H10903

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. N/A

Registry No. H-10903

LOCALITY

State Alaska

General Locality Cook Inlet

Sublocality West of Moose Point Shoal

1999

CHIEF OF PARTY

Doug Lockhart-Racal Palagos-San Diego

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DATE

NOAA FORM 77-28 (11-72)

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

REGISTER NO.
H-10903

HYDROGRAPHIC TITLE SHEET

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.
D

State **ALASKA**

General Locality **Cook Inlet**

Sublocality **West of Moose Point Shoal**

Scale **1:20,000** Date of Survey **July 5 to July 19, 1999**

Instructions Date **11/20/1998** Project No. **OPR-P385-KR-99**

Vessel **F/V QUICKSILVER, R/V DAVIDSON**

Chief of Party **DOUG LOCKHART**

Surveyed by **Lockhart, McKenzie, Arumugam, Moyles, Bushey, Woodford, Greene, Rybarski, ET AL**

Soundings taken by echo sounder **Reson 8101 Multibeam Echo Sounder**

Graphic record scaled by **RACAL PELAGOS PERSONNEL**

Graphic record checked by **RACAL PELAGOS PERSONNEL**

Evaluation by **G. Nelson, B. Mihailov** Automated plot by **HP Design Jet 1050C**

Verification by **G. Nelson, B. Mihailov**

Soundings in **Fathoms and tenths** at **MLLW**

REMARKS: **The purpose of this work is to provide NOAA with modern and accurate data for Cook Inlet.**

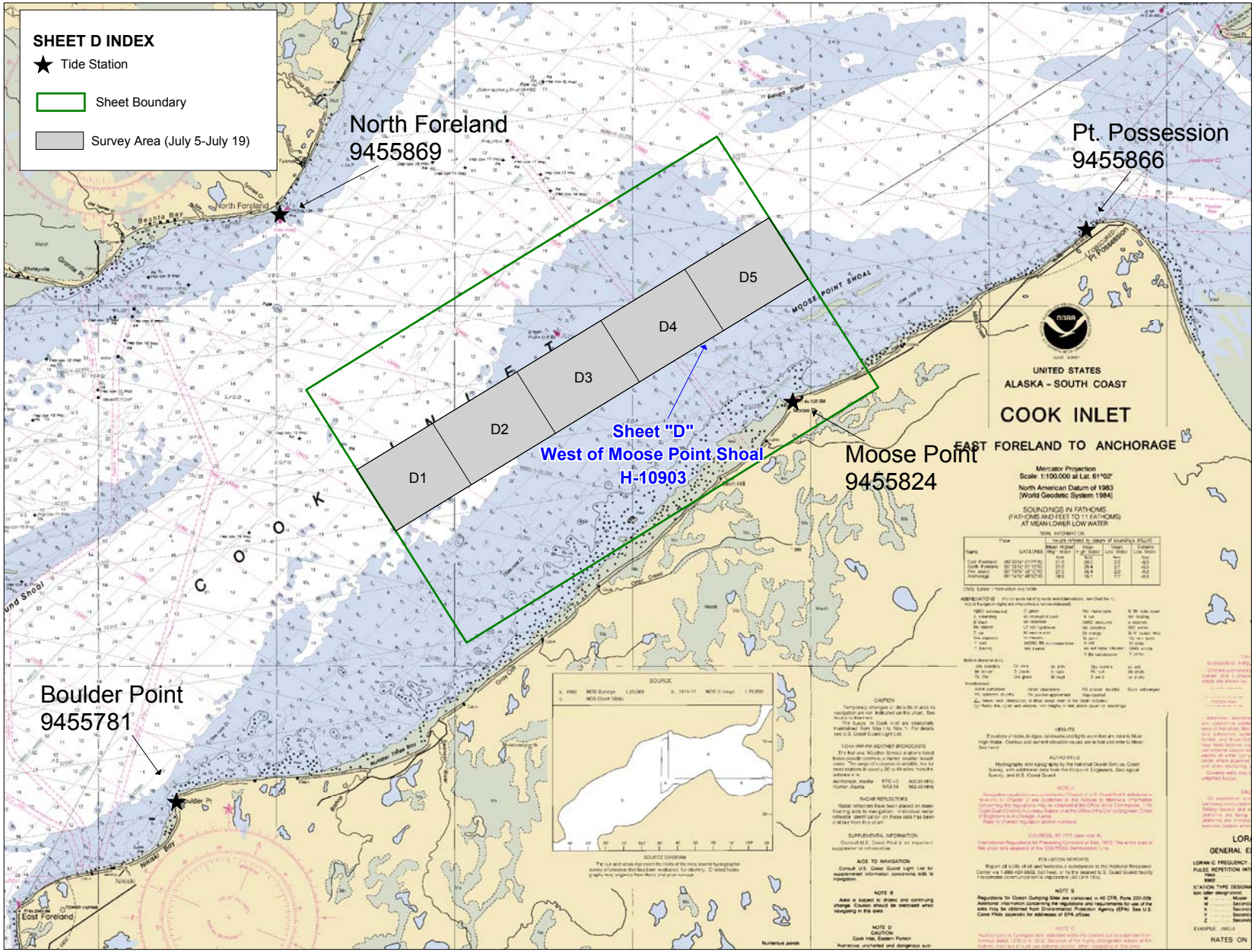
PHB Revision: Report has been evaluated. Comments, revisions, and corrections are entered as endnotes.

ALL TIMES ARE RECORDED IN UTC. **UTM Zone 5**

RACAL PELAGOS

5434 RUFFIN ROAD

SAN DIEGO, AK 99503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Tide Station
Sheet Boundary
Survey Area (July 5-July 19)
North Foreland
9455869
Pt. Possession
9455866
D1
D2
D3
D4
D5
Sheet "D"
West of Moose Point Shoal
H-10903
Moose Point
9455824
Boulder Point
9455781
UNITED STATES
ALASKA - SOUTH COAST
COOK INLET
EAST FORELAND TO ANCHORAGE
MOOSE POINT SHOAL

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Descriptive Report to Accompany Hydrographic Survey H-10903

Scale1: 20000
July 1999
Racal Pelagos, Inc.
R/V Davidson, F/V Quicksilver
Lead Hydrographer: Doug Lockhart

A – Project

Project Number: OPR-P385-KR-98 [2]
Registry Number: H-10903
State: Alaska
Locality: Cook Inlet
Sub-Locality: West of Moose Point Shoal
Sheet D

Original Instructions: May 01, 1998
Change 1, SOW Attachment #1, July 28, 1998

The purpose of this work is to provide NOAA with modern, accurate hydrographic survey data along the shipping approaches to Anchorage, Alaska, through Cook Inlet.

B - Area Surveyed

The area surveyed is a corridor 3.7 km wide and approximately 24.9 km long extending southwest from a point 6 km north of Moose Point. The corridor runs roughly parallel to the southern shoreline of Cook Inlet. The dominant feature along this coast is Moose Point Shoal although it has little impact on the survey corridor. The shoreline on the eastern side of the inlet is littered with large boulders. It is apparent from the sounding data that this boulder field extends through most of the corridor. [3]

Hydrographic data collection began on July 5, 1999 and ended on July 19, 1999. The total area surveyed was 26.35 square nautical miles.

Survey Limits

Work Order #3
Sheet D

Point #	Positions on NAD83	
	Degrees Latitude (N)	Degrees Longitude (W)
1	60.9241600	151.0900934
2	60.8960369	151.0535664
3	61.0123711	150.6689039
4	61.0404755	150.7054308
5	60.9241600	151.0900934

C - Survey Vessels

Processing Ship	R/V Davidson
Official Number	1066485
Owner	Venture Pacific Marine, Inc.
Year Built	1967
Length	153 ft
Beam	38
Draft	17.8
Tonnage	
Gross	883
Net	250
Power	2000 hp
Electrical	2x250

Survey Launch	F/V Quicksilver
Official Number	947419
Owner	Marcus Ballweber
Year Built	1989
Length	32 ft
Beam	15.5
Draft	3
Tonnage	
Gross	28
Net	15
Power	800 hp
Electrical	5 kW

R/V DAVIDSON

The R/V Davidson functioned as a hotel ship and processing lab. Whisker poles were added to both sides of the vessel at mid-ship to accommodate the survey launch and supply vessel. The survey launch, Quicksilver, used the starboard side and the supply vessel, Kazor, used the port side. A gangplank was suspended from the "A" frame on the stern of the Davidson for additional access.

