H10727

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.: A&B (RV Coastal Surveyor)

Registry No.: H-10727

LOCALITY

State: California

General Locality: San Francisco Bay

Sublocality: Vicinity of Alcatraz and Yerba Buena Island

1996

CHIEF OF PARTY
Art A. Kleiner, C&C Technologies, Inc.

NOAA FORM 77-28 (11-72)

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

REGISTER NO.
H-10727

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.
A & B

State: California

General locality: San Francisco Bay

Locality: Vicinity of Alcatraz and Yerba Buena Island

Scale: 1:10,000 Date of survey: December 13-16, 1996

Instructions dated: November 6, 1996 Project No.: OPR-L304-W0

Vessel: R/V Coastal Surveyor (C & C Technologies, Inc.)

Chief of party: Art A. Kleiner, ASCM Certified Hydrographer # 180

Surveyed by: Art A.Kleiner, Pete Alleman, Tim Patro, Joe Alcina,Frank Lipari,Scott Croft

Soundings taken by echo sounder, ~~hand lead, pole~~ Simrad EM 950 (Multibeam)

Graphic record scaled by: N/A

Graphic record checked by: N/A

Evaluation by: J.A. Ferguson, B. Mihailov Automated plot by: Design Jet 650C

Verification by: C & C Technologies, Inc. Personnel, B. Mihailov

Soundings in ~~fathoms~~ feet at ~~MLW~~ MLLW

REMARKS: 100% Multibeam Hydrographic Survey of San Francisco Bay, Areas A & B

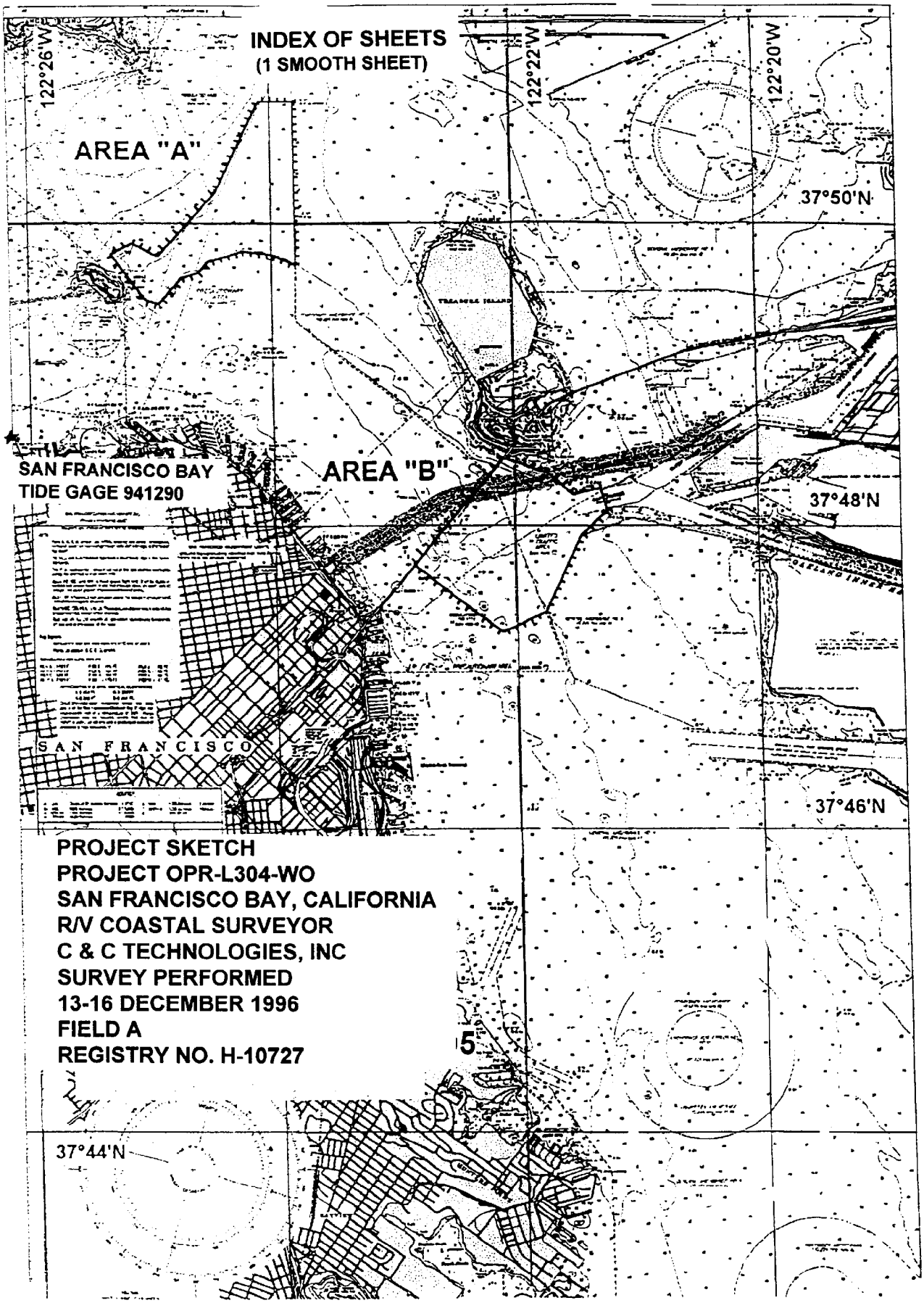
Data collection was in meters, MLLW, Smooth sheet in feet, MLLW

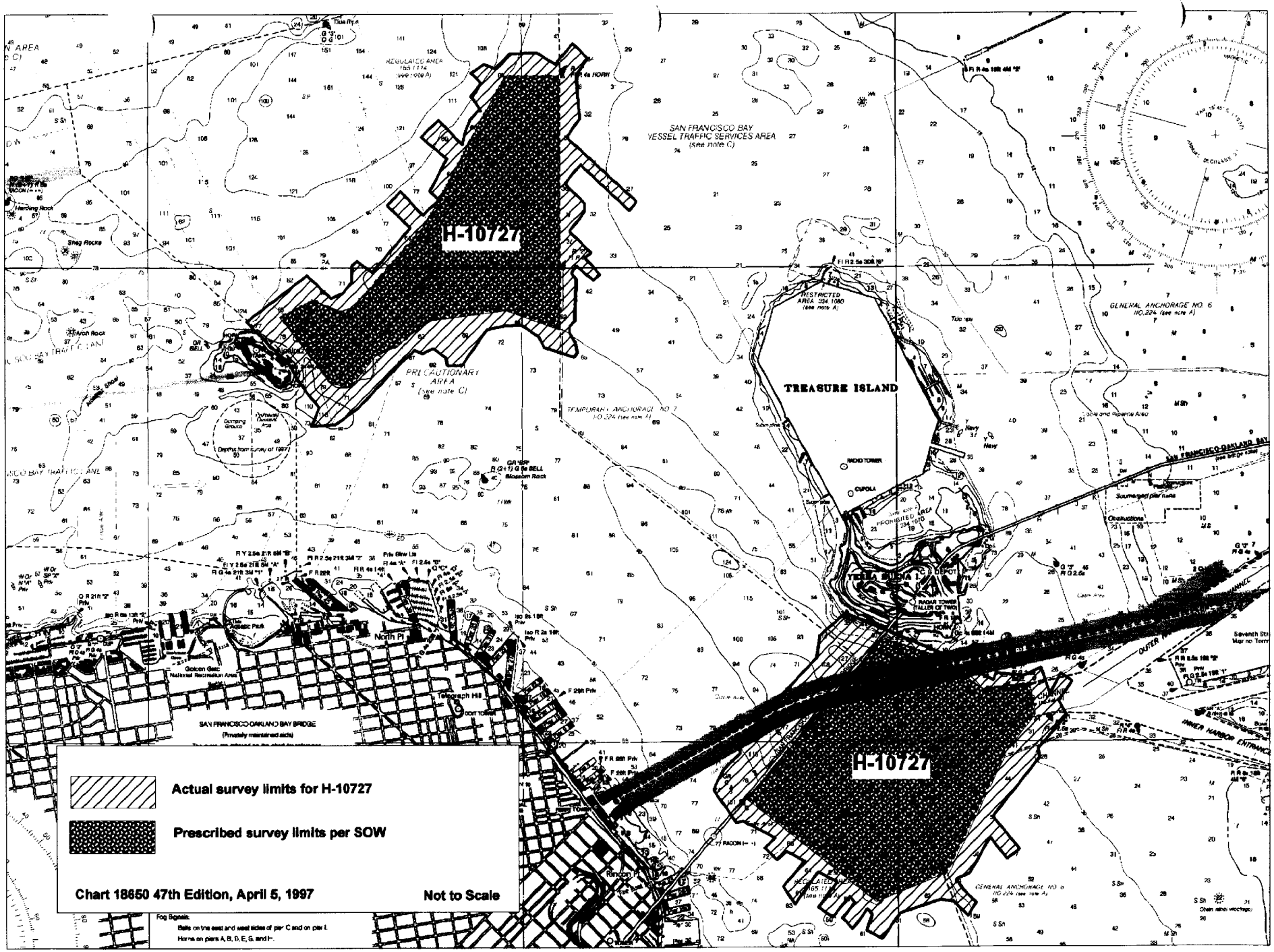
Zone SF6 tide correctors used for Area B and zone SF5 used for Area A

UTC time used exclusively throughout the survey.

Contractor Name: C & C Technologies
730 E. Kaliste Saloom Road
Lafayette, LA 70508
Phone: (318) 261-0660

Marginal notes and revisions to the Descriptive Report were generated at the Pacific Hydrographic Branch during review of the survey work.


