H10850

NOAA FORM 76-35A

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

DESCRIPTIVE REPORT

Type of Survey MULTIBEAM/SIDE SCAN SONAR

Field No. SHEET R

Registry No. H10850

LOCALITY

State TEXAS

General Locality GULF OF MEXICO

Locality 24 MILES ESE OF GALVESTON

1998-1999

CHIEF OF PARTY
STEVEN A. LEMKE/WALTER S. SIMMONS

NOAA FORM 77-28 (11-72)	U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NO. H10850
	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. **R**

State TEXAS

General locality GULF OF MEXICO

Locality 24 MILES ESE OF GALVESTON

Scale 1:20,000 Date of survey 18 Nov 1998 – ~~24~~ 25 Jan 1999

Instructions dated 23 October 1997 as amended Project No. OPR-K171-KR

Vessel M/V Neptune

Chief of party STEVEN A. LEMKE

Surveyed by S. Lemke, W. Simmons, D. Walker, R. Nadeau, L. Gates, M. Estaphan, A. Quintal, S. Ferguson, R. Fischman, L. McAuliffe, B. Andrews, M. Nuzzo, J. Pinhiero

Soundings taken by **echo sounder**, hand lead, pole MULTIBEAM RESON SEABAT 8101

Graphic record scaled by survey personnel

Graphic record checked by survey personnel

Protracted by N/A Automated plot by HP750C ~~HP Designjet~~ 2500CP

Verification by Atlantic Hydrographic Branch Personnel

Soundings in fathoms **feet** meters at MLW **MLLW**

REMARKS: Contract # 50-DGNC-8-90025/SAIC
Contractor Name: Science Applications International Corp.
221 Third Street; Newport, RI 02840

* Hardwritten notes in the Descriptive Report were made during office processing.

AWOIS ✓ & SURF ✓ by MBH on 5/1/01

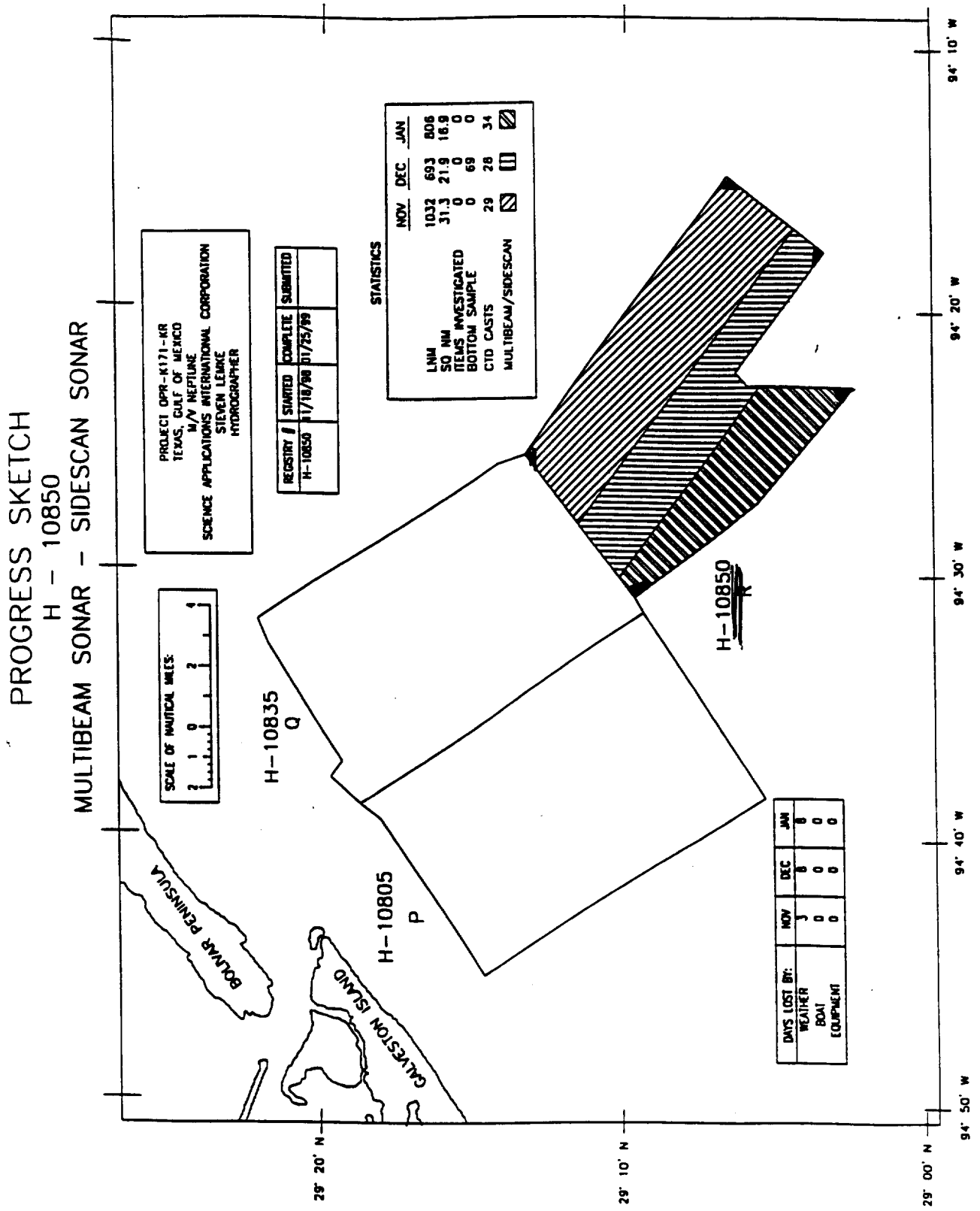
NOAA FORM 77-28 SUPERSEDES FORM C&GS-537.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1976—665-661/1222 REGION NO. 6

INDEX OF SHEETS

The Progress Sketch on the following pages indicate:

1. Survey Outlines
2. Filed Survey Letters and Survey Registry Numbers
3. Work Accomplished by Month


PROGRESS SKETCH
H - 10850
MULTIBEAM SONAR - SIDESCAN SONAR
PROJECT OPR-K171-KR
TEXAS, GULF OF MEXICO
M/V NEPTUNE
SCIENCE APPLICATIONS INTERNATIONAL CORPORATION
STEVEN LEMKE
HYDROGRAPHER
REGISTRY # | STARTED | COMPLETE | SUBMITTED
H-10850 | 11/18/98 | 01/25/99 |
STATISTICS
NOV DEC JAN
LNM 1032 693 806
SQ NM 31.3 21.9 18.9
ITEMS INVESTIGATED 0 0 0
BOTTOM SAMPLE 0 69 0
CTD CASTS 29 28 34
MULTIBEAM/SIDESCAN
SCALE OF NAUTICAL MILES:
2 1 0 2 4
H-10835
Q
H-10805
P
H-10850
BOLIVAR PENINSULA
GALVESTON ISLAND
DAYS LOST BY: NOV DEC JAN
WEATHER 3 8 8
BOAT 0 0 0
EQUIPMENT 0 0 0
29° 20' N
29° 10' N
29° 00' N
94° 50' W
94° 40' W
94° 30' W
94° 20' W
94° 10' W

Science Applications International Corporation (SAIC) warrants only that the survey data acquired by SAIC and delivered to NOAA under Contract 50-DGNC-8-90025/SAIC reflects the state of the sea floor in existence on the day and at the time the survey was conducted.

*Filed with the original field records.

*Filed with originae field records

List of Figures

List of Tables

Descriptive Report to Accompany
Hydrographic Survey H10850
Scale 1:20,000 Surveyed 1998/1999
M/V NEPTUNE
Science Applications International Corporation (SAIC)
Steven A. Lemke, Hydrographer

A. PROJECT

Project Number: OPR-K171-KR
Dates of Instructions: 23 October 1997 **Original:** 50-DGNC-8-90025/SAIC
5 January 1998 Modification #1:56-DGNC-8-24001/SAIC
7 August 1998 Modification #2:56-DGNC-8-24002/SAIC
9 November 1998 Modification #3:56-DGNC-8-24003/SAIC
Dates of Supplemental Instructions: 4 August 1998
Sheet Letter: R
Registry Number: H10850
Purpose: 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.

B. AREA SURVEYED

Description:

The area surveyed was primarily the convergence of five Shipping Safety Fairways at the Approach to Galveston, Texas and the Precautionary Area at the junction of these five fairways. The following coordinates bound the survey approximately:

29.161523 N	094.514909 W
29.223433 N	094.425307 W
29.112429 N	094.247297 W
29.059374 N	094.294823 W
29.107432 N	094.371699 W
29.100379 N	094.380273 W
29.042843 N	094.379977 W
29.094641 N	094.454006 W
29.161523 N	094.514909 W

Dates of multibeam data acquisition (UTC):

11/18/98 – 11/20/98	JD 322 – 324
11/23/98 – 11/29/98	JD 327 – 333
12/01/98 – 12/03/98	JD 335 – 337
12/13/98 – 12/17/98	JD 347 – 351
12/29/98 – 12/30/98	JD 363 – 364
01/11/99 – 01/21/99	JD 011 – 021
01/24/99 – 01/25/99	JD 024 – 025

Dates of side-scan data acquisition (UTC):

11/18/98 – 11/20/98	JD 322 – 324
11/23/98 – 11/29/98	JD 327 – 333
12/01/98 – 12/03/98	JD 335 – 337
12/14/98 – 12/17/98	JD 348 – 351
12/29/98 – 12/30/98	JD 363 – 364
01/05/99 – 01/06/99	JD 005 – 006
01/11/99 – 01/21/99	JD 011 – 021
01/24/99 – 01/25/99	JD 024 – 025

C. SURVEY VESSEL

The M/V Neptune was the platform for multibeam sonar, side-scan sonar, sound velocity, and bottom sample collection. Multibeam and side-scan data acquisition systems were mounted in the main cabin of the M/V Neptune and post processing systems in a CONEX container welded in place on the aft deck of the M/V Neptune. The POS/MV IMU was mounted on the vessel centerline just forward and above the RESON 8101 transducer, below the main deck. Multibeam sounder transducers were mounted on the keel. The side-scan sonar tow position was located at the "A" frame aft center. A Kevlar cable manipulated by hand was used for these configurations. Table C-1 is a list of vessel characteristics for the M/V Neptune.

Table C-1. Survey Vessel Characteristics

Vessel Name	LOA (Ft)	Beam (Ft)	Draft (Ft)	Gross Tonnage	Power (Hp)	Registration Number
M/V Neptune	106.9	26	8	90	1200	D595478

The M/V Neptune layout is depicted in Figure C-1 and the vessel offsets are shown in Table C-2. Figure C-2 shows the M/V Neptune's draft calculations. The Reference Point for the entire multibeam system is located at the top centerline of the POS/MV IMU. The transducer depth was recorded as 3.42 meters from the boat's main deck. The boat deck to waterline was measured and subtracted from the transducer hull depth to determine the draft of the electronic center of the transducer. Lead line comparisons to the corresponding beam confirmed the 3.42 meters as the correct transducer depth below deck. Measurements were made on each side of the vessel before departure from port and upon return to port to prorate the daily draft for fuel and water consumption.

Figure C-1. Configuration of M/V Neptune during Survey Operations

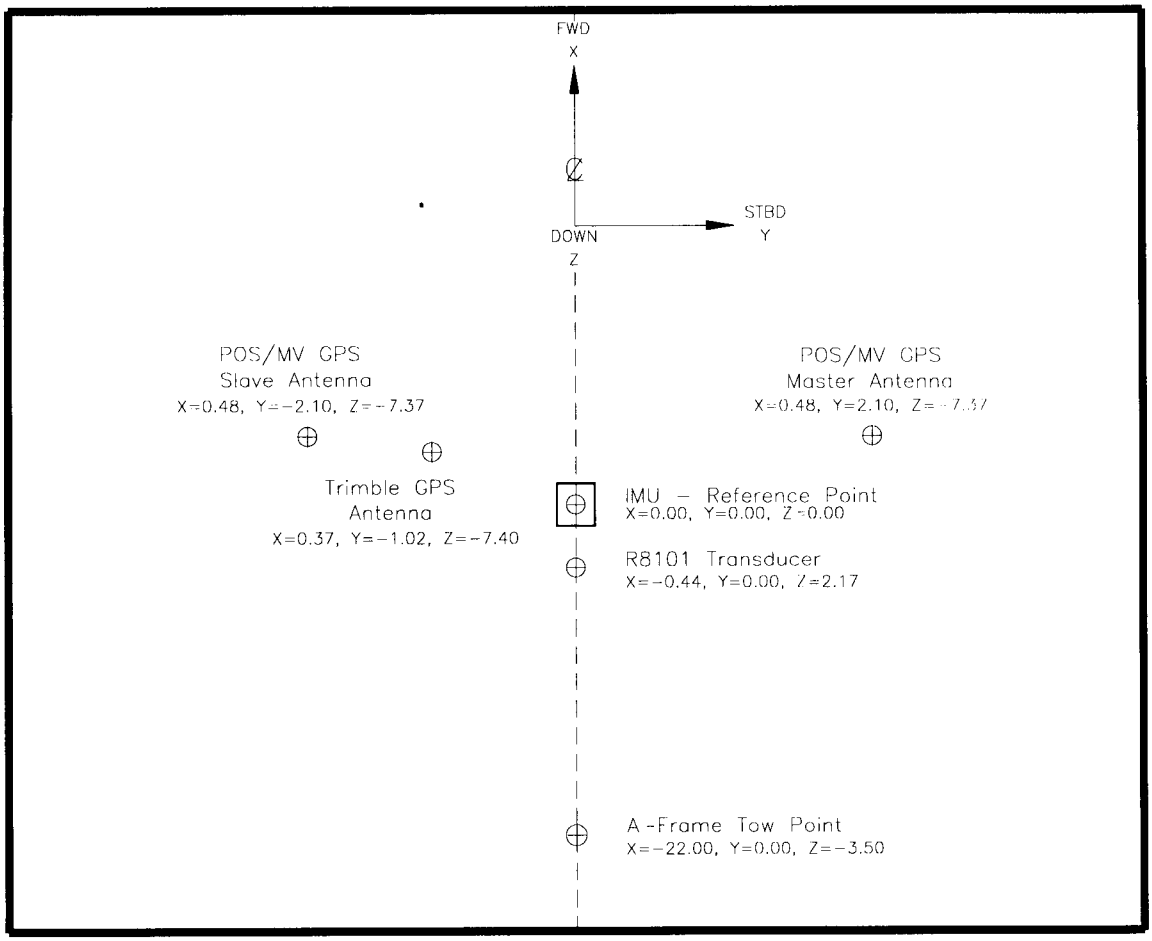
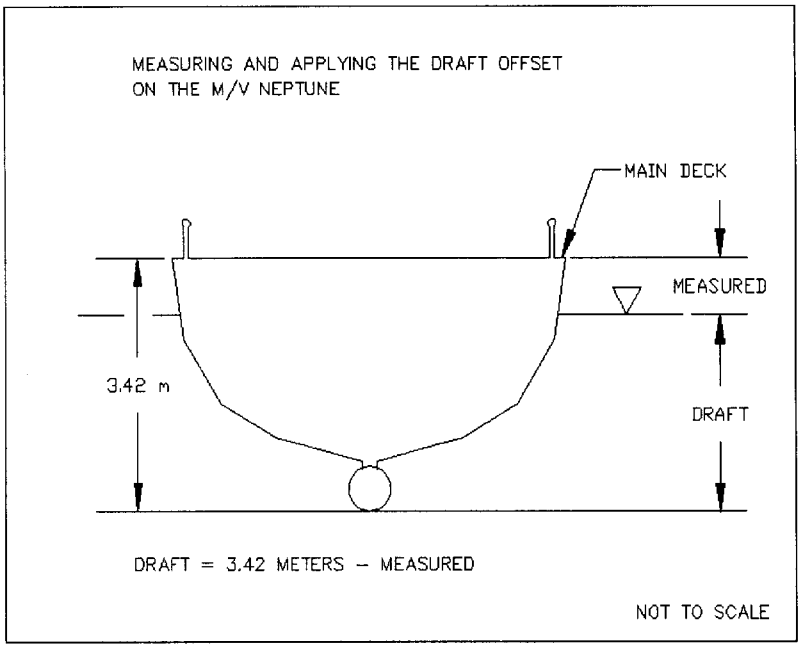


Table C-2. M/V Neptune Antenna and Transducer Locations Relative To the POS/MV IMU Vessel Reference Point

Sensor	Offset in ISS2000		POS/MV IMU	
Multibeam	X		x	-0.44
Reson Coordinate	Y		y	0
	Z		z	2.17
Trimble 7400	X	0.37		
	Y	-1.02		
	Z	-7.40		
GPS Differential Master Antenna			x	0.48
			y	2.10
			z	-7.37
Side-scan Tow PT	X	-22.0		
"A" frame aft	Y	0		
	Z	-3.5		

Figure C-2. M/V Neptune Draft Determination



The SAIC Integrated Survey System (**iss2000**) and the RESON 8101 multibeam system have different coordinate systems, and therefore care must be taken when inputting correctors to the system. The **iss2000** considers "z" to be positive down, while both the RESON and POS/MV consider "z" positive up. Both the **iss2000** and POS/MV consider "x" positive forward, the RESON considers "x" as positive athwart ships to starboard. The SAIC **iss2000** considers "y" positive athwart ships to starboard, the POS/MV considers "y" positive athwart ships to port and the RESON considers "y" as positive forward.