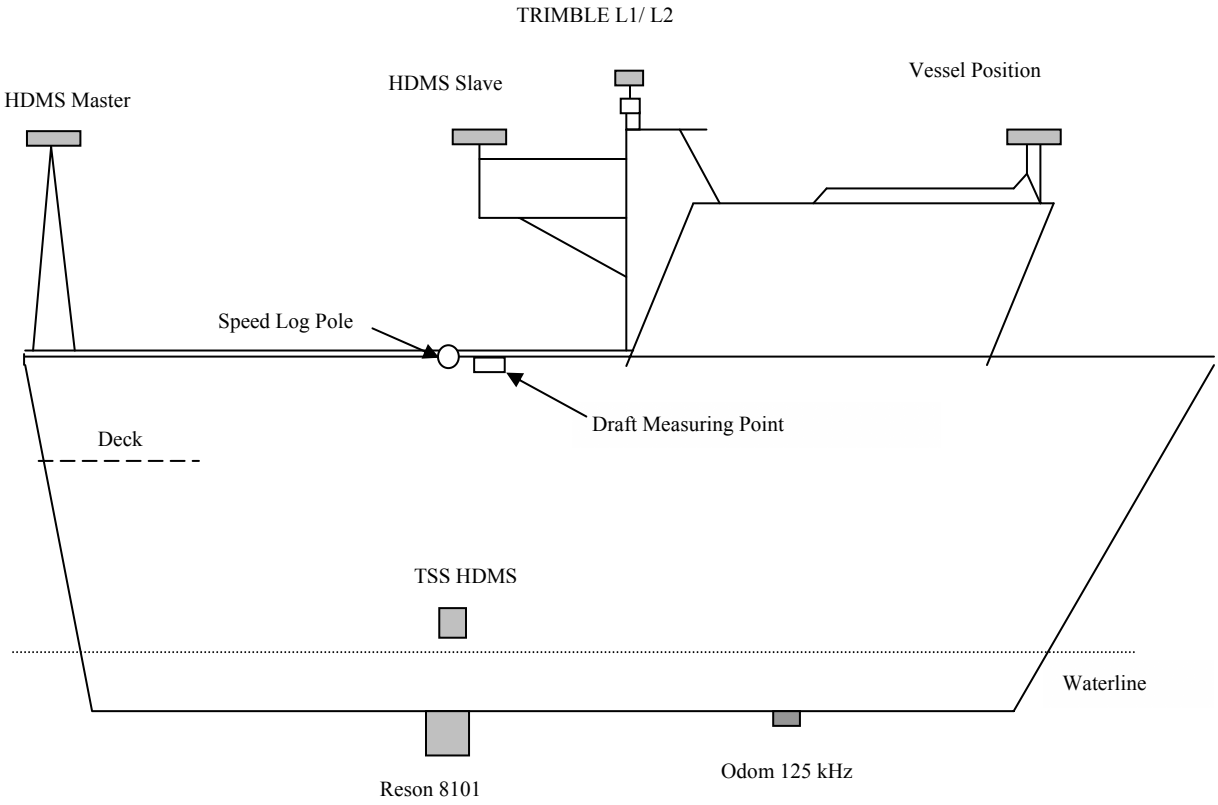
F/V QUICKSILVER

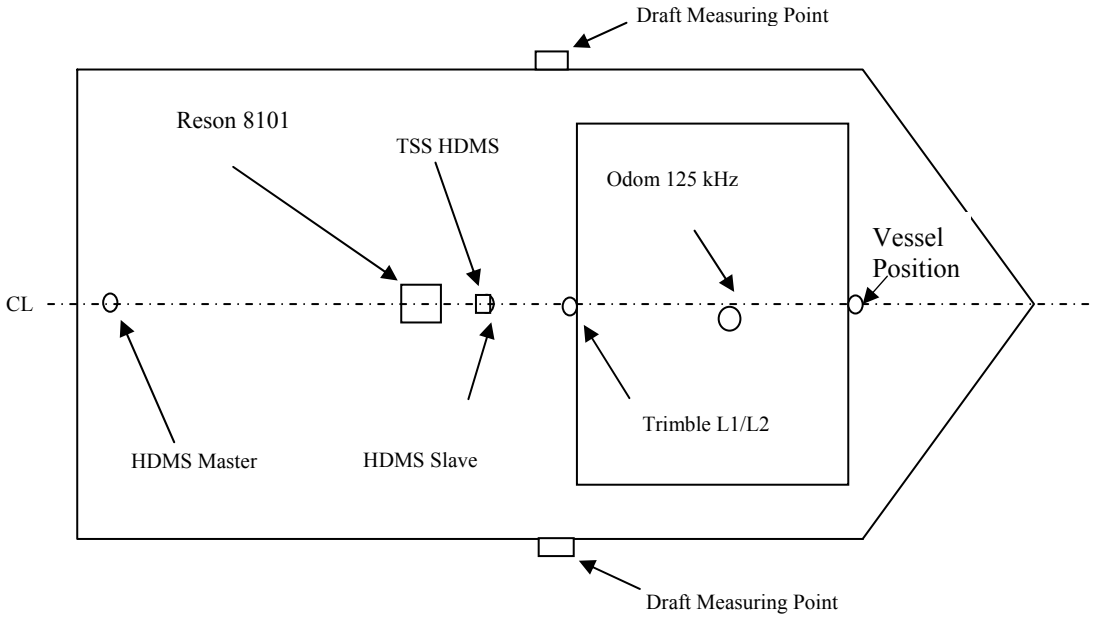
The F/V Quicksilver was refit in Seattle to accommodate a survey crew and acquisition hardware. The keel was cut just aft of mid-ship and a Reson 8101 multibeam sonar was installed. The sonar head was protected forward by a conical cowling and aft by a crescent shaped skid. The accelerometer package for a TSS HDMS was installed directly on top of the 8101 head. A 125 kHz Odom single beam transducer was installed on the starboard side of the keel, 2.69-m forward of the 8101.

Initially, two Novatel antennas were installed for positioning and heading. One directly over the 8101 and accelerometers, the other forward 5.28-m. The aft antenna was used for both the vessel position and as the HDMS master antenna. The forward antenna functioned as the HDMS secondary. During survey operations in Sheet A, degrading HDMS performance resulted in a new antenna configuration. On May 25, 1999, a third antenna was installed above the vessel stern. This antenna was then used as the HDMS master. The center antenna became the HDMS secondary, and the forward antenna was used for vessel position.

A speed log to aid settlement calculations was installed on a pole mount on the starboard side of the Quicksilver. This mount also held an Odom Digibar that was used to monitor surface sound velocities. Two ALM Smart Probe SV&P sensors were deployed from a davit on the starboard side using a small hydraulic winch mounted near the stern.

The quicksilver was fitted with depressors during final mobilization in Homer. These devices are simply weighted, bird shaped pieces of steel that hang in the water on either side of the vessel. The depressor's primary function is to reduce vessel roll. The Quicksilver was operated with the depressors deployed or stowed depending on the needs of the survey crew. Beginning on May 13, depressor status was noted on all survey line logs.





D - Automated Data Acquisition and Processing

ACQUISITION

The primary data set, positions, attitudes, and soundings, was collected with Racal Pelagos' Winfrog Multibeam (WFMB) integrated navigation software. WFMB operated on a Pentium based PC running Windows NT and used a Novatel GPS card for positioning. Digiboard serial interface cards were installed to provide serial ports for all devices.

The WFMB software package uses the 1 PPS output from the Novatel card to continually synchronize the PC clock with GPS time. During timing tests prior to the survey, WFMB was shown to have approximately a 4 millisecond RMS error between the ping and attitude time stamps.

The following windows are available in WFMB for the operator to monitor data quality:

Devices: The Devices window shows the operator which hardware is attached to the PC. It also allows the operator to configure the devices, determine whether they are functioning properly and view data received.

Graphic: The Graphic window shows navigation information in plan view. This includes vessel position, survey lines, and background plots and charts.

Vehicle: The Vehicle window can be configured to show any tabular navigation information required. Typically, this window displays position, time, line name, heading, HDOP, speed over ground, distance to start of line, distance to end of line, and distance off line. Many other data items are selectable.

Calculation: The Calculation window is used to look at specific data items in tabular or graph format. Operators look here to view 1PPS performance, singlebeam to nadir multibeam comparisons, GPS satellite constellations, and position solutions.

Waterfall: The Waterfall display can be configured to view bathymetric or side scan data.

Profile: The Profile window displays the current multibeam profile and the vessel attitude.

Ping Scroller: The Ping Scroller window displays the current profile and a short history of profiles. The profile scrolls down the window and can be filtered by beam number and quality.

QC View: The QC View window displays binned soundings in plan view. The bin size is user defined and can be filtered by beam number and quality.

3-D View: The 3-D window displays a 3-D mesh of the current line of profiles. The mesh can be rotated to a user-specified angle and vertical exaggeration.

Winfrog Multibeam writes XTF, RAW, and DAT files. The XTF files contain all multibeam bathymetry, position, attitude, and heading data required by CARIS to process the soundings. The RAW and DAT files contain position, RTCM, HDOP, singlebeam, speed log, attitude, and heading data as well as event records. The DAT files were not used in the processing on this survey. The RAW files were used for position QC and speed through the water requirements.

Sound velocity profile data from the AML Smart Probes was acquired using Procomm. Data from the SeaBird CTD was acquired using the SeaBird TERM19 program.

PROCESSING

Soundings

All sounding data was processed using Universal Systems CARIS HIPS on Unix workstations running Sun Solaris V7. Three separate filter settings were used during processing: 1782, 1782nad, and 1782nad55. All three used a 5-degree minimum angle filter and rejected all soundings with a quality flag other than 3. Setting file 1782 rejected beams 1-11 and 90-101. File 1782NAD rejected beams greater than 60 degrees past nadir and 1782NAD55 rejected beams greater than 55 degrees past nadir. The filter setting used on each line were noted on the line log. Shallow biased sounding were imported into CARIS work files on a ten meter grid then over-write suppressed for the preliminary smooth sheet.

In high noise areas additional filters may have been applied to specific screens or entire lines. In these instances, the additional filters are noted on the line logs.

Task specific processing was developed for sound velocity corrections and settlement. Tidal correctors were zoned using the CARIS utility in NOAA's HP Tools suite.

Navigation

Raw navigation records were recorded by Winfrog along with ancillary data such as heave, pitch, roll, heading, and speed through the water. Ribbit, a Racal-Pelagos software tool created specifically to manipulate Winfrog files, was used to view and extract individual data items from the raw navigation record. Immediately after each line survey line was run, the acquisition crew opened the raw records and examined position, speed over ground, HDOP, and heave records. Ribbit was also used to extract speed log data for the settlement calculation.

Sound Velocity Corrections

Due to the high data rates and slow descent and assent velocities, far more data was collected on each cast then was required. In addition, the AML probes report data to two decimal places and CARIS only uses one decimal place in depth and velocity. A custom utility was written using Wolfram Research Mathematica to reduce the raw SVP data to the maximum resolution required by CARIS.

Along with reducing the SVP data to CARIS resolution, the program, SVP_05, also compared the profiles from the two separate probes. Before SVP-05 was run, individual profiles were hand edited and split into files for the down and up portions of each cast. Hand editing was restricted to removing data points during the three-minute temperature equilibrium period. A basic algorithm for SVP_05 follows:

1) Read in data from the down and up casts from both probes (four files).
2) Covert pressure to depth and sort on order of increasing depth.
3) Decimate data to contain only one data point for any given 0.01-meter depth increment.
4) Generate an interpolation table for each of the four profiles.
5) Using the interpolation tables, build four new profiles with data points for every 0.01-meters of the total depth.
6) Average the interpolated down and up casts for each probe, resulting in two profiles with 0.01-meter depth resolution.
7) Smooth profiles using a moving median filter with a span of 11 data points (0.11-meter). The moving median filter was applied repeatedly until a constant profile was reached.
8) Calculate the RMS error between the smoothed profiles.
9) Decimate the profile to 0.1-meter depth changes and 0.1-meter/second velocity changes.
10) Plot the results and output final profiles.

The output from SVP_05 was appended to the project SVP file for CARIS, 1782.svp. A ray-bending program was written to test the error in soundings resulting from using the raw profiles and the processed profiles output from SVP_05. Random spot checks showed the error to be at most 0.0015-meters for a beam 60-degrees off nadir.

The RMS error between the two probes stayed below 0.20-m/s. This resulted in a 0.001-m error on beam 99 for cast 1999-148-1221 (this cast was complete for Sheet A, H-10892).

Settlement

A settlement curve was calculated for the F/V Quicksilver using RTK derived elevations. The curve was calibrated to engine RPM and speed log output. To estimate settlement, RPM values were hand logged for each line. Changes in RPM while on line were also noted in the line log. A file was created to store time and RPM values. In Microsoft Excel, a polynomial fit through the settlement curve was used to create a time versus settlement file from the RPM file. This file was appended to the project draft file for use by CARIS.

See Section H., Corrections to soundings for additional information on sound velocity profiles, settlement, and speed log calculations.

E - Side Scan Sonar

Towed side scan sonar operations were not required by this contract. [4]

F - Sounding Equipment

System	Manufacturer	Model	Serial Number
Multibeam echo sounder	Reson	SeaBat 8101 Processor	19245
		SeaBat 8101 Transducer	19245
Echo Sounder	Odom	DF3100MKII	9646
		125 kHz Transducer	PN910

Both sounders were installed prior to the start of the survey and were in use for the duration. No faults of any kind were observed on the sounding equipment during the survey. The singlebeam echo sounder was used at 125 kHz for the entire survey.

The Reson 8101 was operated at a range of 75 meters for nearly all of Sheet D. The few exceptions occurred later in the survey when the 100 meter range was used. See the individual Line Log sheets for additional details. Water depth varied from about 30 meters to less than 8 meters. Line orientation was along the length of swath D, roughly southwest to northeast. Survey lines were defined every 5 meters across track. Before the start of each line, the survey crew chooses the best line to maximize production and maintain coverage. Actual line spacing varied between 30 and 70 meters.

Along track, coverage was planned at 2 pings per meter. This was ensured by monitoring range and speed over ground. Maximum survey speeds were about 10 knots. Slower speeds, around 8 knots were more common. At the 75-meter range, the SeaBat acquires 10 pings per second. Ten knots corresponds to about 5 meters/second resulting in 2 pings per meter.

Sounding quality assurance tools consisted of the ping, waterfall, 3-D, ping scroller displays along with the Q/C Bin View and singlebeam to nadir beam comparison. The waterfall and ping displays allow the operator to view the data on a ping by ping basis. The Q/C Bin View display shows a plan view of tide corrected, motion compensated soundings. This view allows the operator to look across line for systematic error.

The singlebeam to multibeam nadir comparison was completed on each survey shift. This comparison looks for gross errors between the two sounders. Bar checks of the singlebeam and nadir multibeam were also completed when weather and currents allowed.

G - Corrections to Soundings

SOUND VELOCITY PROFILES

Sound velocity casts were done nominally every two hours during multibeam acquisition. Due to the high tidal currents, the sound velocity profiles were variable both geographically and temporally.

Sound Velocity Probes			
Make	**Model**	**Serial Number**	**Calibration Date**
Applied Microsystems Ltd.	Smart Sound Velocity and Pressure	4298-SV&P	3-February-1999
Applied Microsystems Ltd.	Smart Sound Velocity and Pressure	4300-SV&P	3-February-1999
Sea-Bird Electronics, Inc	SBE 19 SEACAT	193520-290	25-March-1999

The AML Smart Probes used for velocity correctors deliver 8 samples-per-second consisting of a pressure and velocity pair. For each cast, probes were held at the surface for two minutes for temperature equilibrium. The probes were then lowered and raised slowly (about 0.2 m/s) to maintain equilibrium. Between casts, the probes were stored in a barrel of fresh water to minimize salt-water corrosion and to help hold them at ambient water temperatures.

