Correctors ✓

The following table shows when the vessel offset correctors used for this survey were last measured:

Vessel No.	Date of Static Draft and Transducer Offset Measurements	Method of Settlement and Squat Measurement	Date of Settlement and Squat Measurement	Location of Settlement and Squat Measurement
2121	March 1999	OTF	March 1999	Port Angeles, WA
2123	March 1999	OTF	March 1999	Port Angeles, WA
2126	March 1999	OTF	March 1999	Port Angeles, WA

Settlement and squat correctors, static draft measurements and vessel offsets are included with the Project Related Data for OPR-P342-RA. ✓

Heave, Pitch, Roll and Heading, Including Biases and Navigation Timing Errors ✓

SWMB launches (VN2121, 2123 and 2126) utilize a TSS POS/MV Model 320 Position and Orientation System (POS), which provides accurate navigation and attitude data to correct for the effects of heave, pitch, roll and heading. The POS generates attitude data in three axes (roll, pitch and heading) to an accuracy of 0.05° or better. Heave measurements supplied by the POS maintain an accuracy of 5% of the measured vertical displacement for movements that have a period of up to 10 seconds. The POS delivers heading measurements by two distinct methods. First, the Dynamic Heading Alignment determines the vessels heading by using the data supplied by the Internal Measurement Unit (IMU) and GPS receivers to achieve heading that is, at best, accurate to within 0.35°. This method suffers from drift but is relatively unaffected by noise. Second, the GPS Azimuth Measurement System (GAMS) determines the geographic vector between two GPS antennas fixed to the vessel by comparing the phase of satellite signals they receive. The error from this method is largely due to noise, but exhibits no drift. The POS uses the advantages of each method to compensate for the disadvantages of the other to arrive at an optimal accuracy of 0.05°. Serial numbers are located in Appendix H. *

SWMB launches Vessel Configuration Files (VCF) were created within the CARIS program VCFEDIT, and applied to the sounding data during processing. Prior to beginning SWMB data acquisition, the launch CARIS Vessel Configuration Files were updated to define the physical relationship between the various components that comprise the systems, including the transducer head, TSS motion sensor and POS/MV positioning system. In addition, these offset files contain heave, roll and pitch biases determined during a "patch test" conducted at Port Angeles, WA on March 26-28, 1999 for vessels 2123 and 2126, and at Shilshole, WA on July 7, 1999 for vessel 2121. Copies of the Vessel Configuration Files are contained in the Project Related Data for OPR-P342-RA, and the VCF's themselves are included with the digital HDCS data.

H. HYDROGRAPHIC POSITION CONTROL (See EVAL RPT, Sec H & I)

The horizontal datum for this project is NAD 83. All soundings were positioned with differential GPS (DGPS) using USCG beacons located at Kenai, AK and Kodiak, AK.

Launch to launch DGPS performance checks were conducted in accordance with Section 3.2 of the FPM. Differential corrections from USCG reference stations were received by the independent launch positioning

* Filed with the hydrographic data .

systems as they were rafted together with their GPS antennae 2-3 meters apart. Copies of DGPS performance checks are included in the Project Related Data for OPR-P342-RA. *

I. SHORELINE ✓

There is no shoreline on this sheet. *concur* .

J. CROSSLINES ✓

There were a total of 32.7 nautical miles of multibeam crosslines, comprising 3.8% of mainscheme hydrography. The Quality Control Report (CARIS HIPS) for the checkline file averaged 99.86% across all beams, with a depth tolerance of 0.023. See Appendix G for the detailed report.*

K. JUNCTIONS (See EVAL RPT, Sec. L)

The following contemporary survey junctions with H10910 and is shown in Figure 2.

Registry #	Scale	Date	Junction side
H10904	1:20,000	1999	North

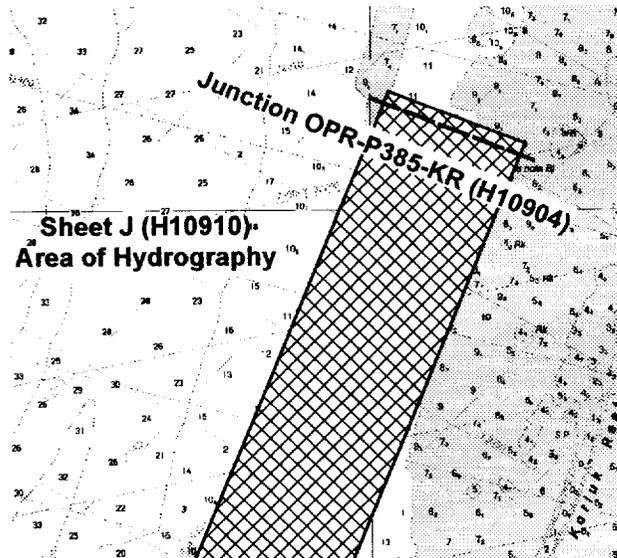


Figure 2. Junction Survey

The northern limit of the present survey was extended 3.2nm to junction with H10904 as approved by N/CS3. Survey H10904 was completed by Terra Surveys, LLC in July-August 1999. Junction analysis will be performed by PHB after application of approved tides and receipt of H10904.

L. COMPARISON WITH PRIOR SURVEYS (See EVAL RPT, Sec. M)

In accordance with correspondence from N/CS3 dated September 3, 1999, no prior survey comparisons were required. A copy of the electronic mail message is included in *Appendix J. this report* .

M. ITEM INVESTIGATIONS ✓

There were no item investigations assigned within the survey area. *concur* .