D. AUTOMATED DATA ACQUISITION AND PROCESSING – See also Evaluation Report

Data acquisition was through the SAIC **iss2000** system. Survey planning, real-time navigation, and data logging were controlled by the **iss2000** on a HP UNIX machine, with navigation and data time tagging running on an OS/2 machine. The **iss2000** provided navigation data to the Klein 2000 sonar system for merging with the side-scan sonar data.

Navigation was recorded from the POS/MV system in the M/V Neptune and from the Trimble 7400. Positioning confidence checks were performed alongside survey control stations in port. Daily positioning confidence checks for the M/V Neptune were done by comparing data recorded from the POS/MV to data recorded from the Trimble DGPS.

The RESON 8101 range scale was maintained at 50 meters for the entire survey. The data acquisition rate for the R8101 was set at 8 pings per second for vessel speeds above 6 knots, and at 5 pings per second for vessel speeds of 6 knots or less. This means that the specified on average 3.2 pings per 3 meters could be obtained at up to 14.5 knots with the 8 pings per second data rate, and at up to 9 knots at the 5 pings per second data rate. At the most common speeds the results were: 10 knots, 8 per pings second, on average 4.6 pings per 3 meters; 6 knots, 5 pings per second, on average 4.9 pings per 3 meters. In all cases the specified on average 3.2 pings per 3

meters was met.

The side-scan sonar equipment used throughout the H10850 survey was the Klein 2000 System. This system recorded data on 8mm Exabyte data tapes as well as side-scan thermal paper rolls. Both channels were set at a range scale of 75 meters. The vessel speed was maintained at 6.0 knots or less, so that there were three or more side-scan sonar pings per meter along track. Once collected, a side-scan processor reviewed the side-scan paper rolls and data tapes. The processor, with the assistance of the hydrographer, would find and verify targets. The processor would also note data gaps due to weather, system problems, the fish altitude out of range, data masking, or any other events that would cause the data to be rejected. The digital data were converted into .xtf format where contact list files (*.cnv) could be generated using ISIS. These files are used for side-scan contact to multibeam feature correlation analysis in the **iss2000** system.

Cleaning of the R8101 multibeam data began with an evaluation of the navigation track line. An automated filter was then applied for minimum and maximum depths of 4 and 20 meters. Then the interactive editing was performed to remove noise, fish, etc. The editing process used the geoswath geo-referenced editor which allowed for both plan and profile views with each beam in its true geographic position and depth. Tidal correctors were not applied in real-time. Observed tides were down loaded from the OPSD/NOAA web page. Preliminary and verified data from the Sabine Offshore Station (877-1081) were applied to the multibeam data using the zoning provided August 4, 1998. NOAA memorandum, "Final Water Level Data for Application to Hydrographic Survey OPR-K171-KR-1998", which is in Appendix F. All H10850 multibeam data were reprocessed with verified tide data from the Sabine Pass Offshore (877-1081) station as downloaded from the NOAA/OPSD web page on February 24, 1999.

Depth data were then gridded to 1-meter cells for quality evaluation and for comparing to side-scan sonar contacts. When anomalies were seen in the 1-meter grids, the edited multibeam files were re-examined and re-edited as needed. When all multibeam files were determined to be satisfactory, the data were binned to a 10-meter cell size, populating the bin with the shoalest sounding in the bin and maintaining its true position and depth with tracking to the gsf data file.

Soundings were selected from the 10-meter binned layer using the **sel_sound** sounding selection software. This routine starts with the shoalest sounding in the survey, flags out soundings that would overlap it on the plot, proceeds to the shoalest remaining sounding and repeats the above process until all soundings in the 10-meter bin layer have been evaluated. The **set_sound** program was run to flag all selected soundings in the gsf multibeam file. The selected sounding file, the platform and navigation aids file, and the feature file were combined to produce the smooth sheet in **AutoCAD**.

Throughout this descriptive report wherever software is mentioned, it is inferred that the most current version of the software available was used. A complete list of all software versions and dates is provided in Appendix K.

Processing of side-scan sonar data is discussed in Section E.

† Data filed with original field records

The real time multibeam acquisition system used for the H10850 survey included:

One UNIX workstation – Used for system control, survey operations, real-time quality control.
One personal computer – Used for running POS M/V and Trimble software and for downloading and conversion of sound velocity data from CTD's.
One personal computer – Used for navigation and time syncing on the O/S-2 operating system.
A custom computer from RESON was used to operate the 8101 system.
A custom computer from RESON was used to operate the R6042 system.

Uninterrupted power supplies (UPS) protected the entire system.

Multibeam Data Processing

Multibeam data processing was done in two stages. Initial data cleaning and validation was done shortly after the data was collected, usually by the same watchstander who had collected the data. To maintain a high degree of continuity between data collection and data processing it was convenient to split a watchstander's work into two phases, one to collect data and the next to process that same data.

On a watch by watch basis, tracklines were made, verified, and corrected to ensure data coverage and also check for navigation errors. Next, outer beams of the multibeam data, which exceeded the accuracy standards calculated by the Hydrographer, were flagged as ignore using the **iss2000** software. Multibeam data was manually edited and the preliminary multibeam coverage grid was then updated. Each watchstander would perform a backup of all data on the processing system at the end of each processing watch. After the watchstander had completed the initial data cleaning, the data were verified by a different watchstander. Any questionable possible obstructions were written down and later evaluated by the Hydrographer. A data manager on the survey vessel would later correct the data for draft and tides, make updated coverage grids, tracklines, sounding grids, selected sounding plots and preliminary data products. The data manager's duties also included routine system backups on all computers except the processing computer and quality control on all data.

In the processing lab in Newport, RI, further quality control occurred and corrections were made to all data. Contact analysis was performed correlating side-scan targets with multibeam features. Multibeam coverage and sounding grids were updated following changes found during the contact analysis. The **iss2000** system used proprietary algorithms to create the grids and selected soundings. Final plots were produced exporting data to a dxf format using the **iss2000** software. These data were then imported into **AutoCAD** for final map production.

E. SIDE-SCAN SONAR

The following side-scan sonar equipment was used for the H10850 survey:

Klein 2000 Side-scan Sonar System towfish leased from RentMAR
Serial Number 122
Vertical beam width 40°, 10° depression, 100/500kHz. (100 kHz data recorded)

1. Side-scan Sonar Data Acquisition Procedure

The watchstander would always have the assistance of the previous watchstander who was located close by processing data. This assistance was necessary for conducting CTD casts as well as towfish deployment and retrieval.

The Klein2000 system was used in the 100 kHz mode during this survey. Side-scan operations were conducted in water depths ranging from 39 to 55 feet. The side-scan towfish altitude off the bottom was maintained between six and 15 meters. The amount of cable deployed was determined by counting the tape markings on the cable. Each tape mark represented 5 meters. As the cable length was adjusted to maintain the proper fish altitude, the operator noted the markings on the cable and entered the value of cable out into the **iss2000**, which calculated layback and fish position. Survey line spacing was 65 meters.

Survey lines were run at an azimuth of 126° and 306°. Both navigation and side-scan sonar data were logged continuously throughout each survey day. Navigation file names were manually changed after each survey line was completed. The range scale was set to 75 meters and never changed throughout the survey. Due to the generally flat nature of the bottom in the survey area, maintaining towfish height above the bottom was relatively easy. Typically, only one or two adjustments to the length of cable deployed were necessary during any survey line.

To verify that the side-scan signal reached the full extent of the slant range setting, records were checked for location of known objects at the far edge of the slant range. Daily confidence checks were conducted using trawl marks and anchor scours that ran through both channels while on line.

When the correct adjustments are made to the Klein system's bottom tracking program, towfish altitude is displayed on the screen. This allowed easy monitoring of towfish altitude. Once proper survey speed was reached and maintained, fine-tune adjustments could be made to the fish altitude by adjusting the length of cable deployed. During periods of good weather, when surface noise was not a problem, the towfish was kept well above the minimum height so that changes in vessel speed did not cause the towfish to drop too low. To avoid hitting the bottom with the towfish during turns, wide turns were made whenever possible so that the amount of cable deployed would not have to be decreased during turns.

2. Problems Encountered During Side-scan Sonar Survey Acquisition

Very large schools of fish and shrimp caused problems by producing large black areas on the side-scan sonar records and sometimes large shadows as well. This normally occurred in the early morning. These areas were all considered gap areas and were rerun as gap fill survey lines.

There was vessel traffic within the survey area, mostly from shrimp boats. The wake from these vessels would sometimes be all that was discernible on the side-scan sonar record. These sections were all considered gap areas and were rerun as gap fill survey lines. When collision with another vessel was eminent, the current survey line was aborted. When this occurred, the survey line was reacquired from the point at which it was aborted, with some overlap to ensure there would be no data gaps. Many shrimp boats that were encountered would not answer their VHF radios after numerous attempts to contact them.

Weather had a negative impact on the quality of the side-scan data. When trying to collect side-scan data in seas of 4-5 feet, the towfish had to be run as deep as specifications would allow in

order to avoid surface noise.

There were minor problems with the loss of GPS, but these were infrequent and usually did not last very long and any resulting gaps were filled later. Losses of the Differential GPS signal from the Coast Guard beacon was experienced on only one day.

3. Side-Scan Sonar Processing

A side-scan processor manually looked at each hardcopy record to review the data and make corrections to annotations if necessary. The processor analyzed the data while noting issues in a text document. Issues would include data gaps, targets, amount of cable out, biota in the water column, etc. The time, paper roll number, survey line, digital tape number, start/end of line, and the cause of any data gaps were all logged in the text document. Digital records were also reviewed and compared with hardcopy records. The text document was updated to reflect changes seen in the digital records.

The digital side-scan records from the Klein 2000 system were converted from the Klein proprietary format to extended triton format (XTF) using a program called Tape2000 purchased from Klein. These XTF files were copied to 4mm tape in tar format and are considered a deliverable to be used with CARIS SIPS. The XTF data also allowed data review and target analysis in Triton Isis.

Catenary files used for tracklines and coverage plots were extracted from the XTF files using a SAIC proprietary program called NAVXTF. This is beneficial for two reasons, the first being that the catenary files, which require a relatively small amount of disk storage space, can summarize the time and position for the XTF formatted data. Thus, they were a good quality check on the XTF formatted data. The second reason was that the catenary files have the same format as the tracklines in **iss2000** and were also used to generate coverage plots.

A time window file was created for each 100% of coverage in order to create both tracklines and coverage plots. The **iss2000** system uses the catenary (towfish navigation) files to create plots using only the good data as defined by time in the time window file. By viewing the coverage plots in the **iss2000** survey-planning tool, a user can easily plan survey lines to fill in any data gaps.

Side-scan Target Analysis

In addition to manually viewing the hardcopy records, ISIS and Target Post Processing Software (Triton/Elics Inc.) were used to select and process target information from the XTF sonar files. Target information includes the following:

1. Year and Julian Day target was acquired.
2. Time target was acquired.
3. Target position Latitude and Longitude.
4. Target identifier (i.e. OBST for Obstruction).
5. Slant range to target (Note: Negative number if target is detected on port side).
6. Fish altitude when target acquired.
7. Target height based on length of shadow and geometric calculation using steps 5 & 6.

Target information is stored in a CTV file and imported into **iss2000**. Once in the **iss2000** system, targets were correlated by position and name. If necessary, target names were used to

find and view digital or hardcopy images of the two targets for shape consistency. After target correlation with all side-scan data, a one-meter grid of the multibeam data was displayed with side-scan targets overlaid on top. Bathymetric features in the multibeam data were then compared with the side-scan target data.

F. SOUNDING EQUIPMENT

The following components were used for acquisition of multibeam bathymetric data using the RESON SeaBat 8101 multibeam system which consisting of:

- One SeaBat Transducer, Serial Number 019704, before Julian day 345, and Serial Number 099707, on and after Julian Day 345
- One SeaBat 8101 Processor, Serial Number 6597
- SeaBat 6042 Controller and Processing Unit, Serial Number 590 P0 794-387

A lead line made of Kevlar line with a 10-lb. mushroom anchor as a weight was used for checking the multibeam echo sounder. The line was marked in feet and was calibrated against a steel tape.

It was found that the RESON 8101/R6042 produced a nearly constant "frown" profile when viewing the data along track. Careful analysis showed that the data met the depth accuracy criteria. Discussions with RESON have not resolved the cause.

G. CORRECTIONS TO SOUNDINGS

1. Speed of Sound

The following systems were used to determine sound velocity profiles for corrections to multibeam sonar soundings.

- Sea-Bird Electronics, Inc., Model 19 CTD, Serial Number 193607-0565, Calibration Date 25 March 1998.
- Sea-Bird Electronics, Inc., Model 19 CTD, Serial Number 1919165-1911, Calibration Date 30 July 1998.

Speed of sound profiles was computed from casts taken with Sea-Bird Electronics, Inc. model 19 CTD. The primary unit was SBE19 #0565. Daily confidence checks were obtained from simultaneous casts with the primary CTD and with SBE19 #1911. All profiles were computed using **SBE Term19**. Computed profiles were copied to the **iss2000** for comparison on the screen. A selected profile was applied to the system, recorded, and sent to the RESON 6042 where a refraction lookup table was computed for application of depth, angle and range correctors to the multibeam sounding data. If sounding depths exceeded the cast depth, the 6042 used the bottom of the table to extend correctors below the table.

There were many factors determining how often a CTD cast was needed. Before the survey began, conditions such as shape and proximity of the coastline, sources and proximity of freshwater and seasonal changes were taken into consideration. After downloading each CTD cast, each was converted to the proper format and compared to the previously applied cast. This procedure allowed for the development of patterns of when CTD casts should be taken. A cast was taken at least once during each 6-hour watch. There were biases toward taking more just

after dawn and dusk and less just before dawn and dusk.

Quality control tools, including real-time displays and a multibeam swath editor, were used to monitor how the sound velocity was effecting the multibeam data. The survey area being primarily of gentle slope, severe effects due to improper sound velocity could easily be seen by viewing multibeam data in an along track direction.

A constant monitoring of weather conditions also had an influence on the frequency of CTD casts. During a bright, sunny day with glassy sea conditions, the thermocline would fluctuate much more rapidly than the days in which there was either overcast or the water surface conditions were rippled by wind. Sunnier days required more frequent CTD casts than did overcast or windy days.

A table including all CTD casts, dates of each cast, the location of the cast, and the maximum depth of each cast is located in Appendix J.

2. Instrument Corrections

No instrument corrections were necessary after the initial installation and calibration was complete.