Data from the following casts were used to determine velocity correctors:

CAST #	DATE (UTC)	JULIAN DAY	TIME (UTC)	DEPTH (m)	NORTHING (m)	EASTING (m)
1	07/05/99	1999-186	21:02	20.9	6766817	626724
2			23:47	18.2	6767258	626819
3	07/06/99	1999-187	02:27	16.4	6767025	626181
4			05:33	20.6	6766239	625041
5			08:23	21.0	6764358	621686
6			11:14	20.0	6767691	626153
7			14:00	17.0	6764451	621102
8			16:02	18.0	6764614	621068
9			18:12	20.0	6764319	620338
10			21:34	22.8	6765330	621051
11	07/07/99	1999-188	00:57	17.7	6764847	620323
12			03:41	20.6	6765098	620527
13			06:10	21.1	6764948	620063
14			20:34	21.9	6767214	621672
15	07/08/99	1999-189	00:12	20.6	6766897	620237
16			03:38	22.3	6769832	624982
17			05:54	24.6	6769666	624823
18			11:17	22.5	6765403	624699
19			13:54	18.6	6763200	621417
20			15:56	16.2	6764745	616457
21			20:42	20.5	6766487	619772
22			23:53	21.4	6763674	615579
23	07/09/99	1999-190	03:53	18.2	6766880	620487
24			06:09	17.9	6765747	619379

CAST #	DATE (UTC)	JULIAN DAY	TIME (UTC)	DEPTH (m)	NORTHING (m)	EASTING (m)
25			09:39	22.5	6766375	620407
26			11:56	23.1	6763136	615968
27			14:08	21.0	6766606	621462
28			21:13	20.5	6765612	620105
29	07/10/99	1999-191	00:46	20.4	6762753	616064
30			03:41	19.6	9792764	616474
31			06:27	18.6	6765682	621136
32			08:27	21.1	67653336	620920
33			1050:	22.5	6762986	617580
34			12:20	23.3	6764024	619205
35			14:25	20.9	6762034	616548
36			16:44	18.9	6765437	621943
37			17:55	16.3	6764080	620030
38			20:32	17.4	6764823	620932
39			23:21	21.8	6764328	621075
40	07/11/99	1999-192	01:40	23.6	6762497	621116
41			04:50	20.4	6764760	621778
42			08:49	18.4	6767110	621668
43			11:08	22.6	6764084	621318
44			12:15	23.2	6764166	621916
45			14:22	22.9	6764425	622485
46			16:22	20.1	6760805	617338
47			23:54	21.7	6762347	613081
48	07/12/99	1999-193	01:39	22.4	6763947	615216
49			03:55	21.4	6764118	616112
50			06:34	19.1	6761546	612826
51			08:55	18.2	6760536	611189
52	07/12/99	1999-193	10:36	20.2	6763590	616069
53			12:10	22.4	6762696	614897
54			13:45	25.7	6760080	611248
55			15:42	23.2	6760173	611754
56			17:48	19.6	6762303	615248
57			20:49	17.4	6760185	612584
58			22:50	17.6	6763227	617032
59	07/13/99	1999-194	01:33	22.6	6761350	614528
60			03:40	25.4	6759353	611892
61			05:52	22.2	6759574	612635
62			08:20	18.8	6759472	612493
63			09:20	17.4	6760477	614094
64			10:48	21.7	6759330	612651
65			12:00	21.8	6760056	613694
66			13:58	24.1	6762028	617083
67			15:51	22.2	6761846	617287
68			17:50	22.2	6759752	614512
69			21:04	16.9	6758573	613300
70			23:20	20.2	6758701	613446
71	07/14/99	1999-195	01:24	22.7	6760743	616825
72			03:27	23.5	6757882	612779
73			04:58	22.1	6761503	618413
74			06:29	19.9	6757099	613607
75			08:30	16.2	6761409	611268

CAST #	DATE (UTC)	JULIAN DAY	TIME (UTC)	DEPTH (m)	NORTHING (m)	EASTING (m)
76			10:33	18.3	6761102	611651
77			12:35	21.7	6757584	606636
78			14:46	28.8	6757657	606929
79			20:25	18.0	6760832	611950
80			22:31	16.1	6760825	612305
81	07/15/99	1999-196	00:20	19.0	6760817	612334
82			02:20	26.2	6757222	607037
83			04:28	27.9	6757296	607464
84			06:15	25.9	6757049	607457
85			08:18	20.0	6760236	612697
86			10:25	18.0	6760343	613025
87			13:09	24.0	6757178	608532
88			15:24	27.0	6756743	608329
89			17:41	24.0	6758813	612042
90			21:54	18.4	6759717	614099
91			23:59	19.2	6758871	613713
92	07/16/99	1999-197	02:42	23.4	6759563	611243
93			05:28	26.3	6756009	608898
94			08:25	21.5	6758658	613211
95			10:09	20.0	6755562	608839
96			11:56	18.0	6757775	612448
97			13:51	25.0	6755359	609018
98			16:00	26.0	6758378	607650
99			1736	29.0	6756796	605230
100			20:48	22.7	6758809	608459
101	07/17/99	1999-198	08:28	24.0	6752868	607771
102			11:07	22.0	6757489	606813
103			17:47	26.0	6759031	608587
104	07/17/99	1999-198	21:07	22.8	6759054	608114
105			22:40	26.4	6755119	603347
106	07/18/99	1999-199	00:44	24.7	6755063	603747
107			02:49	26.5	6754663	603688
108			04:58	26.2	6753555	608383
109			08:50	25.0	6757742	608320
110			11:03	23.0	6757320	608219
111			13:10	20.0	6757267	608597
112			15:23	26.0	6754144	604411
113			17:20	28.0	6754108	604783
114			22:28	24.26	6755543	607913
115	07/19/99	1999-200	00:47	23.6	6753417	604655
116			02:59	24.7	3753043	604459
117			05:01	26.4	6752681	604331
118			08:33	25	6755523	609243
119			10:36	23	6755471	609408

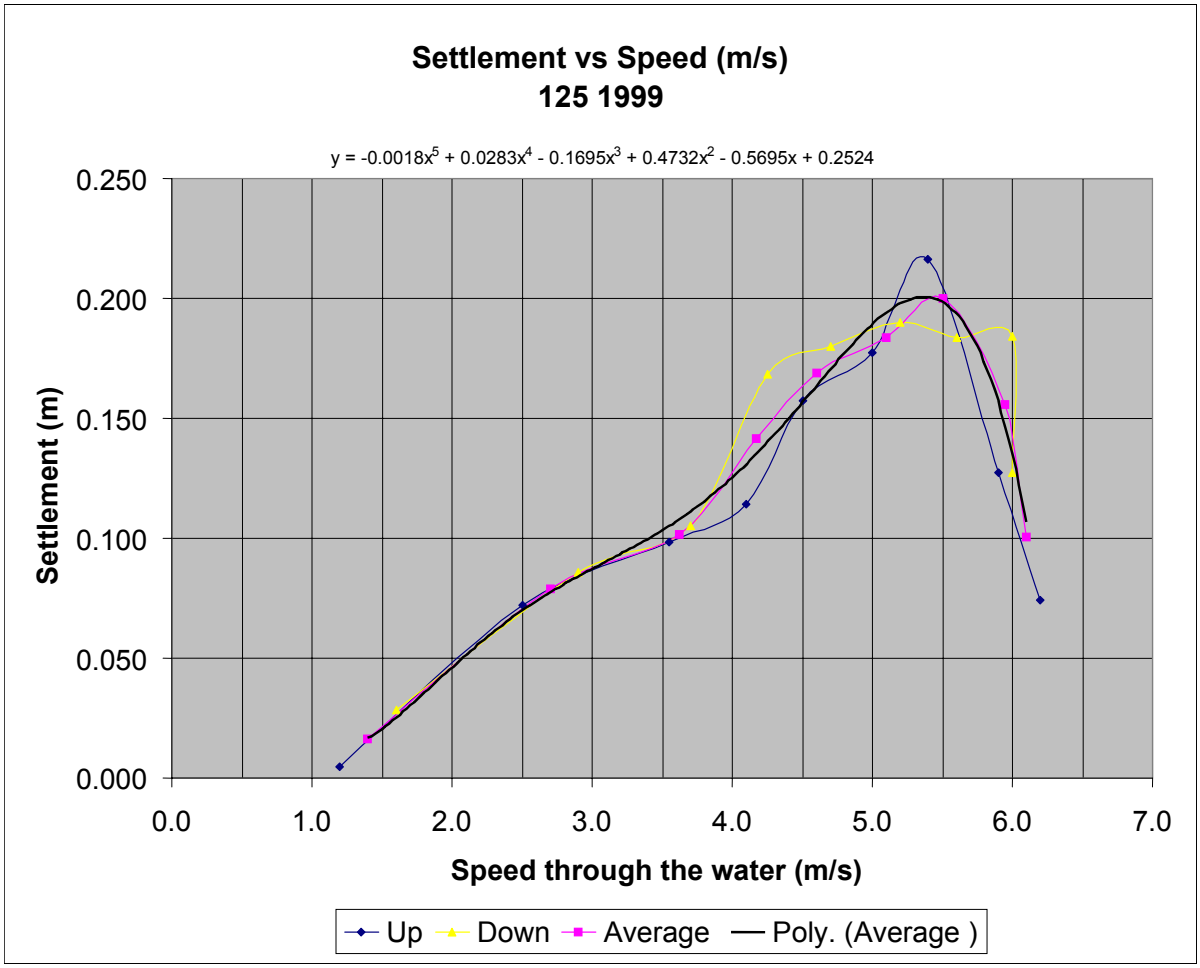
SETTLEMENT CURVE

A settlement curve for the Quicksilver was calculated from RTK GPS derived altitude data. The tests were run in Kachemak Bay. Trimble receivers were used for the base station and remote. RTK positions and altitudes were logged using Winfrog Multibeam every second.

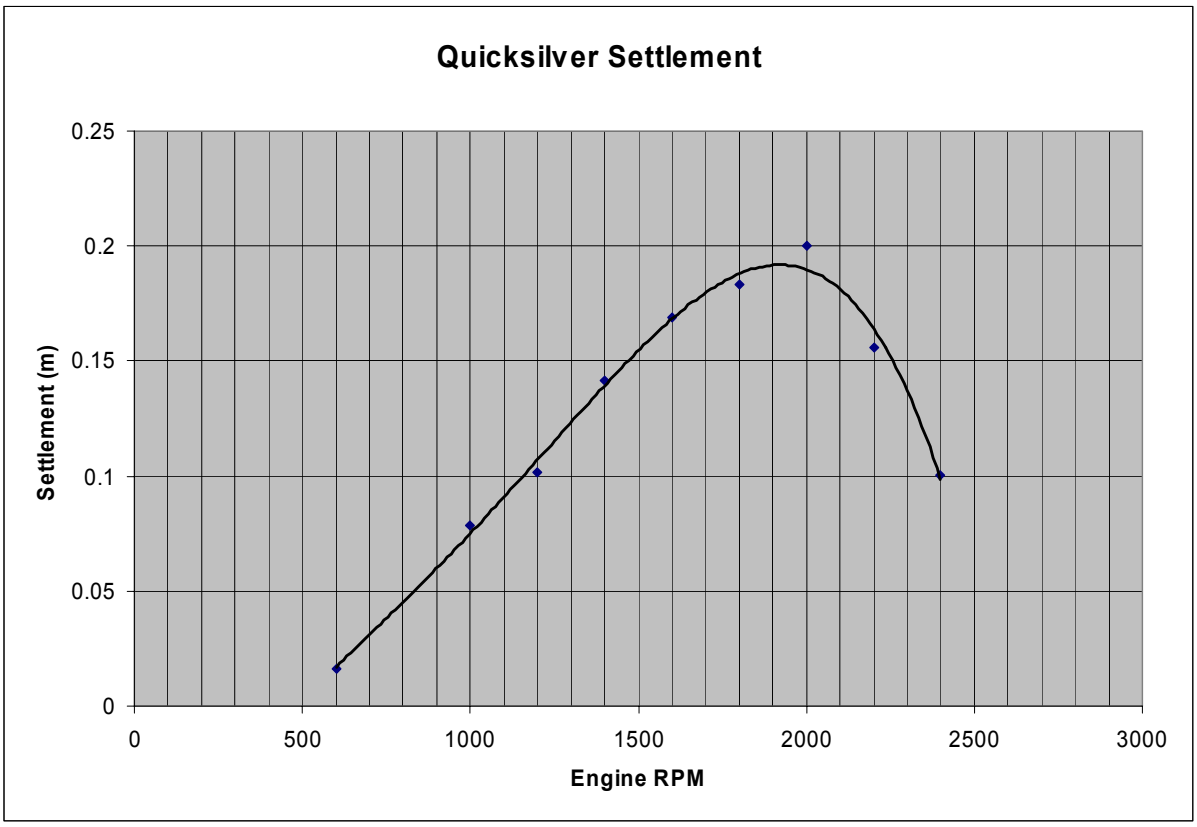
For the Settlement tests, a 500-meter line in the direction of the current was established. The survey vessel occupied the west end of the line for two minutes, logging RTK data. The line was then run heading east at 600 RPM then west at 600 RPM. The survey vessel again occupied the west end of the line. This scenario was repeated in increments of 200 RPM up to 2400 RPM. The test was run initially with the depressors stowed and repeated with the depressors deployed.