* Filed with the hydrographic data .

N. COMPARISON WITH THE CHART (*See EVAL RPT, Sec. 0*)

Survey H10910 was compared to the following charts:

Chart	Scale	Edition Number	Date	Datum
16013	1:969761	27 th	September 6, 1997	NAD 83
16660	1:194154	27 th	April 19, 1997	NAD 83
16661	1:100000	5 th	July 19, 1997	NAD 83
16662	1:100000	5 th	July 5, 1997	NAD 83

✓

H10910 was compared with charts 16660, 16661, and 16662. The current survey agreed well with all three charts, generally within one fathom; exceptions are described in the following paragraphs. *Concur.*

A 9.3-fathom shoal shown on Chart 16662 at 60° 23' 22.11"N, 151° 35' 57.94"W was observed to have a least depth of 10.4 fathoms (Pos. #238190). This shoal could represent a rock observed 420 meters away at 60° 23' 33.09"N, 151° 35' 42.35"W (Pos. #248440) which may have drifted. *Do not concur. The shoal area was adequately located during this survey. The presently charted location of the 9.3 fathom shoal is in error and should be charted based on the present survey.*
 An 11-fathom shoal shown on Chart 16662 at 60° 22' 22.11"N, 151° 35' 57.94"W was observed to have a shoalest depth of 12.7 fathoms (Pos. #128905). *Delete the charted 11-fathom shoal and chart the area based on the present survey.*

In concurrence with Note B of Chart 16662, several boulders were found during this survey. Significant boulders have been noted on the sounding plot included with this report. Many other boulders exist throughout the southern section of the survey. The depths shown on Chart 16662 for this southern section coincide with the least depths of these boulders. Due to the strong tidal currents in the area, the possibility of the boulders shifting is high. *Concur.*

The current survey was also compared to chart 16013. However, due to the small scale of this chart, a reasonable comparison to this survey was not practical. *Concur.*

Final sounding comparisons will be made at PHB after application of smooth tides.

Dangers to Navigation ✓

(ii)
 Eleven dangers to navigation were discovered during the survey and reported to the Seventeenth Coast Guard District on September 13, 1999. Refer to Appendix *X* for more information.

⁷
 An 8.9-fathom shoal was discovered at 60° 27' 28.89"N, 151° 32' 03.56"W (Pos. #160688). This position is between 12-fathom and 13-fathom depths shown on Chart 16662.

⁶
 A 9.7-fathom shoal was discovered at 60° 29' 24.35"N, 151° 30' 59.87"W (Pos. #21710). Chart 16662 shows a 10.2-fathom depth near this position.

⁶
 A 9.8-fathom shoal was discovered at 60° 28' 18.46"N, 151° 28' 47.61"W (Pos. #160594). Chart 16662 shows an 11-fathom depth near this position.

⁸
 A 9.9-fathom shoal was discovered at 60° 30' 54.28"N, 151° 29' 51.27"W (Pos. #12404). Chart 16662 shows an 11-fathom depth near this position.

^{9.8}
 A 10.0-fathom shoal was discovered at 60° 28' 51.32"N, 151° 31' 51.29"W (Pos. #1875). Chart 16662 shows an 11-fathom depth near this position.

A 10.⁰~~2~~-fathom shoal was discovered at 60° 29' 02.25"N, 151° 28' 56.71"W (Pos. #175391). Chart 16662 shows an 11-fathom depth near this position.

A 10.²~~3~~-fathom shoal was discovered at 60° 26' 55.29"N, 151° 32' 09.28"W (Pos. #58892). Chart 16662 shows a 13-fathom depth near this position.

A 10.³~~7~~-fathom shoal was discovered at 60° 28' 04.14"N, 151° 32' 00.13"W (Pos. #20570). Chart 16662 shows 12-fathom depths near this position.

A 10.⁵~~6~~-fathom shoal was discovered at 60° 26' 46.84"N, 151° 33' 36.29"W (Pos. #3428). Chart 16662 shows a 12-fathom depth near this position.

A 10.⁸~~9~~-fathom shoal was discovered at 60° 25' 11.22"N, 151° 31' 05.94"W (Pos. #49148). Chart 16662 shows a 12-fathom depth near this position.

A 10.9-fathom shoal was discovered at 60° 26' 51.15"N, 151° 30' 50.19"W (Pos. #182084). Chart 16662 shows a 13-fathom depth near this position.

(Note: Corrections to above soundings based on the application of approved tides.)

O. ADEQUACY OF SURVEY (See EVAL RPT, Sec. F)

Survey H10910 is complete and adequate to supersede prior surveys in their common areas. One hundred percent shallow-water multibeam coverage was obtained within the survey limits. *Concur.*

P. AIDS TO NAVIGATION ✓

No aids to navigation exist within the survey limits. *Concur.*

Q. STATISTICS ✓

Refer to the Survey Information Summary attached to this report.

R. MISCELLANEOUS ✓

Extensive bottom sampling was not conducted since the project area has been surveyed previously and the characteristics had been determined adequately. Random samples were taken to verify that changes have not occurred. The acquired samples did not indicate areas of significant change, which would have warranted additional sampling. The Hydrographer recommends retaining bottom characteristics as depicted on the chart. *Concur.* Bottom samples were not sent to the Smithsonian in accordance with the Project Instructions.

Strong tidal currents were found during this survey. Several large logs and other debris were found floating predominantly in the shoal area at the northeast end of survey.

S. RECOMMENDATIONS ✓

None.