3. Corrections Determined from Vertical Casts

Lead line comparisons to multibeam center beam soundings were made at least every two weeks to verify the transducer draft and echo sounder instrument correctors. For each comparison, a CTD cast was taken and the sound velocity profile loaded into the **iss2000** and the RESON 6042. Twenty lead line readings, ten from the port side and ten from starboard, were recorded along with the UTC time of observation while the **iss2000** recorded the multibeam readings. **Exammb** was used to determine the appropriate port and starboard beam depth readings for the time and position of each lead line reading.

The results of these readings were entered into a spreadsheet along with the draft readings and any squat correctors that may have been entered into the **iss2000**. The spreadsheet applied a calibration corrector to the lead line readings and converted the readings from feet to meters. It also applied correctors for any settlement and squat inadvertently left in the **iss2000** to the port and starboard multibeam readings.

Each corrected lead line cast depth was compared to the simultaneous multibeam. The ten comparisons were averaged and the standard deviations were computed. The lead line cumulative results are included in Appendix G.

4. Static draft

Depth of the transducer below the deck was determined from measurements made while the boat was on the marine railway, and was verified by lead line comparisons. The static draft was observed by measuring from the main deck to the waterline before getting underway from Galveston and subtracting that measurement from the transducer distance below the deck. If the static draft value changed from the previously noted value, the new value was entered into the RESON system. The static draft was again determined upon return to port and the change in draft was prorated on a daily basis. The prorated draft results are reported in Appendix G.

* Data filed with original field records

5. Settlement and Squat

Measurements of settlement and squat were conducted near 29 20.24N 094 38.10W on day 193, July 12, 1998, in ten meters of water. The following procedures were used to determine the settlement and squat correctors:

- Selected an area of flat bottom at a depth similar to the survey area.
- Planned a survey line across the flat bottom.
  1. Considered the current and wind in planning the line.
  2. Used NOAA Galveston Pleasure Pier (877-1510) station for the water level during the test.
  3. Calibrated the echo sounder, and applied sound velocity profile for the test area. (Timing latency and pitch, roll and heading biases had been determined and applied.)
  4. Approached the line at a slow to moderate speed, brought the RPM's to zero and drifted down the line while recording soundings over the flat bottom.
  5. Ran the line at each of the predetermined RPM settings while recording soundings over the flat bottom.
  6. Applied water level correctors to the soundings.
  7. Subtracted the depth determined from each of the RPM passes from the depth determined on the drifting, zero RPM pass. These differences are the settlement and squat correctors to be applied when operating at the corresponding RPM.
  8. Constructed a lookup table of RPM and settlement and squat correctors in the configuration file so that the computer could interpolate a corrector based upon the RPM entered into the system

Geoswath was used to measure the depth for each pass. The results were compiled into a lookup table of vessel's engine RPM vs. settlement and squat. When on survey line, the engine's RPMs were entered into the **iss2000** system by the real-time system operator. The computer applied settlement and squat correctors interpolated from the lookup table, and recorded them in the "Depth Corrector" field of the GSF data file for each ping.

All results are reported in Appendix G - Settlement and Squat Test.

6. Roll, Pitch and Heading Biases

The following sensor was used for acquisition of Heave, Roll, Pitch and Heading data:

- TSS POS/MV Inertial Navigation System, Serial Number 024

The POS/MV was used for heave, roll, and pitch. The accuracy of the sensor was five percent of one meter or five centimeter for heave ± 0.10° dynamic accuracy for roll and pitch, and ± 0.05° static accuracy for roll and pitch. The POS/MV was used for heading. The dynamic heading accuracy of the unit is better than 0.05°.

Heading, roll, and pitch biases were determined in a series of tests performed in the survey area prior to the start of the survey. A second set of tests was performed after the transducers were changed on JD 347, and a third set of tests were performed on JD 010 after the transducer had be pulled to replace the transducer cable. Prior to conducting any of the tests, a CTD cast was taken to determine the sound velocity profile and entered into the RESON system. Initially the roll, pitch and heading bias was set to 0° in the RESON system.

The roll bias test was run first in an area with relatively flat bottom. The range scale of the

* Data filed with original Field records.

RESON was set to 50 meters. Three lines were run spaced 40 meters apart and each line was run in both directions. The data from parallel lines in the same direction were used for roll bias calculations so that the depths from the center beams from one line were compared against the depths of the mid-swath beams. Tidal corrections were applied to all data before roll corrections were calculated using routines in the **Survey Analysis** software. Roll bias results are shown in Appendix G.

After the roll biases were calculated and entered into the RESON system, a pitch bias test was conducted. The pitch test was conducted by surveying multiple reciprocal lines perpendicular to an anchor scour. During the pitch test, ship speed was maintained at as constant a rate as possible. Tidal corrections were applied to all data before the pitch bias was calculated. Pitch biases were computed by comparing runs in opposite directions. There was no discernable pitch bias as a result of these tests. A bias of 0.0° was kept in the system for both transducers.

Following the roll and pitch bias tests, a heading bias test was conducted. For the heading bias test, five parallel lines were run in opposing directions so that the inner beams from the transducer overlay the intermediate or outer beams of adjacent swaths. The heading bias was then determined by measuring the distance between equal depths and calculating the angle subtended by that distance. Tidal corrections were applied to all data before heading corrections were calculated using routines in the **Survey Analysis** software. After repeated inconclusive test results, it was deemed that the heading bias was zero for both transducers. It is believed that the shallow water depths of the survey area combined with the accuracy of the navigation makes it extremely difficult to measure small degrees of heading bias. Further proof of a heading bias of zero lies in trawl marks crossing through numerous swaths with perfect alignment.

Table App. G-6 contains the results of the Accuracy test conducted on JD 197. The Accuracy Test for data collected after the transducer change was derived from two lines run along the northwest sheet limit and compared to the north ends of the mainscheme lines run in the common area.

Roll, pitch, and heading biases applied in H10850 are shown in Table G-1.
* Verified tides from NOS CO OPS website have been applied by the field unit to the survey data.

Table G-1. Roll, Pitch, and Heading Bias for the M/V Neptune

Julian Days	322-343	346-010	010-025
Roll	0.216	0.270	0.240
Pitch	0.0	0.0	0.0
Heading	0.0	0.0	0.0

H. CONTROL STATIONS - See also Evaluation Report

The horizontal datum used for the survey was the North American Datum (NAD) 1983.

Horizontal control station CG-20 1974 was used for independent checks of the positioning systems on the survey vessel. Data for this station was downloaded from the NOAA/OPSD web page.

* Data filed with original field records

I. HYDROGRAPHIC POSITION CONTROL

The following equipment was used for positioning on the M/V Neptune:

- TSS POS/MV Serial Number 024
- Trimble 7400 GPS Receiver, Serial Number 3713A18839
- Magnavox MX50R Differential Beacon Receiver, Serial Number 302
- 41R Differential Beacon Receiver, Serial Number 3508-102-18550

The primary hydrographic positioning equipment was the POS/MV on the M/V Neptune using correctors from the USCG differential station at Galveston, TX. By setting real-time system thresholds, HDOP, number of satellites, elevation of satellites, and age of correctors were monitored to ensure that the resulting hydrographic positioning errors, at the 95% confidence level, did not exceed ten meters.

When in port, the M/V Neptune tied up to Pier 15 where measurements were made to calculate the offset between the hydrographic navigation position and horizontal control station CG-20, 1974. While measurements were being made, navigation data were being logged. Comparison of the navigation center position computed from the control station and the average position based on navigation resulted in confidence checks that were well within specifications, with no more than 3 meters inverse distance from the check position. Daily position confidence checks were established using a Trimble DGPS with correctors from the U.S. Coast Guard station at Port Aransas, TX. A real-time monitor raised an alarm when the two DGPS positions differed by more than 10 meters horizontally. Positioning confidence checks were well below the allowable inverse distance of less than 15 meters.

The USCG Galveston DGPS station was used as the primary positioning corrector source. The USCG Port Aransas, TX DGPS station was used for daily positioning confidence checks in the M/V Neptune. From JD011 to JD013 data were collected using the USCG Port Aransas, TX DGPS station (#32). The primary DGPS receiver used automatically locks onto the strongest DGPS signal, thus when the USCG Galveston DGPS station came back online M/V Neptune immediately switched over to it

On the M/V Neptune, all antenna, transducer, towpoint, and towfish offsets were measured relative to the POS/MV's IMU. Two separate teams of two people measured and calculated all offsets using a measuring tape. The final offsets from both teams were then compared and agreed very well.

The **iss2000** software calculates the towfish position using an input cable out value and the towpoint configuration or offsets previously measured.

J. SHORELINE

Not applicable.

K. CROSSLINES

There were 182 linear km of crosslines surveyed and 3850 linear km of mainscheme lines surveyed resulting in 4.73 percent coverage by crosslines. Two crosslines originally scheduled were inadvertently removed from the schedule prior to collection. This left the percentage of crosslines to mainscheme comparisons lower than planned. With the exception of two fill lines used for crossline comparisons, all crosslines were collected with transducer serial #019704.

Comparisons of all crossing data in the 1xIHO swaths using MBHAT software, show that more than 96 percent of comparisons are within 30 centimeters and 99.98 percent of comparisons are within 50 centimeters. All comparisons show a bias toward a negative count revealing that the mainscheme data tends to be slightly deeper than most of the crosslines. Further analysis suggested that there was a slight datum change between the two transducers used. All of the negative differences greater than 50 centimeters were observed in the data collected with the second transducer and then compared to the crosslines collected with the original transducer. In comparing four lines of mainscheme that were collected with both transducers there appears to be a datum change of approximately 10 centimeters. The change is also noted in the comparison to sheet Q. The transducer mounting point was not changed between the two transducers and the roll, pitch and heading tests compare favorably. Discussion with RESON has not resolved the cause of the discrepancy.

Table K-1. Junction Analysis Mainscheme vs. Crosslines

Depth Difference Range	All Differences		Positive Differences		Negative Differences		Zero Differences
	Count	Percent	Count	Percent	Count	Percent	Count
To 10 cm	1,847,173	51.98	774,201	57.44	960,867	45.89	112,105
To 20 cm	1,044,683	81.37	431,875	89.48	612,808	75.16	
To 30 cm	523,481	96.10	123,727	98.66	399,754	94.25	
To 40 cm	125,321	99.63	17,568	99.96	107,753	99.39	
To 50 cm	12,559	99.98	538	100.00	12,021	99.97	
To 60 cm	670	100.00	2	100.00	668	100.00	
To 70 cm	12	100.00	0	100.00	12	100.00	
To 80 cm	0	100.00	0	100.00	0	100.00	
To 90 cm	0	100.00	0	100.00	0	100.00	
To 100cm	0	100.00	0	100.00	0	100.00	
>100 cm	0	100.00	0	100.00	0	100.00	
Totals:	3,553,899	100.00%	1,347,911	37.9%	2,093,883	58.9%	3.2%

*L. JUNCTIONS – See also Evaluation Report

This survey junctions with H10835 on the north, H10873 to the Southwest, and H 10876 to the South See Table L-1 for the listing of the Junction Analysis, H10850, Sheet R to H10835, Sheet Q. Of the 326,555 comparisons, 99.45% were within 50 centimeters. The greater percentage of negative differences indicates that the H10850 soundings tend to be deeper than the H10835 soundings in the common area. As noted in section K, the comparisons between the data collected after the transducer change with the H10835 data suggests a slight datum shift and accounts for all the differences greater than 50 centimeter.

Table L-1. Junction Analysis H10850, Sheet R vs. H10835, Sheet Q

Depth Difference Range	All Differences		Positive Differences		Negative Differences		Zero Differences
	Count	Percent	Count	Percent	Count	Percent	Count
To 10 cm	152,642	46.74	52,249	65.89	90,063	38.01	10,330
To 20 cm	84,052	72.48	20,564	91.92	63,488	64.81	
To 30 cm	59,323	90.65	5,799	99.13	53,524	87.40	
To 40 cm	21,634	97.27	657	99.96	20,977	96.25	
To 50 cm	7,112	99.45	29	100.00	7,083	99.24	
To 60 cm	1,650	99.96	0	100.00	1,650	99.94	
To 70 cm	141	100.00	0	100.00	141	100.00	
To 80 cm	1	100.00	0	100.00	1	100.00	
To 90 cm	0	100.00	0	100.00	0	100.00	
To 100cm	0	100.00	0	100.00	0	100.00	
>100 cm	0	100.00	0	100.00	0	100.00	
Totals:	326,555	100.0%	79,298	24.3%	236,927	72.5%	3.2%

M. COMPARISON WITH PRIOR SURVEYS - See also Evaluation Report

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

N. COMPARISON WITH THE CHART - See also Evaluation Report

H10850 was compared to Chart 11323, ~~56~~ 58th edition, ~~28 March 1998~~ 24 JAN 2000 at scale 1:80,000 in lieu of the specified 55th edition.

Charted platform UPRC-HI-178 A,B,C,D, at position 29 12.8N 094 26.6W was not seen in multibeam, in 200% side-scan data, or seen visually. Recommend platform removed from the chart. - Concur - Delete platform charted in 29-12-49 N, 94-26-24 W (See also p. 17 of this report)

Charted obstruction from H10574/94 NOAAS Rude dive investigation 54.5 feet (AWOIS #9835) at 29 09 ~~43.466~~ 44.494N 094 29 25.~~248~~256W is what is believed to be the steel bow of a fishing boat and winch motor 24 feet from the steel bow. H10850 preliminary least depth from side-scan is 51.7 feet. Side-scan revealed a "V" shaped outline and a separate, smaller object approximately 24 feet away from the "V" shape and the H10850 position matches H10574 position. Both objects were in the reconnaissance portion of the multibeam swath data on two passes. Recommend this item remain as charted until an item investigation verifies the least depth. Concur w/ conditions - See also Addendum to H10850 DR - p. 18 - Item 3i. Revise charted depth to 51ft. No change in position needed. Revise to 51 in 29-09-44.04 N, 94-29-25.56 W

Charted wreck from FE #418/95 NOAAS Rude dive investigation 40 feet (AWOIS #8969) at 29 06 43.187N 094 24 08.458W is a 90-foot steel-hulled rig tender lying upside down. H10850 preliminary least depth is 40.1 feet. Recommend this item remain as charted. Concur - No changes in charting needed

Charted obstruction PA 48 feet (AWOIS #8971) at 29 08 30.0N 094 18 30W was not seen in multibeam or in 200% side-scan data. LNM25/93 reported this to be a lost anchor. Recommend this obstruction removed from the chart. - Concur - See also Addendum to H10850 DR p. 19.

Delete (); Obstn PA, (48 Ft rep)

Charted obstruction 29 feet (AWOIS #8913) at 2910 31N 094 22 16W was not seen in multibeam or in 200% side-scan data. LNM51/86 reported this to be wreckage from a destroyed oil structure. Within the search radius, there are two new oil structures. Two side-scan contacts, approximately 100 meters and 120 meters from the charted obstruction with heights less than 2 feet suggesting that some minor debris remains. Recommend this obstruction be removed from the chart. Concur
Delete (); Obstn PA (29 Ft rep)
AWOIS #1325, 8914, and 8915 were removed from latest edition of the chart following the recommendations from FE418/95. H10850 results agree with the FE418 findings and found no shoaling in multibeam or in 200% side-scan data. Concur - no changes in charting needed

Table N-1 lists four new features discovered in H10850. Recommend these features be charted as determined in this survey. Concur

Table N-1. New Features Discovered

Feature Number	Latitude	Longitude	Depth (feet)		Multibeam File Name	Ping	Beam	Depth (meters)	
1	29 12.~~8209~~N	094 26.~~3865~~W	50.13	OBSTR	98327.d09	39583	21	15.28	Chart 50; Obstn
2	29 12.~~7950~~N	094 26.~~0332~~W	50.10	OBSTR	98324.d06	2960	16	15.27	Chart 50; Obstn
XX 3	29 09.~~4194~~N	094 25.~~1845~~W	44.42	WRECK	98337.d05	30035	88	13.54	Chart 94; Wk
8	29 06.~~2893~~N	094 ~~27.1315~~W	51.31	OBSTR	98364.d02	22584	54	15.64	Chart 51; Obstn

Additional targets were detected in the side-scan data only, or in both side-scan and reconnaissance multibeam data. See Section S for recommendations for additional investigations of these targets.