Measurements were directly over the transducer and reduced to the vessel CRP. Consequently, vessel squat had no effect on transducer elevation. Static measurements at the end of the line were used to establish tidal correctors. All data sets were corrected for heave, pitch and roll and reduced to the vessel's common reference point.

The following graph shows the original settlement curve generated from the Kachemak Bay data on Julian day 125 (5/5/99). In the legend, Up refers to the depressors in the stowed position, Down refers to the depressors in the deployed position. The Average curve is the mean value of the up and down curves. The Poly curve is a 5th order polynomial fit of the average curve, used to generate the dynamic draft values for processing.



For this survey, the RPM based settlement curve was used exclusively. Vessel RPM was hand logged for each survey line and settlement values were appended to the dynamic draft file for times just prior to SOL events and after EOL events. The following plot shows the relationship between settlement and engine RPM.



STATIC DRAFT

Static draft was measured from tabs on both sides of the vessel, the average was taken, and then the correction to the common reference point was applied. The table below shows the draft values used in data processing.

DRAFT #	DATE (UTC)	JULIAN DAY	TIME (UTC)	DRAFT (m)
1	07/05/99	1999-186	21:02	-0.033
2	07/06/99	1999-187	08:27	-0.007
3	07/06/99	1999-187	21:34	-0.043
4	07/07/99	1999-188	20:34	-0.033
5	07/08/99	1999-189	09:22	0.008
6	07/09/99	1999-190	09:37	0.003
7	07/09/99	1999-190	20:34	-0.028
8	07/10/99	1999-191	08:22	0.001
9	07/10/99	1999-191	20:32	-0.038
10	07/11/99	1999-192	08:46	0.003
11	07/11/99	1999-192	23:54	-0.018
12	07/12/99	1999-193	20:49	-0.043
13	07/13/99	1999-194	08:19	0.003
14	07/13/99	1999-194	23:20	-0.023
15	07/14/99	1999-195	08:39	0.003

DRAFT #	DATE (UTC)	JULIAN DAY	TIME (UTC)	DRAFT (m)
16	07/14/99	1999-195	22:31	-0.033
17	07/15/99	1999-196	08:18	-0.013
18	07/15/99	1999-196	21:54	-0.010
19	07/16/99	1999-197	17:40	-0.018
20	07/17/99	1999-198	17:50	-0.013
21	07/17/99	1999-198	21:07	-0.008
22	07/18/99	1999-199	08:50	-0.023
23	07/18/99	1999-199	22:28	-0.03
24	07/19/99	1999-200	08:33	-0.013

TIDES [5]

During processing, sounding were reduced to MLLW using data from 3 tide gauges. These gauges were operated by a sub-contractor, LCMF, and the data was delivered to the processing ship at the end of every Julian day.

Gauge	Location	Latitude	Longitude
9455869	North Foreland	61.0425	150.1636
9455912	Fire Island	61.1731	150.2061
9455821	Moose Point	60.9564	150.6833
9455781	Boulder Point	60.7761	151.2450

Tidal zones for this survey were defined after preliminary survey work in the fall of 1998 (SOL 52-DGNC-8-90028, Task Order #1). The zones used have generally the same shape as the NOAA preliminary zones in the survey area but form a finer mesh. The maximum time difference across any zone boundary in the new scheme was 2 minutes. The following plot shows the area around Sheet D and the tide zone layout.

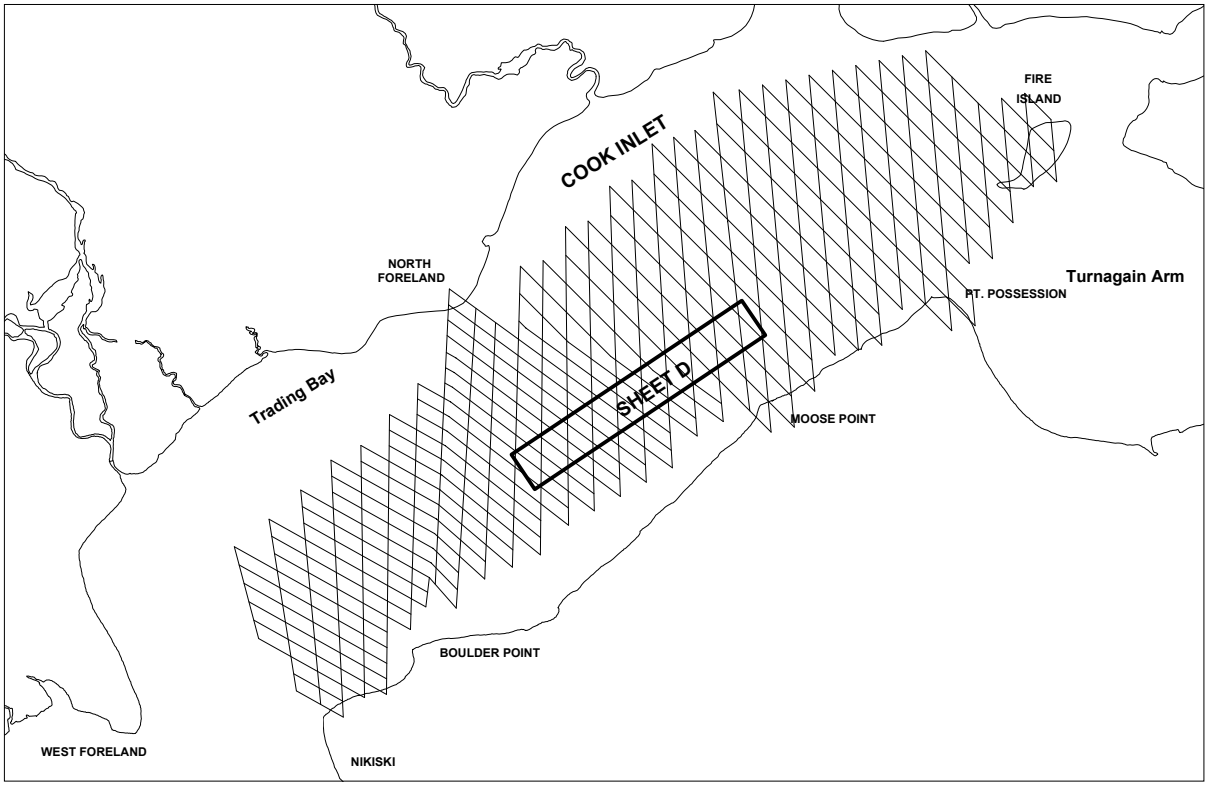
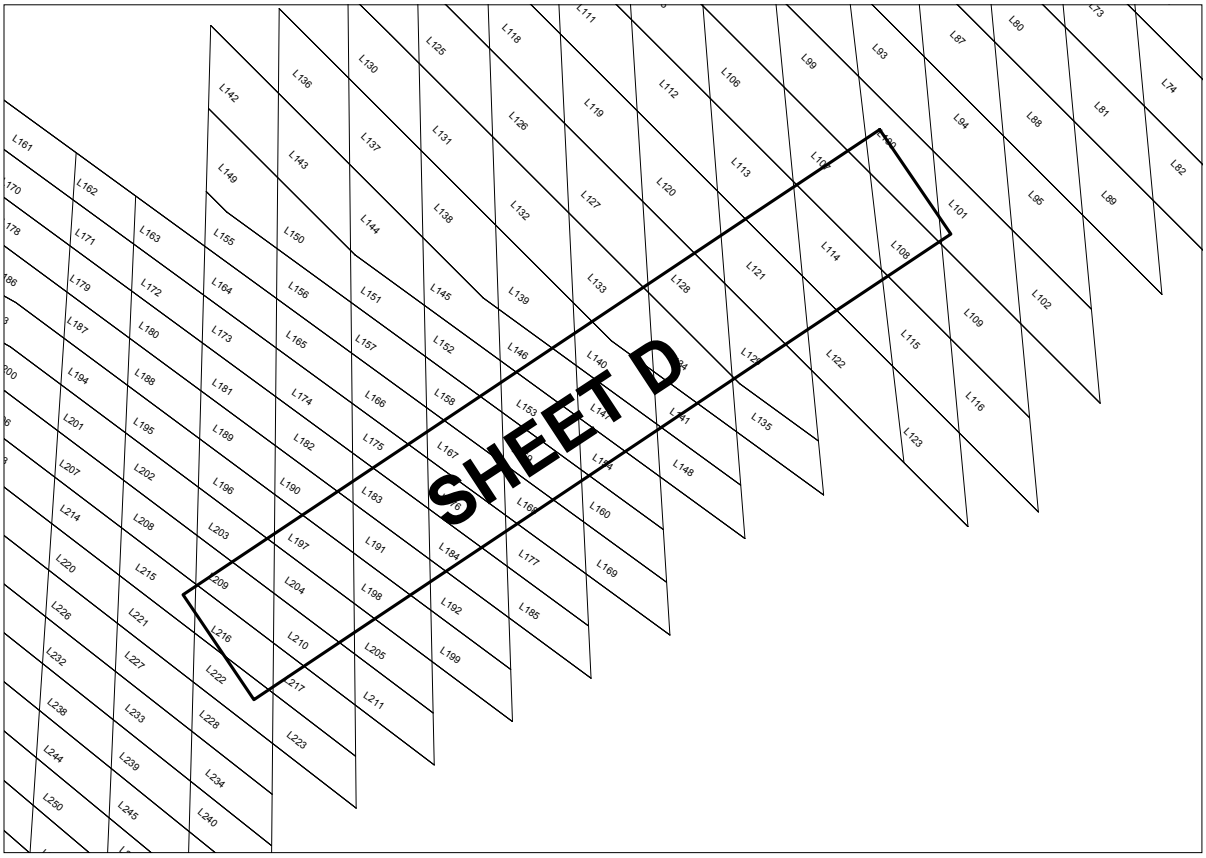


Table of tide zones used in Sheet D processing.