T. REFERRAL TO REPORTS ✓

The following supplemental reports contain additional information relevant to this survey:

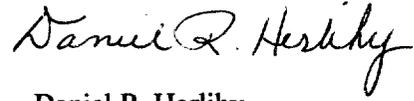
<u>Title</u>	<u>Date Sent</u>	<u>Office</u>
OPR-P342-RA 1999 Coast Pilot Report	TBA	N/CS26
Project Related Data for OPR-P342-RA	Incremental	N/CS34

Respectfully Submitted,



Angie J. Venturato
Ensign, NOAA
Junior Officer

Approved and Forwarded,



Daniel R. Herlihy
Commander, NOAA
Commanding Officer

Survey Information Summary

Project: OPR-P342-RA **Project** COOK INLET NAVIGATION CORRIDORS
Instructions Dated: 6/ 8/99 **Project Change Info:** **Change #** **Dated**
1 7/26/99

Sheet J **Registry Number:** H-10910
Sheet Number: RA-20-07-99

Survey Title: 6 nm Northwest of Cape Kasilof

Data Acquisition Dates: **From:** 21-Jul-99 202 **To:** 19-Aug-99 231

Vessel Usage Summary

VESNO	MS	SPLITS	DEV	XL	S/L	DP	BS	DIVE
2120							1	
2121								
2123								
2126								

Sound Velocity Cast Information

SV Cast information is available in Appendix I

Tide Zone Information

Zone #	Time Corr.	Height Corr.
CK363	1 hr 00 min	X0.94
CK371	0 hr 54 min	X0.96
CK372	0 hr 54 min	X0.94
CK397	0 hr 48 min	X0.94
CK398	0 hr 48 min	X0.96
CK407	0 hr 42 min	X0.96
CK408	0 hr 42 min	X0.94
CK427	0 hr 42 min	X0.94
CK428	0 hr 42 min	X0.96
CK429	0 hr 42 min	X0.97
CK437	0 hr 36 min	X0.98
CK438	0 hr 36 min	X0.97
CK439	0 hr 36 min	X0.96
CK455	0 hr 30 min	X0.97
CK456	0 hr 30 min	X0.98
CK457	0 hr 30 min	X0.99

Tide Gage Information

Tide Gage #	Gage Name	Installed	Removed
945-5711	Cape Kasilof	07/18/99	Terra

Statistics Summary

Type	Total	Percent XL:
BS	6	
SWMB	840.5	SQNM: 0



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Office of NOAA Corps Operations
Pacific Marine Center
 1801 Fairview Avenue East
 Seattle, Washington 98102-3767

NOAA Ship RAINIER
 September 13, 1999

**ADVANCE
 INFORMATION**

Commander (mon)
 Seventeenth Coast Guard District
 Post Office Box 25517
 Juneau, Alaska 99802-5517

Dear CDR Hamblett:

It is requested that the following dangers to navigation be included in the Local Notice to Mariners. The NOAA Ship RAINIER positioned these features while conducting hydrographic survey H10910 in Cook Inlet, Alaska. The dangers are shown graphically on the attached chartlet.

The following dangers to navigation affect the following charts:

Chart	Scale	Edition	Date
16660	1:194,154	27 th	April 9, 1997
16662	1:100,000	5 th	July 5, 1997

The positions are on the NAD 83 datum and depths have been corrected to Mean Lower Low Water using predicted tides.

Feature	Depth (fm)	Latitude (N)	Longitude (W)	Depth (m)
Shoal	8.9	60/27/28.89	151/32/03.56	16.4
Shoal	9.7	60/29/24.35	151/30/59.87	17.8
Shoal	9.8	60/28/18.46	151/28/47.61	18.0
Shoal	9.9	60/30/54.28	151/29/51.27	18.1
Shoal	10.0	60/28/51.32	151/31/51.39	18.3
Shoal	10.2	60/29/02.25	151/28/56.71	18.7
Shoal	10.3	60/26/55.29	151/32/09.28	18.9
Shoal	10.5	60/28/04.14	151/32/00.13	19.2
Shoal	10.6	60/26/46.84	151/33/36.29	19.5
Shoal	10.9	60/25/11.22	151/31/05.94	19.9
Shoal	10.9	60/26/51.15	151/30/50.19	19.9



Chart 16662, 5th Ed.

