H10889

NOAA FORM 76-35A

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

DESCRIPTIVE REPORT

Type of Survey Hydrographic / Side Scan Sonar/ Multibeam

Field No. Sheet F

Registry No. H10889

LOCALITY

State Louisiana

General Locality Gulf of Mexico

Locality 50 NM SSE of Calcasieu Pass

1999

CHIEF OF PARTY
Art Kleiner

NOAA FORM 77-28 (11-72)

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

HYDROGRAPHIC TITLE SHEET

REGISTRY NUMBER: H10889

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 NUMBER: Sheet F

State: Louisiana

General Locality: Gulf of Mexico

Locality: 50 Miles SSE of Calcasieu Pass

Scale: 1:20,000 Date of Survey: June to August, 1999

Instructions Dated: March 23, 1999 Project Number: OPR-K171-KR

Vessel: *M/V Inez McCall*

Chief of Party: Art Kleiner

Surveyed by: P. Melancon, H. Langill, S. Melancon, T. MacEwen, P. McIlvary, J. Belanger, B. West, J. Kirkland, M. Stelly, P. Devall, C. Smith, M. Andrews, S. Reichel

Soundings taken by echosounder, hand lead line, or pole: Simrad EM3000 Multibeam Echosounder

Graphic record scaled by: N/A

Graphic record checked by: N/A

Protracted by: N/A Automated plot by: ~~HP 755 Plotter~~ HP DESIGNJET 2500CP

Verification by: C&C Technologies Personnel ATLANTIC HYDROGRAPHIC BRANCH PERSONNEL

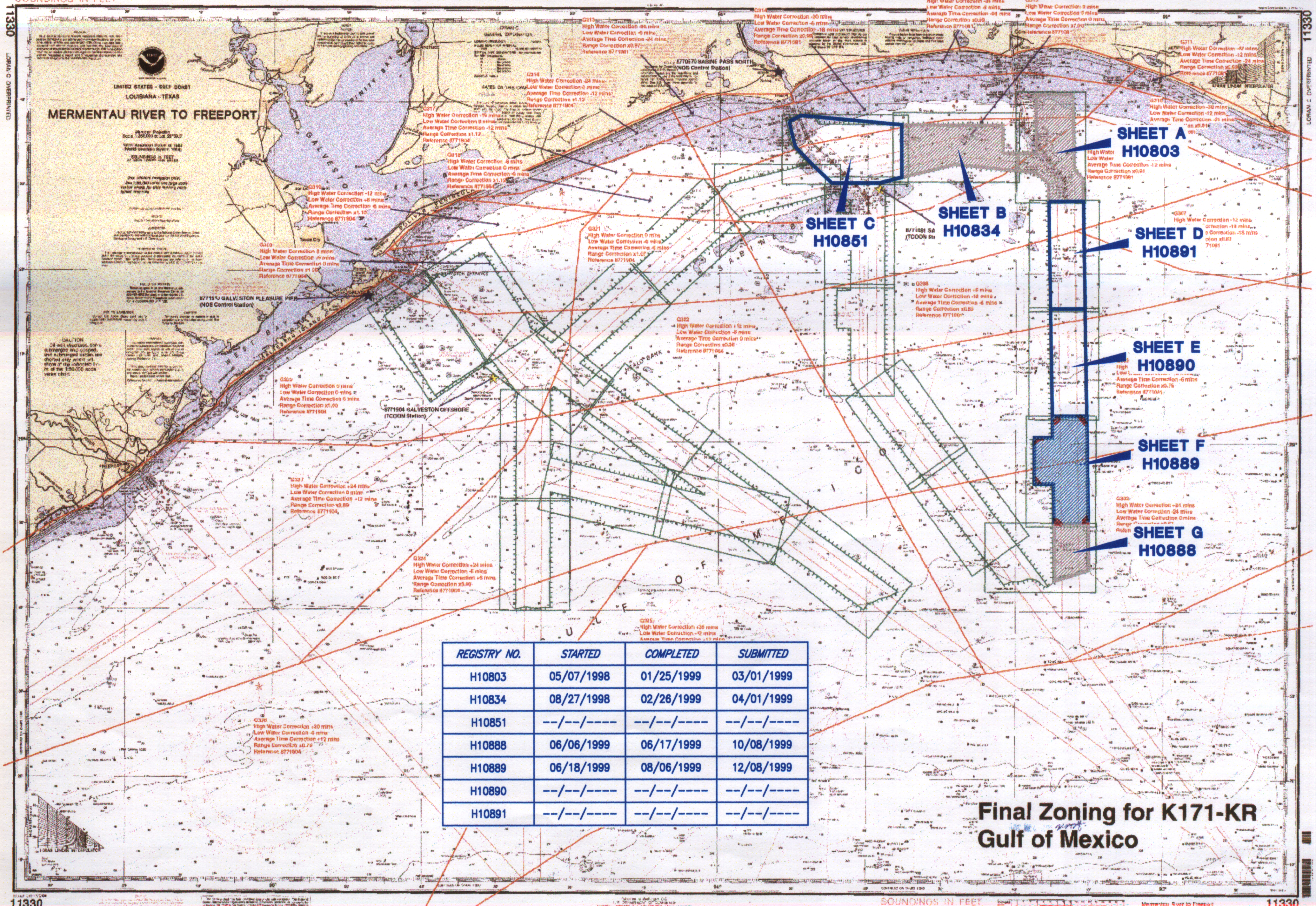
Soundings in: Feet: X Fathoms: ___ Meters: ___ at MLW: ___ MLLW: X

Remarks: Multibeam Hydrographic Survey of Sheet F
Data collection in meters, later converted into feet, referenced to MLLW
200% side scan sonar coverage
UTC time was used exclusively
Tidal Zones: G302 and G303
Tidal Stations: 877-1081

NOAA FORM 77-28 SUPERSEDES FORM C & GS - 537

HAND WRITTEN NOTES IN DESCRIPTIVE REPORT WERE MADE DURING OFFICE PROCESSING.

AWOIS ✓ & SURF ✓ 12/6/00 by MBH



REGISTRY NO.	STARTED	COMPLETED	SUBMITTED
H10803	05/07/1998	01/25/1999	03/01/1999
H10834	08/27/1998	02/26/1999	04/01/1999
H10851	--/--/----	--/--/----	--/--/----
H10888	06/06/1999	06/17/1999	10/08/1999
H10889	06/18/1999	08/06/1999	12/08/1999
H10890	--/--/----	--/--/----	--/--/----
H10891	--/--/----	--/--/----	--/--/----

Final Zoning for K171-KR Gulf of Mexico

TABLE OF CONTENTS

APPENDICES

SEPARATES

* FILED WITH ORIGINAL FIELD RECORDS

A. PROJECT

A.1 Project Number: OPR-K171-KR
Sheet F
Contract No.: 50-DGNC-8-90024 March 13, 1998
Task Order: 56-DGNC-8-23004 June 2, 1999

A.2 The purpose of this contract is to provide NOAA with modern, accurate hydrographic survey data acquired using shallow water multibeam and side scan sonar technology with which to update the nautical charts of the assigned area. Numerous obstructions have been reported in this area. Side scan sonar shall be used to locate these obstructions and a shallow water multibeam sonar system shall be used to determine the least depth over the obstructions as well as determine the depths over the entire project area.