LCM F	Primary Reference		Time	Range		Secondary Reference		Time	Range	LCM F
Zone	Name	Number	mins	Ratio		Name	Number	mins	Ratio	Zone
99	Moose Pt	9455824	6	0.989		N. F'land	9455869	20	1.131	99
100	Moose Pt	9455824	6	1.000		N. F'land	9455869	20	1.144	100
101	Moose Pt	9455824	6	1.010		N. F'land	9455869	20	1.149	101
107	Moose Pt	9455824	4	0.989		N. F'land	9455869	18	1.131	107
108	Moose Pt	9455824	4	1.000		N. F'land	9455869	18	1.144	108
113	Moose Pt	9455824	2	0.978		N. F'land	9455869	16	1.118	113
114	Moose Pt	9455824	2	0.989		N. F'land	9455869	16	1.131	114
115	Moose Pt	9455824	2	1.000		N. F'land	9455869	16	1.144	115
120	Moose Pt	9455824	0	0.967		N. F'land	9455869	14	1.106	120
121	Moose Pt	9455824	0	0.978		N. F'land	9455869	14	1.118	121
122	Moose Pt	9455824	0	0.989		N. F'land	9455869	14	1.131	122
127	Moose Pt	9455824	-2	0.956		N. F'land	9455869	12	1.094	127
128	Moose Pt	9455824	-2	0.967		N. F'land	9455869	12	1.106	128
129	Moose Pt	9455824	-2	0.978		N. F'land	9455869	12	1.118	129
133	Moose Pt	9455824	-4	0.956		N. F'land	9455869	10	1.094	133
134	Moose Pt	9455824	-4	0.967		N. F'land	9455869	10	1.106	134
135	Moose Pt	9455824	-4	0.978		N. F'land	9455869	10	1.118	135
139	Moose Pt	9455824	-6	0.946		N. F'land	9455869	8	1.081	139
140	Moose Pt	9455824	-6	0.956		N. F'land	9455869	8	1.094	140
141	Moose Pt	9455824	-6	0.967		N. F'land	9455869	8	1.106	141
146	Moose Pt	9455824	-8	0.946		N. F'land	9455869	6	1.081	146
147	Moose Pt	9455824	-8	0.956		N. F'land	9455869	6	1.094	147
148	Moose Pt	9455824	-8	0.967		N. F'land	9455869	6	1.106	148
152	Moose Pt	9455824	-10	0.935		N. F'land	9455869	4	1.069	152
153	Moose Pt	9455824	-10	0.946		N. F'land	9455869	4	1.081	153
154	Moose Pt	9455824	-10	0.956		N. F'land	9455869	4	1.094	154
158	Moose Pt	9455824	-12	0.935		N. F'land	9455869	2	1.069	158
159	Moose Pt	9455824	-12	0.946		N. F'land	9455869	2	1.081	159
160	Moose Pt	9455824	-12	0.956		N. F'land	9455869	2	1.094	160
166	Moose Pt	9455824	-14	0.925		N. F'land	9455869	0	1.058	166
167	Moose Pt	9455824	-14	0.935		N. F'land	9455869	0	1.069	167
168	Moose Pt	9455824	-14	0.946		N. F'land	9455869	0	1.081	168
175	Moose Pt	9455824	-16	0.925		N. F'land	9455869	-2	1.058	175
176	Moose Pt	9455824	-16	0.935		N. F'land	9455869	-2	1.069	176
177	Moose Pt	9455824	-16	0.946		N. F'land	9455869	-2	1.081	177
182	N. F'land	9455869	-4	1.046		Moose Pt	9455824	-18	0.914	182
183	Moose Pt	9455824	-18	0.925		N. F'land	9455869	-4	1.058	183
184	Moose Pt	9455824	-18	0.935		N. F'land	9455869	-4	1.069	184
190	N. F'land	9455869	-6	1.046		Moose Pt	9455824	-20	0.914	190
191	Moose Pt	9455824	-20	0.925		N. F'land	9455869	-6	1.058	191
192	Moose Pt	9455824	-20	0.935		N. F'land	9455869	-6	1.069	192
196	N. F'land	9455869	-8	1.034		Moose Pt	9455824	-22	0.904	196
197	N. F'land	9455869	-8	1.046		Moose Pt	9455824	-22	0.914	197
198	Moose Pt	9455824	-22	0.925		N. F'land	9455869	-8	1.058	198
203	N. F'land	9455869	-10	1.034		Boulder	9455781	36	1.046	203
204	N. F'land	9455869	-10	1.046		Moose Pt	9455824	-24	0.914	204
205	Moose Pt	9455824	-24	0.925		N. F'land	9455869	-10	1.058	205
208	N. F'land	9455869	-12	1.023		Boulder	9455781	34	1.034	208

209	N. F'land	9455869	-12	1.034		Boulder	9455781	34	1.046	209
210	N. F'land	9455869	-12	1.046		Boulder	9455781	34	1.057	210
215	N. F'land	9455869	-14	1.023		Boulder	9455781	32	1.034	215
216	N. F'land	9455869	-14	1.034		Boulder	9455781	32	1.046	216
217	N. F'land	9455869	-14	1.046		Boulder	9455781	32	1.057	217
222	Boulder	9455781	30	1.046		N. F'land	9455869	-16	1.034	222

Tide Zones in Sheet D.



Tidal data for a twenty-four hour period was assembled by LCMF and emailed to the Davidson at the end of every day, UTC. A cumulative file for each gauge was updated each day by appending the new data. HPTools (ver. 8.9.5) was used to calculate zoned tidal correctors using CARIS navigation files. The output from HPTools was appended to the project tide file, 1782.tide.

VESSEL ATTITUDE: HEADING, HEAVE, PITCH, AND ROLL

Survey vessel heading and attitude was measured by a TSS HDMS. The HDMS calculated heading from two Novatel GPS generated positions. Attitude was measured by an accelerometer block mounted in the hull of the vessel just over the multibeam transducer. Manufacturers accuracy's for this systems are:

TSS HDMS Accuracy	
Pitch and Roll	0.035°
Heading	0.05°
Heave	5% or 5-cm over 20 seconds

The heave filter in the HDMS was set to 100 seconds. All lines were run with a 2-minute run-in to insure that the heave was stable.

The patch values used to reduce all soundings on this sheet were taken from the June 25, 1999 test that was completed for survey H-10893. The results were as follows:

Patch Test Results June 25, 1999 (1999-176)			
Test	**CARIS Session**	**CARIS Subset**	**Mean correction**
Navigation Timing Error	Patch_062599_nava	3	0.00 sec.
Pitch Offset	Patch_062599_Pitcha	3	0.64°
Azimuth Offset	Patch_062599_Yawa	1	0.00°
Roll Offset	Patch_062599_Rolla	1	-0.31°

H - Hydrographic Position Control

The horizontal control datum for this survey was the North American Datum of 1983 (NAD83). All positions were originally collected in WGS84 and transformed to NAD83 during HIPS worksheet creation. Note, however, that HIPS makes no distinction between WGS84 and NAD83 so the transformation amounts to nothing more than a name change.

Winfrog was configured to write three separate positions into its .RAW files. These were the 303 Pseudorange Console (PR-Console), the 303 Console (Console), and the 300 Quicksilver. The 303 records are always raw antenna positions and do not include vessel offsets or Kalman filtering. The 300 record includes both antenna offsets and filtering. For this survey, however, the antenna offset was set to zero and the Kalman filter was disabled.

The PR-Console and Console are independently calculated pseudorange positions. PR-Console is generated by Winfrog as the weighted arithmetic average of the pseudorange positions calculated from the three separate RTCM sources listed below. The Console position is the pseudorange position calculated on the NovAtel card using a single RTCM source, in this case, the Kenai USCG station.

Winfrog attached the PR-Console position to the bathymetry data in the .XTF files. This position was taken as a reasonable estimate of true position and was checked against the Console and Quicksilver positions at the end of every line for gross error. This method of positioning amounts to a real time verification of the RTCM sources since at least two RTCM sources would have to fail independently in a contrived manner to generate an erroneous position that appeared reasonable.

Offsets are used in Winfrog for display purposes only. Offset values were applied to the data in CARIS HDCS as specified in the vessel configuration file. Vessel offsets used are shown in the following table.

Quicksilver Vessel Offsets				
From	**To**	**X**	**Y**	**Z**
CRP	HDMS Accelerometer	0.000	0.000	0.000
CRP	8101 Transducer	0.000	0.000	0.570
CRP	Odom Transducer	0.140	2.690	0.450
CRP	Navigation GPS Antenna	5.280	-0.030	-4.680
CRP	HDMS Master Antenna	-2.807	0.003	-4.730
CRP	HDMS Slave Antenna	0.081	-0.005	-4.69
CRP	Draft Measuring Point, Port	0.270	-2.357	-1.824
CRP	Draft Measuring Point, Starboard	0.270	2.333	-1.849

Axis used: X positive toward bow
Y positive toward Starboard
Z positive in to the water

All units are meters.

The following GPS equipment was used:

GPS Receivers

Model	Serial Number	Location	Use
Novatel GPS Card , PC Series	450056	Winfrog Nav PC	Primary Navigation

Differential Correction Receivers

Rx. No.	Model	Serial Number	Antenna Serial Number
1	CSI MBX-3	9830-2023-0001	9830-2023-0003
2	CSI-MBX-3	9834-221-0002	9841-2496-0004
3	Yaesu	7m350-84	N/A

Three sources for differential corrections were used. Two of these were U.S Coast Guard stations in Kenai and Kodiak. The third station was installed and maintained by Racal Pelagos near the OSK dock in Nikiski. All three stations were used in a weighted solution. The weights assigned in Winfrog increase as the data becomes less desirable. As indicated in the table below, the Kenai and Nikiski stations were both given equally high preferences. The Kodiak was only used as a backup in this scenario.

Reference Stations

Station	ID	Latitude	Longitude	Elev.	Freq.	Tx. Rate	Rx. No.	Weight
Kenai, USCG	292	60° 40.505’	151° 21.010’	55.56	310	100 BPS	1	1
Kodiak, USCG	294	57° 37.055’	152° 11.631’	26.53	313	100BPS	2	10
Nikiski, RPI	101	60° 44.38613’	151° 18.63855’	69.55			3	1

The Station identified above as Nikiski, RPI, was established on 22 May 1996 by a Racal-Pelagos affiliate. The station was originally identified as NCS STA “OSK”. Verification of this station was completed on 25 August 1999 using National Geodetic Survey monument KIRT (PID UW8067) as control. For verification, one Hertz positions were logged for a 24-hour period (87729 records). Results showed the Nikiski, RPI station to be 1.43 meters from its surveyed position.

Verification data for the Nikiski station can be found in Appendix F. [6]

I - Shoreline

Not applicable; shoreline verification was not required. [7]

J – Crosslines

Sheet D was divided into 5 areas for survey operations. The areas, numbering 1 – 5 from South to North, were 3.7 km wide and about 4 km long. There were six tie lines in areas D1 to D3 & eight tie lines in areas D4 & D5, each 3.7 km in length. Tie lines were planned to measure 5% of the main-scheme line length. Total crossline length was 125.8 km (67.9 nautical miles) or 5.8% of the total main-scheme miles.

A total of 197 tie line crossings were examined using the CARIS HIPS Q/C report. Of these tie lines, twelve had certain beams that failed to reach the specified vertical accuracy. In the table below, it can be seen that the marginal tie lines are clustered in time and space. For example, line D4tie007 from JD 189 at 1602 is

responsible for 3 failures. These failures appear to be associated with high winds and seas during the running of these particular tie lines. It should be noted that the survey data at these points is still in close agreement with offset lines. [8]

CARIS File	Tie Line	Line	JD	Time	No. of Failed Beams
qctie_088	D4tie007	D402080	189	1602	11
qctie_093	D4tie006	D402430	189	1535	6
qctie_094	D4tie007	D402430	189	1602	14
qctie_099	D4tie006	D402760a	189	1535	20
qctie_106	D4tie007	D403270	189	1602	6
qctie_137	D3tie001	D301960	193	0114	5
qctie_138	D3tie002	D302045	193	0050	12
qctie_141	D3tie005	D302235a	193	0609	7
qctie_143	D3tie001	D302455	193	0114	7
qctie_148	D3tie006	D302940	193	0542	6
qctie_155	D3tie001	D303545	193	0114	7
qctie_156	D3tie002	D303650	193	0050	5

K – Junctions [9]

H-10903 (Sheet D) junctions with H-10893 (Sheet B, OPR-P385-KR-98, Surveyed 6/15/99 – 7/8/99) along the northern edge of the survey area. The surveys are in close agreement along their common borders. The agreement was noted in the field using the 2-meter DTM's created for coverage verification. The conformity is also apparent in the preliminary smooth sheets.