NOAA Ship RAINIER

OPR-P342-RA-99

Cook Inlet, AK

Survey H10910

ADVANCE INFORMATION

9.9 Shoal
60/30/54.61 N
151/29/51.44 W

10.2 Shoal
60/29/02.25 N
151/28/56.71 W

9.8 Shoal
60/28/18.46 N
151/28/47.61 W

10.9 Shoal
60/26/51.15 N
151/30/50.19 W

10.3 Shoal
60/26/55.29 N
151/32/09.28 W

9.7 Shoal
60/29/24.35 N
151/30/59.87 W

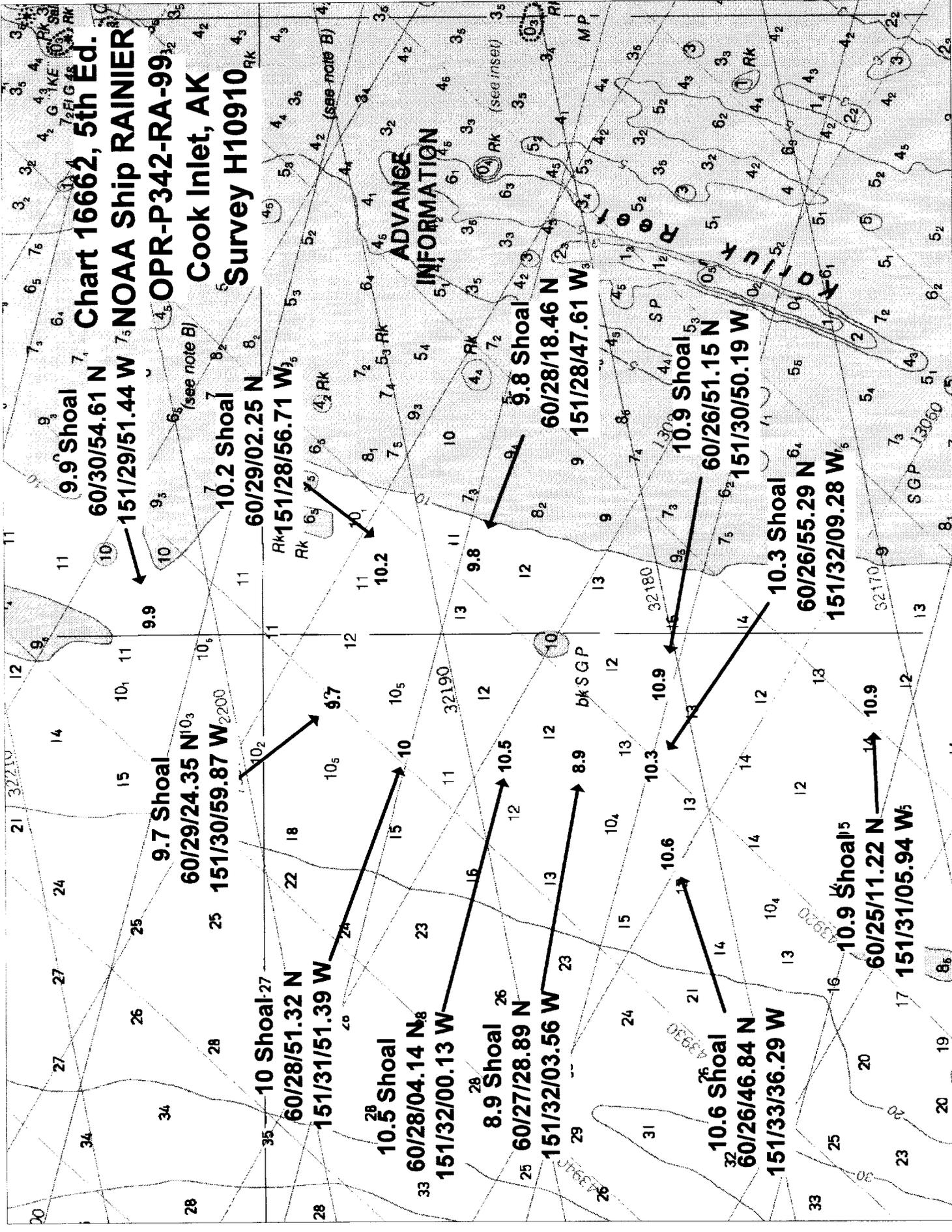
10 Shoal
60/28/51.32 N
151/31/51.39 W

10.5 Shoal
60/28/04.14 N
151/32/00.13 W

8.9 Shoal
60/27/28.89 N
151/32/03.56 W

10.6 Shoal
60/26/46.84 N
151/33/36.29 W

10.9 Shoal
60/25/11.22 N
151/31/05.94 W



Lotus cc:Mail for FOO Rainier

Date: 9/3/99
Sender: Don.Haines@noaa.gov (Don Haines)
To: FOO Rainier
Priority: Normal
Subject: Comparison with Priors

Gentlemen:

RA has requested that relieved of the duty of performing prior comparisons for the Cook Inlet and Kodiak Projects, since the surveys were nav area and 100% multibeam. I discussed this with Dennis and we agree to relieve RA of this for these two projects.

As this subject involves several different variables, it should be discussed at the board meeting to allow consistency between both coasts and contracts.

Don

APPROVAL SHEET

for

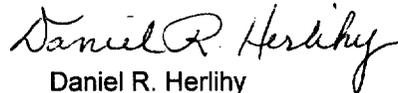
H10910

RA-20-07-99

Standard field surveying and processing procedures were followed in producing this survey in accordance with the NOS Hydrographic Surveys Specifications and Deliverables; the Hydrographic Survey Guidelines; and the Field Procedures Manual, as updated for 1998.

The field sheet and accompanying records have been examined by me, are considered complete and adequate for charting purposes, and are approved. All records are forwarded for final review and processing to N/CS34, Pacific Hydrographic Branch.

Approved and Forwarded,



Daniel R. Herlihy
Commander, NOAA
Commanding Officer
NOAA Ship RAINIER

GEOGRAPHIC NAMES

H-10910

Name on Survey	A ON CHART NO. 16660, 16661, 16662 B ON PREVIOUS SURVEY NO. C ON U.S. QUADRANGLE MAPS D FROM LOCAL INFORMATION E ON LOCAL MAPS F P.O. GUIDE OR MAP G RAND McNALLY ATLAS H U.S. LIGHT LIST K										
	ALASKA (title)	X		X							
COOK INLET	X		X								2
* KARLUK REEF	X		X								3
* KASILOF, CAPE	X		X								4
											5
											6
											7
											8
											9
											10
											11
											12
											13
* Outside survey limits											14
											15
											16
											17
											18
											19
											20
											21
											22
											23
											24
											25