B. AREA SURVEYED

B.1 Sheet F, shown on the INDEX OF SHEETS, is located 50 miles south southeast of Calcasieu Pass, Louisiana in the Gulf of Mexico.

B.2 The area was bounded by the following survey limits.

Latitude (N)	Longitude (W)
29° 03' 01.52"	93° 15' 18.74"
29° 03' 01.52"	93° 10' 39.28"
29° 50' 16.04"	93° 10' 27.11"
29° 50' 16.38"	93° 15' 03.52"
29° 54' 59.85"	93° 15' 08.59"
29° 54' 59.55"	93° 17' 42.85"
29° 00' 29.19"	93° 17' 43.89"
29° 00' 29.46"	93° 15' 15.36"
29° 03' 01.52"	93° 15' 18.74"

B.3 Data collection was performed between June 18, 1999 (J.D. 169) and August 6, 1999 (J.D. 218). An Abstract of Times of Hydrography is included in*Appendix E.

* FILED WITH ORIGINAL FIELD RECORDS

C. SURVEY VESSELS

C.1 The *M/V Inez McCall* was leased from Cameron Offshore Boats, Inc. by C & C Technologies for the duration of the survey. A vessel diagram is included as part of Appendix G.* FILED WITH ORIGINAL FIELD RECORDS

C.2 The M/V *Inez McCall* was used for all survey operations including multibeam soundings, side scan sonar operations, sound velocity casts, positioning, on-board processing, and interim deliverable production.

C.3 Vessel Description

		M/V *Inez McCall*
Registration/Official Number		638285
Length (feet)		110
Beam (feet)		25
Tonnage	Gross	92
	Net	62

C.4 Unusual vessel configuration: None

D. AUTOMATED DATA ACQUISITION AND PROCESSING

SEE ALSO THE EVALUATION REPORT

D.1 Hydrographic data were collected and processed using C & C Technologies' proprietary HydroMap software run on a SUN Sparc Ultra2/2170 workstation. HydroMap was used to collect data from the survey instruments and record it on high speed AIT tape drives. All data were time tagged and recorded to file in their raw form. No subsampling was performed. Data collected by HydroMap include Simrad EM3000D, POS/MV, Trimble GPS, Satloc DGPS, Endeco YSI Sound Velocity Probe, Seabird CTD sensor, and Echotrac single beam echosounder.

D.2 Two Endeco/YSI conductivity-temperature probes were mounted at the multibeam echosounder transducers to provide real-time sound velocity measurements at the transducer location. The sensor data were integrated with the EM-3000D to provide corrections for beam pointing angles during data collection.

Two Seabird SEACAT SBE 19 Profilers were used simultaneously to measure the water column sound velocity during hydrographic operations. The profilers were deployed to a minimum of 95% of the maximum water depth in the survey area to be covered. The sound velocity data from the casts were applied to the multibeam data at the time of collection.

D.3 Processing was performed in the following manner. Details of the processing steps are provided in Appendix I.* FILED WITH ORIGINAL FIELD RECORDS

1) For each survey line, processing involved the following steps:
   a) Extraction of generic vessel navigation data
   b) Performance of time correlation and georeferencing
   c) Data binning
   d) Data editing

2) Merging of data

3) Generation of smooth sheet

4) Generation of back-trace data

D.4 EG&G 260 side scan sonar data were collected and processed using the Triton Elics Isis software, run on a Windows 95 PC. Side scan data were recorded digitally together with time and position data, fed from HydroMap, and saved in extended triton format (.xtf) to 8mm AIT tapes.

D.5 The ISIS software was used to process the side scan data. Sonar targets and positions were recorded using this software.

D.6 A list of software and version numbers used for data collection and processing is given in Appendix K.*

E. SIDE SCAN SONAR

E.1 Side scan sonar data were collected using two EG&G 260 towfish, S/N 23998 and S/N 24534. Data were recorded using Isis software. Digital data were saved to Magneto Optical Disks and to 8 mm AIT tapes and analog data were printed in real-time on an EPC 1086 recorder.

The side scan sonar towfish was towed from the stern of the survey vessel. The towpoint was 16.14 meters astern of the navigation center. The dual frequency fish was operated at a frequency of 100 kHz for the duration of the survey.

E.2 Side scan data were collected across the survey area in all water depths. A range of 75 meters per channel was used throughout the survey. The towfish were configured with 20° (S/N 24534) and 33° (S/N 23998) depression angles. The towfish altitude was maintained between 6 and 7 meters. A 65 meter line spacing was used to adequately provide the required 200 % coverage with the side scan sonar.

* FILED WITH ORIGINAL FIELD RECORDS

In an attempt to decrease the effects of surface reflections and allow survey operations to be carried out in rougher sea state conditions, a shim was placed between the transducer mount and the side scan sonar S/N 23998 towfish body to change the depression angle from 20° to 33°.

E.3 Fix marks (shot points) were recorded and annotated at an interval of 150 meters for all lines. All shot points were annotated with line name, date, time, position (easting and northing), event number, and layback.

E.4 Side scan sonar confidence checks were performed daily during survey operations. When possible, features seen during normal survey operations such as drag scars, dredged channels, or platforms were used as the target for the confidence checks. On several occasions, it was necessary to break line and find a known target to use for the confidence check. Each time a confidence check was performed it was annotated as such on the analog records and was noted in the survey log. The survey logs are included with the data and are submitted as Separates.*

E.5 Both the analog and digital copies of the side scan data were reviewed in the field. All measurements and positions were taken from the digital records using the ISIS software. The digital data were reviewed first and then the analog data were reviewed to make sure that all of the proper annotations had been made. All features and targets that were tagged on the digital records were also annotated appropriately on the analog records.

E.6 Fix files extracted from the HydroMap digital data were used to establish proof of coverage. The fix files were edited to exclude any areas for which the data were rejected. A hatching subroutine in AutoCAD was then used to show the swath width on either side of the trackline. Alternate lines were chosen for the first 100% coverage and the remaining lines were used to make up the second 100% coverage.