A new, uncharted, lighted platform was found at position 29 06.~~2307~~N 094 26.~~329~~W with a designation of ENRON-HI-207-B. Recommend adding the platform to the chart. Concur - no changes in charting needed. See also p. 17 of this report.
Traces of the trench for an apparent uncharted pipeline from the platform at 29 07.~~674~~N 094 28.~~032~~W to the platform at 29 06.2307N 094 26.329W were seen in both the multibeam and the side-scan sonar. Concur - no changes in charting necessary.

XX The dangerous wreck PA, Lucky Jason Alexander, reported in LNM 42/98 at 29 09 01N 094 28 36W was not found at that position. No obstructions were seen in the multibeam or in the 200% sidescan data. Recommend removal of this symbol from the chart. Concur - Delete (HH); PA (See xx above & below)

XX The new wreck found at position 29 09.~~219~~N 094 25.~~184~~W with a preliminary least depth of 42 feet is believed to be the Lucky Jason Alexander. On the smooth sheet, a 44-foot depth is depicted because the 42-foot sounding is outside the swath that meets contract standards. This wreck was reported to the U S Coast Guard 8th district as a danger to navigation on January 18, 1999 with a preliminary shoalest depth of 41 feet. Danger to navigation report from March 15, 1999 corrected the least depth to 42 feet corrected to MLLW using verified tide correctors. Recommend further investigation of this wreck. Concur Chart 94; Wk in Lat 24-09-25.14 Lon 94-25-10.98
Delete (41) Obstn in 29-09-25.14N, 94-25-11.04W
See also p. 20 of H10850 Addendum Section (NE-3)

O. NOT USED BY CONTRACTOR

6 Pages from Addendum p. 20 Investigation

** See also Addendum H10850 DR p. 20 - New Item (NE-3)

P. AIDS TO NAVIGATION - See also Evaluation Report

See Section N for discussion of charted pipelines and possible new pipelines. These pipelines are all buried and are not useful as aids to navigation. U.S. Coast Guard buoys were found on station as listed in Table P-1. These buoys adequately serve their apparent purpose.

Table P-1. U.S. Coast Guard Buoys

Latitude	Longitude	Buoy Descriptor
29 09.476N 28.56	094 25.909W	RW "GA" Strobe Fl 2.5s Mo (A) WHISTLE — LL#1165
29 10.394N 23.64	094 27.128W	Y "A" Fl Y 2.5s — LL#1167.1
*29 06.725N 43.5	094 24.136W	BR "B" Fl (2) 5s — LL#1147

* This GP is the location of the wreck it marks. The buoy GP is 29-06-35N, 94-24-05.9W

Oil Platforms were found at the positions listed in Table P-2. The platforms are near their charted positions with the exceptions of the charted platform UPRC-A,B,C,D, which was not found in the survey limits and a new platform at 29 06.231N 094 26.329W. (See also p. 15 of this report)

43.86 19.74

See also p. 16 of this report

Table P-2. Oil Platforms, Lighted

Latitude	Longitude	Platform Descriptor	
29 10.535N 32.10	094 22.253W 5.18	"EXXON-HI-176-B" Racon (—•)	- No change needed
29 10.523N 31.38	094 22.316W 18.96	"APACHE-HI-176-2-3-4"	No change needed
29 11.178N 10.68	094 23.843W 50.58	"ARCO-HI-177A"	- No change needed
29 09.342N 20.52	094 29.721W 43.26	"EOG-HI-173A"	"
29 07.795N 47.7	094 28.025W 01.5	"SH-HI-194-JA"	"
29 07.674N 40.44	094 28.033W 01.98	"ENRON-HI-207-A"	"
29 06.231N 13.86	094 26.329W 19.74	"ENRON-HI-207-B"	"
29 07.636N 38.16	094 22.424W 25.44	"AP-HI-195-1"	"

Q. STATISTICS

Survey statistics are as follows:

2531 nm	Linear nautical miles of sounding lines (multibeam and side-scan)
72 nm^2	Square nautical miles of multibeam and side-scan
91	Number of sound velocity casts
0	Number of items investigated

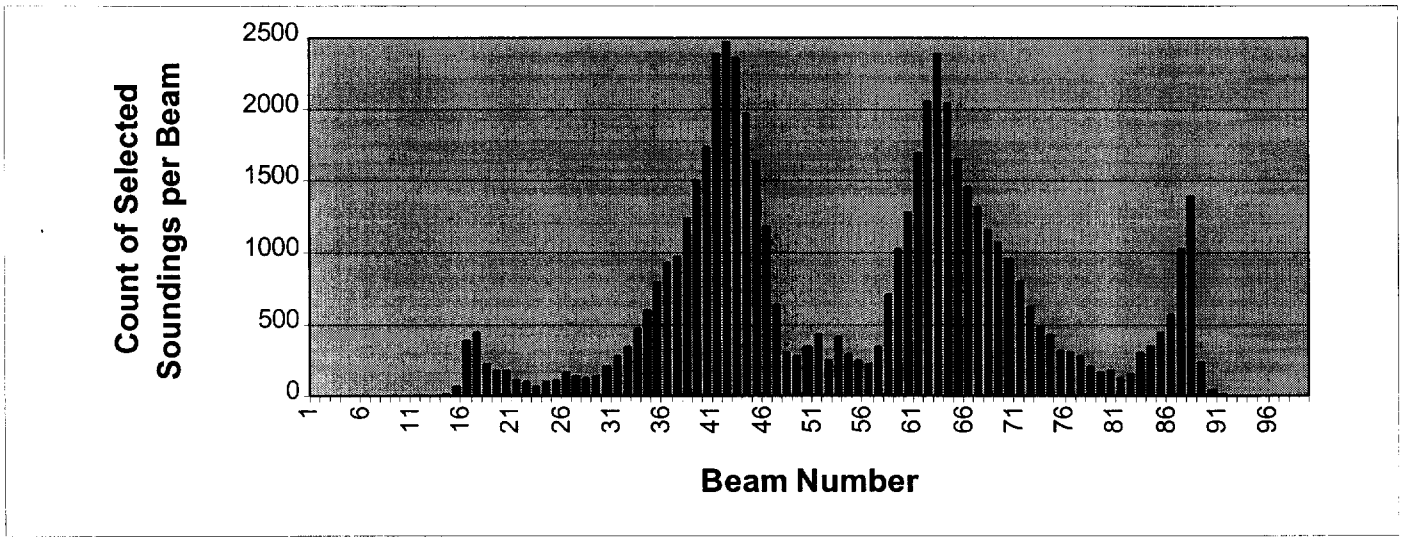
R. MISCELLANEOUS - See also Evaluation Report

Due to the design of the multibeam transducer installation on the hull of the vessel, it was possible to collect useable multibeam data in seas up to 5-6 feet. While using the Klein 2000, side-scan data quality would decrease in 4-5 foot seas. Typically, if the wave period was long with little chop, acceptable data was collected in the direction of the seas.

Figure R-1 shows the distribution by beam number of the 54,640 soundings selected for the smooth sheet. The majority of soundings appear to be in the area where the bottom detection

algorithm changes from phase to amplitude. All of the soundings selected meet the position and depth accuracy specifications (position error not to exceed 10 meters at 95% confidence, depth error not to exceed 0.3 meter at 90% confidence).

Figure R-1. Histogram of Selected Soundings by Beam Number



S. RECOMMENDATIONS - See also Addendum H10850 DR Section N.

Recommend the entire common area of charts 11323, and 11330 be reconstructed with data from this survey.

Table S-1 lists items that are recommended for further investigation under separate instructions.

Table S-1. H10850 Items for Investigation

Item	Latitude North	Longitude West	Multibeam			Side-scan	Description
			Depth Feet	Swath	Height Feet	Height Feet	
I-1	29 11.634	094 23.100	50.5	Recon	1.1	1.0	No Further Work
I-3~~4~~	29 10.542	094 22.325	49.5	Recon	2.7	2.7	Concur
I-5	29 10.376	094 21.722	49.9	Recon	1.6	1.6	" (Same as I-7)
I-7~~8~~	29 10.379	094 21.721	49.9	Recon	1.6	2.6	" (Same as I-5)
I-12~~3~~	29 05.354	094 16.294	39.7	Recon	3.6	3.0	" (Same as I-13)
I-13	29 05.347	094 16.281	39.7	Recon	3.6	1.6	" (Same as I-12)
I-14	29 09.433	094 24.493	50.7	Recon	1.0	1.6	" (Same as I-16)
I-15	29 11.944	094 26.460	52.8	Recon	0.0	3.0	"
I-16	29 09.429	094 24.481	50.7	Recon	1.0	3.3	" (Same as I-14)
I-17	29 08.258	094 23.078	52.5	Recon	3.4	2.0	" (Same as I-19)
I-19	29 08.258	094 23.078	52.5	Recon	3.4	0.7	" (Same as I-17)
I-30	29 10.271	094 29.736	49.6	Recon	6.4	1.3	" (Same as I-50)
I-31	29 09.731	094 29.420	52.5	Recon	3.4	2.6	" AWOIS #9835 - same as I-32

Item	Latitude North	Longitude West	Multibeam			Side-scan	Description
			Depth Feet	Swath	Height Feet	Height Feet	
I-32	29 09.733	094 29.419	52.5	Recon	3.4	4.3	AWOIS #9835 Concur (same as I-31)
I-35	29 09.320	094 29.773	52.7	Recon	0.0	2.0	Concur (same as I-36)
I-36	29 09.316	094 29.772	52.7	Recon	0.0	1.6	" (same as I-35)
I-37	29 09.344	094 29.917	55.8	Recon	0.0	1.6	No further investigation needed
I-38	29 09.347	094 29.915	55.8	Recon	0.0	2.6	"
I-39	29 07.664	094 28.104	53.8	Recon	0.0	2.3	"
I-40	29 06.643	094 27.896	53.1	Recon	0.0	0.7	"
I-41	29 06.651	094 27.912	53.1	Recon	0.0	1.0	"
I-45	29 03.460	094 23.701	57.4	Recon	1.1	4.3	Concur (same as I-46)
I-46	29 03.466	094 23.713	57.4	Recon	1.1	3.6	" (same as I-45)
I-50	29 10.274	094 29.736	49.0	Recon	6.6	1.3	" (same as I-30

T. REFERRAL TO REPORTS

None.

APPENDIX A: DANGER TO NAVIGATION REPORT

Reports of a danger to navigation were filed on January 18,and March 17,1999.
These reports are enclosed in Appendix A along with the section of chart 11323 indicating the position of danger. These reports can be referred to as:

January 18, 1999

Commander (OAN)
Eighth Coast Guard District
Hale Boggs Federal Building
New Orleans, LA 70130-3396

REPORT OF DANGER TO NAVIGATION

Dear Sir:

While conducting hydrographic survey operations in the approaches to Galveston, Texas, Science Applications International Corporation discovered an uncharted obstruction. Attached are the Report of Danger to Navigation and a section of chart 11323 indicating the position of this danger.

Differential GPS, side-scan sonar, and multibeam sonar were used to determine the position and depth. These data are preliminary and subject to office review.

Sincerely,
SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

Steven A. Lemke
Lead Hydrographer

Enclosures

Cc: Lt. David Neander, NOAA
Contracting Officer's Technical Representative

REPORT OF DANGER TO NAVIGATION

Hydrographic Survey Registry Number: H-10850

State: Texas

General Locality: Gulf of Mexico

Sublocality: Approach to Galveston (24 Miles ESE of Galveston)

Project Number: OPR-K171-KR

The following object was found during hydrographic survey operations:

Object Discovered: Obstruction

Covered 41 feet corrected to Mean Lower Low Water using verified tide correctors.

Affected nautical charts:

Chart Number	Edition		Reported Depth	Charted Horizontal Datum	Geographic Position	
	No.	Date			Latitude	Longitude
11323	56	03/28/98	41 ft	NAD 83	29° 09.419′ N	094° 25.184′ W

March 15, 1999

Commander (OAN)
Eighth Coast Guard District
Hale Boggs Federal Building
New Orleans, LA 70130-3396

REPORT OF DANGER TO NAVIGATION

Dear Sir:

While conducting hydrographic survey operations in the approaches to Galveston, Texas, Science Applications International Corporation discovered two uncharted obstructions. Attached are the Report of Danger to Navigation and a section of chart 11323 indicating the position of these dangers.

Differential GPS, side-scan sonar, and multibeam sonar were used to determine the position and depth. These data are preliminary and subject to office review.

Sincerely,
SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

Steven A. Lemke
Lead Hydrographer

Enclosures

Cc: Lt. David Neander, NOAA
Contracting Officer's Technical Representative

REPORT OF DANGER TO NAVIGATION

Hydrographic Survey Registry Number: H-10850

State: Texas

General Locality: Gulf of Mexico

Sublocality: Approach to Galveston (24 Miles ESE of Galveston)

Project Number: OPR-K171-KR

The following objects were found during hydrographic survey operations:

Affected nautical charts:

Chart Number	Edition		Class	Reported Depth	Charted Horizontal Datum	Geographic Position	
	No.	Date				Latitude	Longitude
11323	56	03/28/98	WRECK	42 ft	NAD 83	29° 09.419′ N	094° 25.184′ W
11323	56	03/28/98	OBSTN possible exposed pipeline	50 ft	NAD 83	29° 12.821′ N	094° 26.387′ W

Science Applications International Corporation
An Employee-Owned Company

April 1, 1999

LETTER OF APPROVAL

REGISTRY NUMBER H10850

This report and the accompanying smooth sheet are respectfully submitted.

Field operations contributing to the accomplishment of survey H10850 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.

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

Steven A. Lemke
Hydrographer
April 1, 1999

Admiral's Gate, 221 Third Street, Newport, Rhode Island 02840 Office: (401) 847-4210 FAX: (401) 849-1585
Other SAIC Offices: Albuquerque, Colorado Springs, Dayton, Falls Church, Huntsville, Las Vegas, Los Altos, Los Angeles, McLean, Oak Ridge, Orlando, San Diego, Seattle, Tucson

DESCRIPTIVE REPORT ADDENDUM

to Hydrographic Survey
Sheet R
H10850

24 NM ESE of Galveston
Gulf of Mexico
Texas

NOAA FORM 77-28 (11-72)	U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTRY NO. Addendum to H10850
	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. **R**

State TEXAS

General locality GULF OF MEXICO

Locality 24 MILES ESE OF GALVESTON

Scale 1:20,000 Date of survey ~~16~~ 7 July 1999 – ~~19~~ 20 July 1999

Instructions dated 23 October 1997 as amended Project No. OPR-K171-KR

Vessel R/V Neptune

Chief of party WALTER S. SIMMONS

Surveyed by W. Simmons, G. Ghiorse, D. Walker, L. Gates, L. McAuliffe, E. Tobey, M. Estaphan, B. Ramaswamy

Soundings taken by (**echo sounder,**) hand lead, pole MULTIBEAM RESON SEABAT 8101

Graphic record scaled by survey personnel

Graphic record checked by survey personnel

Protracted by Automated plot by HP Design Jet 2500CP

Verification by Atlantic Hydrographic Branch Personnel

Soundings in fathoms (**feet,**) meters at MLW, (**MLLW**)

REMARKS: Contract # 50-DGNC-8-90025/SAIC
Contractor Name: Science Applications International Corp.
221 Third Street; Newport, RI 02840

Handwritten notes in the Descriptive Report were made during office processing.