INDEX OF SHEETS
(1 SMOOTH SHEET)
122°26'W
122°22'W
122°20'W
AREA "A"
AREA "B"
37°50'N
37°48'N
37°46'N
37°44'N
SAN FRANCISCO BAY
TIDE GAGE 941290
SAN FRANCISCO
PROJECT SKETCH
PROJECT OPR-L304-WO
SAN FRANCISCO BAY, CALIFORNIA
R/V COASTAL SURVEYOR
C & C TECHNOLOGIES, INC
SURVEY PERFORMED
13-16 DECEMBER 1996
FIELD A
REGISTRY NO. H-10727
5


H-10727
H-10727
TREASURE ISLAND
SAN FRANCISCO BAY
VESSEL TRAFFIC SERVICES AREA
(See note C)
PRECAUTIONARY
AREA
(See note C)
RESTRICTED
AREA 334.1060
(See note A)
GENERAL ANCHORAGE NO. 6
110.224 (See note A)
TEMPORARY ANCHORAGE NO. 7
110.224 (See note A)
REGULATED AREA
165.1114
(See note A)
PROHIBITED AREA
334.1070
(See note A)
SAN FRANCISCO-OAKLAND BAY BRIDGE
(Privately maintained aids)
Actual survey limits for H-10727
Prescribed survey limits per SOW
Chart 18650 47th Edition, April 5, 1997
Not to Scale
Fog Signals:
Bells on the east and west sides of pier C and on pier I.
Horns on piers A, B, D, E, G, and H.

A. PROJECT

A.1 Project Number: OPR-L304-WO
Date: November 6, 1996
Dates of Changes: NONE

A.2 Purpose of the Survey: To provide NOAA with modern, accurate hydrographic survey data acquired using shallow water multibeam sonar technology with which to update the nautical charts of the assigned area. Shoaling has been reported in Areas A and B. A shallow water multibeam sonar system was used to determine the depths over the entire project areas.

B. AREA SURVEYED

See Field Rpt, Section B.

B.1 Areas A and B, shown on the INDEX OF SHEETS, are both located in San Francisco Bay. Area A is located just east of Alcatraz Island. Area B is located just south of the San Francisco-Oakland Bridge, toward the eastern landing of the bridge.

B.2 Data collection of Area A was performed on December 13, 1996 and December 14, 1996.

B.3 Data collection of Area B was performed between December 14, 1996 and December 16, 1996.

C. SURVEY VESSELS

C.1 C & C Technologies', Inc., R/V COASTAL SURVEYOR was used to perform the multibeam survey of the two areas. Her dimensions and specifications are as follows:

Dimensions:	40' x 12' x 3.7'
USCG:	Designated Research Vessel, subchapter "C"
Flag:	U.S.
Registry:	U.S. Coastwise and Registry
Tonnage:	16 GRT
	11 DWT
Lab space:	9' x 11'
	6' x 10'
Speed:	11 knots
Minimum speed for full roll stabilization:	5 knots
Minimum survey speed:	2.5 knots
Propulsion:	1 x Cat 3116; 205 shp cont."A"; 2.57:1 reduction
Auxiliary:	1 x Isuzu/Lima 20 kw; 240/120 V; 60 Hz;
Power distribution:	38 ea. 115 volt receptacles

	2 ea. 230 volt receptacles
	1 ea. 12 volt receptacles
	7 ea. 24 volt receptacles
Fuel capacity:	400 gallons
Potable water:	60 U.S. gallons
Roll stabilization:	Niad 173 active fins
Loran:	Micrologic Mariner
Magnetic compass:	Ritchie 5"
Fluxgate compass:	Robertson RFC 300
Radar:	Furuno 1930
Depth sounder:	Standard DS 40
Autopilot:	Robertson AP 300
VHF:	Standard Omni 25 watt
Cellular phone:	Motorola 5 watt
Air conditioning:	3 x 1.25 tons
Heating:	3 x 16,000 BTU

C.2 The COASTAL SURVEYOR was utilized for all multibeam hydrographic survey activities including soundings, velocity casts, positioning, and on-board processing and preliminary plots. Concur

C.3 Unusual vessel configuration: Roll Stabilization features.

C.3 Problems encountered: None

D. AUTOMATED DATA ACQUISITION AND PROCESSING

D.1 Survey data acquisition and processing were accomplished with HydroMap software version 3.14 dated 12/97.

D.2 HydroMap collected data from all the survey instruments and recorded it on high speed disk drives. All data were time-tagged and recorded to files in their raw form. No subsampling was performed. Data collected included Simrad EM-950, GPS Unit 1, GPS Unit 2, POS/MV (motion and position), gyrocompass, Endeco YSI sound velocity probe, Seabird CTD sensor, and Echotrac echosounder.

Simrad data includes depth datagrams with depths corrected for roll, pitch, heave, draft, and ray bending. The depth datagrams also include date, time, raw range travel-time, roll, ship pitch, heave, gyro heading, transducer pitch angle, sound velocity at the transducer, across track range to sounding, along track range to sounding, and quality factor of the sounding.

Data were processed in real-time to provide the hydrographer maximum feedback. This was accomplished by creating a mathematical surface model of the sea floor. The precise x, y and z values of the original soundings were retained along with data files from each stage of

processing; no data were discarded. See: Appendix I* for system diagram and detailed explanation of automated data collection and processing.

D.3 Simrad EM-950 Operator Unit (OPU) software version 4.01 dated 8/96 was used during the entire survey.

D.4 Simrad EM-950 Bottom Detect Unit (BDU) software version 2.55 dated 9/96 was used during the entire survey.

D.5 Sound velocity data were extracted by Hydromap and validated utilizing Seabird's Seasoft software, version 4.020 dated 12/96.

D.6 Software utilized in the POS/MV motion reference / navigation unit was version 1.5 7/96.

D.7 During the data collection process, Micronautics software version TIDE.1 dated 11/95 was used to generate predicted tidal correctors.

D.8 The two Trimble 4000SSi GPS receivers, used as real-time checks, were integrated with navigation software version 7.22, dated 10/96.

D.9 A Sun SparcStation 20 workstation computer with UNIX Solaris operating system version 2.5 dated 10/95 was used to collect and process all hydrographic data during the course of the survey.

D.10 Data were post processed at a 2-meter bin size, multi shifted at 0.1-meter intervals. This assured that at least one sounding would ensonify the top of a 3 x 3-meter shoal. See: Appendix I.*

D.11 Survey speed was limited to ensure 3.2 pings for each 3 meters of travel.

D.12 No non-standard automated acquisition or processing methods were used.

E. SONAR EQUIPMENT ✓

N/A

No side scan sonar (SSS) operations were conducted on this survey.

F. SOUNDING EQUIPMENT ✓

F.1 Hydrographic soundings were acquired with a Simrad EM-950, S/N 002, multibeam echosounder. Operating at 95 kHz., this system produced soundings at a rate of up to 240 per second in a swath of up to 7.4 times the water depth. It was employed in the 150 degree equal-angle mode, providing 60 soundings across the swath spaced at 2.5 degrees apart.

* Filed with the survey records.

These soundings were interlaced on alternating pings, effectively producing 120 soundings across the entire swath.

F.2 An Applied Analytics, Inc. POS/MV motion reference unit, S/N 258, was integrated with the multibeam echosounder for real-time heave, pitch, and roll corrections. This system, operating at 100 Hz., was utilized for primary navigation and to apply the heave, pitch, roll correctors that were determined during the patch test.

Calibration included linear and angular measurements prior to vessel mobilization, in addition to a patch test procedure. See: "DRAFT/LEAD LINE CONFIGURATION WORKSHEET", "POS/MV PROJECT ACCEPTANCE DOCUMENT", and PATCH TEST WORKSHEET(S) for ROLL, PITCH, YAW, and LATENCY, Appendix G.*

F.3 An S.G. Brown 1000A, S/N FCA271, gyrocompass was used for yaw corrections during the data collection process. These data were correlated daily with heading information provided by the POS/MV system and the Course Made Good (CMG) derived from the Trimble GPS data. See: "DAILY PROCEDURES FOR NOAA MULTIBEAM SURVEY IN SAN FRANCISCO BAY", Appendix G. *

F.4 Two Seabird SEACAT SBE 19 Profilers, S/Ns 1730 (primary) and 439 (secondary, were used simultaneously to measure the sound velocity in the water column during hydrographic survey operations. They were deployed to a depth of at least 95% of the maximum depth encompassed in each survey area. See: Appendix G for calibration documentation and cast information. *

F.5 An Endeco/YSI conductivity-temperature probe, S/N 96J0645AA, was mounted at the multibeam echosounder transducer to measure spatial changes in the surface water sound velocity. Its data were integrated with the Simrad EM-950, which applied beam-steering corrections during the data collection process.

F.6 A 200 kHz. Echotrac fathometer, S/N 9392, integrated with a TSS 335B, S/N 535, for heave corrections, was used in conjunction with a lead line and bar check for multibeam data verification purposes. Prior to data collection each day, vessel draft was measured and a correction was entered into the Simrad EM-950 operator console. A lead line measurement was then taken and compared to the multibeam echosounder reading. See: "DAILY DRAFT/LEADLINE WORKSHEET", Appendix G. *

F.7 At the work site, a bar check was effected upon the Echotrac fathometer. See: "SINGLEBEAM ECHOSOUNDER CALIBRATION DOCUMENT", Appendix G. * Singlebeam echosounder data were then compared to the Simrad EM-950 during the data collection process.

F.8 To measure changes in the vessel's static draft, a ball valve was installed in the vessel hull within close proximity (one foot horizontally) of the POS/MV sensor. A clear plastic tube attached to this valve was aligned with a relative scale, which provided daily

* Filed with the survey records.

measurements of changes in static draft of the vessel. These corrections were then applied to the Simrad operator unit. See: "DAILY DRAFT/LEADLINE WORKSHEET" and "ANGULAR ALIGNMENT WORKSHEET", Appendix G.*

F.9 There were no faults in sounding equipment that affected the accuracy or quality of the data.

F.10 An accuracy test was conducted prior to the commencement of survey operations to quantify the accuracy and precision of the multibeam system. This included a cross line junction comparison test consisting of one cross line and three main scheme lines. See: "Precision - Field Cross Lines" and "Mean Differences - Field Cross Lines", Appendix G.*

F.11 Accuracy tests were also conducted during survey performance on cross line junctions. See: "Precision - Main vs Cross Lines, Area A", "Mean Differences - Main vs Cross Lines, Area A", and plots titled "Mean Difference Area A" and Mean Difference Area B", Appendix G.*

G. CORRECTIONS TO SOUNDINGS ✓

G.1 Sound velocity through the water column was determined by simultaneous casts with Seabird SBE 19 SEACAT Profilers, S/Ns 1730 and 439, both calibrated in November, 1996. Each set of casts was downloaded and calculated with both Seabird Seasoft software using the Chen Millero equation (file names with *.b and *.c extensions) and Hydromap using the Del Grosso equation (file names with *.a extensions). Mean differences of less than 0.05 meters per second existed throughout all the profile data. Casts were taken on an as-needed basis, which constituted a total of eight profiles acquired over three survey days.