E.7 One significant contact was observed in the survey area. The object appeared very close to nadir on one of the lines and near the middle of the port side on another. On one line the measured height of the contact was 3.2 m, on the other line it was 0.3 m. The object was visible in the multibeam and showed a relief of just 15 cm. Tif files of the two views of the contact are included with the deliverables and the contact is listed in the sonar contact list. The depth over the object was taken at the highest point over the object. However, it is less than a foot different than the surrounding depths and does not show up as a significant contact or an obstruction. The contact does however appear on the contact plot and in the sonar contact list as a significant contact.

Several contacts interpreted to be insignificant debris were also tagged. Targets were measured online using the ISIS software. Each time a target was tagged, a

* FILED WITH ORIGINAL FIELD RECORDS

file was created containing the target type, position, measurements, time and other relevant information. These target locations and types were then plotted in AutoCAD so that correlations could be made between contacts seen on adjacent lines. A sonar contact list was made of all tagged targets. The sonar contact list is included as a *separate with the side scan sonar data.

E.8 There were many fish in the area during the survey times and they showed up on the side scan sonar frequently. In one particular instance, on line 135, the fish showed up on the side scan and the multibeam and appeared similar to a sonar contact. However upon inspection of the adjacent lines it was apparent that the object was a school of fish.

A different pattern characteristic of a school of fish was seen over and over again in the side scan records. A representative image is included with the sonar contact table to aid in interpretation of the data. Many of these instances were initially included in the preliminary sonar contact table but upon closer inspection it was determined that the pattern was that of a school of fish.

F. SOUNDING EQUIPMENT

F.1 A Simrad EM3000D dual-head multibeam sonar system, S/N 138, was used for all hydrographic operations. Head 1 (port side) was S/N 605 and head 2 (starboard side) was S/N 604. This system operates at a frequency of 300 kHz with 127 receive beams for each transducer.

F.2 A 200 kHz Echotrac 3200 MK II single beam echosounder, S/N 9555, was used as a continuous real-time check of the multibeam echosounder depth readings. Heave compensation was accomplished by corrections provided by the POS/MV motion sensor.

F.3 A draft tube was installed to measure daily changes in the vessel static draft. A valve was installed in the vessel hull and a clear plastic tube was attached to the valve. The tube was calibrated with a relative scale and daily measurements of the static draft were taken and entered into the multibeam echosounder as the "water level down" (draft) value.

F.4 Periodic lead line measurements were taken as an additional check of the single beam and multibeam echosounder depth readings. The lead line was marked off at 10-centimeter intervals using a cloth metric tape measure. An average of several readings was taken as the depth value.

F.5 All of the above mentioned equipment was used during the entire survey and in all water depths.

* DATA FILED WITH ORIGINAL FIELD RECORDS

G. CORRECTIONS TO SOUNDINGS

G.1 Two Endeco/YSI conductivity-temperature probes, model number 600R, were mounted at the multibeam echosounder transducers to provide real-time sound velocity measurements at the transducer location. The sensor data were integrated with the EM-3000D to provide corrections for beam pointing angles during data collection.

Two Seabird SEACAT SBE 19 Profilers were used simultaneously to measure the water column sound velocity during hydrographic operations. The profilers were deployed to a minimum of 95% of the maximum water depth in the survey area to be covered. The sound velocity data from the casts were applied to the multibeam data at the time of collection prior to the commencement of the next survey line. Appendix J* contains a list of sound velocity profiles, dates, times, positions, and the survey lines to which each profile was applied. Below is a table of dates and locations of all casts used for sound speed corrections.

M/V *Inez McCall*					
Date	**Latitude (N)**	**Longitude (W)**	**Date**	**Latitude (N)**	**Longitude (W)**
06/19/99	28° 50' 09.47"	93° 10' 12.07"	07/16/99	28° 55' 06.54"	93° 17' 31.29"
06/19/99	28° 50' 47.53"	93° 10' 51.53"	07/17/99	28° 55' 14.31"	93° 17' 35.17"
06/19/99	28° 54' 14.25"	93° 13' 04.56"	07/17/99	28° 55' 37.34"	93° 11' 02.46"
06/20/99	28° 50' 25.04"	93° 14' 44.97"	07/17/99	28° 55' 45.89"	93° 10' 50.03"
06/22/99	28° 51' 12.84"	93° 10' 41.70"	07/18/99	28° 56' 02.87"	93° 17' 31.42"
06/23/99	28° 51' 38.15"	93° 14' 53.07"	07/19/99	28° 56' 14.90"	93° 17' 41.89"
06/29/99	28° 52' 19.03"	93° 11' 13.63"	07/19/99	28° 56' 31.14"	93° 17' 26.03"
06/30/99	28° 52' 27.34"	93° 10' 33.84"	07/25/99	28° 56' 30.12"	93° 15' 20.90"
07/06/99	28° 52' 31.58"	93° 14' 54.59"	07/25/99	28° 56' 39.15"	93° 10' 58.75"
07/06/99	28° 52' 42.46"	93° 10' 38.26"	07/25/99	28° 56' 51.93"	93° 10' 41.01"
07/06/99	28° 52' 40.72"	93° 09' 45.48"	07/26/99	28° 56' 59.58"	93° 17' 33.89"
07/07/99	28° 52' 52.46"	93° 14' 32.50"	07/27/99	28° 57' 10.18"	93° 15' 46.33"
07/07/99	28° 53' 10.11"	93° 11' 03.79"	07/27/99	28° 57' 30.59"	93° 10' 41.45"
07/07/99	28° 53' 23.10"	93° 10' 40.04"	07/28/99	28° 57' 58.29"	93° 10' 48.68"
07/08/99	28° 53' 52.27"	93° 10' 57.23"	07/28/99	28° 58' 07.75"	93° 10' 36.30"
07/09/99	28° 54' 18.04"	93° 15' 01.58"	07/28/99	29° 00' 26.36"	93° 12' 56.00"
07/09/99	28° 53' 02.50"	93° 11' 20.20"	07/29/99	28° 57' 27.21"	93° 15' 10.02"
07/10/99	28° 50' 29.88"	93° 14' 56.23"	07/29/99	28° 57' 07.36"	93° 16' 59.39"
07/10/99	29° 00' 44.33"	93° 15' 08.80"	07/29/99	29° 02' 56.30"	93° 14' 52.48"
07/10/99	29° 02' 49.76"	93° 12' 58.60"	07/29/99	28° 57' 08.44"	93° 17' 27.64"
07/10/99	29° 00' 38.69"	93° 12' 59.44"	07/29/99	28° 57' 19.50"	93° 15' 10.33"
07/10/99	29° 00' 47.87"	93° 15' 02.93"	07/29/99	28° 57' 25.01"	93° 17' 36.14"
07/11/99	29° 01' 13.73"	93° 14' 49.27"	07/30/99	28° 57' 41.10"	93° 13' 51.49"