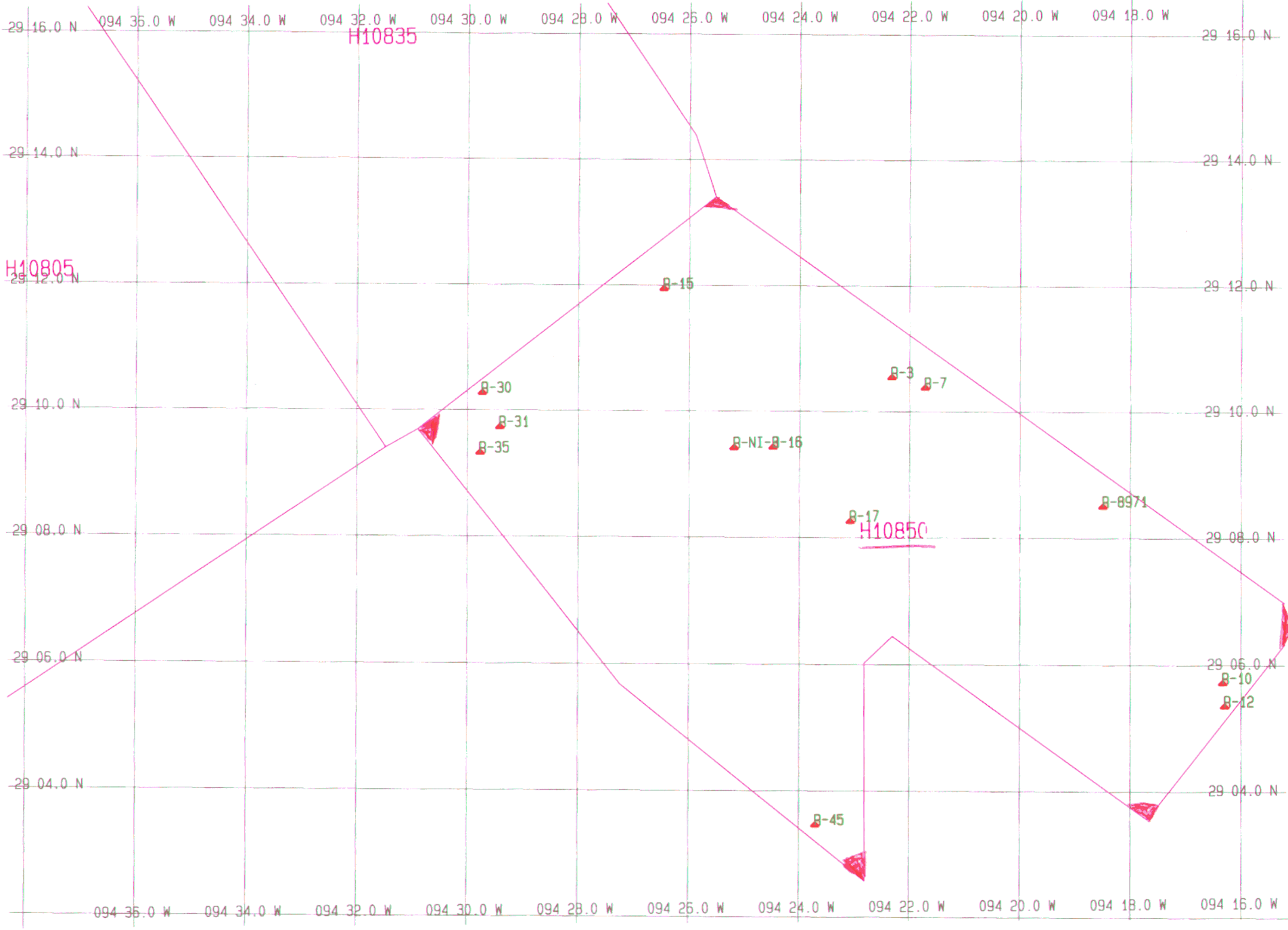
NOAA FORM 77-28 SUPERSEDES FORM C&GS-537.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1976—665-661/1222 REGION NO. 6

INDEX OF SHEETS

The Index of Sheets on the following page indicates:

1. Survey Outlines
2. Survey Registry Numbers
3. Location of Items Investigated


094 36.0 W
094 34.0 W
094 32.0 W
094 30.0 W
094 28.0 W
094 26.0 W
094 24.0 W
094 22.0 W
094 20.0 W
094 18.0 W
094 16.0 W
29 16.0 N
29 14.0 N
29 12.0 N
29 10.0 N
29 08.0 N
29 06.0 N
29 04.0 N
H10835
H10805
H10850
B-15
B-3
B-7
B-30
B-31
B-35
B-NI-B-16
B-17
B-8971
B-10
B-12
B-45

Science Applications International Corporation (SAIC) warrants only that the survey data acquired by SAIC and delivered to NOAA under Contract 50-DGNC-8-90025/SAIC reflects the state of the sea floor in existence on the day and at the time the survey was conducted.

* Filed with the original field records

* Filed with the original field records.

List of Figures

List of Tables

Descriptive Report Addendum to Accompany
Hydrographic Survey H10850
Scale 1:20,000 Surveyed 1999
R/V NEPTUNE
Science Applications International Corporation (SAIC)
Walter S. Simmons, Hydrographer

A. PROJECT

Project Number: OPR-K171-KR
Dates of Instructions: 23 October 1997 **Original:** 50-DGNC-8-90025/SAIC
5 January 1998 Modification #1:56-DGNC-8-24001/SAIC
7 August 1998 Modification #2:56-DGNC-8-24002/SAIC
9 November 1998 Modification #3:56-DGNC-9-24003/SAIC
9 April 1999 Modification #4:56-DGNC-9-24004/SAIC
12 July 1999 Modification #5:56-DGNC-9-24005/SAIC
Dates of Supplemental Instructions: 4 August 1998, 25 May 1999
Sheet Letter: R
Registry Number: H10850
Purpose: Additional Item Investigations to Accompany Hydrographic Survey H10850.

B. AREA SURVEYED

Description:

The area surveyed was primarily the convergence of five Shipping Safety Fairways at the Approach to Galveston, Texas and the Precautionary Area at the junction of these five fairways. The following coordinates bound the survey approximately:

29 09.69138 N	094 30.89454 W
29 13.40598 N	094 25.51842 W
29 06.74574 N	094 14.83782 W
29 03.56244 N	094 17.68938 W
29 06.44592 N	094 22.30194 W
29 06.02274 N	094 22.81638 W
29 02.57058 N	094 22.79862 W
29 05.67846 N	094 27.24036 W
29 09.69138 N	094 30.89454 W

Dates of multibeam data acquisition (UTC):

07/16/99	JD 197
07/18/99	JD 198
07/19/99	JD 200

Dates of side scan data acquisition (UTC):
07/16/99 JD 197

C. SURVEY VESSEL

The R/V Neptune was the platform for multibeam sonar, side scan sonar, and sound velocity data collection. Two CONEX containers were welded in place on the aft deck of the R/V Neptune. One container was used for multibeam and side scan data collection, the other for data processing. The POS/MV IMU was mounted on the vessel centerline just forward and above the RESON 8101 transducer, below the main deck. The multibeam sounder transducer was mounted on the keel. The side scan sonar tow position was located at the "A" frame aft center. A double-armored co-ax conductor cable on a SeaMac winch was used for towing the side scan. Table C-1 is a list of vessel characteristics for the R/V Neptune.

Table C-1. Survey Vessel Characteristics

Vessel Name	LOA (Ft)	Beam (Ft)	Draft (Ft)	Gross Tonnage	Power (Hp)	Registration Number
R/V Neptune	106.9	26	8	90	1200	D595478

The R/V Neptune sensor configuration is depicted in Figure C-1 and the vessel offsets are shown in Table C-2. Figure C-2 shows the R/V Neptune's draft calculations. All measurements are in meters. The Reference Point for the entire multibeam system is located at the top centerline of the POS/MV IMU. The transducer depth was recorded as 3.42 meters below the boat's main deck. The distance below the boat deck to the water surface was measured and subtracted from the transducer hull depth to determine the draft of the electronic center of the transducer. Lead line comparisons to the corresponding beam confirmed the 3.42 meters as the correct transducer depth below deck. Measurements were made on each side of the vessel before departure from port and upon return to port in order to prorate the daily draft for fuel and water consumption.

Figure C-1. Configuration of R/V Neptune during Survey Operations, measurements in meters

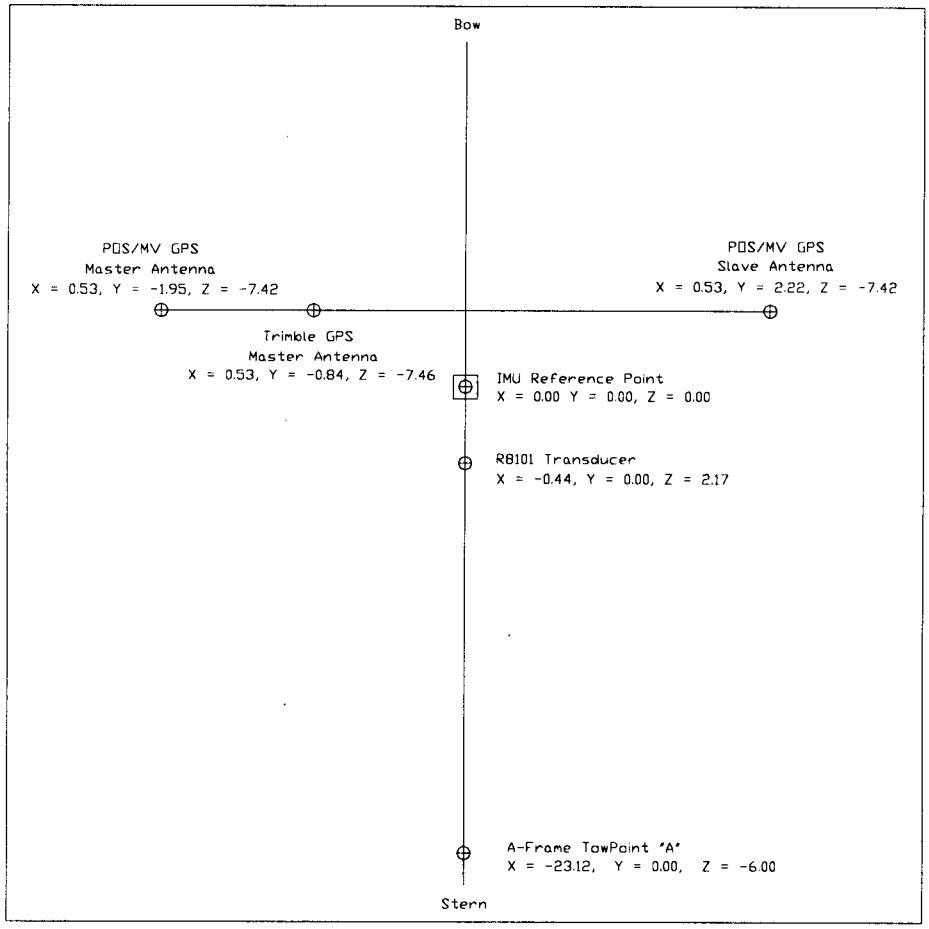
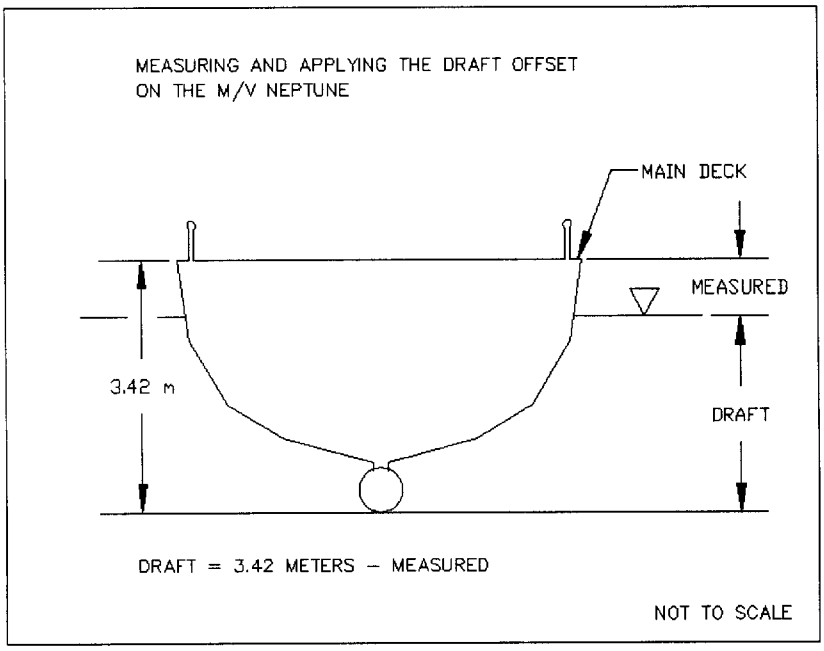


Table C-2. R/V Neptune Antenna and Transducer Locations Relative To the POS/MV IMU Vessel Reference Point, measurements in meters

Sensor	Offset in ISS2000		POS/MV IMU	
Multibeam Reson 8101 Transducer	X		X	-0.44
	Y		Y	0
	Z		Z	2.17
Trimble 7400 Antenna	X	0.53		
	Y	-0.84		
	Z	-7.46		
POS/MV GPS Master Antenna			X	0.53
			Y	-1.95
			Z	-7.42
Side Scan Tow Point "A" frame aft	X	-23.12		
	Y	0		
	Z	-6.00		

Figure C-2. R/V Neptune Draft Determination



The SAIC Integrated Survey System (**iss2000**) and the RESON 8101 multibeam system have different coordinate systems, and therefore care must be taken when inputting correctors to the system. The **iss2000** considers "z" to be positive down, while both the RESON and POS/MV consider "z" positive up. Both the **iss2000** and POS/MV consider "x" positive forward, the RESON considers "x" as positive athwart ships to starboard. The SAIC **iss2000** considers "y" positive athwart ships to starboard, the POS/MV considers "y" positive athwart ships to port and the RESON considers "y" as positive forward.

D. AUTOMATED DATA ACQUISITION AND PROCESSING - See also the Evaluation Report

Data acquisition was through the SAIC **iss2000** system. Survey planning, real-time navigation, and data logging were controlled by the **iss2000** on a HP UNIX machine, with navigation and data time tagging running on an OS/2 machine. The **iss2000** provided navigation data to the Klein 5500 sonar system for merging with the side scan sonar data.

Navigation was recorded from both the POS/MV system and the Trimble 7400. Data from the POS/MV was used as the primary navigation merged with both multibeam and side scan data. Positioning confidence checks were performed alongside survey control stations in port. Daily positioning confidence checks for the R/V Neptune were done by comparing data recorded from the POS/MV to data recorded from the Trimble DGPS.

The RESON 8101 range scale was set to 35 meters in the shallower areas, and was set to 50 meters for the remainder of the sheet. The data acquisition rate for the R8101 was set at maximum for the range scale selected. This means that the specified on average 3.2 pings per 3 meters could be obtained at up to 14.5 knots with the 8 pings per second data rate. At an average speed of 8.5 knots the specified average of 3.2 pings per 3 meters was met.

The side scan sonar equipment used throughout the H10850 survey was the Klein 5500 System. This Transceiver/Processor Unit (TPU) was networked to a personal computer that logged data to hard disk. On a watch-by-watch basis, these raw Klein formatted data were transferred to a side scan sonar-processing computer where they were archived to 4mm tape. Both channels were set at a range scale of 100-meters throughout the survey, except for some gap fills where the hydrographer decided to set the range scale to 75-meters each side to reduce the occurrence of additional gaps caused by surface wave interference. Vessel speed averaged 8 to 9 knots and never exceeded 10 knots. This ensured three or more side scan sonar pings per meter along track.

Once collected and archived to tape, the side scan data were converted to eXtended Triton Format (XTF). A side scan processor then reviewed the side scan data using Triton ISIS software. The processor would note data gaps due to weather, system problems, the fish altitude out of range, data masking, or any other events that would cause the data to be rejected. With the assistance of the hydrographer, the processor would find and verify contacts and create a contact list using ISIS. This contact list was later imported into the **iss2000** system for side scan contact to multibeam feature correlation.