Dennis J. Rausley
Chief Geographer
JAN 28 2000



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
Silver Spring, Maryland 20910

TIDE NOTE FOR HYDROGRAPHIC SURVEY

DATE: December 22, 1999

HYDROGRAPHIC BRANCH: Pacific
HYDROGRAPHIC PROJECT: OPR-P342-RA-99
HYDROGRAPHIC SHEET: H-10910

LOCALITY: 6 NM Northwest of Cape Kasilof, AK

TIME PERIOD: July 22 - August 20, 1999

TIDE STATION USED: 945-5711 Cape Kasilof, AK
Lat. 60° 20.2'N Lon. 151° 22.8'W
PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters
HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 5.850 meters

REMARKS: RECOMMENDED ZONING

Use zone(s) identified as: CK394, CK395, CK399, CK400, CK401, CK407, CK408, CK409, CK434, CK435, CK441, CK442, CK443, CK467, CK468, CK469, CK470, CK477, CK480, CK481, CK482, CK483, CK493 & CK494.

Refer to attachments for zoning information.

Note 1: Provided time series data are tabulated in metric units (Meters), relative to MLLW and on Greenwich Mean Time.

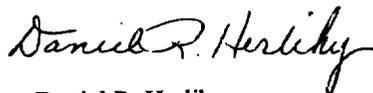
Note 2: Nikiski, AK served as datum control for subordinate tide stations and for tidal zoning in this hydrographic survey. Accepted datums for this station have been updated recently and have changed significantly from previous values.

The current National Tidal Datum Epoch (NTDE) used to compute tidal datums at tide stations is the 1960-78 NTDE. Traditionally, NTDEs have been adjusted when significant changes in mean sea level (MSL) trends were found through analyses amongst the National Water Level Observation Network (NWLON) stations. Epochs are updated to ensure that tidal datums are the most accurate and practical for navigation, surveying and engineering applications and reflect the existing local sea level conditions. For instance, analyses of sea level trends show that a new NTDE is necessary and efforts are underway to update the



This is advance information subject to office review. Questions concerning this letter should be directed to the Chief, Pacific Hydrographic Branch, (206) 526-6835. Refer to survey project OPR-P342-RA-99 and Danger to Navigation message RA-13-99. More information on current RAINIER survey projects may be obtained by e-mail; contact the Field Operations Officer at FOO.RAINIER@NOAA.GOV.

Sincerely,



Daniel R. Herlihy
Commander, NOAA
Commanding Officer

Attachment

cc: NIMA
PMC
N/CS261
N/CS34

**ADVANCE
INFORMATION**

1960-78 NTDE to a more recent 19-year time period. However, analyses also show that there are several geographic areas whose sea level trends are strongly anomalous from the average trends found across the NWLON and thus, must be treated differently. One of these areas is in Cook Inlet, Alaska. Nikiski has shown a significant relative sea level change due to continued vertical land movement after the 1964 earthquake. NOS has adopted a procedure for computing accepted tidal datums for this anomalous region by using an MSL value calculated from the last several years of data rather than the 19-year NTDE. The accepted range of tide is still based on the 19-year NTDE and, when applied to the updated MSL, will result in updated values for Mean High Water (MHW) and Mean Lower Low Water (MLLW) derived through standard datum calculation procedures. For Nikiski, the MSL value was computed from the period of 1994-1998. This resulted in a lowering of the MLLW datums relative to land by approximately 1.0 ft at Nikiski compared to the previous MLLW elevations used in surveys prior to January 1, 1998. Subordinate tide stations in the area used for hydrographic surveys and controlled by Nikiski will be affected similarly. Accepted datums have been computed and may be accessed on the Internet through the URL specification <http://www.co-ops.nos.noaa.gov>.

For -----
CHIEF, REQUIREMENTS AND DEVELOPMENT DIVISION

Final tide zone node point locations for OPR-P342-RA-99,
Sheet H-10910.

Format: Longitude in decimal degrees (negative value denotes
Longitude West),
Latitude in decimal degrees
Tide Station (in recommended order of use)
Average Time Correction (in minutes)
Range Correction

	Tide Station Order	AVG Time Correction	Range Correction
Zone CK394			
-151.641618 60.323932	945-5711	-12	0.96
-151.714292 60.336038			
-151.721656 60.289472			
-151.641663 60.278677			
-151.641618 60.323932			
Zone CK395			
-151.541398 60.307198	945-5711	-12	0.97
-151.641618 60.323932			
-151.641663 60.278677			
-151.530774 60.263658			
-151.541398 60.307198			
Zone CK399			
-151.550301 60.347025	945-5711	-6	0.98
-151.548639 60.336652			
-151.541398 60.307198			
-151.427199 60.288135			
-151.435607 60.29553			
-151.45777 60.327774			
-151.50207 60.336721			
-151.550301 60.347025			
Zone CK400			
-151.641609 60.366506	945-5711	-6	0.97
-151.641618 60.323932			
-151.541398 60.307198			
-151.548639 60.336652			
-151.550301 60.347025			
-151.641609 60.366506			

Zone CK401

-151.707366 60.379871	945-5711	-6	0.96
-151.714292 60.336038			
-151.641618 60.323932			
-151.641609 60.366506			
-151.696917 60.378305			
-151.707366 60.379871			

Zone CK407

-151.477091 60.362959	945-5711	0	0.98
-151.555767 60.381014			
-151.550301 60.347025			
-151.50207 60.336721			
-151.45777 60.327774			
-151.470767 60.346613			
-151.477091 60.362959			