All profiles that were uploaded to the Simrad EM-950 for real-time sound velocity corrections during survey operations (file names with *.a extensions in "Appendix Ø"J * documentation) are listed in the following table.

* Filed with hydrographic records.

CAST No.	DATE	EASTING UTM ZONE 10 (METERS)	NORTHING UTM ZONE 10 (METERS)	PROFILE APPLIED TO LINES	AREA
1	12-11-96	534162	4184639	TESTING	N/A
2	12-12-96	551451	4186203	PATCH TEST	N/A
3	12-12-96	552783	4188722	PATCH TEST	N/A
4	12-13-96	552783	4188722	TIE 1-4 & 1-8	A
5	12-13-96	551927	4186356	9-29	A
6	12-14-96	551226	4186375	30-44	A
7	12-14-96	551253	4186310	45-53	A
8	12-14-96	555077	4187423	TIE 1-2 & 1-2	B
9	12-14-96	555432	4184345	TIE 3-5 & 3-12	B
10	12-15-96	555102	4184747	13-51	B
11	12-15-95	555199	4184207	52-66	B

These above values were calculated with Hydromap using the Del Grosso equation.

G.2 A listing of all casts taken during the survey can be found in Appendix J. *

G.3 Instrument calibration documentation can be found in Appendix G. *

G.4 There were no unusual or unique methods or instruments used for correcting echo soundings.

G.5 A singlebeam fathometer was employed throughout the survey for validation of the multibeam data. A bar check was performed on the singlebeam fathometer at the beginning of the survey and these data were collected and compared to the multibeam echosounder during survey operations. Each day, a lead line was performed dockside and compared to the singlebeam and multibeam echosounders. During the survey, a mean sound velocity was calculated from each velocity cast and then loaded into the singlebeam echosounder to correct for variations in the sound velocity. See: "SINGLEBEAM ECHOSOUNDER CALIBRATION DOCUMENT", Appendix G.*

Conditions at the dock made lead line verification difficult (the bottom was somewhat sloped and the limited depth of 2-4 meters beneath the transducer inhibited the EM-950's beam forming). Daily lead line checks were within the system specification of ±15 centimeters and no adjustments of the data were effected. See: "DRAFT/LEAD LINE WORKSHEET" and

* Filed with the hydrographic records

"DAILY PROCEDURES FOR NOAA MULTIBEAM SURVEY IN SAN FRANCISCO BAY", Appendix G. *

Quantitative statistical analysis at cross line junctions during the course of the survey was used to determine the need to update the velocity profile being utilized by the Simrad EM-950. Cross line data, totaling approximately ten percent of the main scheme lines, were collected prior to the collection of any main scheme data (amounting to five cross lines in Area A and five cross lines in Area B). During the course of the survey, as each junction was completed, a statistical analysis was performed. When mean differences in the outer beams of the cross line to main scheme line junctions (based upon a beam-by-beam analysis) approached 0.3 meters, data collection was halted and a new velocity cast was taken.

Each velocity cast included the deployment of two Seabird CTD units that were lashed together. These units were lowered to a depth of at least 95% (generally 100%+) of the working depth at each survey area. These data were verified using both Seabird and C & C software. Surface sound velocity data were then compared to real-time YSI Endeco data collected at the EM-950 transducer depth.

G.6 Changes in static draft were measured each day with a system that included a ball valve installed in the vessel hull within close proximity (one foot horizontally) of the POS/MV Vertical Reference Unit (VRU). A clear plastic tube attached to this valve was used to determine the vessel static draft by aligning it with a relative scale fastened vertically at the centerline of the vessel. These corrections were then applied to the Simrad operator unit. See: "DAILY DRAFT/LEAD LINE WORKSHEET" and "ANGULAR ALIGNMENT WORKSHEET", Appendix G. *

All heave, pitch, and roll measurements were extrapolated in real-time to the Simrad EM-950 transducer by the POS/MV. This was accomplished by measuring the linear offsets between transducer, GPS antenna, and the VRU and then applying these values to the POS/MV control software. See: "DRAFT/LEAD LINE CONFIGURATION WORKSHEET" and "POS/MV PROJECT ACCEPTANCE DOCUMENT", Appendix G. *

G.7 Settlement and squat were measured at the project site by two different methods, Electronic Level and Kinematic GPS. This was accomplished on two different occasions, December 9 and December 16. Rough sea conditions on December 9 resulted in inconsistent data, so the test was repeated on December 16. During the second squat test, the weather was also rough so this test was performed at the leeward side of Buena Vista Island at the U.S. Coast Guard Station.

The Electronic Level method was performed first. Here, a level rod was affixed to the vessel above the Vertical Reference Unit (VRU) and an electronic level was set up on shore. With the survey vessel stationary, an elevation was read from the level rod affixed above the VRU and a corresponding tide reading was recorded. Several traverses were made with the vessel carrying an average load in its normal position. Elevations were recorded at varying RPMs from idle to maximum.

To implement the Kinematic settlement/squat test, a GPS antenna was firmly affixed to the vessel above the VRU and a Kinematic receiver was set up on shore. With the survey vessel in a stationary position, an elevation was read from the Kinematic GPS receiver onboard the vessel and a corresponding tide reading was recorded. Several traverses were made with the vessel carrying an average load in its normal position. Elevations were recorded at varying RPM from idle to maximum.

The resulting data from these observations were corrected for tide and an average settlement/squat value was calculated for each corresponding vessel RPM, accurate to the nearest 0.01 meters. These calculated values were then plotted on a curve as a function of engine RPM. See: "SQUAT TEST - R/V COASTAL SURVEYOR", Appendix G. *

Squat data derived by both methods show close correlation. The range of squat over the speed ranges used during survey operations was 2.5 to 7 centimeters, resulting in a maximum change in squat during the survey of 4.5 centimeters. After consultations with the COTR, it was agreed that it would be difficult to correct for each of the numerous RPM adjustments, which were required during the survey to compensate for the dynamic tidal currents in the operational area. It was decided that a correcting value of 4 centimeters, which is within the squat range and biased shoaler, would be applied to the entire data set.

G.8 A POS/MV model 310 motion reference unit, serial number 258, manufactured by Applied Analytic, Inc. was utilized for heave, pitch, and roll compensation in real-time. Specifications include a roll/pitch error of 0.05 degrees and a heave error of <5% of heave amplitude for periods of 20 seconds or less. Resolution is 0.01 degrees in roll and pitch 1.0 centimeters in heave at 100 Hz. See: "POS/MV 310 SPECIFICATIONS", Appendix G. *

G.9 Sea conditions had no effect on the multibeam data during the survey. Concur

G.10 Poor sea conditions produced inconsistent data during the first squat test, but these data were discarded and the test was later repeated with positive results.

G.11 Severe current fluctuations required frequent adjustment to vessel RPM (ranging from 800 - 1400 RPM) during the survey.

G.12 Turbidity in the water column, resulting from a passing hopper dredge working in the Port of Oakland, produced spurious soundings in the record on several occasions. This effect was observed on the profile display of the Simrad EM-950 Operator Unit and the Echotrac singlebeam echosounder, which revealed the true bottom return with a false bottom-echo suspended above it. In each case, when the sediment dispersed, additional survey lines were traversed over the same location to fill "holidays" in the data. Data was analyzed during office processing and found to be consistent with surrounding depth information.

G.13 The Tidal datum for this project is Mean Lower Low Water (MLLW). The operating tide station at San Francisco, CA (station number 941 4290) served as the primary reference station for datum determination of smooth tides. Smooth tides applied to the final smooth sheets were provided by NOS.

* Filed with the hydrographic records.

G.14 Four tidal zones, SF3, SF5, SF6, and SF32, encompass the survey area. Area B is encompassed entirely by tidal zone SF6. The eastern and western edges of Area A lie within tidal zones SF3 and SF32 respectively, while the majority of Area A is concentrated in tidal zone SF5.

G.15 Due to this limited overlap of tidal zoning, permission was granted by the COTR to use tidal zone SF6 exclusively in Area A. The zoning effects of tidal zones SF3, SF32, and SF5, as supplied by NOS, are represented in the chart titled "Tide Comparison" located in Appendix G.

As this chart reveals, tidal zones SF5 and SF32 mirror each other during the entire survey. Tidal zone SF3 varies by 15 centimeters during a 2-hour period. Assuming this 15-centimeter offset to be located at the centroid of the tidal zone, it would have little influence at the western portion of Area A. Rather than shifting the soundings 15 centimeters deeper by applying an assumed bias, we selected a conservative approach and applied no offset.

G.16 Predicted tidal data, based upon NOS information provided by Micronautics software version TIDE.1 dated November 8, 1995, were used to correct soundings during the data collection process.

G.17 Final smooth tides, acquired from NOS, were applied to the raw uncorrected soundings in the final smooth sheet.

A tide note for survey H-10727, dated January 21, 1997 is attached to this report.

H. CONTROL STATIONS

See Eval Rpt., Section H

H.1 The horizontal datum for this project is the North American Datum of 1983 (NAD 83).

H.2 This survey was conducted using Differential GPS (DGPS) positioning. Differential corrections were supplied from USCG station **Point Blunt, CA {Frequency 310 kHz}**.

H.3 Horizontal Control Stations: ✓

SF ARIES 1: The horizontal position was established by classical geodetic methods and adjusted by the National Geodetic Survey in March 1994.

NAD 83 (1992)	*ZONE # 10 UTM*
Latitude = 37-48-17.67407 (N)	X = 547,948.946 M
Longitude = 122-27-19.11489 (W)	Y = 4,184,309.389 M
Height = 2.995 M	

PT. COASTAL: The horizontal position was established by *C&C Technologies* using GPS observations, differentially corrected with Kinematic GPS.