Cleaning of the R8101 multibeam data began with an evaluation of the navigation track line. An automated filter was then applied for minimum and maximum depths of 4 and 30 meters. Then the interactive editing was performed to remove noise, fish, etc. The editing process used the geoswath geo-referenced editor which allowed for both plan and profile views with each beam in its true geographic position and depth. Tidal correctors were not applied in real-time. Observed tides were down loaded from the NOAA/CO-OPS web page. Preliminary and verified data from the Sabine Offshore Station (877-1081) were applied to the multibeam data using the zoning provided August 4, 1998. NOAA memorandum, "Final Water Level Data for Application to Hydrographic Survey OPR-K171-KR-1998", which is in Appendix F. All H10850 multibeam data were reprocessed with verified tide data from the Sabine Pass Offshore (877-1081) station as downloaded from the NOAA/CO-OPS web page.

Depth data were then gridded to 1-meter cells for quality evaluation and for comparing to side scan sonar contacts. When anomalies were seen in the 1-meter grids, the edited multibeam files were re-examined and re-edited as needed. When all multibeam files were determined to be satisfactory, the data were binned to a 10-meter cell size, populating the bin with the shoalest sounding in the bin and maintaining its true position and depth with tracking to the gsf data file.

Soundings were selected from the 10-meter binned layer using the **sel_sound** sounding selection software. This routine starts with the shoalest sounding in the survey, flags out soundings that would overlap it on the plot, proceeds to the shoalest remaining sounding and repeats the above process until all soundings in the 10-meter bin layer have been evaluated. The **set_sound** program was run to flag all selected soundings in the gsf multibeam file. The selected sounding file, the platform and navigation aids file, and the feature file were combined to produce the smooth sheet in **AutoCAD**.

Throughout this descriptive report wherever software is mentioned, it is inferred that the most current version of the software available was used. A complete list of all software versions and dates is provided in Appendix K.

Processing of side scan sonar data is discussed in Section E.

The real time multibeam acquisition system used for the H10850 survey included:

One UNIX workstation – Used for system control, survey operations, real-time quality control.

* Data filed with field records

One personal computer – Used for running POS M/V and Trimble software and for downloading and conversion of sound velocity data from CTD's.
One personal computer – Used for navigation and time syncing on the O/S-2 operating system.
A custom computer from RESON was used to operate the 8101 system.
A custom computer from RESON was used to operate the R6042 system.

Uninterrupted power supplies (UPS) protected the entire system.

Multibeam Data Processing

Multibeam data processing was done in two stages. Initial data cleaning and validation was done shortly after the data were collected, usually by the same watchstander who had collected the data. To maintain a high degree of continuity between data collection and data processing it was convenient to split a watchstander's work into two phases, one to collect data and the next to process that same data.

On a watch by watch basis, tracklines were made, verified, and corrected to ensure data coverage and also check for navigation errors. Next, outer beams of the multibeam data, exceeding accuracy standards calculated by the Hydrographer, were flagged as invalid using the **iss2000** software. Multibeam data were manually edited and the preliminary multibeam coverage grid was then updated. Each watchstander would perform a backup of all data on the processing system at the end of each processing watch. After the watchstander had completed the initial data cleaning, a different watchstander, a data manager, or the hydrographer verified the data. Any questionable possible obstructions were written down and later evaluated by the hydrographer. A data manager on the survey vessel would later correct the data for draft and tides, make updated coverage grids, tracklines, sounding grids, selected sounding plots and preliminary data products. The data manager's duties also included routine system backups on all computers and quality control on all data.

In the processing lab in Newport, RI, further quality assurance reviews were done, and corrections were made to all data. Contact analysis was performed correlating side scan contacts with multibeam features. Multibeam coverage and sounding grids were updated following changes found during the contact analysis. The **iss2000** system used proprietary algorithms to create the grids and selected soundings. Final plots were produced exporting data to a dxf format using the **iss2000** software. These data were then imported into **AutoCAD** for final map production.

E. SIDE SCAN SONAR

The following side scan sonar equipment was used for the H10850 survey:

Klein 5500 Side scan Sonar System towfish
- Serial Number 250
- Vertical beam width 40°, 0° depression, 455kHz.
- K-Wing Depressor, serial number 435

Transceiver/Processing Unit (TPU), serial number 109
Display/Control/Data logging computer

1. Side Scan Sonar Data Acquisition Procedure

The watchstander would always have the assistance of the previous watchstander who was located close by processing data. This assistance was necessary for conducting CTD casts as well as towfish deployment and retrieval. A minimum of four people were used during towfish deployment and retrieval.

Side scan operations were conducted in water depths ranging from 38 to 68 feet. The side scan towfish altitude off the bottom was maintained between eight and fifteen meters. The MacArtney Sheave used had a cable counter with a read out in meters. The cable out data was broadcast from the cable counter to the **iss2000** system where layback and fish position was calculated. The cable length was adjusted to maintain the proper fish altitude using a remote controller for the SeaMac winch. The watchstander appended to a side scan annotation file when changes were made to the cable out length. These annotation files were later merged with the XTF data using proprietary software.

Maintaining towfish height above the bottom was relatively easy due to the remote controller for the winch. Adjustments to the length of cable deployed were required several times during each survey line. These primarily occurred in the Heald Bank area and an area of shallower water in the southern portion of the sheet. A proprietary software program, which displays the towfish and water depths, made monitoring the towfish altitude easy.

The depressor allowed the amount of cable out to be less than the water depth. This permitted turns to be tighter and thus faster than surveys previously conducted without the use of a depressor. There was also no need to worry about the towfish hitting the seafloor while conducting CTD casts. In addition, the depressor kept the towfish below the propwash even at higher survey speeds of 9 knots.

Navigation and multibeam file names were manually changed after each survey line, or item investigation, was completed. The Klein 5500 data logging software automatically changes the file name every ten minutes. The side scan range scale was set to 50-meters where specified, and to 75-meters where the range scale was not specified.

Watchstanders used proprietary software to create digital annotation files that were later merged with XTF side scan data.

Daily confidence checks were conducted using trawl marks, anchor scours, and geologic features (sand waves) that ran through both channels while on line.

2. Problems Encountered During Side Scan Sonar Survey Acquisition

Sargasso weed floating on the water surface was a continual detriment to acquisition of good side scan data. The Klein 5500 locks on to the strongest signal. In water depths less than 60 feet, this usually means the water surface if Sargasso or wind waves are present.

Weather also had a negative impact on the quality of the side scan data. When operating in 3 to 4 foot seas, it was frequently impossible to avoid surface wave noise and the subsequent large number of data gaps.

Use of the 50-meter and 75-meter range scales reduced the impact of these problems.

3. Side Scan Sonar Processing

After being archived to 4mm tape, digital side scan data from the Klein 5500 system were converted from the Klein proprietary format to eXtended Triton Format (XTF) using a SAIC proprietary program called xtf_io. These XTF files were copied to 4mm tape in tar format and are the deliverables to be used with CARIS SIPS. The XTF data also allowed data review and target analysis in Triton Isis.

A side scan processor looked at each record using Triton ISIS to review the data. A spreadsheet was used to log times where data gaps were caused by seaweed interference, biota in the water column, or other reasons. The time, survey line, corresponding multibeam file, start/end of line, side scan file name, watch id number, line azimuth, and data gaps information were all logged in the spreadsheet. This information was used to set the bad data off line so that they were ignored in processing and in coverage analysis.

Annotation files logged in real-time by the watchstanders were later corrected for errors and additional annotations were added. Additional annotations include contacts, confidence checks, and comments on the records. The corrected annotations were merged into the XTF data using the xtf_io program. Trackline data were extracted from the XTF files for each Julian day.

A time window file, which lists the times of all valid data, was created for each 100% of coverage in order to create both trackline and coverage plots in the **iss2000** system. By viewing the coverage plots in the **iss2000** survey-planning tool, a user can easily plan survey lines to fill in any data gaps.

Side Scan Contact Analysis

ISIS and Contact Post Processing Software (Triton/Elics Inc.) were used to select and process contact information from the XTF sonar files. Contact information includes the following:

1. Year and Julian Day contact was acquired.
2. Time contact was acquired.
3. Contact position - Latitude and Longitude.
4. Contact identifier (i.e. OBST for Obstruction).
5. Slant range to contact (Note: Negative number if contact was detected on port side).
6. Fish altitude when contact was acquired.
7. Contact height, based on length of shadow and geometric calculation using steps 5 & 6.

Contact information was stored in .CON files that were converted into a .CTV file using a SAIC proprietary program called isis2ctv. During the conversion, a postscript image file was made of each contact. This .CTV file can be directly loaded into **iss2000** as a separate data layer. Once in the **iss2000** system, contacts were correlated by position and height with the one-meter grid of the multibeam data displayed with side scan contacts overlaid. Bathymetric features in the multibeam data were then compared with the side scan contact data, and features were selected for the smooth sheet.

F. SOUNDING EQUIPMENT

The following components were used for acquisition of multibeam sounding data using the RESON SeaBat 8101 multibeam system:

- Transducer, Serial Number 099707
- 8101 Processor, Serial Number 13819
- R6042 Controller and Processing Unit, Serial Number 590 P0 794-387

A lead line made of Kevlar line with an 8 pound mushroom anchor as a weight was used for checking the multibeam echo sounder. The line was marked in feet and was calibrated against a steel tape. Lead line comparisons are summarized in Appendix G Numerous comparisons, at least one per watch, were made between the R8101 center beam depth verses the side scan fish depth plus the fish altitude height. These values were almost always identical. This method of confidence checks was implemented to replace the single beam Echotrak that was not working during the site investigations.

G. CORRECTIONS TO SOUNDINGS

1. Speed of Sound

The following systems were used to determine sound velocity profiles for corrections to multibeam sonar soundings.

- "A" - Sea-Bird Electronics, Inc., Model 19 CTD, Serial Number 193607-0565, Calibration Date: 23 February 1999.
- "B" - Sea-Bird Electronics, Inc., Model 19 CTD, Serial Number 2710, Calibration Date: 15 October 1998.
- "C" - Sea-Bird Electronics, Inc., Model 19 CTD, Serial Number 1915869-2389, Calibration Date: 02 September 1998.

The primary unit was SBE19 #0565. Daily confidence checks were obtained from simultaneous casts with the primary CTD and one of the other two CTD's. After downloading CTD casts, both were converted to the proper format and compared to each other and to the previously applied cast. All profiles were computed using **SBE Term19** and converted using the **SBE DatCnv** software. Computed profiles were copied to the **iss2000** for comparison on the screen. A selected profile was applied to the system, recorded, and sent to the RESON 6042, where a refraction lookup table was computed for application of speed of sound and ray tracing correctors to the multibeam sounding data. If sounding depths exceeded the cast depth, the 6042 used the bottom of the table to extend correctors below the table.

Factors considered in determining how often a CTD cast was needed included: shape and proximity of the coastline, sources and proximity of freshwater, seasonal changes, wind, sea state, cloud cover, and changes from the previous profile. A cast was taken at least once during each 6-hour watch. Normally there were two casts per 6 hour watch during daylight, and one cast per 6 hour watch during darkness.

Quality control tools, including real-time displays and a multibeam swath editor, were used to monitor how the sound velocity was affecting the multibeam data. Severe effects due to improper sound velocity could easily be seen by viewing multibeam data in an along track direction.

A table including all CTD casts, dates of each cast, the location of the cast, and the maximum depth of each cast is located in Appendix J.

* Data filed with field records

2. Instrument Corrections

No instrument corrections were necessary after the initial installation and calibration was complete.

3. Corrections Determined from Vertical Casts

Lead line comparisons to multibeam center beam soundings were made at least every two weeks to verify the transducer draft and echo sounder instrument correctors. For each comparison, a CTD cast was taken and the sound velocity profile loaded into the **iss2000** and the RESON 6042. Twenty lead line readings, ten from the port side and ten from starboard, were recorded along with the UTC time of observation while the **iss2000** recorded the multibeam readings. **Exammb** was used to determine the appropriate port and starboard beam depth readings for the time and position of each lead line reading.

The results of these readings were entered into a spreadsheet along with the draft readings and any squat correctors that may have been entered into the **iss2000**. The spreadsheet applied a calibration corrector to the lead line readings and converted the readings from feet to meters. It also applied correctors for any settlement and squat inadvertently left in the **iss2000** to the port and starboard multibeam readings.

Each corrected lead line cast depth was compared to the simultaneous multibeam. The ten comparisons were averaged and the standard deviations were computed. The lead line cumulative results are included in Appendix G.

4. Static draft

Depth of the transducer below the deck was determined from measurements made while the boat was on the marine railway in 1998, and was verified by lead line comparisons. The static draft was observed by measuring from the main deck to the waterline before getting underway from Galveston and subtracting that measurement from the transducer distance below the deck. If the static draft value changed from the previously noted value, the new value was entered into the RESON system. The static draft was again determined upon return to port and the change in draft was prorated on a daily basis. The measured and prorated draft results are reported in Appendix G, Table App. G-4.

5. Settlement and Squat

Measurements of settlement were conducted near 29°11.7'N 094°28.8'W on day 138, May 19, 1999, in fifteen meters of water. The following procedures were used to determine the settlement correctors:

- Selected an area of flat bottom at a depth similar to the survey area.
- Planned a survey line across the flat bottom.
  1. Considered the current and wind in planning the line.
  2. Used Sabine Offshore (877-1081) station for the water level during the test.
  3. Calibrated the echo sounder, and applied sound velocity profile for the test area. (Timing latency and pitch, roll and heading biases had been determined and applied.)
  4. Approached the line at a slow to moderate speed, brought the RPM's to zero and drifted down the line while recording soundings over the flat bottom.
  5. Ran the line at each of the predetermined RPM settings while recording soundings over the flat bottom.
  6. Applied water level correctors to the soundings.

* Data filed with field records.

7. Subtracted the depth determined from each of the RPM passes from the depth determined on the drifting, zero RPM pass. These differences are the settlement and squat correctors to be applied when operating at the corresponding RPM.
8. Constructed a lookup table of RPM and settlement and squat correctors in the configuration file so that the computer could interpolate a corrector based upon the RPM entered into the system

Geoswath was used to measure the depth for each pass. The results were compiled into a lookup table of vessel's engine RPM vs. settlement and squat. When on survey line, the engine's RPM was entered into the **iss2000** system by the real-time system operator. The computer applied settlement and squat correctors interpolated from the lookup table, and recorded them in the "Depth Corrector" field of the GSF data file for each ping.

All results are reported in Appendix G, Table App. G-5.

6. Roll, Pitch and Heading Biases

The following sensor was used for acquisition of Heave, Roll, Pitch and Heading data:

- TSS POS/MV Inertial Navigation System, Serial Number 024

The POS/MV was used for heave, roll, and pitch. The accuracy of the sensor was five percent of one meter or five centimeter for heave ± 0.10° dynamic accuracy for roll and pitch, and ± 0.05° static accuracy for roll and pitch. The POS/MV was used for heading. The dynamic heading accuracy of the unit is better than 0.05°.

Heading, roll, and pitch biases were determined in a series of tests performed in the survey area prior to the start of the survey. Prior to conducting any of the tests, a CTD cast was taken to determine the sound velocity profile and entered into the RESON system. Initially, the roll, pitch, and heading biases were set to 0° in the RESON system.

The roll bias test was run first in an area with relatively flat bottom. The range scale of the RESON was set to 50-meters. Three lines were run spaced 40-meters apart and each line was run in both directions. The data from parallel lines in the same direction were used for roll bias calculations so that the depths from the center beams from one line were compared against the depths of the mid-swath beams. Tidal corrections were applied to all data before roll corrections were calculated using routines in the **Survey Analysis** software. Roll bias results are shown in Appendix G, Table App. G-3.