Zone CK408

-151.555767 60.381014	945-5711	0	0.97
-151.641619 60.400682			
-151.641609 60.366506			
-151.550301 60.347025			
-151.555767 60.381014			

Zone CK409

-151.641619 60.400682	945-5711	0	0.96
-151.666938 60.406492			
-151.702162 60.412453			
-151.707366 60.379871			
-151.696917 60.378305			
-151.641609 60.366506			
-151.641619 60.400682			

Zone CK434

-151.641602 60.430226	945-5711	+6	0.97
-151.641619 60.400682			
-151.555767 60.381014			
-151.560906 60.412675			
-151.641602 60.430226			

Zone CK435

-151.560906 60.412675	945-5711	+6	0.98
-151.555767 60.381014			
-151.477091 60.362959			
-151.490399 60.397313			

-151.560906 60.412675

Zone CK441

-151.505164 60.435269	945-5711	+12	0.99
-151.490399 60.397313			
-151.435989 60.385467			
-151.454069 60.425425			
-151.505164 60.435269			

Zone CK442

-151.566483 60.447104	945-5711	+12	0.98
-151.560906 60.412675			
-151.490399 60.397313			
-151.505164 60.435269			
-151.566483 60.447104			

Zone CK443

-151.640529 60.459629	945-5711	+12	0.97
-151.64159 60.442491			
-151.641602 60.430226			
-151.560906 60.412675			
-151.566483 60.447104			
-151.621011 60.457617			
-151.640529 60.459629			

Zone CK467

-151.57191 60.489758	945-5711	+18	0.97
-151.582998 60.491646			
-151.638228 60.496612			
-151.640529 60.459629			
-151.621011 60.457617			
-151.566483 60.447104			
-151.57191 60.489758			

Zone CK468

-151.518004 60.480578	945-5711	+18	0.98
-151.57191 60.489758			
-151.566483 60.447104			
-151.505164 60.435269			
-151.50899 60.445118			
-151.518004 60.480578			

Zone CK469

-151.470383 60.472463	945-5711	+18	0.99
-151.518004 60.480578			

-151.50899 60.445118
-151.505164 60.435269
-151.454069 60.425425
-151.463551 60.446334
-151.470383 60.472463

Zone CK470

-151.422019 60.463609	945-5711	+12	1.00
-151.470383 60.472463			
-151.463551 60.446334			
-151.454069 60.425425			
-151.402166 60.415401			
-151.417034 60.446334			
-151.422019 60.463609			

Zone CK477

-151.473666 60.485057	945-5711	+18	1.00
-151.470383 60.472463			
-151.422019 60.463609			
-151.427569 60.482781			
-151.458649 60.484239			
-151.473666 60.485057			

Zone CK480

-151.43872 60.5213	945-5711	+24	1.02
-151.427569 60.482781			
-151.379602 60.48054			
-151.388575 60.51889			
-151.43872 60.5213			

Zone CK481

-151.483539 60.522936	945-5711	+24	1.00
-151.473987 60.484973			
-151.458649 60.484239			
-151.427569 60.482781			
-151.43872 60.5213			
-151.470667 60.522857			
-151.483539 60.522936			

Zone CK482

-151.52885 60.523183	945-5711	+24	0.99
-151.518004 60.480578			
-151.470383 60.472463			
-151.473666 60.485057			
-151.483539 60.522936			

-151.52885 60.523183

Zone CK483

-151.576222 60.523452	945-5711	+24	0.98
-151.57191 60.489758			
-151.518004 60.480578			
-151.52885 60.523183			
-151.576222 60.523452			

Zone CK493

-151.538535 60.561199	945-5711	+24	0.99
-151.52885 60.523183			
-151.483539 60.522936			
-151.493121 60.559471			
-151.538535 60.561199			

Zone CK494

-151.493121 60.559471	945-5711	+24	1.00
-151.483539 60.522936			
-151.470667 60.522857			
-151.43872 60.5213			
-151.449293 60.557775			
-151.493121 60.559471			

HYDROGRAPHIC SURVEY STATISTICS

H-10910

RECORDS ACCOMPANYING SURVEY: To be completed when survey is processed.

RECORD DESCRIPTION		AMOUNT	RECORD DESCRIPTION		AMOUNT
SMOOTH SHEET		1	SMOOTH OVERLAYS: POS., ARC, EXCESS		N/A
DESCRIPTIVE REPORT		1	FIELD SHEETS AND OTHER OVERLAYS		N/A
DESCRIP- TION	DEPTH/POS RECORDS	HORIZ. CONT. RECORDS	SONAR- GRAMS	PRINTOUTS	ABSTRACTS/ SOURCE DOCUMENTS
ACCORDION FILES					
ENVELOPES					
VOLUMES					
CAHIERS					
BOXES					

SHORELINE DATA	
SHORELINE MAPS (List):	None
PHOTOBATHYMETRIC MAPS (List):	None
NOTES TO THE HYDROGRAPHER (List):	None
SPECIAL REPORTS (List):	None
NAUTICAL CHARTS (List):	16661, 5th Ed., July 19, 1997; 16662, 5th Ed., July 5, 1997

OFFICE PROCESSING ACTIVITIES
The following statistics will be submitted with the cartographer's report on the survey