NAD 83 (1992)	*UTM ZONE # 10*
Latitude = 37-48-26.7363 (N)	X = 549,013.460 M
Longitude = 122-26-35.5560 (W)	Y = 4,184,594.960 M

H.4 Horizontal control was established using a Trimble 4000SSi GPS receiver with Real Time Kinematic (RTK) availability. The RTK base station receiver was set up on a known first order horizontal and first order vertical monument "SF ARIES 1" and was used to broadcast differential (Kinematic) corrections to a second GPS receiver. The second Trimble 4000SSi GPS receiver with RTK availability was used to set a temporary point "Coastal" at dock site of the R/V Coastal Surveyor in San Francisco Marina. The new point "Coastal" was used to check the horizontal accuracies of the differentially-corrected GPS at the beginning and end of each survey day.

H.5 Point "Coastal" was also used to verify the two independent GPS receivers, differentially corrected from independent reference stations, Point Blunt, CA and Pigeon Point, CA. The difference between these two positions measured at point "Coastal" were considered to be within the specifications in the Scope of Work.

H.6 There are no photogrammetric problems, positioning problems, or unconventional survey methods pertinent to this survey.

I. HYDROGRAPHIC POSITION CONTROL ✓

I.1 This survey was conducted using two Trimble 4000SSi GPS receivers and a POS/MV inertial navigation unit, embedded with a NovAtel GPS receiver. All units were integrated with differential GPS (DGPS) corrections. Data were continuously collected from all three GPS units throughout the survey and these real-time positional solutions were projected on the coverage chart display during survey performance.

I.2 Differential corrections from USCGS Point Blunt were used for GPS Unit 1 and the POS/MV embedded GPS unit. GPS Unit 2 was differentially corrected from USCGS Pigeon Point.

I.3 Accuracy requirements were met as specified by the Scope of Work. The Horizontal Dilution of Precision (HDOP) as specified by the Scope of Work was monitored by Hydromap data collection software during data collection. When this value exceeded the allowable limit (HDOP = 2.5), survey operations were suspended until DGPS performance improved. If the positioning degraded beyond acceptable limits while on line, the data were automatically rejected by Hydromap software.

I.4 Control Equipment:

DGPS ✓

Unit 1:
Trimble 4000-SSi
S/N 3507a-09632
Firmware Version: 7.22v
MBX2 USCG DGPS Receiver S/N Y1002

Unit 2:
Trimble 4000-SSi
S/N 3605a-14345
Firmware Version: 7.22v
MBX2 USCG DGPS Receiver S/N 35-1056

POS/MV embedded GPS unit:
NovAtel 3151ROEM
S/N CGN95350036
Firmware Version: 3.33

The differential corrections were supplied from, USCG station **Point Blunt, CA {Frequency 310 kHz}** for Unit 1 and the POS/MV embedded GPS unit. USCG station **Pigeon Point, CA {Frequency 287 kHz}** was used to differentially correct GPS Unit 2 receiver.

I.5 The DGPS system requires no calibration from outside sources. However, to check the position accuracy of the DGPS system, a daily performance check was conducted before and after each survey by placing each GPS antenna over point "Coastal". The inverse between the measured GPS positions and point"Coastal" did not exceed the accuracy requirements as specified by the Scope of Work.

A continuous DGPS performance check was also conducted during survey operations using comparisons between the three GPS receivers. See: Appendix H.*

I.6 DGPS was the primary positioning system, so no calibration corrections were applied to the raw positioning data.

I.7 **a)** There were no unusual methods used to calibrate or operate the electronic positioning equipment.

b) There were no DGPS malfunctions experienced on board the ship during the Hydrographic survey.

c) Data quality was not affected by weather or atmospheric conditions.

* Filed with the survey records.

d) While surveying under the San Francisco-Oakland Bay Bridge a momentary loss of some or all satellites would occur while passing under the bridge. Therefore, survey lines were oriented perpendicular to the bridge in a NW-SE direction to limit the duration of interference. Analysis of data during office processing found depth information to be consistent with surrounding information.

e) POS/MV positional data, relying upon inertial navigation during poor satellite visibility, proved to be immune to the GPS outages and multipath encountered during survey operations beneath the San Francisco-Oakland Bridge. Therefore, the smooth sheet was processed incorporating POS/MV as primary navigation. For purposes of consistency, Areas A and B both were processed with POS/MV positioning. See Eval. Rpt, Section I.

Plots of DGPS verification data can be found in Appendix H.* GPS Unit 1 (differentially corrected from Point Blunt) is designated as "nav0". GPS Unit 2 (differentially corrected from Pigeon Point) is designated as ~~"nav2"~~ "nav1". The POS/MV embedded GPS unit (differentially corrected from Point Blunt) is designated as ~~"nav1"~~ nav. 2

f) No systematic errors were detected that required adjustments.

g) The GPS antennas for Units 1 and 2 were located directly over the position of the EM-1000 transducer, so no antenna offsets or layback correctors were applied. The POS/MV reports its position at the Inertial Measurement Unit (IMU), 9.8 meters aft of the transducer, so a correcting offset was applied in HydroMap software.

J. SHORELINE

N/A

Shoreline in brown from Chart 18650 47th Ed, April 5, 1997 was used on the smooth sheet for orientation purposes only

K. CROSS LINES ✓

K.1 Five cross lines were run in each area (ten total), which constituted approximately ten percent of the total data collected. As the survey progressed, a statistical analysis was performed at each cross line on a beam-by-beam basis. When the outer beam comparisons between the cross lines and main scheme lines reflected a mean difference nearing 0.3 meters, data collection was halted and a new velocity cast was taken.

K.2 The results of this analysis are characterized in the charts titled "Area A Difference Plot" and "Area B Difference Plot", Appendix G.* Each map presents a contoured difference of all cross lines compared to main scheme lines in that respective survey area.

K.3 AREA A chart was developed from a total of 118,969 collocated sounding pairs median-filtered at a two meter bin size. AREA B chart was developed from a total of 232,885 collocated sounding pairs median-filtered at a two meter bin size.

* Filed with the survey data.

K.4 Statistical results of the cross line comparison for each area are as follows:

AREA A:

Mean difference	-0.022 meters (cross lines deeper)
Standard deviation	0.137 meters
RMS	0.139 meters

AREA B:

Mean difference	0.058 meters (main scheme lines deeper)
Standard deviation	0.152 meters
RMS	0.163 meters

L. JUNCTIONS

See Evel Rpt., Section J

N/A

M. COMPARISON WITH PRIOR SURVEYS

See Evel Rpt., Section M. Survey H-10727 was compared to the following prior surveys

N/A

H-9794 (1978) 1:10,000
H-9844 (1979-81) 1:10,000
H-10456 (1993) 1:10,000

N. COMPARISON WITH THE CHART

See Evel Rpt., Section N

N.1 The following large-scale charts were compared to this survey:

Chart#	Edition	Date	Scale
18650	~~46th~~	~~August, 1995~~	1:20,000
18653	5th	October, 1995	1:20,000
18650	47th	April 5, 1997	1:20,000

Only the northern tip of the survey Area A was encompassed by chart #18653. There are two charted soundings common to the present survey.

Charts were corrected with Automatic Notice to Mariners (ANM) through 3/17/97 and Local Notice to Mariners (LNM) through 4/97.

N.2 The following small-scale charts may be affected by this survey, but were not compared:

Chart#	Scale
50	1:10,000,000
INT-50	1:10,000,000
501	1:10,000,000
INT-801	1:10,000,000
530	1:3,500,000

Largest scale charts encompassing survey area are listed above. There is no requirement to compare with these smaller scale charts.

18007	1:1,200,000
18022	1:868,003
18010	1:811,980
18680	1:210,688
18640	1:207,840
18020	1:144,000
18652	1:40,000; 1:80,000
18649	1:40,000

N.3 No Danger to Navigation Reports were issued during this survey. ✓ Concur

N.4 Comparisons to the latest editions of charts 18650 and 18653 were made between the charted and surveyed soundings. This was accomplished by overlaying a photocopy of the chart, produced on clear-film and at an enlarged scale of 1:10,000, on the smooth sheet. Surveyed soundings within 3 mm of charted soundings at the charted scale of 1:20,000 were compared.

AREA A: (Northeast of Alcatraz Island)

Chart 18650 was corrected by the replacement of one sounding and the addition of two soundings as per the weekly Notice to Mariners (NM), dated 25/96. North Channel Buoy "1" was added to the chart as per NM 42/96. Chart 18653 was unaffected in the survey area by NM and LNM.

The bottom appears to be largely composed of migratory sand waves. Charted soundings are not currently positioned on top of peaks. It is assumed that this mismatch is caused by shifting sand waves.

The comparison revealed significant changes in the least depths. Surveyed soundings collected near charted soundings were generally about 1 meter shoaler than represented by the chart. Concur In addition, surveyed soundings in areas between charted soundings were often shoaler than the surrounding charted soundings by about 1.5 to 2.0 meters (4.9 to 6.6 feet). Concur This may be the result of sea floor dynamics coupled with the dense data acquired by multibeam technology during this survey. See: "THE ACCURACY OF THE DEPTH INFORMATION OF THE NAUTICAL CHART", Lt. P.J. Velberg B. Sc., Hydrographic Journal No. 68 April, 1993, Appendix F.*

N.5 It is recommended that soundings from the current survey be used to replace charted soundings where charted soundings are deeper. Concur It is further recommended that shallower soundings on the chart not be replaced due to the sea floor dynamics in the survey area. There are no significantly shoaler soundings on the chart than shown on the present survey. The present survey should supersede charted depths within the common area.

N.6 There no AWOIS item in section "A" of the survey area. Concur

* Filed with the Survey Records

AREA B: (South of Yerba Buena Island)

Chart 18650 was corrected to replace tabulated depths for the Oakland Bar Channel from NM 19/96.

A comparison revealed significant changes in bathymetry. Soundings collected in deep areas were generally deeper** than the chart. Do not concur Soundings in other areas were generally about one meter (3.3 feet) shoaler than collocated charted soundings. Concur In addition, surveyed soundings in areas between charted soundings were often shoaler than the surrounding charted soundings by about 1.5 to 2.0 meters (4.9 to 6.6 feet). This may be the result of sea floor dynamics coupled with the dense data acquired by multibeam technology during this survey. See: "THE ACCURACY OF THE DEPTH INFORMATION OF THE NAUTICAL CHART", Lt. P.J. Velberg B. Sc., Hydrographic Journal No. 68 April, 1993, Appendix F.*
** The present survey found depths to be generally ± 3 feet shoaler.
Within the Oakland Bar Channel the surveyed soundings were deeper than those tabulated in NM 19/96. Evidence of dredging was apparent in the raw data and is assumed to explain the deeper depths. Concur LNM reveals that tabulated channel depths change several times per year. For charted and tabulated depths within the Oakland Bar Channel, it is recommended that the Army Corps of Engineers be contacted prior to any changes.