L - Comparisons with Prior Surveys [10]

Comparison with prior surveys was not required under this contract. See Section N for comparison to the nautical charts.

M - Item Investigation Reports [11]

No AWOIS items were assigned under this contract.

N - Comparison with the Chart [12]

Comparisons were made with the following charts

Chart No.	Edition/Date	Datum	Scale
16663	5th Ed., Jul 12, 1997	NAD 83	1:100000

Danger to Navigation [13]

Sixty dangers to navigation, typically individual boulders, were discovered in the survey area. These features are documented in Appendix A, Dangers to Navigation.

Comparison of Soundings

Overall, there is an excellent match between preliminary smooth sheet soundings and posted soundings on chart 16663. Soundings were considered equivellent [14] if the smooth sheet compares to the chart with the vertical error budget for the survey. Three soundings were found shoaler than those on the chart. The shallowest of these rises to 6 fathoms.

The three points are highlighted in red on the chart comparison sheet included in Separate 8.

O - Adequacy of the Survey [15]

The survey is a complete navigable area hydrographic survey and is adequate to supercede all prior surveys within their common areas. Data density was planned at two soundings per meter along track and demonstrated to be sufficient to detect a 2-meter square by 1-meter high shoal. Soundings fell within the error budget specified in the Statement of Work Attachment #1, Section 5.2 at greater than the 95% confidence level. More than 5 meters of overlap was maintained throughout the survey.

P - Aids to Navigation

There were no charted aids to navigation in the survey area. No uncharted aids to navigation were found in the survey area.[16]

ADJUSTMENT TO STATIC DRAFT

An incorrect offset was initially used to calculate the static draft applied to all soundings collected on the F/V Quicksilver on this sheet. The offset error produced in a 42-cm underestimation of draft and a resultant 42-cm underestimation of depth.

The F/V Quicksilver was surveyed during systems installation in Seattle from 4/11/1999 to 4/15/1999. Tabs were welded to the Port and Starboard gunwales to aid in the measurement of static draft. The vertical offsets from the common reference point (CRP) on top of the motion reference unit (MRU) to tabs were surveyed as:

Port	1.824 m
Stbd	1.849 m

These values were entered in the vessel-offset sheet and later included in this descriptive report. The two values were averaged (1.836) for entry to the acquisition system. However, the data were collected and processed using a vertical offset of 1.416, instead of the proper value of 1.836. This error was corrected by applying a constant offset in the CARIS work file. The following data flow was used:

1- Add a value of 1.378 feet to all the work file soundings
2- Generate a DTM
3- Create contours
4- Export soundings and contours to smooth sheet
5- Hand edit contours
6- Verify dangers to navigation and chart comparison

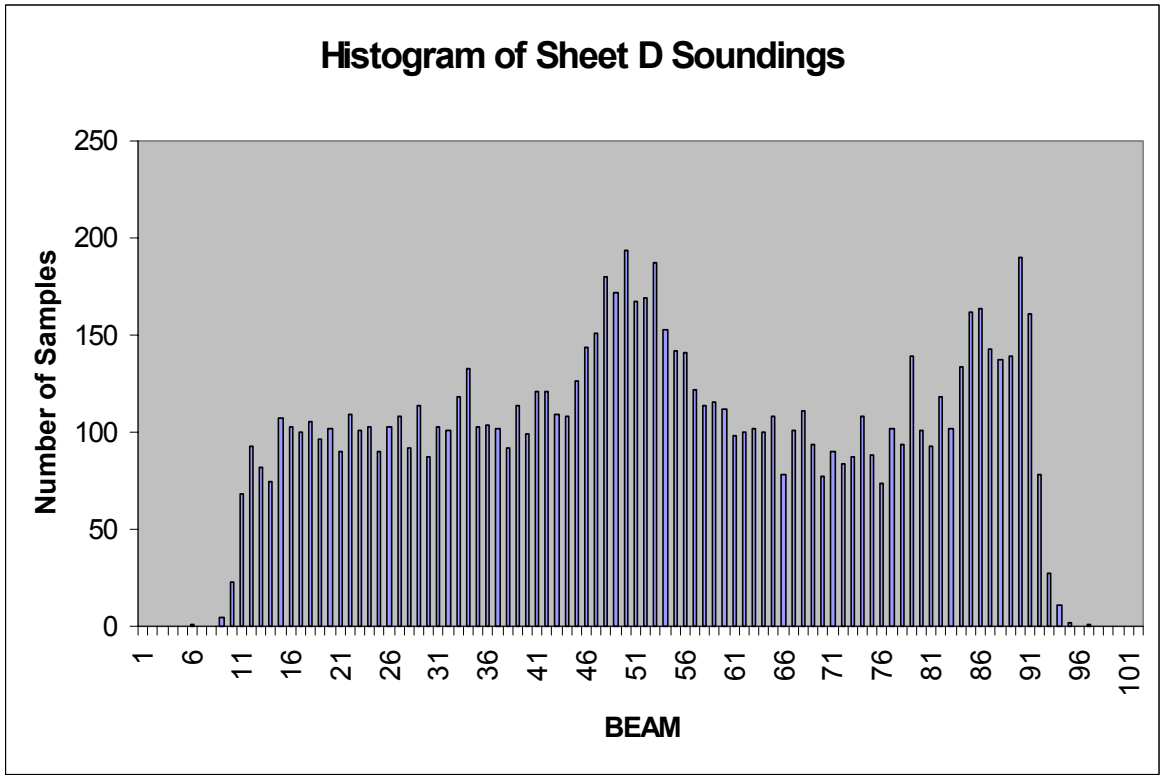
Using this method, the CARIS HDCS files remain in error. The CARIS work file and the smooth sheet are correct. [17]

Q - Statistics

Lineal and square miles apply to both multibeam and singlebeam coverage.

Lineal Nautical Miles	1179
Square Nautical Miles	26.35
Days of acquisition	14
Total number of soundings	462,389,618
Number of selected soundings on preliminary smooth sheet	9473
Number of detached positions	0
Number of bottom samples	0
Number of velocity casts	119
Number of tide stations installed	4

Note: Singlebeam soundings were collected on each line and are available in the digital data set in the WinFrog



.RAW files. Singlebeam data was used for QC purposes only and were not processed, included in the total number of soundings and were not used in smooth sheet production.

R – Miscellaneous

SMOOTH SHEET HISTOGRAM

A histogram of the selected smooth sheet soundings is displayed below. Although soundings used to compile the smooth sheet fell within the specified error budget at nearly 100% confidence, the distribution of soundings across sonar beams is not level. The distribution of soundings shows two outstanding features.

The First feature is the large spike on the nadir beams 46-56. In this region, the normal amplitude detect problem associated with the Seabat is aggravated by the location of an Odom 125kHz transducer just forward of the multibeam transducer. Noise from the Odom is summed into the returns measured by the Seabat, resulting in early digitization. The small dip in the histogram on either side of the nadir spike is likely the result of a graphical shadow zone created by the shoaler nadir soundings. Once these soundings are drawn, other soundings in the very densely sampled area around nadir can not be selected.

The second feature is the large spike on the starboard beams and the valley inboard of it. The Quicksilver was fitted with a pole mount for a speed log and velocity probe on the starboard rail abeam of the 8101 transducer. This pole was removed before the start of survey operations for this sheet. However, a support bracket welded to the hull just under the water line remained in place. Turbulence from this bracket was visible in the unedited bathymetric profiles. It is apparent that, even after editing, some noise remained, resulting in the spike.

The valley at beam 71 is the result of the survey line pattern. As the lines were run, port beams overlapped port beams from the adjacent line, starboard overlapped starboard. The additional soundings seen in beams 81 – 92 were essentially robbed from beams 66 – 78 creating a deficit of soundings for these beams.

TIDES

In a few cases, soundings collected during extreme low tides were removed from the data set. This typically occurred when Moose Point was the primary gauge and it went dry. In each instance, these lines were identified in subset as having a clear vertical offset from the surrounding data. While this offset was roughly 20 –30 centimeters and less that the vertical accuracy specification, it was decided that the lines misrepresented the bathymetry. New lines were run to fill in over the rejected lines.

S - Recommendations

This survey matches closely with the existing chart. Although the seabed features are the result of a dynamic hydraulic environment, the seafloor along the survey corridor appears to be relatively stable. Frequent surveys in this region are probably not required.[18]

T - Referral to Reports [19]

Title	Transmittal Information
Technical Report for Tidal Zoning Survey, Cook Inlet, Alaska	SOL 52-DGNC-8-90028 Task order No. 1
Quality Management Plan	Racal Pelagos, QMP-1702-01
Acquisition Procedures, Proprietary	Racal Pelagos, OP-1702-02
Processing Procedures, Proprietary	Racal Pelagos, OP-1702-03

Appendix A - Danger to Navigation

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
OFFICE OF COAST SURVEY
Pacific Hydrographic Branch
Seattle, Washington 98115-0070

ADVANCE INFORMATION

April 3, 2000

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Seventeenth Coast Guard District
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Building 50-6
Juneau, Alaska 98802

Dear Sir:

During processing of the hydrographic survey H-10903 in Cook Inlet, NOAA contractor, Racal Pelagos discovered 31 dangers to navigation. The dangers affects the following charts:

Chart	Edition/Date	Datum
16660	27th, 4/19/97	NAD 83
16663	5th, 7/12/97	NAD 83

It is recommended that the enclosed Report of Dangers to Navigation be included in the Local Notice to Mariners.

Questions concerning this report should be directed to the Pacific Hydrographic Branch at (206) 526-6835

Sincerely,

JCG

James C. Gardner
Commander, NOAA
Chief, Pacific Hydrographic Branch

Enclosures

cc: NIMA
NCS/261

CODE	SURNAME	DATE	CODE	SURNAME	DATE
N/CS34	Gary C Nelson	4/03/00			
N/CS34	DWall	4-3-00			

FILE COPY

7

Hydrographic Survey Registry Number: H-10903

ADVANCE INFORMATION

Survey Title: State: Alaska
Locality: Cook Inlet
Sublocality: West of Moose Point Shoal

Project Number: OPR-P385-KR-98

Survey Date: July, 2000

Features are reduced to Mean Lower Low Water using contractor verified tides from contractor tide gauges.