PROCESSING ACTIVITY	AMOUNTS		
	VERIFICATION	EVALUATION	TOTALS
POSITIONS ON SHEET			
POSITIONS REVISED			
SOUNDINGS REVISED			
CONTROL STATIONS REVISED			
	TIME-HOURS		
	VERIFICATION	EVALUATION	TOTALS
PRE-PROCESSING EXAMINATION			
VERIFICATION OF CONTROL			
VERIFICATION OF POSITIONS			
VERIFICATION OF SOUNDINGS			
VERIFICATION OF JUNCTIONS			
APPLICATION OF PHOTOBATHYMETRY			
SHORELINE APPLICATION/VERIFICATION			
COMPILED OF SMOOTH SHEET	73.0		73.0
COMPARISON WITH PRIOR SURVEYS AND CHARTS		24.0	24.0
EVALUATION OF SIDE SCAN SONAR RECORDS			
EVALUATION OF WIRE DRAGS AND SWEEPS			
EVALUATION REPORT		36.0	36.0
GEOGRAPHIC NAMES			
OTHER (Chart Compilation)		47.5	47.5
USE OTHER SIDE OF FORM FOR REMARKS	TOTALS	73.0	107.5
		107.5	180.5

Pre-processing Examination by R. Davies	Beginning Date	Ending Date
Verification of Field Data by E. Domingo, R. Davies, G. Nelson, R. Mayor, D. Doles	Time (Hours) 73.0	Ending Date 7/3/00
Verification Check by D. Hill	Time (Hours) 2	Ending Date 9-28-00
Evaluation and Analysis by I. Almacén	Time (Hours) 60.0	Ending Date 7/5/00
Inspection by D. Hill	Time (Hours) 2	Ending Date 9-28-00

**EVALUATION REPORT
H-10910**

A. PROJECT

Project information is adequately discussed in the hydrographer's report.

B. AREA SURVEYED

The survey area is adequately discussed in the hydrographer's report

Page-size plots of the charted area depicting the specific limits of supersession accompany this report as Attachments 1 and 2.

The bottom consists mainly of sand, gravel and pebbles. Depths range from 6.5 to 19.5 fathoms.

C. SURVEY VESSELS

Survey vessels are adequately discussed in the hydrographer's report.

D. AUTOMATED DATA ACQUISITION AND PROCESSING

The acquisition and processing of data in the field has been adequately discussed in the hydrographer's report.

Office processing of survey data was conducted using the same Computer Aided Resource Information System (CARIS), and Hydrographic Processing System (HPS) used by the hydrographer. The smooth sheet was compiled with MicroStation 95.

Digital data for this survey exists in the standard HPS format, a database format using the .dbf extension. In addition, the smooth sheet drawing is filed in the MicroStation format, i.e., dgn extension. Copies of these files have been forwarded to the Hydrographic Surveys Division and a backup copy retained at PHB. Database records forwarded are in the Internal Data Format (IDF) and are in compliance with specifications in existence at the time of survey processing.

The drawing files necessarily contain information that is not part of the HPS data set such as geographic names text, line-type data, and minor symbolization. In addition, those soundings deleted from the drawing for clarity purposes remain unrevised in the HPS digital files to preserve the integrity of the original hydrographic data set. Cartographic codes used to describe the digital data are those authorized by Hydrographic Survey Guideline No. 35 and No. 75.

The data are plotted using a Universal Transverse Mercator (UTM) projection and are depicted on a single sheet.

E. SONAR EQUIPMENT

Side scan sonar was not utilized during this survey.

F. SOUNDING EQUIPMENT

Sounding equipment has been adequately discussed in the hydrographer's report.

G. CORRECTIONS TO SOUNDINGS

Soundings and elevations have been reduced to Mean Lower Low Water (MLLW) or Mean High Water (MHW) as appropriate, with approved tide correctors obtained from the Center For Operational Oceanographic Products and Services. The approved tide correctors are zoned from Cape Kasilof, Alaska, gage 945-5711. It should be noted the tidal datums for the survey area were recently re-computed based on mean sea level observations between 1994 and 1998. Specific information on this significant adjustment is contained in the attached Tide Note.

Other sounding reducers include corrections for static draft, dynamic draft, sound velocity, heave, roll and pitch. These reducers have been reviewed and are consistent with NOS specification.

H. CONTROL STATIONS

Control stations have been adequately discussed in the hydrographer's report.

The positions of horizontal control stations used during hydrographic operations are published values based on NAD 83. The geographic positions of all survey data are based on NAD 83. The smooth sheet is annotated with an NAD27 adjustment tick based on values determined with the NGS program NADCON. Geographic positions based on NAD27 may be plotted on the smooth sheet utilizing the NAD 83 projection by applying the following corrections.

Latitude: -2.093 seconds (-64.767 meters)
Longitude: 8.035 seconds (122.936 meters)

I. HYDROGRAPHIC POSITION CONTROL

Hydrographic position control has been adequately discussed in the hydrographer's report.

Differential GPS (DGPS) was used to control this survey. A horizontal dilution of precision (HDOP) not to exceed 7.5 for a 1:20,000 scale survey was computed for survey operations. The maximum (HDOP) allowable limit has not been exceeded during this survey and the quality of data obtained is good. During shallow water multibeam (SWMB) data gathering, satellite configuration as indicated by HDOP and the number of satellites, is monitored visually on HYPACK. The final positions are provided by the POS-MV that combines the DGPS position with inertial navigation information. In the event that the differential GPS corrector signal is lost, the POS-MV will continue to provide positions based on inertial navigation. Data was analyzed during processing to ensure it contains no significant errors. DGPS performance checks were conducted in the field and found adequate.

Additional information concerning specific control system type, calibrations and system checks can be found in the hydrographer's report and in the separates related to horizontal position control and correction to position data.