After the roll biases were calculated and entered into the RESON system, a pitch bias test was conducted. The pitch test was conducted by surveying multiple reciprocal lines perpendicular to an anchor scour. During the pitch test, ship speed was maintained at as constant a rate as possible. Tidal corrections were applied to all data before the pitch bias was calculated. Pitch biases were computed by comparing runs in opposite directions. There was no discernable pitch bias as a result of these tests. A bias of 0.0° was kept in the system for the survey.

Following the roll and pitch bias tests, a heading bias test was conducted. For the heading bias test, five parallel lines were run in opposing directions so that the inner beams from the transducer overlay the intermediate or outer beams of adjacent swaths. The heading bias was then determined by measuring the distance between equal depths and calculating the angle subtended by that distance. Tidal corrections were applied to all data before heading corrections were calculated using routines in

* Data filed with field records

the **Survey Analysis** software. After repeated inconclusive test results, it was deemed that the heading bias was zero. It is believed that the shallow water depths of the survey area combined with the accuracy of the navigation makes it extremely difficult to measure small degrees of heading bias. Further proof of a heading bias of zero lies in trawl marks crossing through numerous swaths with perfect alignment.

Table App. G-6 contains the results of the Accuracy test conducted on JD 197. The Accuracy Test for data collected after the transducer change was derived from two lines run along the northwest sheet limit and compared to the north ends of the mainscheme lines run in the common area.

Roll, pitch, and heading biases applied in H10850 are shown in Table G-1. * Verified tides from NOS co-ops web site have been applied to the survey data

Table G-1. Roll, Pitch, and Heading Bias for the R/V Neptune

Julian Days	139-209
Roll	0.40
Pitch	0.00
Heading	0.00

H. CONTROL STATIONS - See also Evaluation Report.

The horizontal datum used for the survey was the North American Datum (NAD) 1983.

Horizontal control stations CG-20 1974 and CG-21 1974 were used for independent checks of the positioning system on the survey vessel. Data for these stations were downloaded from the NOAA/NGS web page.

I. HYDROGRAPHIC POSITION CONTROL

The following equipment was used for positioning on the R/V Neptune:

- TSS POS/MV, Serial Number 024
- Trimble 7400 GPS Receiver, Serial Number 3713A18839
- Trimble Differential Beacon Receiver
- 41R Differential Beacon Receiver, Serial Number 3508-102-18550

The primary hydrographic positioning equipment was the POS/MV, which used correctors from the USCG differential station at Galveston, TX. The **iss2000** monitored HDOP, number of satellites, elevation of satellites, and age of correctors to ensure the resulting hydrographic positioning errors did not exceed ten meters at the 95% confidence level.

When in port, the R/V Neptune tied up to Pier 15 where measurements were made to calculate the offset between the hydrographic navigation position and horizontal control station CG-20, 1974. While measurements were being made, navigation data were being logged. Comparison of the navigation center position computed from the control station and the average position based on navigation resulted in confidence checks that were well within specifications, with no more than 3 meters inverse distance from the check position. Daily position confidence checks were established using a Trimble DGPS with correctors from the U.S. Coast Guard station at Port Aransas, TX. A real-time monitor raised an alarm when the two DGPS positions differed by more than 10 meters

* Data filed with field records.

horizontally. Positioning confidence checks were well below the allowable inverse distance of less than 15 meters.

The USCG Galveston DGPS station was used as the primary positioning corrector source. The USCG Port Aransas, TX DGPS station was used for daily positioning confidence checks. The primary DGPS receiver automatically locks onto the strongest DGPS signal; therefore, when the USCG Galveston DGPS station was off the air for upgrades, primary navigation used the USCG Port Aransas, TX DGPS station. When the USCG Galveston DGPS station came back online, primary navigation switched back to it.

All antenna, transducer, towpoint, and towfish offsets were measured relative to the POS/MV's IMU. Two separate teams of two people measured and calculated all offsets using a measuring tape. The final offsets from both teams were compared and were found to agree.

The **iss2000** software calculates the towfish position using an automatic cable out value and the towpoint configuration or offsets previously measured.

J. SHORELINE

Not applicable.

K. CROSSLINES

Not applicable.

L. JUNCTIONS - See also the Evaluation Report

Not applicable.

M. COMPARISON WITH PRIOR SURVEYS - See also the Evaluation Report

Not applicable.

N. COMPARISON WITH THE CHART - See also the Evaluation Report

H10850 was compared to Chart 11323, ~~57~~ 58th edition, ~~27 March 1999~~ 24 JUNE 2000 at scale 1:80,000 in lieu of the specified 55th edition.

Item 3: (See also p 16 of H10850 Descriptive Report)

I-3 originates in SAIC's table S-1 and is recommended by SAIC for an additional investigation. I-3 is located at 29°10.~~542~~ 32.52'N, 094°22.~~325~~ 4.50'W. Side scan height is 2.7, and reconnaissance multibeam height is 2.7'. I-3 was not detected in the 2nd 100% side scan. I-3 is located near two charted oil platforms, and is 100m northwest of AWOIS 8913 (OBSTN PA 29' rep). Upon inspection of the side scan image, NOAA has determined that this item justifies additional work by SAIC. Additional

investigation shall be conducted using shallow water multibeam, specifically two orthogonal lines crossing the contact near nadir.

Method of Investigation: Shallow water multibeam orthogonal lines crossed with the item near nadir.

Results of Investigation: Full coverage in the area of the reported feature was obtained using shallow water multibeam. Data were fully corrected, including application of verified tides from station 877-1081, Sabine Offshore, TX.

Least depth:	~~39 feet~~ * 50 ft (See e-mail from SAIC, 11-7-99)
Latitude:	29 10.541' N 29-10-32.46
Longitude:	094 22.318' W 94-22-19.0E
File:	hbmba99197.d10
Time:	15:46:18

(Surrounding depths are 50-51 ft, so this is not an obstn)

Comparison with the Chart and Charting Recommendations: Recommend removal of charted Obstn PA (22 ft. rep), dotted circle, blue tint, and charting of ~~39~~ Obstn, dotted circle, blue tint. ~~Do not~~ concur with conditions

Delete OBSTN PA 29 ft rep changes 50

Comparison with the Smooth Sheet: Recommend addition of ~~39~~ 50 Obstr to smooth sheet. DO NOT CONCUR. too close to platforms. NO change to charting

Item 7:

I-7 originates in SAIC's table S-1 and is recommended by SAIC for an additional investigation. I-7 is located at 29°10.379'N, 094°21.721'W. Side scan height is 2.61, and reconnaissance multibeam height is 1.6'. I-7 correlates with side scan target 5 (I-5 in SAIC's table S-1) which has a side scan height of 1.6'and a reconnaissance multibeam height of 1.6'. I-7 is located 900m southeast from AWOIS 8913 (OBSTN PA 29' rep), which is located near two charted oil platforms. Upon inspection of the side scan image, NOAA has determined that this contact justifies additional work by SAIC. Additional investigation shall be conducted using shallow water multibeam, specifically two orthogonal lines crossing the contact near nadir.

Method of Investigation: Shallow water multibeam orthogonal lines crossed with the item near nadir.

Results of Investigation: Full coverage in the area of the reported feature was obtained using shallow water multibeam. Data were fully corrected, including application of verified tides from station 877-1081, Sabine Offshore, TX.

Least depth:	49 feet
Latitude:	29 10.3795' N 29-10-22.77
Longitude:	094 21.7297' W 94-21-43.7E
File:	hbmba99197.d11
Time:	15:59:18

Comparison with the Chart and Charting Recommendations: Recommend charting 49 Obstn, dotted circle, blue tint. Concur

Comparison with the Smooth Sheet: Recommend addition of 49 Obstr to smooth sheet. Concur

Chart 49 Obstn in 29-10-22.77N Lat 94-21-43.7EW Lon

To: M@H@C["Eric Sipos" <Eric.Sipos@noaa.gov>]
From: "Walter Simmons" <wsimmons@mtg.saic.com>
Cc: M@H@C["George Ghiorse" <ghiorse@mtg.saic.com>],
M@H@C[<dave.neander@noaa.gov>]
Subject: Re: Item 3, H10850 "R" addendum
Attachment:
Date: 11/2/99 7:32 AM

Could not open your attachment, but SAIC reviewed our own files and the correct recommendation is the 50' not obstruction at the stated position.

The apparent noise you saw is actually return from the leg of an oil platform. Corrected data and Descriptive Report page are being prepared.

Walter S. Simmons
Science Applications International Corporation
Hydrographic Field Party in the R/V NEPTUNE
offshore 713-646-9221, inshore 409-770-4362
Newport RI office 401-847-4210

—— Original Message ——
From: Eric Sipos <Eric.Sipos@noaa.gov>
To: <wsimmons@mtg.saic.com>
Cc: <dave.neander@noaa.gov>
Sent: Wednesday, October 27, 1999 11:29 AM
Subject: Item 3, H10850 "R" addendum

> Please refer to the attached bitmap.
>
> The Addendum to H10850, Sheet "R", lists a least depth of 39 ft for item 3 with
> a lat/long of 29-10-32.46, 94-22-19.08 and a time of 15:46:18. However, when
> I look at the SWMB data, I come up with a least depth of 50 ft at that
> lat/long/time. There is a 39 ft spike a few meters nearby at a 29-10-31.56,
> 94-22-18.96 and a time of 15:53:09.299 but it looks like it could be noise.
> (it shows up on the 15:53 pass but not on the 15:46 pass).
>
> The SSS shows a 2-3 ft contact, but not anything close to a 12 ft contact.
>
> Can you please take another look at Item 3 and confirm whether SAIC is
> recommending the 39 ft beam/ping or the 50 ft beam/ping be added to the smooth
> sheet.
>
> Thanks.
> Rick S.
>

Verify Do not chart - too close to platforms

Item I-10:

I-10 originates in SAIC's Side Scan Contact List, and was not recommended by SAIC for further investigation. I-10 is located at 29°05.721'N, 094°16.331'W. Side scan height is 3.6, and was not detected in the multibeam. I-10 correlates with side scan target 11 (height 3.3'). Upon further inspection of the side scan images, this feature takes on the appearance of a wreck located within a scour. This item is located within the Galveston Ship Channel Safety Fairway. NOAA has determined that this contact justifies additional work by SAIC. Additional investigation shall be conducted using shallow water multibeam, specifically two orthogonal lines crossing the contact near nadir.

Method of Investigation: Shallow water multibeam orthogonal lines crossed with the item near nadir.

Results of Investigation: Full coverage in the area of the reported feature was obtained using shallow water multibeam. Data were fully corrected, including application of verified tides from station 877-1081, Sabine Offshore, TX. Object was detected within a scour. Least depth of 45 feet in a 50 foot scour. Surrounding area 45 feet.

Least depth:	45 feet
Latitude:	29 05.716' N 29-05-42.96N
Longitude:	094 16.327' W 94-16-19.62W
File:	hbmba99197.d12
Time:	17:02:50

Comparison with the Chart and Charting Recommendations: Recommend application of smooth sheet soundings. Concur

Comparison with the Smooth Sheet: This is an area of 45-foot soundings. Recommend no changes to the smooth sheet. Concur - NO changes in charting necessary

Item 12:

I-12 originates in SAIC's table S-1 and is recommended by SAIC for an additional investigation. I-12 is located at 29°05.354'N, 094°16.294'W. Side scan height is 3.0', and reconnaissance multibeam height is 3.6'. I-12 correlates with side scan target 13 (I-13 in SAIC's table 8-1), which has a side scan height of 1.6' and a reconnaissance target 13 (I-13 in SAIC's table S-1), which has a side scan height of 1.6' and a reconnaissance multibeam height of 3.6'. NOAA has determined that this contact justifies additional work by SAIC. Additional investigation shall be conducted using shallow water multibeam, specifically two orthogonal lines crossing the contact near nadir.
Method of Investigation: Shallow water multibeam orthogonal lines crossed with the item near nadir.

Results of Investigation: Full coverage in the area of the reported feature was obtained using shallow water multibeam. Data were fully corrected, including application of verified tides from station 877-1081, Sabine Offshore, TX. Obstruction was detected.

Least depth:	38 feet
Latitude:	29 05.349' N 29-05-20.94
Longitude:	094 16.273' W 94-16-16.38
File:	hbmba99197.d13
Time:	17:16:50

Comparison with the Chart and Charting Recommendations: Recommend charting 38 Obstn, dotted circle, blue tint. Concur

Comparison with the Smooth Sheet: This is an area of 43-foot soundings. Recommend addition of 38 Obstr to smooth sheet. Concur Chart 38 Obstn in Lat 29-05-20.94 N Lon 94-16-16.38 W

Item 15:

I-15 originates in SAIC's table S-1 and is recommended by SAIC for an additional investigation. I-15 is located at 29°11.944'N, 094°26.460'W. Side scan height is 3.0', and reconnaissance multi beam height is 0.0'. I-15 is located within the Galveston Ship Channel Inbound Lane. I-15 did not correlate with another contact from the 2nd 100% side scan coverage. Upon inspection of the side scan image, NOAA has determined that this contact justifies additional work by SAIC. Additional investigation shall be conducted using shallow water multibeam, specifically two orthogonal lines crossing the contact near nadir.

Method of Investigation: Shallow water multibeam orthogonal lines crossed with the item near nadir.

Results of Investigation: Full coverage in the area of the reported feature was obtained using shallow water multibeam. Data were fully corrected, including application of verified tides from station 877-1081, Sabine Offshore, TX. No feature was detected.

Least depth:	52 feet
File:	hbmba99198.d06 and 99198.d08

Comparison with the Chart and Charting Recommendations: Charted depth is 52 feet as found in this investigation. Concur

Comparison with the Smooth Sheet: Recommend no changes to the smooth sheet. Concur - No charting changes necessary

Item 16:

I-16 originates in SAIC's table S-1 and is recommended by SAIC for an additional investigation. I-16 is located at 29°09.429'N, 094°24.481'W. Side scan height is 3.3', and reconnaissance multibeam height is 1.0'. I-16 correlates with side scan target 14 (I-14 in SAIC's table S-1), which has a side scan height of 1.6' and a reconnaissance multibeam height of 1.0'. I-16 is located in the charted Precautionary Area at the entrance to the Inbound and Outbound Lanes for the Galveston Ship Channel. NOAA has determined that this contact justifies additional work by SAIC. Additional investigation shall be conducted using shallow water multibeam, specifically two orthogonal lines crossing the contact near nadir.

Method of Investigation: Shallow water multibeam orthogonal lines crossed with the item near nadir.

Results of Investigation: Full coverage in the area of the reported feature was obtained using shallow water multibeam. Data were fully corrected, including application of verified tides from station 877-1081, Sabine Offshore, TX. No feature was detected.

Least depth:	52 feet
File:	hbmba99197.d06

Comparison with the Chart and Charting Recommendations: Charted depth is 52 feet as found in this investigation. Concur

Comparison with the Smooth Sheet: Recommend no changes in the smooth sheet. Concur - No Charting changes necessary

Item 17:

I-17 originates in SAIC's table S-1 and is recommended by SAIC for an additional investigation. I-17 is located at 29°08.258'N, 094°23.078'W. Side scan height is 2.0', and reconnaissance multibeam height is 3.4'. I-17 correlates with side scan target 19 (I-19 in SAIC's table S-1), which has a side scan height of 0.7' and a reconnaissance multibeam height of 3.4'. I-17 is located in the charted Precautionary Area at the entrance to the Inbound and Outbound Lanes for the Galveston Ship Channel. NOAA has determined that this contact justifies additional work by SAIC. Additional investigation shall be conducted using shallow water multibeam, specifically two orthogonal lines crossing the contact near nadir.

Method of Investigation: Shallow water multibeam orthogonal lines crossed with the item near nadir.

Results of Investigation: Full coverage in the area of the reported feature was obtained using shallow water multibeam. Data were fully corrected, including application of verified tides from station 877-1081, Sabine Offshore, TX. No feature was detected.