N.7 For areas outside of the Oakland Bar Channel, it is recommended that soundings from the current survey be used to replace charted soundings where charted soundings are deeper. Concur It is further recommended that shallower soundings on the chart not be replaced due to the sea floor dynamics in the survey area. Do not concur See statement added to AREA A, Section N.5

N.8 There was one AWOIS item in this survey area. The description is as follows:

AWOIS 51153 ✓ See Evel Report, Section N.

State and Locality: San Francisco, CA

Charted Position: Lat. 37/47/41.8N Long. 122/22/16.0W

Type of Feature: Wreck, Dangerous, ED (Depth unknown)

Source: LNM 6/11/82

Method of Investigation: 100% multibeam coverage, 250 meter search radius

Results of Investigation: The wreck was not found. No indication in either bathymetry or backscatter imagery was detected.

Comparison with Chart: Submerged wreck symbol annotated *ED* is charted at above position.

* Filed with the survey records.

Recommendation: Effect a more comprehensive survey of the AWOIS location to locate or disprove the wreck.

do not concur, remove charted wreck ED. 100% bottom coverage within specified search radius was accomplished. No indication of wreck at charted location.

N.9 The Oakland Bay Bridge forms the northern boundary of Area B. Its clearance was not measured. Concur Retain clearance as presently charted.

O. ADEQUACY OF SURVEY ✓ See Eval Rpt, Section O.

N/A

P. AIDS TO NAVIGATION ✓

P.1 There are three floating aids to navigation within survey area A and five floating aids to navigation within or adjacent to survey area B. In USCG Light List Volume VI, Pacific Coast and Pacific Islands, they are identified as follows:

AREA A: ✓

Buoy	Charted Position	Surveyed Position	Inverse (meters)	Light List No.
R "4" (Horn)	37/50/50 N 122/23/47 W	37/50/~~81~~ 48.6 N ✓ 122/23/~~77~~ 46.2 W	38.7	5400 Vol. VI
R "2" (Num)	37/50/00 N 122-23-47 W	37/49/~~98~~ 58.8 N ✓ 122/23/~~78~~ 46.8 W	37.36	5350 Vol. VI
G "1" (Can)	*37/49/55.3 N *122/24/33 W	37/49/55 N ✓ 122/24/32 W	12.49	5348 Vol. VI

AREA B: ✓

Buoy	Charted Position	Surveyed Position	Inverse (meters)	Light List No.
G "1" (Bell)	37/48/14 N 122/21/25 W	37/48/16N 122/21/25W	59.0 ~~69.39~~	4605 Vol. VI
R "2" (Nun)	37/48/07 N 122/21/12 W	37/48/05 N 122/28/18 W	172.0 ~~167.8~~	4606 Vol. VI
G/R "D" (Nun)	37/48/01 N 122/22/27 W	37/48/01 N 122/22/27 W	9.0 ~~9.62~~	4455 Vol. VI
G/R "D" (Nun)	37/48/06 N 122/22/33 W	37/48/07 N 122/22/36 W	60.0 Plots on Smooth Sheet ~~Out of Area~~	4450 Vol. VI
R/G "B" (Can)	37/47/46 N 122/22/55 W	37/47/47 N 122/22/55 W	26.0 Plots on Smooth Sheet ~~Out of Area~~	4430 Vol. VI

*From Notice to Mariners 42/96

P.2 All aids to navigation located within the boundaries or adjacent to survey area's A or B were listed in the Light List Volume VI., 1996 with the exception of No. 5348, which was located in NM 42/96 and LNM 38/96 (although incorrectly listed as on chart 18653, rather than chart 18650).

P.3 A plot of charted and surveyed positions of the aids to navigation ~~can be found~~ is ~~in~~ ~~Diagram Q-1, Appendix F~~. Concur
Included in this report.

P.4 There were no overhead cables or overhead pipelines located in survey areas A or B. The San Francisco-Oakland Bay Bridge crosses over the northwesterly edge of survey area B and the BART Tunnel passes through the northern corner of area B, which can be found in Diagram Q-2, Appendix F. These features have been shown on the smooth sheet for orientation only.

P.5 Ferries and Tour Boats follow irregular routes through survey areas A and B on a daily basis.

P.6 There are no ferry terminals located within survey areas A or B. Concur

Q. STATISTICS ✓

a) Lineal nautical miles of sounding lines (shallow water multibeam)	95.7
b) Lineal nautical miles of sounding lines (side scan sonar)	0

c) Square nautical miles of hydrography	1.74
d) Hours of data acquisition (sounding, velocity casts, etc.)	39 crew hours
e) Hours of survey support (testing, calibration, etc.)	277 man hours
f) Hours of data processing, chart production, and reporting	585 man hours
g) Hours of weather downtime	0
h) Number of velocity casts	11
I) Number of tide stations installed	0
j) Number of horizontal control stations occupied/established	1
k) Number of Items Investigated	0
l) Number of soundings collected	Area A = 6,036,024 Area B = 7,601,908 TOTAL = 13,637,932

R. MISCELLANEOUS ✓

R.1 **a)** Evidence of sea floor dynamics, in the form of large sand waves, was found during this survey. Comparisons of soundings collected on consecutive days reveals a 0.45-meter (1.5-foot) vertical displacement, coupled with a 15-meter (49-foot) horizontal migration.

A report analyzing this phenomenon titled, "THE ACCURACY OF THE DEPTH INFORMATION OF THE NAUTICAL CHART", Lt. P.J. Velberg B. Sc., Hydrographic Journal No. 68 April, 1993, can be located in Appendix F. *

b) Data collected outside of the survey boundaries as specified in the Scope of Work are not guaranteed to meet the object detection criteria as specified by the Scope of Work. All depth data collected outside survey boundaries is valid and meets charting criteria.

c) No evidence of unusual submarine features was found during this survey.

d) No evidence of anomalous tidal conditions was found during this survey.

e) No observations of unusual currents were recorded during this survey.

Filed with the hydrographic records.

f) No evidence of magnetic anomalies was found during this survey.

g) No bottom samples were taken during this survey. Concur
Bottom samples have been transferred to the smooth sheet from prior survey H-9494

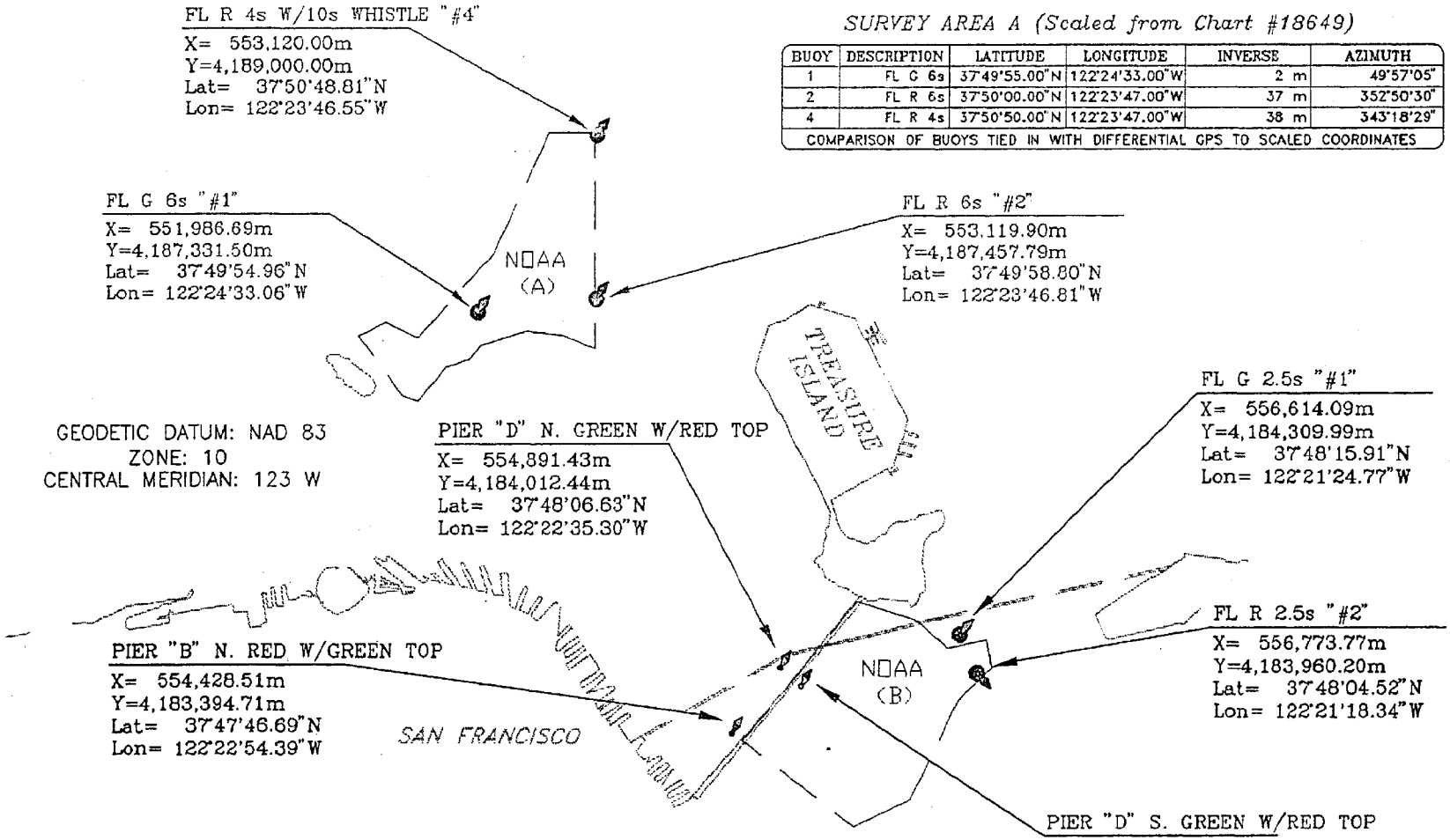
S. RECOMMENDATIONS ✓

S.1 The Port of Oakland is currently conducting dredging operations in its inner and outer harbors. Project plans involve a two-stage development of the harbor. To our knowledge, the first stage will bring the navigational depth to 12.8 meters (42-feet); the second stage furthers that depth to 15.2 meters (50-feet). C & C Technologies, Inc. is not aware of the project timetable and/or what effect the dredging project will have upon this survey.