* DATA FILED WITH ORIGINAL FIELD RECORDS

07/11/99	29° 01' 22.41"	93° 10' 46.58"	07/30/99	28° 57' 42.20"	93° 13' 13.88"
07/12/99	29° 01' 47.48"	93° 13' 44.42"	07/31/99	28° 58' 01.03"	93° 11' 42.69"
07/12/99	29° 01' 50.21"	93° 10' 47.25"	08/01/99	28° 58' 15.40"	93° 10' 42.43"
07/13/99	29° 02' 17.67"	93° 11' 04.63"	08/01/99	28° 58' 33.18"	93° 17' 18.64"
07/14/99	29° 02' 25.85"	93° 11' 04.84"	08/01/99	28° 58' 43.32"	93° 17' 34.09"
07/14/99	29° 02' 55.90"	93° 10' 59.79"	08/02/99	28° 59' 01.25"	93° 11' 00.36"
07/14/99	29° 01' 47.66"	93° 10' 45.19"	08/02/99	28° 59' 09.55"	93° 17' 34.10"
07/15/99	28° 56' 33.66"	93° 17' 29.52"	08/03/99	28° 59' 35.16"	93° 11' 09.20"
07/15/99	28° 57' 06.43"	93° 16' 00.98"	08/03/99	28° 59' 41.56"	93° 17' 34.32"
07/15/99	28° 54' 36.02"	93° 13' 50.86"	08/04/99	28° 59' 56.87"	93° 17' 24.80"
07/15/99	28° 57' 43.52"	93° 11' 28.80"	08/05/99	29° 00' 07.41"	93° 10' 43.77"
07/15/99	28° 54' 30.10"	93° 10' 51.61"	08/05/99	29° 00' 27.87"	93° 17' 29.86"
07/16/99	28° 54' 48.92"	93° 15' 01.10"	08/06/99	28° 57' 52.35"	93° 16' 41.54"
07/16/99	28° 55' 03.80"	93° 17' 35.94"			

Two Seabird sound velocity profilers, S/N 1730 and S/N 1174, were used on the M/V *Inez McCall.* Following are the calibration dates for each of the Seabirds used during the survey. The calibration records are included in Appendix G.*

Seabird Serial Number	Date of Calibration
1730	March 26, 1999
1174	March 25, 1999

G.2 No instrument corrections were necessary for the multibeam or single beam echosounders.

G.3 An Echotrac 3200MK II single beam echosounder, S/N 9555, was run continuously throughout the survey for validation of the multibeam depth data. Heave compensation for the single beam echosounder was accomplished using the POS/MV motion sensor. The mean sound velocity taken from each sound velocity profile was entered into the single beam echosounder to correct for water column sound speed. A lead line reading was performed once a day as an additional check of depth readings. Readings from the draft tube were used to determine static draft.

G.4 Readings of the draft tube were taken daily to ensure that the proper static draft value was entered into the multibeam and single beam echosounders. In addition to the daily measurements, readings were also taken each time the vessel departed the dock and anytime changes in fuel and water loads were made.

G.5 A settlement test was performed aboard the M/V *Inez McCall* on April 27, 1998. Three lines were run at RPM values ranging from 0 to 1800. The amount of settlement was measured for eight different RPM values for each line. The results of the settlement test revealed that the greatest change over the entire RPM range

* DATA FILED WITH ORIGINAL FIELD RECORDS

G.5 A settlement test was performed aboard the M/V *Inez McCall* on April 27, 1998. Three lines were run at RPM values ranging from 0 to 1800. The amount of settlement was measured for eight different RPM values for each line. The results of the settlement test revealed that the greatest change over the entire RPM range was less than 20 centimeters. The settlement test log and results are included in Appendix G.*

The multibeam data were corrected for settlement during post processing. Three survey speeds were used during data collection: 4.5 knots for main scheme lines, 6.5 knots for cross lines, and 8 knots for multibeam-only reruns. The lines were processed in groups based upon survey speed and the corresponding settlement was added to the depth readings in as an elevation offset during post processing.

G.6 An Applied Analytics, Inc. POS/MV 320 motion sensor was integrated with the multibeam echosounder to provide real-time heave, pitch, and roll corrections. This system, which has an internal GPS receiver, was used in conjunction with SATLOC differential corrections for primary navigation throughout the survey and was used to determine heave, pitch, and roll offsets during the patch tests.

SATLOC is based upon technology developed by NASA for space docking, which requires accuracy and reliability at a great distance from the Reference Site (RS). SATLOC computes a unique correction for each receiver based upon a variety of GPS conditions from horizon to horizon. This technique is referred to as a State Space Model (SSM). From a cold start-up, SATLOC determines its location using its integral GPS then calculates a line of sight to each satellite in view. Next it receives the SSM and applies the ionosphere model to correct for GPS signal delays, orbital correctors, and clock correctors. The output solution is a differential correction message unique to your exact location.

G.7 Prior to the survey, a standard patch test procedure was performed at the work site to determine correctors for roll, pitch, yaw, and system latency. Procedures for a standard patch test are outlined below and patch test results are included in Appendix G.*

Roll:
Iterations of linear regression were performed upon the mean differences from eight pairs of collinear reciprocal lines to verify the roll mounting angles for each transducer head and to compute the roll corrector value applied by the POS/MV.

Pitch:
Two pairs of collinear reciprocal lines were run at the lowest practical survey speed over the calibration target to calculate the offsetting pitch corrector value applied by the EM-3000. The following formula was used: cp = atan (dt / (2 x water depth), where cp = pitch corrector value and dt = target offset distance.

* DATA FILED WITH ORIGINAL FIELD RECORDS

Latency:
Two pairs of collinear reciprocal lines were run at the highest practical survey speed over the calibration target to calculate the offsetting latency corrector value applied by the EM-3000. The following formula was used: dl = dt / (2 x velocity), where dl = latency corrector value and dt = target offset distance.

Yaw:
One pair of reciprocal lines with approximately 25% overlap was run over the calibration target. No offset was required, so a zero (0) misalignment value was entered into the POS/MV. The following formula is used for this calculation: cy = atan (dt / (2 x offset from track line)), where cy = yaw corrector value and dt = target distance offset.

G.8 The tidal datum used for the survey was Mean Lower Low Water (MLLW). During post-processing, tidal data from the Sabine Pass offshore tidal station (877-1081) were used with correction offsets for tide zones 302 and 303. The tidal zone, stations, and offsets used during post-processing are given in the table below.