Affected Nautical Charts:

CHART	EDITION/DATE	DATUM
16660	27th Ed., Apr 19, 1997	NAD83
16663	5th Ed., Jul 12, 1997	NAD83

The dangers are the following Soundings:

ITEM	DANGER	DEPTH	LATITUDE	LONGITUDE
A	SOUNDING	9.3FM	60/53/55.467N	151/03/26.032W
B	SOUNDING	8.9FM	60/54/38.939N	151/03/03.546W
C	SOUNDING	9.5FM	60/54/28.386N	151/04/02.674W
D	SOUNDING	10.5FM	60/55/21.343N	151/04/48.242W
E	SOUNDING	10.8FM	60/55/40.361N	151/04/02.677W
F	SOUNDING	9.7FM	60/55/06.909N	151/03/07.795W
G	SOUNDING	9.3FM	60/56/13.603N	151/01/51.308W
H	SOUNDING	7.2FM	60/56/17.715N	151/01/02.227W
I	SOUNDING	7.4FM	60/55/05.357N	151/00/03.150W
J	SOUNDING	7.4FM	60/55/55.633N	150/59/08.113W
K	SOUNDING	9.7FM	60/56/56.890N	150/59/50.703W
L	SOUNDING	7.6FM	60/56/38.269N	150/58/30.762W
M	SOUNDING	7.1FM	60/56/57.264N	150/58/00.170W
N	SOUNDING	8.9FM	60/56/26.800N	150/57/27.289W
O	SOUNDING	8.3FM	60/56/20.307N	150/56/44.459W
P	SOUNDING	9.1FM	60/55/52.042N	150/56/42.787W
Q	SOUNDING	5.1FM	60/57/35.105N	150/57/21.752W
R	SOUNDING	8.4FM	60/57/00.114N	150/56/07.231W
S	SOUNDING	6.1FM	60/56/53.552N	150/55/41.001W
T	SOUNDING	6.8FM	60/57/23.353N	150/55/25.116W
U	SOUNDING	6.9FM	60/56/33.202N	150/54/50.140W
V	SOUNDING	6.4FM	60/57/03.333N	150/54/27.113W
W	SOUNDING	6.6FM	60/57/00.946N	150/52/39.923W
X	SOUNDING	5.4FM	60/57/52.956N	150/53/27.969W
Y	SOUNDING	6.2FM	60/57/47.034N	150/52/11.180W
Z	SOUNDING	5.3FM	60/58/52.114N	150/52/37.295W

ITEM	DANGER	DEPTH	LATITUDE	LONGITUDE
AA	SOUNDING	6.9FM	60/58/22.628N	150/55/50.176W
AB	SOUNDING	6.1FM	60/58/45.857N	150/48/48.329W
AC	SOUNDING	5.2FM	60/57/53.406N	150/51/06.449W
AD	SOUNDING	6.4FM	61/00/03.047N	150/50/00.638W
AE	SOUNDING	6.4FM	60/58/53.255N	150/47/29.073W

ADVANCE
INFORMATION

Appendix B - Landmarks and Non-Floating Aids to Navigation Lists

There were no landmarks or non-floating aids to navigation within the survey area.[20]

Appendix C - List of Geographic Names

No new geographic names in the survey area were discovered.

Appendix D - Tides and Water Levels

Abstract of Times of hydrography

YEAR	DAY	START TIME (UTC)	END TIME (UTC)	COMMENTS
1999	186	21:12:59	23:35:20	
1999	187	00:03:35	23:59:59	
1999	188	00:00:00	23:14:49	
1999	189	00:22:46	23:47:52	
1999	190	00:04:03	23:59:59	
1999	191	00:00:00	23:59:59	
1999	192	00:00:00	23:59:59	
1999	193	00:00:00	23:59:59	
1999	194	00:00:00	23:59:59	
1999	195	00:00:00	23:59:59	
1999	196	00:00:00	23:59:59	
1999	197	00:00:00	23:59:59	
1999	198	00:00:00	23:59:59	W.O.W 1140-1730
1999	199	00:00:00	23:59:59	
1999	200	00:00:00	12:00:00	

All time UTC.

Please refer to the Descriptive Report for H-10892 or H-10893 for the tide note for North Foreland, Fire Island, Moose Point and Point Possession tide gauges.

Appendix E - Calibration Data

Appendix F - DGPS Verification Data

The point used for the Racal Pelagos Nikiski differential station is identified alternatively as TNH PT 20 and NCS STA “OSK” in the following literature.

Appendix G - Data Processing Routine [21]

Please see proprietary document Racal Pelagos Processing Procedures, OP-1702-03, delivered separately. A data flow diagram showing generalized processing procedures and a directory structure plan are included in Separate 8.

Appendix H - Data Acquisition and Processing Software

Acquisition

Winfrog Multibeam	1.3 NOAA	5/3/99

Processing

CARIS HIPS	4.3	9/24/98 *
Chart-X	1.5.2	1/99
Mathematica	3.0.1.1x	N/A
SVP_05		5/1/99
SVP_draft		5/18/99
MapInfo Professional	5.0	N/A
HP Tools	8.9.5	N/A
Microstation SE	05.07.01.14	N/A
Ribbit Cable & Pipe	1.4	5/10/99

* See following page for details on CARIS updates and patches.

CARIS Version in Use

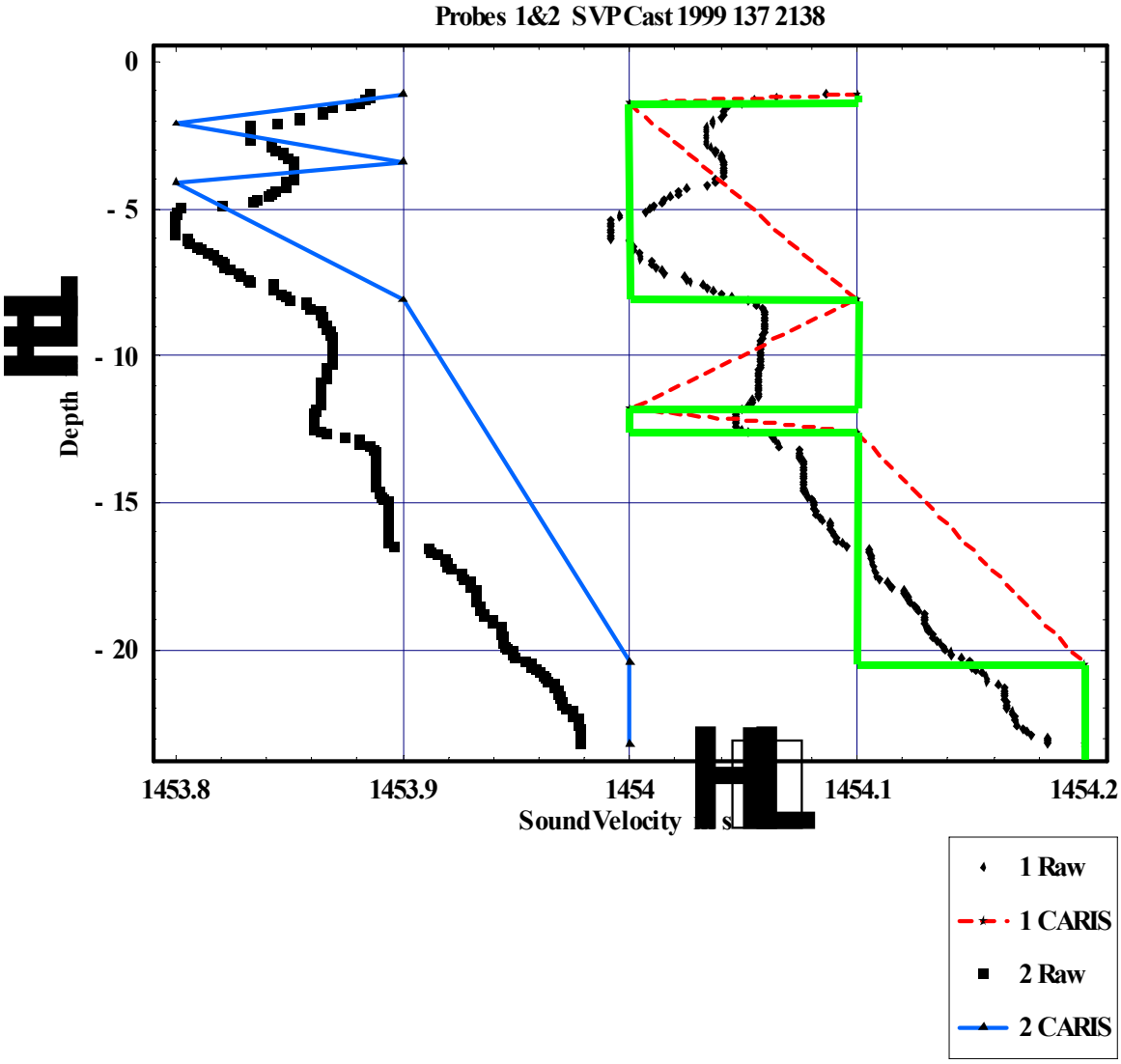
CARIS version 4.3 installed on 09-24-98.

UPDATES/PATCHES
---

xtfToHDCS	-updated 09-24-98
ConvertToHDCS	-updated 09-24-98
hdcs	-updated 09-24-98
hdcsLineMerge	-updated 09-24-98
resontoHDCS	-updated 09-24-98
ConvertToHDCS	-updated 01-21-99
HDCS	-updated 01-21-99
programSettings	-updated 01-21-99
hdcs	-updated 01-21-99
hdcsLineMerge	-updated 01-21-99
xtfToHDCS	-updated 01-21-99
bin/makehist	-updated 03-18-99
bin/refohdcs	-updated 03-18-99
bin/swathedit	-updated 03-18-99
cld/refohdcs	-updated 03-18-99
refohdcs.com	-updated 03-18-99
refohdcscl.com	-updated 03-18-99
refomany.com	-updated 03-18-99
refomanycl.com	-updated 03-18-99
refohdcs.frm	-updated 03-18-99
refohdcscl.frm	-updated 03-18-99
refomany.frm	-updated 03-18-99
refomanycl.frm	-updated 03-18-99
sys/makehist.cla	-updated 03-18-99
sys/SWATHEDIT	-updated 03-18-99
hips/bin/hdcs	-updated 04-01-99
hips/bin/hdcsLineMerge	-updated 04-01-99
hips/bin/xtftoHDCS	-updated 04-01-99
hips/sys/HDCS	-updated 04-01-99
hips/sys/ConvertToHDCS	-updated 04-01-99
hips/sys/programSettings	-updated 04-01-99
hips/form/export_dxf.frm	-updated 04-01-99
hips/com/export.com	-updated 04-01-99
hips/com/DXFcorrect.awk	-updated 04-01-99
caris/bin/sun4_2/cared.x	-updated 05-13-99
caris/system/msgfil.dat	-updated 05-13-99

Appendix I - SVP Data

The following graphs of sound velocity profiles show raw data sets from both probes in black and processed data in red and blue. Please note that CARIS HDCS has decimeter resolution in depth and 0.1 m/s resolution in velocity for its SVP calculations. Data was decimated to these values for use in CARIS. That fat green line on the graph below shows the velocity step function that is used by CARIS in its constant velocity model. On all the following graphs, the red and blue lines trace the vertices of the velocity step function. Errors induced by this approximation are described in Section D of the main body of this report.



Appendix J – Supplemental Correspondence

RECRD 50174 VESSLTERMS OBSTRUCTION CHART 5310 AREA P

CARTOCODE 0104 SNDINGCODE 127 DEPTH 28

NATIVLAT 60/58/24.70 NATIVLON 150/49/09.40 convert NATIVDATUM 6

LAT83 60/58/22.70 LONG83 150/49/17.40 Update GP GPQUALITY High

60 58 22.7 150 49 17.4 GPSOURCE Direct

LATDEC 60.972972222222 LONDEC 150.8215

PROJECT OPR-P385 ITEMSTATUS Assigned SEARCHTYPE Full

RADIUS 500 INIT MBH ASSIGNED 6/4/1998

TECNIQ MB,S2,ES,DI

Technignote

History

AWOIS ITEM 50174

HISTORY
H9696/77--OPR-469-FA-77; 5.9 FM SNDG. FOUND IN 9-10 FMS. SUBSEQUENTLY INVESTIGATED BUT NOT FOUND; VERIFIER THINKS FIX AND SOUNDING RECORD WERE NOT RECORDED SIMULTANEOUSLY, THINKS THAT ROCK LIES BETWEEN RECORDED POSITION AND END OF LINE SOME 200 METERS NE. QC CONCURS BUT RECOMMENDS A WD SEARCH. PRESENTLY CHARTED AS A 5-FM RK, PA.
MONTHLY ACTIVITIES REPORT, 7/20/82--NEGATIVE SEARCH. 5 FM ROCK FOUND APPROX 50 METERS SOUTH.
H10018/82--OPR-P358-RA-82; ITEM 2; MINI-RANGER III RANGE/RANGE CONTROL; ECHO SOUNDER; ROCK COVERED 28FT VERIFIED IN LAT.60-58-24.7N, LONG.150-49-09.4W. LEADLINE VERIF.NOT POSSIBLE DUE TO STRONG CURRENTS. (ENTERED, 1/16/84, MJF)

Fieldnote No investigation of this AWOIS item was required during survey H10903 (1999). A 4 fm 4 ft sounding was found at 60/58/22.7N, 150/49/17.4W. The evaluator recommends charting a 4 fm 4 ft Rk at this location.