J. SHORELINE

There is no shoreline within the area of this survey.

K. CROSSLINES

Crosslines are adequately discussed in the hydrographer's report.

L. JUNCTIONS

Survey H-10910 junctions with the following surveys.

<u>Survey</u>	<u>Year</u>	<u>Scale</u>	<u>Area</u>
H-10904	1999	1:20,000	Northern Limit

The junction with survey H-10904 is complete and "Joins" note had been added to the smooth sheet. Comparison is considered good.

M. COMPARISON WITH PRIOR SURVEYS

Comparison with the following prior surveys was accomplished as part of the standard office processing procedure.

<u>Survey</u>	<u>Year</u>	<u>Scale</u>	<u>Datum</u>
H09437	1974	1:20,000	NAD 27
H09545	1975	1:20,000	NAD 27

H09777	1978	1:20,000	NAD 27
H10252	1987	1:10,000	NAD 27
H10617	1995	1:10,000	NAD 27

The legibility of the prior survey digital raster images is mixed. However, they were all adequately registered to the present survey smooth sheet. Legibility problems were related to some unreadable individual sounding values on the smooth sheets for surveys H09777 and H09545. For the purpose of making an area wide comparison of bottom topography however, the values could be approximately deciphered.

Comparison with the above listed prior surveys reveals good agreement. The soundings generally agree within one fathom except in areas noted during this survey and reported as dangers to navigation. With one exception, a more thorough coverage of the area utilizing the shallow water multibeam (SWMB) system has revealed no significant changes around this particular portion of Cook Inlet. The smooth sheet has been annotated to indicate the presence of several isolated rocks which do not appear on prior surveys. These features are probably boulders which are common to this area. The designation of selected depths as rocks was done based on interpretation of the echo sounder data vice a diver observation.

Survey H-10910 is adequate to supersede the prior surveys within the area of common coverage.

N. ITEM INVESTIGATIONS

There were no item investigations assigned for this survey.

O. COMPARISON WITH CHART

Survey H-10910 was compared with the following chart.

<u>Chart</u>	<u>Edition</u>	<u>Date</u>	<u>Scale</u>	<u>Datum</u>
16661	5th	July 19, 1997	1:100,000	NAD 83
16662	5th	July 5, 1997	1:100,000	NAD 83

a. Hydrography

Charted hydrography originates with the previously mentioned prior surveys and requires no further discussion.

Survey H-10910 is adequate to supersede charted hydrography within the common area.

The charted Note B, Caution, advising mariners of uncharted boulders in the eastern portion of Cook Inlet should be reviewed for possible revision to include mention of other areas to include that common to the present survey.

b. Dangers to navigation

Eleven (11) dangers to navigation (DTON) were discovered during this survey and transmitted to the USCG, NIMA, N/CS261 and N/CS3 on September 13, 1999. A copy of the report is attached. No additional dangers were found during office processing.

P. ADEQUACY OF SURVEY

The hydrography contained on survey H-10910 is adequate to:

- delineate the bottom configuration, determine least depths, and draw the required depth curves;
- reveal there are no significant discrepancies or anomalies requiring further investigation; and
- show the survey was properly controlled and soundings are correctly plotted.

The hydrographic records and reports received for processing are adequate and conform to the requirements of the Hydrographic Manual, 4th Edition, revised through Change No. 3, the Hydrographic Survey Guidelines, the Field Procedures Manual, April 1998 Edition, and the Specifications and Deliverables 1999.

Q. AIDS TO NAVIGATION

There are no aids to navigation located within the survey area.

There were no features of landmark value found within the area of this survey.

R. STATISTICS

Statistics are adequately itemized in the hydrographer's report.

S. MISCELLANEOUS

Miscellaneous information is adequately discussed in the hydrographer's report.

T. RECOMMENDATIONS

Survey H-10910 is an adequate hydrographic survey. No additional work is recommended.

U. REFERRAL TO REPORTS

Referral to reports is adequately discussed in the hydrographer's report.



Isagani A. Almacén
Cartographer

APPROVAL SHEET
H-10910

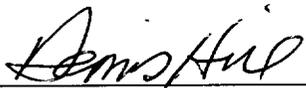
Initial Approvals:

The completed survey has been inspected with regard to survey coverage, delineation of the depth curves, development of critical depths, cartographic symbolization, comparison with prior surveys and verification or disproval of charted data. The survey records and digital data comply with NOS requirements except where noted in the Evaluation Report.



Dennis Hill
Supervisory Cartographer
Pacific Hydrographic Branch
Date: 9-28-00

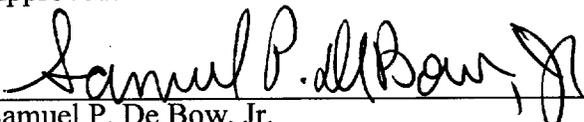
I have reviewed the smooth sheet, accompanying data, and reports. This survey and accompanying digital data meet or exceed NOS requirements and standards for products in support of nautical charting except where noted in the Evaluation Report.



James C. Gardner
Commander, NOAA
Chief, Pacific Hydrographic Branch
Date: 9-28-00

Final Approval

Approved:



Samuel P. De Bow, Jr.
Captain, NOAA
Chief, Hydrographic Surveys Division
Date: 11-8-00

ATTACHMENT 1
H-10910 LIMITS DEPICTED ON CHART
16662, 5th EDITION, JULY 5, 1997
LIMIT LINE DENOTES AREA OF SUPERSESSION
 Superseded Area Of Chart 16662