Tidal Zone	Tide Station	Time Correction			Height Correction
		HW	LW	Ave	
G302	877-1081	+24	-24	0	0.67
G303	877-1081	+12	-18	-6	0.75

VERIFIED TIDES FROM NOS CO OPS WEBSITE HAVE BEEN APPLIED TO THE SURVEY DATA

H. CONTROL STATIONS SEE ALSO THE EVALUATION REPORT

H.1 The horizontal datum used for the survey was NAD83 (North American Datum of 1983).

H.2 No horizontal control stations were established for this survey. Existing land based stations used for SATLOC and Coast Guard beacon are listed in Appendix C.

H.3 Results of the 24-hour monitoring of the SATLOC differential signal are shown in Appendix H.* Results of the test are as follows:

A fix was taken every second totaling 94,682 position values (26.3 hours).
The average PDOP value was 1.20.
The difference between control point LCG25 and average DGPS position:
Northing = 0.12 meters
Easting = 0.87 meters

* DATA FILED WITH ORIGINAL FIELD RECORDS

A scatter-plot of the mean radial position error, with the mean HDOP annotated on the plot, is included in Appendix H.*

I. HYDROGRAPHIC POSITION CONTROL

I.1 Positioning aboard the M/V *Inez McCall* was acheived using a Trimble 4000SSi 9-channel GPS receiver, a SATLOC Trimble DSM 12 channel GPS receiver, and a POS/MV inertial navigation unit embedded with two NovAtel GPS receivers. All units were integrated with differential GPS (DGPS) corrections. Data were continuously recorded from all three GPS units throughout the survey. The real-time positional solutions were projected on the real-time coverage display during survey operations.

I.2 The DGPS integration included the following checks and settings to ensure that all requirements as specified in the Statement of Work were met:

- All GPS receivers were set to have at least an 8-degree elevation mask; typically an 11-degree elevation mask was used.
- The audio alarm was set to sound each time a GPS position that was not differentially corrected was received.
- A PDOP value of 7 was used to ensure that at least 4 satellites were being received at all times.

I.3 The accuracy requirements, as specified in the Statement of Work, were met. Both DGPS systems used for this survey met the 95% confidence level and did not exceed the 10-meter limit as specified in the Statement of Work. The Horizontal Dilution of Precision (HDOP) was monitored by HydroMap data collection software during data collection. When the HDOP value exceeded the allowable limit of 2.5, survey operations were suspended until DGPS performance improved. If positioning quality degraded beyond acceptable limits while on line, the data were automatically rejected by HydroMap software.

I.4 No difficulties that would have degraded the expected positional accuracy were encountered.

I.5 Positioning equipment utilized during this project, identified by manufacturer, model, and serial number are:

Unit 1:

Trimble 4000-SSi
S/N 3507A09641
Firmware Version: 7.22v
MBX2 USCG DGPS Receiver
Unit # 212

* DATA FILED WITH ORIGINAL FIELD RECORDS

Unit 2:

Trimble DSM
S/N not available (board)
Satloc Receiver (C&C)
Unit # 0047

Unit 3:

POS/MV V.3
(2) NovAtel 3151ROEM
Satloc Receiver (C&C)
Unit # 0047

I.6 The DGPS positioning system does not require calibrations. A comparison of each of the three positioning systems was performed for each line of data and can be found in Appendix H.*

While computing the comparisons between each of the positioning systems it was discovered that the Version 3 upgrade to the POS/MV was not incrementing the date correctly each day at midnight UTC. This error resulted in the first two digits of the year incrementing instead of the two-digit day of the month.

This problem did not affect the data processing. The Simrad EM3000 time synchronizes once on startup and then again every second unless the time difference between itself and the POS vary by greater than five seconds. Consequently, at midnight on the first night the Simrad did not synchronize to the POS. However, the Simrad date and time remained correct and accurate because it continues to set the second on the one pulse per second.

In Hydromap processing, the time in the Simrad datagrams is used to apply all corrections, in particular the tide corrections.

In order to correlate the dates prior to performing the positioning system comparisons, the correct dates were extracted from the Trimble data by matching up the times (time of day) in the GGA strings. We have included the corrected POS/MV navigation files as part of the deliverables.

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

I.8 There were no equipment malfunctions or substandard operations that would have affected the positioning equipment.

I.9 The USCG DGPS Receivers, which were used as the corrections for the secondary positioning system, can be affected by atmospheric conditions such as

* DATA FILED WITH ORIGINAL FIELD RECORDS

thunderstorms. The Radio link from the tower site can be cut off temporarily by this atmospheric condition, but in no way is the data quality damaged. The HydroMap software was configured to provide an audio warning and automatically reject the data if a DGPS signal was not received within 20-second timeframes as specified in the Statement of Work.

I.10 No poor geometric configurations were encountered during this survey.

I.11 No systematic errors that required adjustments were detected.

I.12 Antenna offset and layback corrections were measured using conventional methods by two different procedures. These conventional methods involved the employment of tape measures, a hand level, and a plum bob.

The first method was to take the measurements twice by two different personnel. The second method was to measure incrementally such that the sums and differences of the measures could be used to check the overall dimensions.

All distances were referenced to the navigation center, which is the POS/MV IMU. A list and diagram of the determined measurements are provided in Appendix G.*

J. SHORELINE

"Not Applicable"

K. CROSS LINES

HydroMap contains a tool that compares data from a main line with data from cross lines. The comparison calculates the mean difference and noise level as a function of cross-track position. The measurements are used for quantitative quality assurance system accuracy and ray-bending analysis. All cross line statistical results are included as Separates II.*

K.1 Reference Data

In general, cross lines, which consisted of a minimum of 5 percent of the main scheme lines, were used to produce reference data. The reference data were considered to be an accurate representation of the bottom. Since the data were collected from an orthogonal direction, the errors were independent.

The cross lines were processed to produce the best possible data. Frequent sound velocity profiles were taken to minimize any possible ray-bending. The swath

* DATA FILED WITH ORIGINAL FIELD RECORDS

was restricted to an angular sector of 10 degrees, resulting in a swath width of less than 2 meters to ensure that there were no measurable ray-bending or roll errors. The data were binned and thinned using a median filter. The data were then carefully edited to ensure that there were no remaining outliers.

K.2 Test line

The line to be evaluated, the test line, was processed to produce a trace file. Trace files were comprised of binned soundings that had not been thinned. Processing parameters were set to include all beams.

K.3 Cross Analysis

To perform the cross analysis, all lines of the reference data set were utilized and the results were "stacked" to produce more significant statistics.

The following operations were performed for each line of the reference data:

Optionally remove tidal effects:

Residual tidal effects were removed by eliminating the difference between the reference line data and the near-nadir beams of the test line. The beams of the test line that fell within a small (operator settable) angular sector from nadir were subtracted from the corresponding soundings of the reference data. The average difference was used to temporarily offset all of the test line soundings for comparison to this reference line.