Proprietary

YEARSUNK NIMANUM SYSTEMNUM 8922 Print Record

Appendix K - Approval Sheet

Approval Sheet

For

H-10903

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

OPR-P385-KR-98 statement of work and hydrographic manual;
Racal Pelagos Quality Management Plan (QMP-1702-01);
Racal Pelagos Acquisition Procedures (QMP-1702-02);
Racal Pelagos Processing Procedures (QMP-1702-03);
Technical Report for Tidal Zoning Survey, Cook Inlet, Alaska (SOL 52-DGNC-8-90028 T.O. No. 1).

The data were reviewed daily during acquisition and processing

The digital data and supporting records have been reviewed by me, are considered complete and adequate for charting purposes, and are approved. All records are forwarded for final review and processing to the Chief, Pacific Hydrographic Branch. [22]

Approved and forwarded,

Douglas Lockhart, Racal Pelagos
Lead Hydrographer
RPI Survey Party

[1] PHB Revision – All Separates are filed with the field data with the exception of proprietary reports. Proprietary reports are filed with the Contracting Officers Technical Representative (COTR).
[2] PHB Revision – Strike through ~~98~~ and replace with 99
[3] PHB Revision – Areas of boulders were not noted on the smooth sheet. Boulder notations are shown on the Hdrawing as evident from the DTM.
[4] PHB Revision - Concur
[5] PHB Revision – Additional tidal information is filed with the survey records.
[6] PHB Revision – Appendix F is filed with the survey records.
[7] PHB Revision – Concur
[8] PHB Revision – Concur
[9] PHB Revision – The eastern portion of H10903 junctions with H10893 (1:20,000, 1999). The junction is complete. Sounding agreement within the junction is good. The western portion of H-10903 junctions with H10924 (1:20,000, 1999). The junction is complete. Sounding agreement within the junction is good. "Joins" notes were added to the smooth sheet at PHB.
[10] PHB Revision – The smooth sheet was compared to prior surveys H09648 (1976), H09696 (1977), and H10018 (1982). H09648 covered the western portion of H10903. In general H10903 is .5 to 2 fathoms shoaler than H09648. H09696 covered the central portion of H10903. In general H10903 is .5 to 2 fathoms shoaler than H09696. H10018 covered the eastern portion of H10903. There is good agreement between the two surveys with H10903 generally 1 to 5 feet shoaler. Differences between the present and prior work is largely attributed to the dynamic bottom movement in this part of Cook Inlet. Additional information is found in section B and N of this report. The present survey is considered adequate to supersede the prior surveys within the common area.
[11] PHB Revision – No AWOIS items were assigned for investigation. One AWOIS item (50174) is within the survey area. Survey H10903 shows the AWOIS item as a 4 fathom 4 feet sounding located at latitude 60° 58' 22.7"N, longitude 150° 49' 17.4"W. The smooth sheet did not show a "Rk" notation. The AWOIS history indicates a 28 ft (4 fathoms 4 feet) rock was verified by survey H10018. Chart 16663 (Continuous Maintenance Drawing, last revised 4/30/2002) shows a 4 fathom 3 feet rock at this location. The evaluator recommends charting a 4 fathoms 4 feet Rk at latitude 60° 58' 22.7"N, longitude 150° 49' 17.4"W as shown on the smooth sheet. The "Rk" notation is shown on the Hdrawing. An updated AWOIS report is attached to this report.
[12] PHB Revision - The Continuous Maintenance Drawings for chart 16665, last revised 1/30/2002, and chart 16663, last revised 4/30/2002 were used for chart comparisons during office processing. No bottom samples were required for this survey. The charted bottom samples should be retained as charted. The present survey is adequate to supersede charts 16663 and 16665 within the common area.
[13] PHB Revision – Thirty-one rather than sixty DTONs were reported. The DTONs were reported as soundings not boulders. There were no boulder notations on the smooth sheet. Boulder notations are shown on the Hdrawing as evident from the DTM. DTON's were reviewed at PHB. Thirty-one DTON's were reported to USCG, NIMA, and N/CS261. The DTON's were reported prior to corrections being made to the final smooth sheet (See Adjustment to Static Draft, p. 19a). As a result, the reported DTON's were 1 to 3 feet too shoal. The correct values are on the smooth sheet and will be shown on the HDrawing.
[14] PHB Revision – Strike through ~~equivellent~~ and replace with equivalent.
[15] PHB Revision – With the exception of the following data, reports and smooth sheets are generally in compliance with specifications: 1.) the format for the soundings plotted on the smooth sheet is not in compliance with specifications. The tenths of fathoms value should be depicted as a superscript. Instead, it is depicted as a subscript. The accuracy of the sounding values is not affected, just the plotted appearance. 2.) No "Rk" notation was shown on the smooth sheet (see endnote 10). 3.) Boulder notations were not shown on the smooth sheet 4.) An incorrect project number was used for the survey. The project number should be OPR-P385-KR-99 rather than OPR-P385-KR-98. The project number was changed on the smooth sheet, in ink, by hand, at PHB. All footers in this report should read OPR-P385-KR-99.
[16] PHB Revision – Concur
[17] PHB Revision – A PHB review of the smooth sheet showed the data were in compliance with specifications after 1.378 feet was applied to all of the work file soundings.
[18] PHB Revision – Concur
[19] PHB Revision – See endnote 1.
[20] PHB Revision – Concur

[21] PHB Revision – See endnote 1.
[22] PHB Revision – See 30 day Acceptance Review of H10903 attached to this report.

MEMORANDUM FOR: Brian Greenawalt, NOAA
Contracting Officer's Technical Representative

FROM: Gary C. Nelson
Assistant Contracting Officer's Technical Representative
Pacific Hydrographic Branch

SUBJECT: 30-DAY Acceptance Review of H-10903

The Pacific Hydrographic Branch has conducted a 30-day acceptance review of the following contract hydrographic survey:

Registry No:	H-10903
State:	Alaska
General Locality:	Cook Inlet
Locality:	West of Moose Point Shoal
Contractor:	Racal-Pelagos
Project:	OPR-P385-KR
Contract No:	50-DGCN-8-90028
Date Received by PHB:	April 26, 2000
30 Day Review by:	May 26, 2000

The data submitted for H-10903 was reviewed for compliancy with the Statement of Work.

The 30-day review included but was not limited to the following:

1. An inventory of specified deliverables
2. A review of the SWMB Patch Test data to confirm proper bias values
3. A qualitative review of SWMB cross line comparison data.
4. An examination of the DTM, created by Racal-Pelagos, with the smooth sheet overlaid to ensure shoal areas were portrayed correctly on the smooth sheet.
5. A CARIS workfile of selected shoal soundings was created to compare with the smooth sheet. The comparison was used to verify valid shoal soundings were carried through to the smooth sheet.
6. A preliminary comparison of prior surveys and appropriate nautical charts with the smooth sheet was completed.
7. The data were reviewed for appropriate application of biases, sound velocity, and tides.
8. A preliminary review of the Descriptive Report and smooth sheet. (Note: The results of the final review will be detailed in the Evaluation Report).

Based upon the review, it is concluded that H-10903 has no major deficiencies that would deem

it out of compliance with the Statement of Work. It is recommended that H-10903 be accepted.

cc: Jim Gardner
Dennis Hill

NOAA FORM 77-27(H)
(9-83)

U.S. DEPARTMENT OF COMMERCE

HYDROGRAPHIC SURVEY STATISTICS

REGISTRY NUMBER
H-10903

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

RECORD DESCRIPTION	AMOUNT	RECORD DESCRIPTION	AMOUNT
SMOOTH SHEET	1	SMOOTH OVERLAYS: POS., ARC, EXCESS	
DESCRIPTIVE REPORT	1	FIELD SHEETS AND OTHER OVERLAYS	

DESCRIPTION	DEPTH/POS RECORDS	HORIZ. CONT. RECORDS	SONAR-GRAMS	PRINTOUTS	ABSTRACTS/ SOURCE DOCUMENTS	
ACCORDION FILES						
ENVELOPES						
VOLUMES						
CAHIERS						
BOXES						

SHORELINE DATA

SHORELINE MAPS (List):

PHOTOBATHYMETRIC MAPS (List):

NOTES TO THE HYDROGRAPHER (List):

SPECIAL REPORTS (List):

NAUTICAL CHARTS (List):

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			
COMPILATION OF SMOOTH SHEET			21
COMPARISON WITH PRIOR SURVEYS AND CHARTS			
EVALUATION OF SIDE SCAN SONAR RECORDS			
EVALUATION OF WIRE DRAGS AND SWEEPS			
EVALUATION REPORT			40
GEOGRAPHIC NAMES			
OTHER (Chart Compilation)			45
*USE OTHER SIDE OF FORM FOR REMARKS — TOTALS			106

Pre-processing Examination by	*Beginning Date* 04/28/2000	*Ending Date*
Verification of Field Data by Contract Compliance By G. Nelson	*Time (Hours)* 21	*Ending Date*
Verification Check by	*Time (Hours)*	*Ending Date*
Evaluation and Analysis by G. Nelson, B. Mihailov	*Time (Hours)* 40	*Ending Date* 08/26/2003
Inspection by G. Nelson	*Time (Hours)* 10	*Ending Date* 08/29/2003

U.S. GOVT. PRINTING OFFICE 1983: 764-008/6061

APPROVAL SHEET
H10903

Initial Approvals:

The survey and associated records have been inspected with regard to survey coverage, delineation of the depth curves, development of critical depths, cartographic symbolization, and verification or disproval of charted data. The survey records and digital data comply with NOS requirements except where noted in the Descriptive Report and are adequate to supersede prior surveys and nautical charts in the common area.

Gary C. Nelson for Date: 9 Sept. 2003
Dennis Hill
Chief, Cartographic Team
Pacific Hydrographic Branch

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 Descriptive Report.

Date: SEPT 12, 2003
John E. Lowell Jr.
Commander, NOAA
Chief, Pacific Hydrographic Branch

AWOIS ✓ & SURF ✓ by MBH 9/16/03

NOAA FORM 75-96
(10-83)

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

MARINE CHART BRANCH

RECORD OF APPLICATION TO CHARTS

FILE WITH DESCRIPTIVE REPORT OF SURVEY NO. H-10903

INSTRUCTIONS

A basic hydrographic or topographic survey supersedes all information of like nature on the uncorrected chart.
1. Letter all information.
2. In "Remarks" column cross out words that do not apply.
3. Give reasons for deviations, if any, from recommendations made under "Comparison with Charts" in the Review.

CHART	DATE	CARTOGRAPHER	REMARKS
166665	8/25/03	G.NELSON/B. MIHALOV	Full Part Before After Marine Center Approval Signed Via Full application of
			Drawing No. sndgs, curves and features from
			smooth sheet
166663	8/26/03	G.NELSON/B. MIHALOV	Full Part Before After Marine Center Approval Signed Via Full application
			Drawing No. of sndgs, curves and features from
			smooth sheet, and through chart 166665
16665	10/8/03	J. Sherry/LEB	Full Part Before After Marine Center Approval Signed Via
			Drawing No. full application of Soundings, Curves,
			and features through BP 181644
16663	10/8/03	J. Sherry/LEB	Full Part Before After Marine Center Approval Signed Via
			Drawing No. full application of soundings, curves
			and features through BP 181645
16662	10/9/03	J. Sherry/LEB	Full Part Before After Marine Center Approval Signed Via
			Drawing No. full application through 16663
16660	10/9/03	J. Sherry/LEB	Full Part Before After Marine Center Approval Signed Via
			Drawing No. full application through 16663
			Full Part Before After Marine Center Approval Signed Via
			Drawing No.
			Full Part Before After Marine Center Approval Signed Via
			Drawing No.
			Full Part Before After Marine Center Approval Signed Via
			Drawing No.
			Full Part Before After Marine Center Approval Signed Via
			Drawing No.

SUPERSEDES C&GS FORM 8352 WHICH MAY BE USED.