Least depth:	51 feet
File:	hbmba99197.d05

Comparison with the Chart and Charting Recommendations: Charted depth is 51 feet as found in this investigation. Concur

Comparison with the Smooth Sheet: Recommend no changes to the smooth sheet. Concur no charting changes necessary

Item 30:

I-30 originates in SAIC's table S-1 and is recommended by SAIC for an additional investigation. I-30 is located at 29°10.271'N, 094°29.736'W. Side scan height is 1.3', and reconnaissance multibeam height is 6.4'. I-30 correlates with side scan target 50 (I-50 in SAIC's table S-1), which has a side scan height of 1.3' and a reconnaissance multibeam height of 6.6'. I-30 is located in the Outbound Lane of the Galveston Ship Channel. NOAA has determined that this contact justifies additional work by SAIC. Additional investigation shall be conducted using shallow water multibeam, specifically two orthogonal lines crossing the contact near nadir.

Method of Investigation: Shallow water multibeam orthogonal lines crossed with the item near nadir.

Results of Investigation: Full coverage in the area of the reported feature was obtained using shallow water multibeam. Data were fully corrected, including application of verified tides from station 877-1081, Sabine Offshore, TX. No feature was found.

Least depth:	54 feet
File:	hbmba99197.d02

Comparison with the Chart and Charting Recommendations: Charted depths are 54 feet as found in this investigation. Concur

Comparison with the Smooth Sheet: Recommend no changes to the smooth sheet. Concur - NC Charting changes necessary

Item 31 (AWOIS 9835): (See also DR H10850 p.15-Section N1)

I-31 originates in SAIC's table S-1 ~~43.80~~ and is recommended by SAIC for an additional investigation. I-31 is also identified as AWOIS Item 9835, and correlates with side scan target 32 (1-32 in SAIC's table S-1). I-31 is located at 29°09.~~731~~ N, 094°29.~~420~~ W. Side scan height is 2.6', and reconnaissance multibeam height is 3.4'. Target 32 (I-32) has a side scan height of 4.3' and a reconnaissance multibeam height of 3.4'. AWOIS 9835 is believed to be the steel bow of a fishing vessel and a winch motor located 24' from the steel bow. Both objects were in the reconnaissance portion of the multibeam swath. I-31 is located in the Outbound Lane of the Galveston Ship Channel. NOAA has determined that this contact justifies additional work by SAIC. Additional investigation shall be conducted using shallow water multibeam, specifically two orthogonal lines crossing the contact near nadir. ~~25.2~~

Method of Investigation: Shallow water multibeam orthogonal lines crossed with the item near nadir.

Results of Investigation: Full coverage in the area of the reported feature was obtained using shallow water multibeam. Data were fully corrected, including application of verified tides from station 877-1081, Sabine Offshore, TX. An obstruction was detected at 51 feet.

Least depth:	51 feet
Latitude:	29 09.734' N 29-09-44.04N
Longitude:	094 29.426' W 94-29-25.56W
File:	hbmba99197.d03
Time:	10:51:08

Comparison with the Chart and Charting Recommendations: Recommend replacement of charted 54 Obstn, dotted circle, blue tint with 51 Obstn, dotted circle, blue tint. Concur

Comparison with the Smooth Sheet: This is an area of 54-foot soundings. Recommend addition of 51 Obstr to smooth sheet. Concur Chart '51' Obstn in 29-09-44.04N 94-29-25.56W

Item 35: Revise depth to 51 from 54, No change in location - (See H10850 DR p.15)

I-35 originates in SAIC's table S-1 ~~19.2~~ and is recommended by SAIC for an additional investigation. I-35 is located at 29°09.~~32~~ N, 094°29.~~773~~ W. Side scan height is 2.0', and reconnaissance multibeam height is 0.0'. I-35 correlates with side scan target 36 (I-36 in SAIC's table S-1), which has a side scan height of 1.6' and a reconnaissance multibeam height of 0.0'. I-35 is located 250m west of the Outbound Lane of the Galveston Ship Channel. NOAA has determined that this contact justifies additional work by SAIC. Additional investigation shall be conducted using shallow water multibeam, specifically two sets of orthogonal lines with the contacts position near nadir. ~~46.30~~

Method of Investigation: Shallow water multibeam orthogonal lines crossed with the item near nadir.

Results of Investigation: Full coverage in the area of the reported feature was obtained using shallow water multibeam. Data were fully corrected, including application of verified tides from station 877-1081, Sabine Offshore, TX. The area includes the apparent end of a small ledge.

Least depth:	54 feet
File:	hbmba99198.d02 and 99198.d04

Comparison with the Chart and Charting Recommendations: charted depths are 53 to 54 feet, as found in this investigation. Concur

Comparison with the Smooth Sheet: This is an area of variable depth, 54 to 56 feet. Recommend no changes to the smooth sheet. Concur - NOChartmg changes necessary

Item 45:

I-45 originates In SAIC's table S-1 and is recommended by SAIC for an additional investigation. I-45 is located at 29°03.460'N, 094°23.701'W. Side scan height is 4.3', and reconnaissance multibeam height is 1.1'. I-45 correlates with side scan multibeam height of 1.1'. I-45 is located 350m east of the Safety Fairway. Upon inspection of the side scan images, NOAA has determined that this contact justifies additional work by SAIC. Additional investigation shall be conducted using shallow water multibeam, specifically two orthogonal lines crossing the contact near nadir.

Method of Investigation: Shallow water multibeam orthogonal lines crossed with the item near nadir.

Results of Investigation: Full coverage in the area of the reported feature was obtained using shallow water multibeam. Data were fully corrected, including application of verified tides from station 877-1081, Sabine Offshore, TX.

Least depth:	54 feet
Latitude:	29 03.463' N 29-03-27.78N
Longitude:	094 23.709' W 94-23-42.54W
File:	hbmba99197.d04
Time:	12:10:25

Comparison with the Chart and Charting Recommendations: Charted depths are 54 to 55 feet as found in this investigation. Recommend application of smooth sheet soundings, and charting a 54 Obstn, dotted circle, blue tint. Concur

Comparison with the Smooth Sheet: this is an area of 55- to 56-foot soundings. Recommend addition of 54 Obstr to smooth sheet. Concur w/ condition: chart 54 ft depth in surrounding soundings 55-56 ft - Do not chart as obstn. No changes to smooth sheet necessary)

AWOIS Item 8971: (See also H10850DR, p. 15)

AWOIS Item 8971 is addressed in Section N of SAIC's Descriptive Report, and is recommended by SAIC for the obstruction to be removed from the chart. The item is a charted obstruction cleared to 48', located at 29°08' 30"N, 094°18'30"W. LNM25/93 reported this to be a lost anchor. This item was not detected in the 200% side scan or multibeam swath. NOAA has determined that this item justifies additional work by SAIC. Additional investigation shall be conducted using side scan sonar. Side scan coverage shall be 200%, encompassing the area within a 1500m radius around 29°22'00"N,

094°32'00" W, outside of the original survey area. If the item in question is detected with side scan, multibeam data shall be acquired, specifically two orthogonal lines crossing the contact near nadir. If additional significant side scan contacts are detected within the 1500m radius. SAIC shall identify these items for-additional potential investigations.

Method of Investigation: Side scan, 200% coverage to detect objects. Shallow water multibeam orthogonal lines crossed with detected item near nadir.

Results of Investigation: Full coverage in the area of the 1500 meter circle outside the H10850 limits, and shallow water multibeam over the detected contact. Data were fully corrected, including application of verified tides from station 877-1081, Sabine Offshore, TX.

Least depth:	50 feet
File:	hbmba99200.d02

Comparison with the Chart and Charting Recommendations: Side scan contact appeared as a possible lost anchor. No feature was detected in the multibeam data. Only this contact was found within a 1500-meter radius of the charted feature. Recommend removal of the charted Obstn PA (48 ft rep), dotted circle, blue tint. Concur - Delete charted Obstn PA (48 Ft rep) in Lat 29-08-30 N Lon 94-18-30 W

Comparison with the Smooth Sheet: This item is outside the smooth sheet area. Recommend no change to the smooth sheet. Concur

New Item (NI-3): - See also DR for H10850 page 16 Section N.

NI-3 is addressed in Section N of SAIC's Descriptive Report (Table N-1, Feature 3), and is recommended for an additional investigation. NI-3 is located at 29°09.~~419~~ 25.14'N, 094°25.~~184~~ 11.04'W, and was detected in the side scan (targets 21 and 22, heights 13.1' and 14.1', respectively). This feature is believed to be the F/V Lucky Jason Alexander, which was sunk in a tropical storm during the fall 1998. Multibeam heights were obtained over the feature, however the shoalest portion of the wreck appeared in the reconnaissance portion of the swath. A 44' depth is depicted on the smooth sheet, and a 42' sounding was detected in the reconnaissance swath. NOAA has determined that this contact justifies additional work by SAIC. Additional investigation shall be conducted using shallow water multibeam, specifically two orthogonal lines crossing the contact near nadir.

Method of Investigation: Shallow water multibeam orthogonal lines crossed with the item near nadir.

Results of Investigation: Full coverage in the area of the reported feature was obtained using shallow water multibeam. Data were fully corrected, including application of verified tides from station 877-1081, Sabine Offshore, TX.

Least depth:	44 feet
Latitude:	29 09.~~419'~~ 25.14 N
Longitude:	094 25.~~183'~~ 10.98 W
File:	hbmba99197.d07

Comparison with the Chart and Charting Recommendations: Recommend replacement of charted 41 Obstn PA, dotted circle, blue tint with 44 Wk, dotted circle, blue tint. Concur - Chart 44' Wk in Lat 29-09-25.14N, 94-25-10.98W Longitude. Delete charted ~~29-25~~ 41' Obstn From Lat ~~29-09~~ 29-09-25.14N; 94-25-11.04W

Comparison with the Smooth Sheet: Smooth sheet shows 44 Wk. Recommend no changes to the smooth sheet (no new AR.

O. ADEQUACY OF SURVEY See case Evaluation Report

Not applicable.

P. AIDS TO NAVIGATION - See case Evaluation Report

Not applicable.

Q. STATISTICS

Survey statistics are as follows:

13	Linear nautical miles of sounding lines (multibeam and side scan)
2	Linear nautical miles of sounding lines (multibeam only)
4	Number of sound velocity casts
13	Number of items investigated

R. MISCELLANEOUS - See case Evaluation Report

S. RECOMMENDATIONS

See Section N for recommendations.

T. REFERRAL TO REPORTS

Descriptive Report, H10850, 02 April 1999.

Science Applications International Corporation
An Employee-Owned Company
221 Third Street
Newport, RI 02840
(401) 847-4210

September 17, 1999

LETTER OF APPROVAL

REGISTRY NUMBER H10850

This report and data are respectfully submitted.

Field operations contributing to the accomplishment of survey H10850, Item Investigations, were conducted under my direct supervision with frequent personal checks of progress and adequacy. This report and data have been closely reviewed and are considered complete and adequate as per the Statement of Work.

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

Walter S. Simmons
Hydrographer
September 17, 1999

NOAA FORM 76-155
(11-72)

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

GEOGRAPHIC NAMES

SURVEY NUMBER

H-10850

Name on Survey	A ON CHART NO. 11325, 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	
GALVESTON (title)	X		X							1
GULF OF MEXICO	X		X							2
TEXAS (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

Chief Cartographer

JAN 19 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

REFERENCE NO.
N/CS33-17-01

LETTER TRANSMITTING DATA

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

☐ ORDINARY MAIL ☐ AIR MAIL
☐ REGISTERED MAIL ☒ EXPRESS
☐ GBL (Give number)_____

TO:

CHIEF, DATA CONTROL GROUP, N/CS3x1
NOAA / NATIONAL OCEAN SERVICE
STATION 6815, SSMC3
1315 EAST-WEST HIGHWAY
SILVER SPRING, MARYLAND 20910-3282

DATE FORWARDED
~~03/26/2001~~
04-10-01

NUMBER OF PACKAGES
1

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.

H10850

TEXAS, GULF OF MEXICO, 24 MILES ESE OF GALVESTON

ONE TUBE CONTAINING THE FOLLOWING:

1 SMOOTH SHEET FOR SURVEY H10850
1 ORIGINAL DESCRIPTIVE REPORT
1 DRAWING HISTORY FORM (NOAA FORM #76-71) FOR NOS CHART 11323
1 RECORD OF APPLICATION TO CHART FORM (NOAA FORM #75-96)
1 H-DRAWING ON MYLAR FOR NOS CHART 11323
2 COMPOSITE DRAWINGS (PARTS NORTH AND SOUTH) ON PAPER FOR NOS CHART 11323

FROM: (Signature) Pierce A. Blanchard

RECEIVED THE ABOVE
(Name, Division, Date)

Return receipted copy to:

NOAA \ NATIONAL OCEAN SERVICE
ATLANTIC HYDROGRAPHIC BRANCH N/CS33
439 WEST YORK STREET
NORFOLK, VA. 23510-1114

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

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

ATLANTIC HYDROGRAPHIC BRANCH
EVALUATION REPORT FOR H10850 (1998-1999)

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:

CARIS HIPS/SIPS
AutoCAD, Release 14
Hydrographic Processing System (HPS)
MicroStation 95, version 5.05
SiteWorks, version 2.01
NADCON, version 2.10
I/RAS B, version 5.01

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). 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 datum, move the projection lines 0.870 seconds (26.79 meters or 1.34 mm at the scale of the survey) north in latitude and 0.664 seconds (17.94 meters or 0.90 mm at the scale of the survey) west in longitude.

L. JUNCTIONS

H10835 (1998-1999) to the Northwest
H10873 (1999-2000) to the Southeast
H10876 (1999-2000) to the South

Standard junctions were effected between the present survey and surveys H10835 (1998-1999), H10873 (1999-2000), and H10876 (1999-2000).

Present survey depths are in harmony with the charted hydrography to the northeast and west.

M. COMPARISON WITH PRIOR SURVEYS

A comparison of prior surveys was not done during office processing. This is in accordance with section 4. of the memorandum titled *Changes to Hydrographic Survey Processing*, dated May 24, 1995. This also applies to 100% Side Scan coverage with 100% Multibeam coverage.

The present survey is adequate to supersede the prior surveys in the common area.

N. COMPARISON WITH CHARTS

11323	(58th Edition, Jun. 24/00)
11300	(37th Edition, Jun. 24/00)
11330	(12th Edition, Aug. 08/98)
11340	(65th Edition, Feb. 05/00)

Hydrography

The charted hydrography originates with prior surveys. Agreement between the charted depths and present survey soundings is adequate.

1. There is a holiday on the smooth sheet in the vicinity of Latitude 29°10'32"N, Longitude 94°22'15"W. This is the result of the hydrographer deleting soundings to put labels on the two oil platforms there.

Dangers to Navigation

Two Danger to Navigation reports were submitted to Commander(OAN), Eighth Coast Guard District, New Orleans, Louisiana for inclusion in the Local Notice to Mariners, and to the Marine Chart Division, N/CS3x1, Silver Spring, Maryland. Copies of the reports are appended to the Descriptive Report.

The present survey is adequate to supersede the charted hydrography in the common area, except as noted in this report.

O. ADEQUACY OF SURVEY

This is an adequate hydrographic survey and should supersede all prior surveys within the common area with the exception of those items noted above.

P. AIDS TO NAVIGATION

The hydrographer located 3 floating aids to navigation on the present survey. These aids appear adequate to serve their intended purpose.

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:

11323 (58th Edition, JUN 24, 2000) 1:80,000

H10850

Marilyn Schlüter

Marilyn L. Schlüter
Cartographic Technician
Verification of Field Data
Evaluation and Analysis

APPROVAL SHEET
H10850

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 disproval 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.

Deborah A. Bland Date: 23 Mar 2001
Deborah A. Bland
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.

James S. Verlaque, LCDR/NOAA Date: 23 MAR 2001
James A. Verlaque
Lieutenant Commander, NOAA
Chief, Atlantic Hydrographic Branch

****

Final Approval:

Approved: Samuel P. de Bow, Jr. Date: June 12, 2001

Samuel P. De Bow, 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. H10850

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
11323	2/23/01	D.A. Blan	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.

SUPERSEDES C&GS FORM 8352 WHICH MAY BE USED