Difference all soundings and Bin the results:

Each sounding of the test was subtracted from the sounding in the corresponding bin of the reference line. The resulting differences were used to accumulate statistics based on an operator settable across-track binning criteria. The across-track binning was based upon across-track distance, beam number, and angle from nadir. The bin size was also settable by the operator.

K.4 Results From All Reference Lines Stacked

The accumulated statistics of all test line soundings as compared to all reference lines were processed to produce four across-track profiles. The profiles represent the mean difference, standard deviation, root-mean-square difference, and percentile confidence interval. The data are provided in graphical form in Separates II.* DATA FILED WITH ORIGINAL FIELD RECORDS

K.5 Interpretation

Ray-bending:

The effects of ray-bending were measured by observing the values of the mean difference curve. The value of the difference at a given across-track distance indicates the amount of vertical error being introduced by incorrect ray-bending corrections.

Residual ray-bending errors occur when the sound velocity profile loaded into the sonar does not match the real world. The errors will normally be reduced if a new sound velocity profile is recorded and loaded into the sonar unit.

Errors in the velocity of sound at the sonar head cause the sonar to miscalculate the beam pointing angles, which result in a symmetric mean difference curve that closely resembles the error due to incorrect sound velocity profiles.

Evaluation Procedure:

At the end of each line, beam analysis was run to measure the ray-bending at the outer edge of the intended usable swath. If the ray-bending exceeded the allowable tolerance, another sound velocity cast was taken.

When the ray-bending appeared to be variable along the line, the survey was segmented into smaller sub-areas.

When the sound velocity changed so quickly in time and space that the specified accuracy could not be met, a narrower swath was used in that area.

Vertical accuracy:

The RMS difference and the confidence interval reflect the vertical accuracy of the system. The 90% confidence interval must be below 0.25 meters when measured beam-by-beam.

Roll Error:

Residual roll error was measured by determining the slope of the mean difference curve with the data being analyzed in terms of cross-track distance. With cross lines, the slope directly indicates the roll bias. With reciprocal lines, the slope will indicate approximately twice the roll bias.

K.6 Each main line was compared to all the cross lines that had overlapping data. A graph was produced for each main line showing the mean difference, RMS difference, and confidence interval for each beam. The graphs showed the multibeam data to be repeatable with 90% of the soundings within 5 to 10 centimeters across the entire swath.

L. JUNCTIONS SEE ALSO THE EVALUATION REPORT

This survey junctions with Gulf of Mexico hydrographic survey H10888 (1999), Sheet G, to the south and hydrographic survey H10890 (1999), Sheet E, to the north. Preliminary evaluations of the junctions reveal that depths match across the sheet limits.

M. COMPARISON WITH PRIOR SURVEYS SEE ALSO THE EVALUATION REPORT

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

N. COMPARISON WITH THE CHART SEE ALSO THE EVALUATION REPORT

N.1 The following nautical chart was used for comparison for this survey. It should be noted that the chart was released after the Work Order was effected. Therefore, a later chart edition than that indicated in Attachment #3 of the Statement of Work is reflected.

Chart Number	Scale	Edition	Edition Date
11330	1:250,000	12	August 8, 1998

All Local Notices to Mariners that applied to the survey area were also taken into consideration for the chart comparison.

N.2 Only ~~five~~ Eight charted soundings lie within the survey limits. Below is a comparison of each of those charted soundings against the survey depths.

The charted sounding of 77 feet, located at approximately 29°02'45"N, 93°14'00"W, is 1 to 2 feet shoaler than the survey depth. ✓

The charted sounding of 72 feet, located at approximately 28°59'48"N, 93°12'24"W, is 8 to 9 feet shoaler than the survey depth. ✓

The charted sounding of 72 feet, located at approximately 28°57'00"N, 93°10'30"W, is 2 to 6 feet shoaler than the survey depth. ✓

The charted sounding of 72 feet, located at approximately 28°55'12"N, 93°11'36"W, is 1 to 5 feet shoaler than the survey depth. ✓

To the east of this sounding an area of disturbed seafloor exists. Depths in this area range from 69 feet to 78 feet.

The charted sounding of 74 feet, located at approximately 28°56'27"N, 93°14'24"W, is 2 to 3 feet shoaler than the survey depth. ✓

The charted sounding of 84 feet, located at approximately 28°52'48"N, 93°14'24"W, is about the same or 1 foot shoaler than the survey depth. ✓

In the extreme southeastern corner there is a 5 foot deep circular de~~pression~~on. Shoal

N.3 There are no charted or AWOIS items within the survey limits.

N.4 Four charted pipelines lie within the survey area. It is recommended that these pipeline locations be maintained as charted. Concur

N.5 ~~One~~ Two charted platforms ~~is~~ are shown in the survey area. At the time of the survey the platform was no longer at the charted location. It is recommended that the platform be removed from the chart. Concur w/ clarification
SEE ALSO THE EVALUATION REPORT

O. <NOT USED BY CONTRACTOR> SEE ALSO THE EVALUATION REPORT "ADEQUACY OF SURVEY"

P. AIDS TO NAVIGATION

P.1 There are no aids to navigation within the survey bounds.

Q. STATISTICS

Lineal nautical miles of sounding lines (Side scan and multibeam)	2132.98 nm
Lineal nautical miles of sounding lines (Multibeam only)	78.98 nm
Square nautical miles (multibeam and 200% side scan coverage)	63.56 nm^2

Number of velocity casts (applied to data)	74
Number of supplemental tide stations	0
Number of horizontal control stations occupied/established	0
Number of items investigated	0

R. MISCELLANEOUS SEE ALSO THE EVALUATION REPORT

R.1 The "Histogram of Selected Soundings by Beam Number" is dominated by peaks at the outer edges of the swath and humps near nadir. The outer swath peaks are centered on beams 40 and 212. The nadir humps are centered near beams 93 and 160. There are also peaks near beam 65 and beam 138.