S.2 No evidence was found of AWOIS item number 51153, reported at location LAT 37-47-41.9N, LONG 122-22-12.7W, in either bathymetry or backscatter imagery during the multibeam sonar survey. It is recommended that a more comprehensive survey of the AWOIS location be performed to locate or disprove the wreck. Do not concur. Reference Section N.B.

T. REFERRAL TO REPORTS ✓

N/A



SURVEY AREA A (Scaled from Chart #18649)

BUOY	DESCRIPTION	LATITUDE	LONGITUDE	INVERSE	AZIMUTH
1	FL G 6s	37°49'55.00"N	122°24'33.00"W	2 m	49°57'05"
2	FL R 6s	37°50'00.00"N	122°23'47.00"W	37 m	352°50'30"
4	FL R 4s	37°50'50.00"N	122°23'47.00"W	38 m	343°18'29"

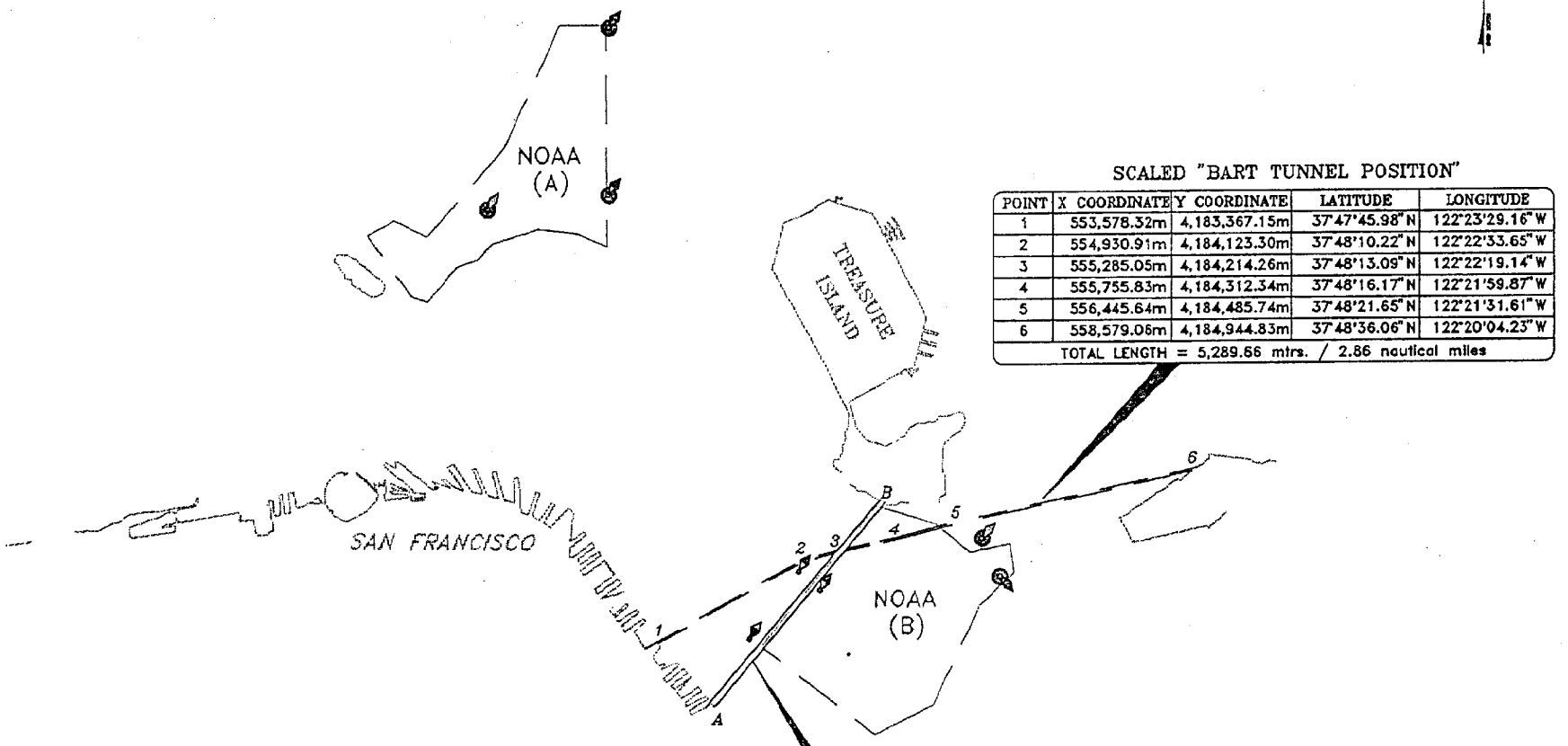
COMPARISON OF BUOYS TIED IN WITH DIFFERENTIAL GPS TO SCALED COORDINATES

SURVEY AREA B (Scaled from Chart #18649)

BUOY	DESCRIPTION	LATITUDE	LONGITUDE	INVERSE	AZIMUTH
1	FL G 2.5s	37°48'14.00"N	122°21'25.00"W	59 m	155°27'28"
2	FL R 2.5s	37°48'07.00"N	122°21'12.00"W	172 m	63°45'25"
D(S)	PIER D SOUTH	37°48'01.00"N	122°22'27.00"W	9 m	83°50'04"
D(N)	PIER D NORTH	37°48'06"N	122°22'33"W	60 m	109°02'43"
B	PIER B NORTH	37°47'46"N	122°22'55"W	26 m	215°03'01"

COMPARISON OF BUOYS TIED IN WITH DIFFERENTIAL GPS TO SCALED COORDINATES

Dwg -1



SCALED "BART TUNNEL POSITION"

POINT	X COORDINATE	Y COORDINATE	LATITUDE	LONGITUDE
1	553,578.32m	4,183,367.15m	37°47'45.98"N	122°23'29.16"W
2	554,930.91m	4,184,123.30m	37°48'10.22"N	122°22'33.65"W
3	555,285.05m	4,184,214.26m	37°48'13.09"N	122°22'19.14"W
4	555,755.83m	4,184,312.34m	37°48'16.17"N	122°21'59.87"W
5	556,445.64m	4,184,485.74m	37°48'21.65"N	122°21'31.61"W
6	558,579.06m	4,184,944.83m	37°48'36.06"N	122°20'04.23"W
TOTAL LENGTH = 5,289.66 mtrs. / 2.86 nautical miles				

POINT	X COORDINATE	Y COORDINATE	LATITUDE	LONGITUDE
A	554,090.93m	4,182,789.70m	37°47'27.13"N	122°23'08.36"W
B	555,678.32m	4,184,680.24m	37°48'28.13"N	122°22'02.93"W
TOTAL LENGTH = 2,468.59 mtrs. / 2.47 kilometers				

SCALED "SAN FRANCISCO\OAKLAND BAY BRIDGE"

GEODETIC DATUM: NAD 83
ZONE: 10

Dwg. Q-2

LETTER OF APPROVAL

REGISTRY NO. H-10727

This report and the accompanying smooth sheet are respectfully submitted.

Field operations contributing to the accomplishment of survey H-10727 were conducted under my direct supervision with frequent personal checks of progress and adequacy. This report and smooth sheet have been closely reviewed and are considered complete and adequate as per the Statement of Work.

Art A. Kleiner
ACSM Certified Hydrographer #180
C & C Technologies, Inc.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
Office of Ocean and Earth Sciences
Silver Spring, Maryland 20910

TIDE NOTE FOR HYDROGRAPHIC SURVEY

DATE: January 21, 1997

HYDROGRAPHIC SURVEYS DIVISION: Headquarters

HYDROGRAPHIC PROJECT: OPR-L304-WO

HYDROGRAPHIC SHEET: H-10727

LOCALITY: San Francisco Bay, CA

TIME PERIOD: December 12 - 16, 1996

TIDE STATION USED: 941-4290 San Francisco, CA
Lat. 37° 48.4'N Lon. 122° 27.9'W

PLANE OF REFERENCE (MEAN LOWER LOW WATER): 0.000 meters

HEIGHT OF HIGH WATER ABOVE PLANE OF REFERENCE: 1.594 meters

REMARKS: RECOMMENDED ZONING

Use zone(s) identified as: SF3, SF5, SF6 & SF32

Refer to attachment(s) for zoning information.