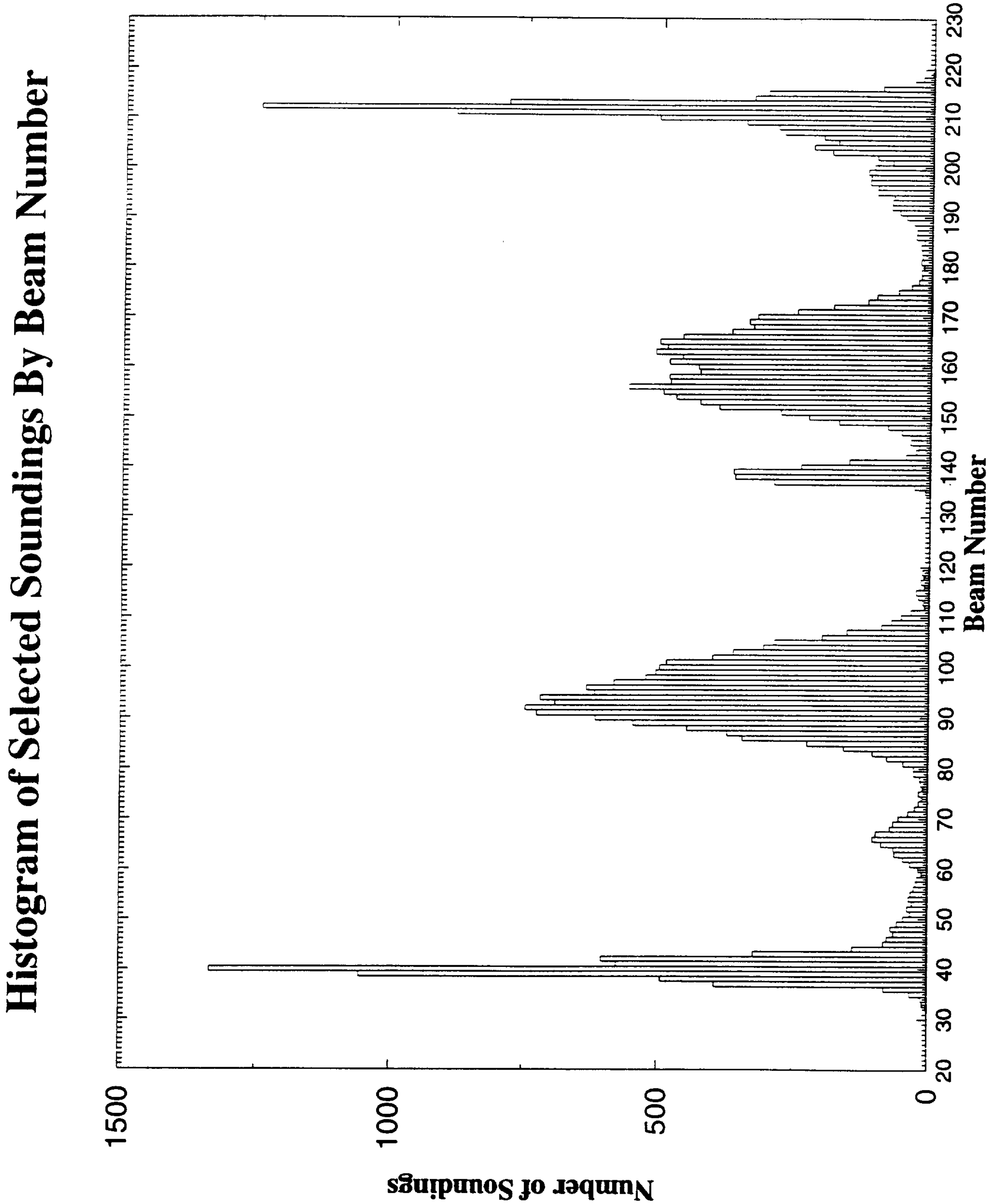
The selected soundings are shoal selected. Therefore, beams that tend to have the most residual noise or shoal bias after processing are over-represented.

In addition to biases and noise, representation in the selected soundings is also a result of data thinning. Specifically, outer beams are favored in the histogram due to the EM3000D's characteristically reduced data density and an "edge effect", which is created when bins do not fall completely within the multibeam swath.

Because the beam distribution of the EM3000-D is FFT and the heads overlap, the data density in the outer part of the swath is only about 5% of the data density near nadir. This results in less data thinning in the outer beams and thus over-representation of the outer beams by a factor of approximately 20.

Due to an "edge effect", bins that fall on the edge of the swath may contain as few as fifteen soundings. Data thinning exacerbates the over-representation of these beams.

The gap at the center of the histogram does not represent an absence of data. It is the result of the Simrad EM3000D's internal beam numbering and reflects overlap between the two transducer heads. Extremely dense data exists at nadir, which is centered at beams 110 to 120 and 140 to 150.


Histogram of Selected Soundings By Beam Number
Beam Number
Number of Soundings
20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
0 500 1000 1500

S. RECOMMENDATIONS

None

T. REFERRAL TO REPORTS

None

SATLOC Network Reference Site Locations

Site	Location	Position		Height (m)
		Latitude (N)	Longitude (W)	
1	Oroville, CA	40° 52.9980'	124° 49.8000'	0.0
2	Olympia, WA	47° 2.0860'	122° 53.8750'	37.6825
3	Carlsbad, CA	33° 10.6310'	117° 1.7432'	72.0003
4	Havre, MO	48° 33.4299'	109° 42.6492'	791.8482
5	Hayden, CO	40° 29.1294'	107° 13.3653'	1997.7965
6	Roswell, NM	33° 23.6976'	104° 35.3462'	1094.9161
7	Lincoln, NE	40° 46.3464'	96° 41.9594'	356.5398
8	Friendswood, TX	29° 32.2868'	95° 9.1430'	13.2840
9	Grand Forks, ND	47° 56.9471'	97° 1.0397'	251.4338
10	Quincy, IL	47° 56.9471'	47° 56.9471'	195.8410
11	Ignace, MI	45° 51.2067'	84° 42.1916'	154.7440
12	Vero Beach, FL	27° 38.6992'	80° 24.2609'	1.7467
13	Richmon, VA	37° 32.2743'	77° 25.7797'	55.5616
14	Orono, ME	44° 54.1224'	68° 40.1203'	23.5873

USCG DGPS Reference Site Locations

Site	Location	Position		Height (m)
		Latitude (N)	Longitude (W)	
1	English Turn, LA	29° 52.70'	89° 56.50'	-
2	Galveston. TX	29° 19.80'	94° 44.20'	-

LETTER OF APPROVAL

REGISTRY NO. H10889

This report and the accompanying smooth sheet are respectfully submitted.

Field operations contributing to the accomplishment of survey H10889 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 Kleiner 12.9.99

Art Kleiner
Hydrographer
C & C Technologies, Inc.
December, 1999

NOAA FORM 76-155
(11-72)

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

GEOGRAPHIC NAMES

SURVEY NUMBER

H-10889

Name on Survey	A ON CHART NO. 11330	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	
CALCASIEU PASS (title)	X		X							1
GULF OF MEXICO	X		X							2
LOUISIANA (title)	X		X							3
										4
										5
										6
										7
										8
										9
										10
										11
										12
										13
										14
										15
										16
										17
										18
										19
										20
										21
										22
										23
										24
										25

Approved:

OCT 4 2000

NOAA FORM 76-155 SUPERSEDES C&GS 197

NOAA FORM 61-29
(12-71)

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

LETTER TRANSMITTING DATA

REFERENCE NO.
N/CS 33-78-00

DATA AS LISTED BELOW WERE FORWARDED TO YOU BY (Check)

- [ ] ORDINARY MAIL
- [ ] AIR MAIL
- [ ] REGISTERED MAIL
- [X] EXPRESS
- [ ] GBL (Give number)________________

DATE FORWARDED 11/20/2000

NUMBER OF PACKAGES 1

TO:

NOAA / National Ocean Service
Chief, Data Control Group, N/CS 3x1
SSMC3, Station 6826
1315 East-West Hwy.
Silver Spring, MD 20910-3282

NOTE: A separate transmittal letter is to be used for each type of data, as tidal data, seismology, geomagnetism, etc. State the number of packages and include an executed copy of the transmittal letter in each package. In addition the original and one copy of the letter should be sent under separate cover. The copy will be returned as a receipt. This form should not be used for correspondence or transmitting accounting documents.

H10889

Louisiana
Gulf of Mexico, 50 nm ESE of Calcasieu Pass

1 Descriptive Report / Evaluation Report

1 Mylar final AHB Smooth Sheet
1 Paper Composite plot for Nos chart 11330
1 Mylar H-Drawing for NOS chart 11330

1 Smooth Sheets (Contractor)
4 Miscellaneous Plots (Contractor)

ATTN: George Myers 301-713-2709

FROM: (Signature) Maxine Fetterly

RECEIVED THE ABOVE
(Name, Division, Date)

Return receipted copy to:

Maxine Fetterly
Atlantic Hydrographic Branch
439 W. York St.
Norfolk, VA 23510

NOAA FORM 61-29 SUPERCEDES FORM C AND GS 413 WHICH MAY BE USED.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1988 - 554-006-61309

11/17/2000

HYDROGRAPHIC SURVEY STATISTICS
REGISTRY NUMBER: H10889

NUMBER OF CONTROL STATIONS	0
NUMBER OF POSITIONS	0
NUMBER OF SOUNDINGS	0

	TIME-HOURS	DATE COMPLETED
PREPROCESSING EXAMINATION	17.0	/ /
VERIFICATION OF FIELD DATA	20.0	/ /
QUALITY CONTROL CHECKS	11.0	
EVALUATION AND ANALYSIS	6.0	
FINAL INSPECTION	13.5	/ /
COMPILATION	27.0	/ /
TOTAL TIME	94.5	

ATLANTIC HYDROGRAPHIC BRANCH APPROVAL	/ /

ATLANTIC HYDROGRAPHIC BRANCH
EVALUATION REPORT FOR H10889 (1999)

This Evaluation Report has been written to supplement and/or clarify the original Descriptive Report. Sections in this report refer to the corresponding sections of the Descriptive Report.

D. AUTOMATED DATA ACQUISITION AND PROCESSING

The following software was used to process data at the Atlantic Hydrographic Branch:

Hydrographic Processing System
NADCON, version 2.10
MicroStation 95, version 5.05
I/RAS B, version 5.01
Caris HIPS/SIPS
AutoCAD, Release 12

The smooth sheet was plotted using a Hewlett Packard DesignJet 2500CP plotter.

H. CONTROL STATIONS

Horizontal control used for this survey during data acquisition is based upon the North American Datum of 1983 (NAD 83). Office processing of this survey is based on these values. The smooth sheet has been annotated with ticks showing the computed mean shift between the NAD 83 and the North American Datum of 1927 (NAD 27).

To place this survey on the NAD 27, move the projection lines 0.890 seconds (27.397 meters or 1.37 mm at the scale of the survey) north in latitude, and 0.554 seconds (15.013 meters or 0.75 mm at the scale of the survey) west in longitude.

L. JUNCTIONS

H10888 (1999) to the south
H10890 (1999) to the north

A standard junction was effected between the present survey and H10888(1999)to the south, and H10890(1999) to the north. There are no junctional surveys to the east or west. Present survey depths are in harmony with the charted hydrography to the east and west.

M. COMPARISON WITH PRIOR SURVEYS

A comparison with prior surveys was not done during office processing in accordance with section 4. of the memorandum titled "Changes to Hydrographic Survey Processing", dated May 24, 1995.

N. COMPARISON WITH CHART 11330 (12th EDITION, AUG. 8/98)

Hydrography

The charted hydrography originates with the prior surveys and requires no further consideration. The hydrographer makes adequate chart comparisons in section N. of the Descriptive Report. The following should be noted:

The following charted platforms were not observed in their charted positions. Only one platform was addressed, but not named, by the hydrographer. It is recommended that data from the Eighth Coast Guard District, New Orleans, Louisiana, be consulted for proper chart disposition.

Platform name	Latitude	Longitude
WOG-WC-254-1	29°01'07"N	93°10'36"W
UXPL-WC-367-1	28°53'22"N	93°14'45"W

Except as noted above, the present survey is adequate to supersede the charted hydrography within the common area.

O. ADEQUACY OF SURVEY

This is an adequate hydrographic/side scan sonar/multi-beam survey. No additional work is recommended.

R. MISCELLANEOUS

Chart compilation was done by Atlantic Hydrographic Branch personnel, in Norfolk, Virginia. Compilation data will be forwarded to Marine Chart Division, Silver Spring, Maryland. The following NOS Chart was used for compilation of the present survey:

11330 (12th Edition, AUG 8/98)

H10889

Robert Snow

Robert Snow
Cartographic Technician
Verification of Field Data
Evaluation and Analysis

APPROVAL SHEET
H10889

Initial Approvals:

The completed survey has been inspected with regard to survey coverage, delineation of depth curves, development of critical depths, cartographic symbolization, and verification or disapproval of charted data. The digital data have been completed and all revisions and additions made to the smooth sheet during survey processing have been entered in the digital data for this survey. The survey records and digital data comply with NOS requirements except where noted in the Evaluation Report.

Maxine Fetterly   Date: 10/17/00

Maxine Fetterly
Cartographer
Atlantic 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.

Robert G. Pol...   Date: 10/31/00

For Andrew L. Beaver
Lieutenant Commander, NOAA
Chief, Atlantic Hydrographic Branch

****

Final Approval:

Approved: Samuel P. DeBow, Jr.   Date: January 31, 2001

Samuel P. DeBow, Jr.
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 H10889

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
11330	11/3/00	Marian [signature]	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.
			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.
			Full Part Before After Marine Center Approval Signed Via
			Drawing No.
			Full Part Before After Marine Center Approval Signed Via
			Drawing No