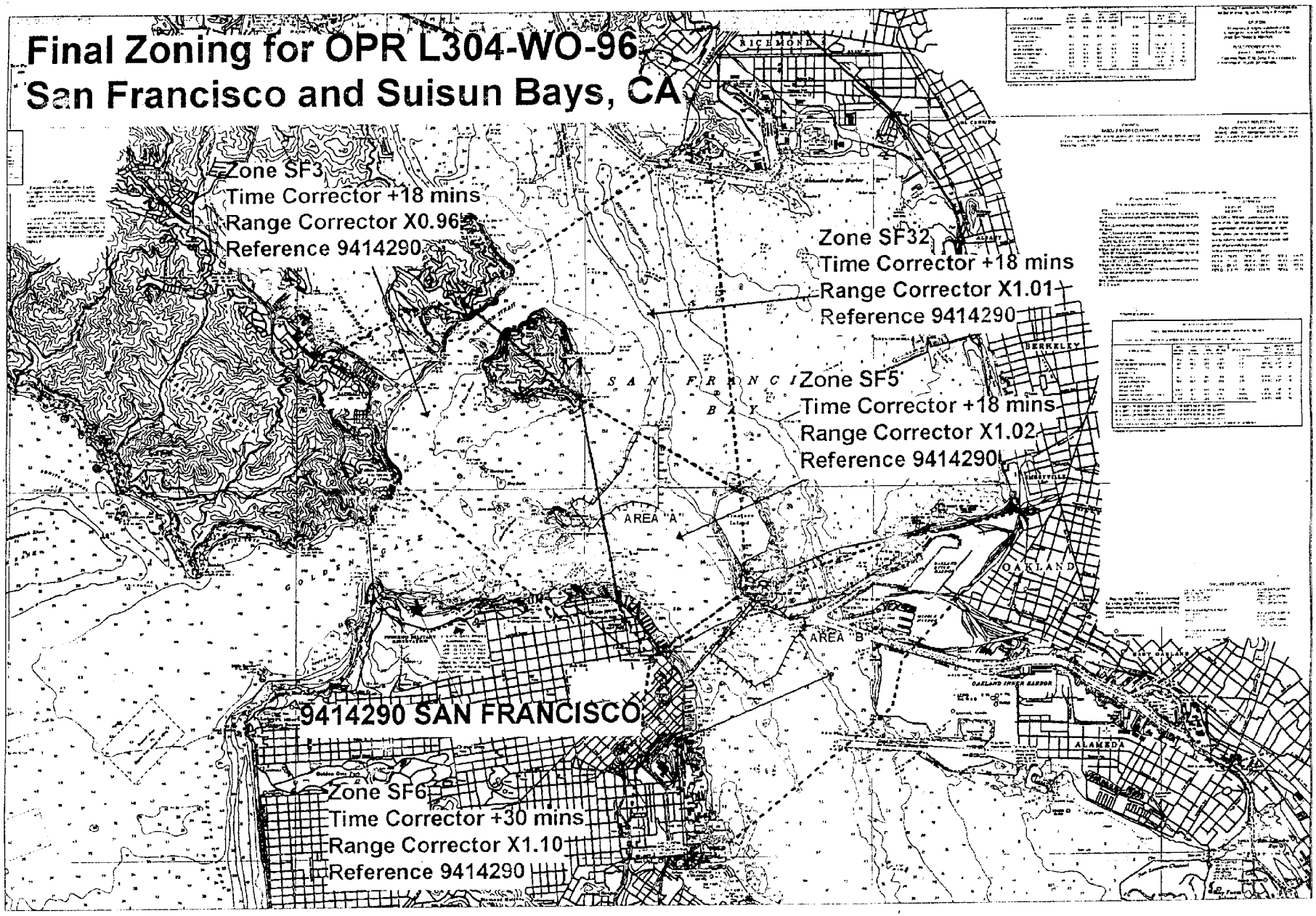
Note: Provided time series data are tabulated in metric units (meters) and on Greenwich Mean Time.

CHIEF, TIDAL ANALYSIS BRANCH

Final tide zone nodal point locations for OPR L304-WO-96.

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 SF3			
-122.423976 37.804296	941-4290	+18	0.96
-122.406466 37.806026			
-122.418065 37.853102			
-122.452512 37.875677			
-122.468689 37.872972			
-122.500581 37.858397			
-122.472099 37.836181			
-122.423976 37.804296			
Zone SF5			
-122.406466 37.806026	941-4290	+18	1.02
-122.397767 37.794731			
-122.369649 37.810144			
-122.371817 37.83229			
-122.418065 37.853102			
-122.406466 37.806026			
Zone SF6			
-122.397767 37.794731	941-4290	+30	1.10
-122.404438 37.75049			
-122.38096 37.74896			
-122.327768 37.783431			
-122.325007 37.793732			
-122.285964 37.828087			
-122.327515 37.821218			
-122.369649 37.810144			
-122.397767 37.794731			
Zone SF32			
-122.381498 37.913302	941-4240	+18	1.01
-122.452512 37.875677			
-122.418065 37.853102			
-122.371817 37.83229			
-122.381498 37.913302			


Final Zoning for OPR L304-WO-96
San Francisco and Suisun Bays, CA
Zone SF3
Time Corrector +18 mins
Range Corrector X0.96
Reference 9414290
Zone SF32
Time Corrector +18 mins
Range Corrector X1.01
Reference 9414290
Zone SF5
Time Corrector +18 mins
Range Corrector X1.02
Reference 9414290
9414290 SAN FRANCISCO
Zone SF6
Time Corrector +30 mins
Range Corrector X1.10
Reference 9414290
AREA "A"
AREA "B"
RICHMOND
BERKELEY
OAKLAND
ALAMEDA

NOAA FORM 76-155
(11-72)

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

GEOGRAPHIC NAMES

SURVEY NUMBER

H-10727

Name on Survey	A ON CHART NO. 18650	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	
ALCATRAZ ISLAND	X		X							1
CALIFORNIA (title)	X									2
SAN FRANCISCO	X		X							3
SAN FRANCISCO BAY	X		X							4
TREASURE ISLAND	X		X							5
YERBA BUENA ISLAND	X		X							6
										7
										8
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Approved
Chief Geographer
JUN 15 1998

NOAA FORM 76-155 SUPERSEDES C&GS 197

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

U.S. DEPARTMENT OF COMMERCE

HYDROGRAPHIC SURVEY STATISTICS

REGISTRY NUMBER: H-10727

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

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

DESCRIPTION	DEPTH/POS RECORDS	HORIZ. CONT. RECORDS	SONAR-GRAMS	PRINTOUTS	ABSTRACTS/ SOURCE DOCUMENTS	
ACCORDION FILES						
ENVELOPES						
VOLUMES						
CAHIERS						
BOXES Digital Tapes	1					

SHORELINE DATA

SHORELINE MAPS (List): NA

PHOTOBATHYMETRIC MAPS (List): NA

NOTES TO THE HYDROGRAPHER (List): NA

SPECIAL REPORTS (List): NA

NAUTICAL CHARTS (List): 18650/47th Ed., April 5, 1997

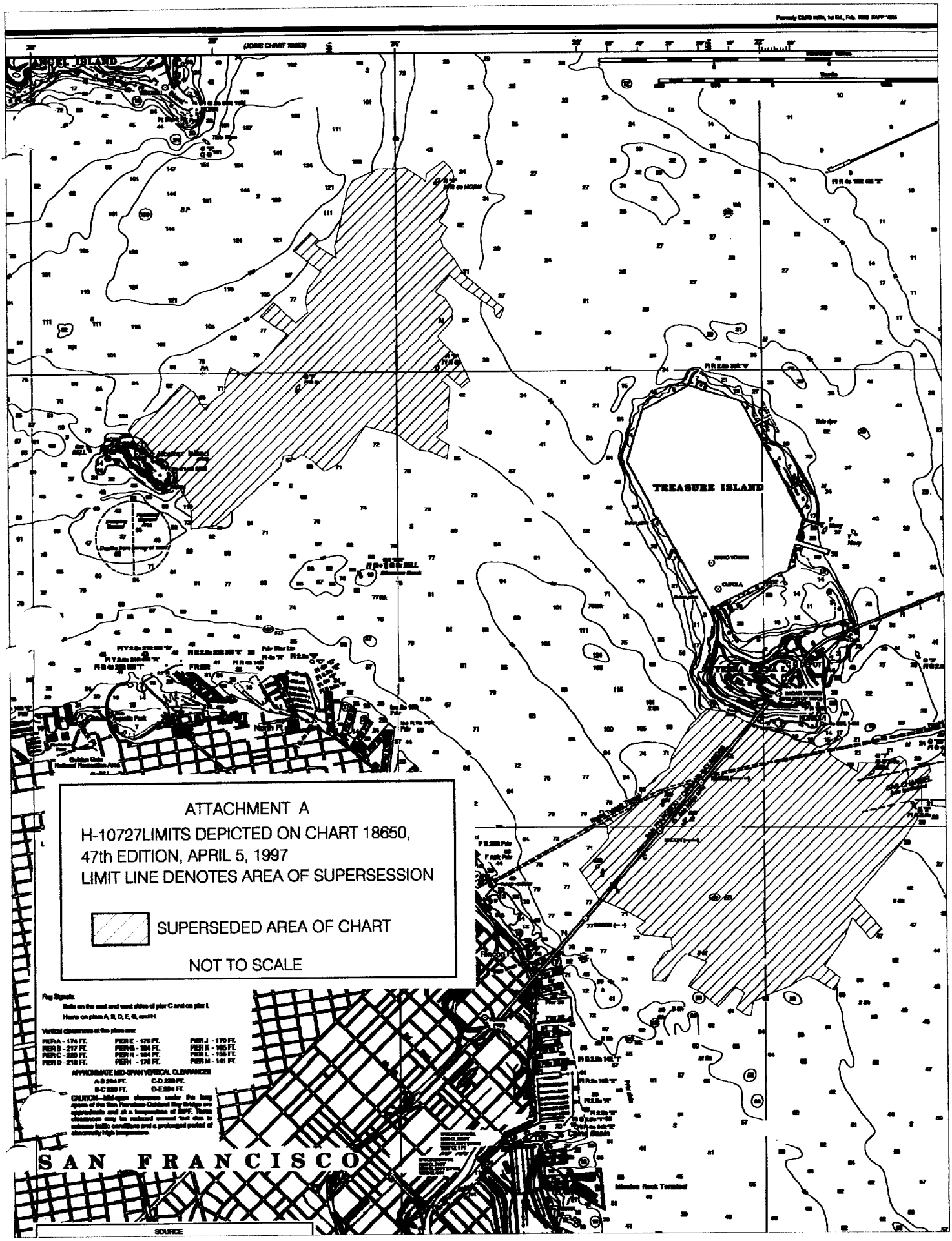
OFFICE PROCESSING ACTIVITIES

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	200		200
VERIFICATION OF JUNCTIONS			
APPLICATION OF PHOTOBATHYMETRY			
SHORELINE APPLICATION/VERIFICATION			
COMPILATION OF SMOOTH SHEET	60		60
COMPARISON WITH PRIOR SURVEYS AND CHARTS			
EVALUATION OF SIDE SCAN SONAR RECORDS			
EVALUATION OF WIRE DRAGS AND SWEEPS			
EVALUATION REPORT		45	45
GEOGRAPHIC NAMES			
OTHER*			
*USE OTHER SIDE OF FORM FOR REMARKS — TOTALS	260	45	305

Pre-processing Examination by Pacific Hydrographic Branch	*Beginning Date* 3/26/97	*Ending Date* 3/26/97
Verification of Field Data by J. Ferguson, B. Mihailov	*Time (Hours)* 160	*Ending Date* 6/24/98
Verification Check by B. Olmstead	*Time (Hours)* 4	*Ending Date* 6/25/98
Evaluation and Analysis by B. Mihailov	*Time (Hours)* 45	*Ending Date* 6/25/98
Inspection by B. Olmstead	*Time (Hours)* 8	*Ending Date* 7/17/98


TREASURE ISLAND
SAN FRANCISCO
ATTACHMENT A
H-10727LIMITS DEPICTED ON CHART 18650,
47th EDITION, APRIL 5, 1997
LIMIT LINE DENOTES AREA OF SUPERSESSION
SUPERSEDED AREA OF CHART
NOT TO SCALE

EVALUATION REPORT

H-10727

A. PROJECT

Survey H-10706 was conducted under contract DACW43-96-D-0523 initiated by the U.S. Army Corps of Engineers. NOS issued a Statement of Work specifying the completion of a survey for the purpose of updating nautical charts. Shallow water multibeam sonar technology was designated as the primary system for acquiring soundings. Least depths were to be determined with the shallow water multibeam sonar system.

The NOS work was completed as part of Purchase Order No. NA97AANCG0028.

The contractor, hereafter identified as the hydrographer, performing the work was C & C Technologies, Inc. Specific information pertaining to this contractor may be obtained from the Hydrographic Surveys Division (N/CS3).

The hydrographer's report contains a complete discussion of the project information.

B. AREA SURVEYED

The survey area is adequately described in the hydrographer's report. Page-size plots of the charted area depicting the limits of supersession accompany this report as Attachment 1.

Bottom sampling was not required for this contract. Depths range from 14 to 121 feet.

C. SURVEY VESSELS

See the hydrographer's report.

D. AUTOMATED DATA ACQUISITION AND PROCESSING.

See the hydrographer's report.

The Pacific Hydrographic Branch converted Simrad data to USL CARIS/HIPS, version 4.2.7, for processing. Outer beams one through three and 58 through 60 were rejected during the conversion process. The hydrographer determined that these outer beams may not meet accuracy requirements, and therefore, they were removed as a precaution. CARIS data were then converted to a format for use in the Hydrographic Processing System (HPS).

During the evaluation phase, Pacific Hydrographic Branch (PHB) noted excessive noise in sonar beams 21 through 23, apparently the result of a systematic error associated with those beams. The cause of these errors was not identified by the hydrographer. PHB manually rejected the suspect data, and the remaining dataset was then reduced with approved tides, reviewed for remaining noisy beam data then binned using 10-meter bins with shoal bias. Overlapping

soundings were suppressed and the resulting data were exported to HPS for the creation of data files to be used in compiling a smooth sheet and the IDF archive data format.

Digital data for this survey exists in the standard HPS format that is 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 will be forwarded to the Hydrographic Surveys Division and a backup copy will be 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 is plotted using a Universal Transverse Mercator projection and are depicted on a single sheet.

E. SONAR EQUIPMENT

Side scan sonar was not employed during this contract.

F. SOUNDING EQUIPMENT

A Simrad EM-950 shallow water multibeam survey system was used during this contract. Sounding equipment has been adequately addressed in the hydrographer's report.

G. CORRECTIONS TO SOUNDINGS

Data have been reduced to Mean Lower Low Water. The reducers for multibeam data include corrections for actual tide, dynamic draft, and sound velocity. Heave, pitch and roll correctors were applied by Simrad EM-950 software.

Reduction of soundings for tide was accomplished during office processing. Tide reducers were derived from the San Francisco gage, 941-4290, in accordance with the attached Tide Note.

H. CONTROL STATIONS

Section H of the hydrographer's report contains an adequate discussion of horizontal control.

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 NAD 27-adjustment tick based on values determined with the NGS program NADCON. Geographic positions based on NAD 27 may be plotted on the smooth sheet utilizing the NAD 83 projection by applying the following corrections:

Latitude: -0.037 seconds (-1.153 meters)
Longitude: 3.535 seconds (90.244 meters)

I. HYDROGRAPHIC POSITION CONTROL

Section I of the hydrographer's report contains an adequate description of the hydrographic positioning system used during the survey. The contractor replaced the primary Differential GPS positions with POS/MV computed positions to avoid the positioning problems encountered when surveying near the San Francisco-Oakland Bridge. At the time of office processing, CARIS HIPS did not allow replacement of positioning systems, therefore, the final smooth sheet was compiled using Differential GPS positions. All data with questionable positional data due to bridge obstructions were rejected.

NAD 83 is used as the horizontal datum for plotting and position computations.

J. SHORELINE

Shoreline shown on the smoothsheet is for orientation purposes only. Shoreline was digitized from a raster image of chart 18650, 47th Edition, April 5, 1997. The line representing the shoreline is shown on the smoothsheet in brown. Attached cultural features, the Oakland Bay Bridge and the BART Rapid Transit Tunnel, are also depicted in brown on the smoothsheet.

K. CROSSLINES

Crosslines are discussed in the hydrographer's report.

L. JUNCTIONS

Junctioning with contemporary surveys was not required for this contract.

M. COMPARISON WITH PRIOR SURVEYS

Comparison with prior surveys was not required for this contract. Comparison with prior surveys was conducted as a part of office processing and is discussed as follows.

Survey	Year	Scale
H-9794	1978	1:10,000
H-9844	1979-81	1:10,000
H-10456	1993	1:10,000

Prior survey H-10456 covers the entire area of the present survey and is the source for most of the charted depth information. However, there are a few soundings and bottom characteristics which still originate from prior surveys H-9794 and H-9844 conducted between 1978-81. Present survey depths within the common areas of the prior surveys reveal a general shoaling of one to six feet. The present survey verified both prominent ridges found in 1993. These ridges run northeast to southwest for approximately 700 hundred meters and rise up four to eight feet from the bottom. The central positions of these features are as follows; latitude 37°48'00"N, longitude 122°22'00" W and latitude 37°49'42"N, longitude 122°24'45" W. Differences with

the prior surveys are largely attributed to continuous shoaling and other dynamic seafloor processes. Smaller differences may be attributed to greater sounding coverage.

The hydrographer compiled an analysis of sand wave activity in the vicinity of Alcatraz Island. This document is filed with the survey field records but is summarized within the descriptive report, Section N, Comparison with Chart; Section R, Miscellaneous. The evaluator concurs with the conclusion that the area is dynamic as indicated by the rapid migration of sand waves. This condition should be taken into account during any future comparison of survey results.

Several bottom characteristics were transferred from H-9794 in the vicinities of Alcatraz Island and Yerba Buena Island. With the transfer of these bottom characteristics, survey H-10727 is adequate to supersede the prior surveys within the common areas.

N. ITEM INVESTIGATIONS

There was one AWOIS item, 51153, within the survey area. This item, a charted submerged dangerous wreck, ED, was investigated using 100 percent multibeam coverage and a search radius of 250 meters. There was no indication that the dangerous submerged wreck ED, exists at the charted location and should be removed from the chart. See the hydrographer's report, Section N, Comparison with Chart, Item N.8, for additional information.

O. COMPARISON WITH CHART

Survey H-10727 was compared with the following charts.

Chart	Edition	Date	Scale	Datum
18650	47th	April 5, 1997	1:20,000	NAD83
18653	6th	July 5, 1997	1:20,000	NAD83

a. Hydrography

Charted hydrography originates with the previously discussed prior surveys and miscellaneous sources. The prior surveys have been adequately addressed in section M and require no further discussion. Miscellaneous source data has been adequately adressed except as follows.

Submerged cable areas should remain as charted.

Survey H-10727 is adequate to supersede charted hydrography within the common area.

b. Dangers To Navigation

No dangers to navigation were discovered during survey operations or during office processing.

c. Controlling Depths

The depths found along the area of Bar Channel which was partially covered by this survey are consistent with and or deeper than the published controlling depths. There are no other channels with controlling depths located within the area of this survey. See the hydrographer's report, Section N, Comparison with Chart, Area B, for additional information.

P. ADEQUACY OF SURVEY

Hydrography contained on survey H-10727 is adequate to:

a. delineate the bottom configuration, determine least depths, and draw the required depth curves;

b. reveal there are no significant discrepancies or anomalies requiring further investigation; and

c. 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, and the Field Procedures Manual, April 1994 Edition.

Q. AIDS TO NAVIGATION

There are several charted fixed aids to navigation within the survey area. These features were not verified and or located during survey operation and should remain as charted. There are eight floating aids to navigation located within the survey limits. These aids were adequately located during survey operations and serve their intended purpose. Additional information relating to these floating aids can be found in the hydrographer's report, Section P, Aids to Navigation.

Landmarks were not addressed as part of this survey and should remain as charted.

R. STATISTICS

Statistics are contained in section Q of the hydrographer's report.

S. MISCELLANEOUS

Miscellaneous information is discussed in section R of the hydrographer's report. No additional miscellaneous items were noted during office processing.

T. RECOMMENDATIONS

This is an adequate hydrographic survey. No additional survey work is recommended.

U. REFERRAL TO REPORTS

The hydrographer's report contains no reference to additional reports in Section T, Referral to Reports. However, several appendices attached to the original descriptive report have been removed and filed with the field records. These documents contain significant background information on system characteristics, equipment calibrations and processing procedures. These separates also contain detailed plots used by the contractor during the systematic analysis of cross-line agreements.

Bob Mihailov
Cartographer

APPROVAL SHEET
H-10727

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.

Bruce A. Olmstead Date: 7/17/98
Bruce A. Olmstead
Senior Cartographer, Cartographic Section
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 Evaluation Report.

Kathy Timmons Date: 7/28/98
Kathy Timmons
Commander, NOAA
Chief, Pacific Hydrographic Branch

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Final Approval

Approved:

Andrew A. Armstrong III Date: Aug 26, 1998
Andrew A. Armstrong III
Captain, NOAA
Chief, Hydrographic Surveys Division

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-10727

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
18650	7/16/98	B. M Shaefer	Full ~~Part Before~~ After Marine Center Approval Signed Via
			Drawing No. Full application of soundings and features from
			Smooth Sheet.
18653	7/17/98	B. M Shaefer	Full ~~Part~~ ~~Before~~ After Marine Center Approval Signed Via
			Drawing No. Full application of soundings from Smooth Sheet
			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
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SUPERSEDES C&GS FORM 8352 WHICH MAY BE USED.