H10874

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 "T"

Registry No. H10874

LOCALITY

State TEXAS

General Locality GULF OF MEXICO

Locality 48 NM SOUTH SOUTHWEST OF SABINE PASS

1999 - 2000

CHIEF OF PARTY
WALTER S. SIMMONS, OIC

LIBRARY & ARCHIVES

DATE NOV 8 2000

NOAA FORM 77-28
(11-72)

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

REGISTRY NO.
H10874

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. T

State TEXAS

General locality GULF OF MEXICO

Locality 48 nautical MILES SSW OF SABINE PASS

Scale 1:20,000 Date of survey 31 May 1999 – 30 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, R. Nadeau, L. Gates, A. Quintal, J. Infantino, L. McAuliffe, B. Andrews, E. Tobey, S. Lemke, B. Ramaswamy, M. Estaphan

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 HP1055CM - Field HP DesignJet 2500CP - office

Verification by Hydrographic Surveys 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 made during office processing

AWOIS ✓ & SURF ✓ 10-18-00 by MBH

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

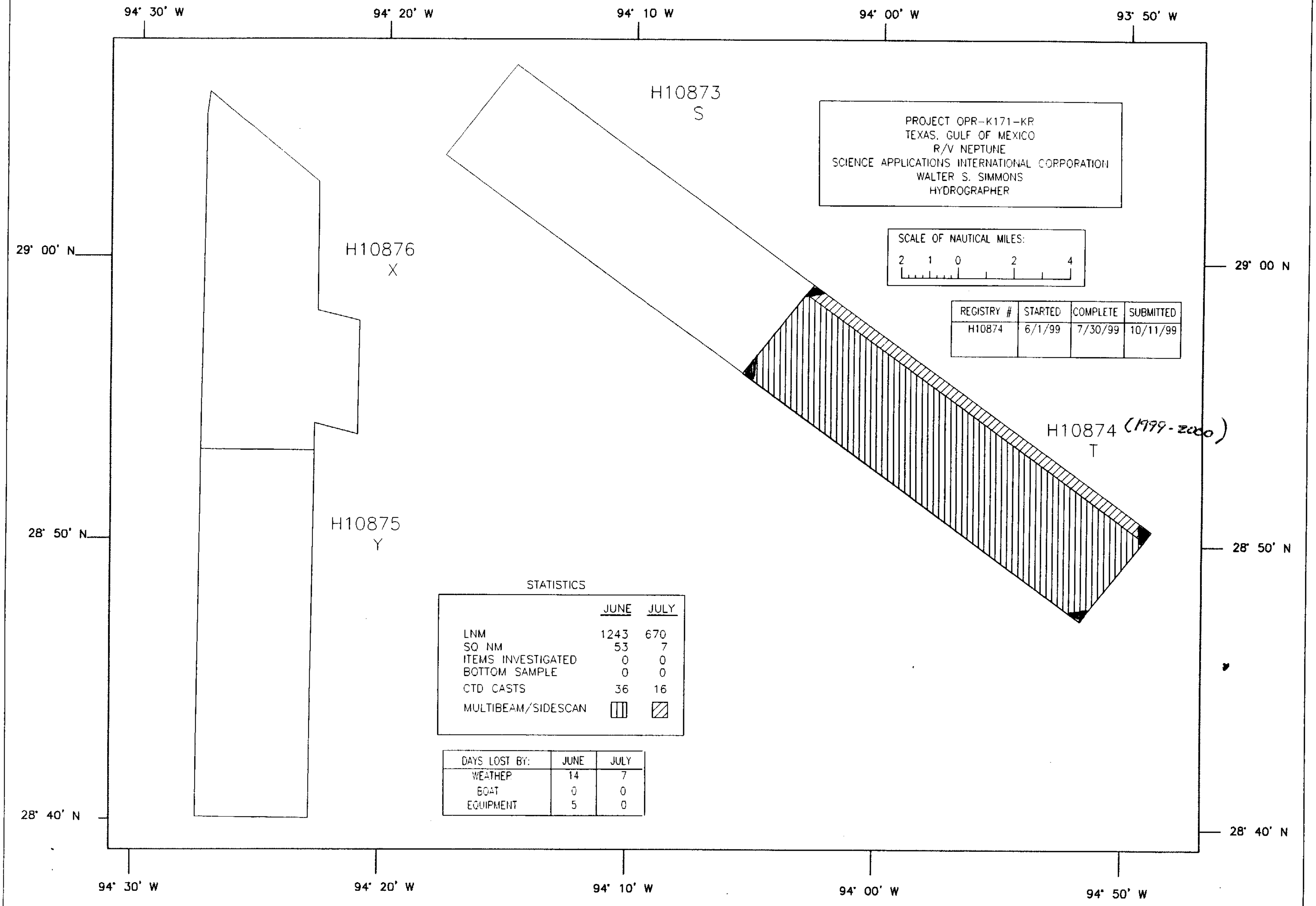
☆ U.S. GOVERNMENT PRINTING OFFICE: 1976—665-661/1222 REGION NO. 6

INDEX OF SHEETS

The Progress Sketch on the following page indicates:

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

PROGRESS SKETCH
H10874
MULTIBEAM SONAR – SIDESCAN SONAR



REGISTRY #	STARTED	COMPLETE	SUBMITTED
H10874	6/1/99	7/30/99	10/11/99

STATISTICS

	JUNE	JULY
LNM	1243	670
SQ NM	53	7
ITEMS INVESTIGATED	0	0
BOTTOM SAMPLE	0	0
CTD CASTS	36	16
MULTIBEAM/SIDESCAN		

DAYS LOST BY:	JUNE	JULY
WEATHER	14	7
BOAT	0	0
EQUIPMENT	5	0

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.

*Data filed with original field data

* Data filed with field records.

List of Figures

List of Tables

Descriptive Report to Accompany
Hydrographic Survey H10874
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: T
Registry Number: H10874
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 Shipping Safety Fairway at the Approach to Galveston, Texas. The following coordinates bound the survey approximately:

28.985523 N	094.044740 W	28-59-07.9, 94-02-41.66
28.841806 N	093.815283 W	28-50-30.5, 93-48-55.02
28.788846 N	093.862524 W	28-47-19.84, 93-51-45.08
28.932596 N	094.091899 W	28-55-57.34, 94-05-30.83
28.985523 N	094.044740 W	28-59-07.9, 94-02-41.06

Dates of multibeam data acquisition (UTC):

05/31/99 – 06/04/99	JD 151 – 155
06/09/99 – 06/16/99	JD 160 – 167
06/20/99	JD 171
06/22/99 – 06/23/99	JD 173 – 174
07/07/99 – 07/08/99	JD 188 – 189
07/11/99	JD 192
07/17/99 – 07/20/99	JD 198 – 201
07/22/99 – 07/24/99	JD 203 – 205
07/27/99	JD 208
07/29/99 – 07/30/99	JD 210 – 211

Dates of side scan data acquisition (UTC):

05/31/99 – 06/04/99	JD 151 – 155
06/09/99 – 06/15/99	JD 160 – 166
06/20/99	JD 171
06/22/99 – 06/23/99	JD 173 – 174
07/07/99 – 07/08/99	JD 188 – 189
07/11/99	JD 192
07/17/99 – 07/20/99	JD 198 – 201
07/22/99 – 07/24/99	JD 203 – 205
07/29/99 – 07/30/99	JD 210 – 211

C. SURVEY VESSEL

The R/V Neptune was the platform utilized 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 was 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

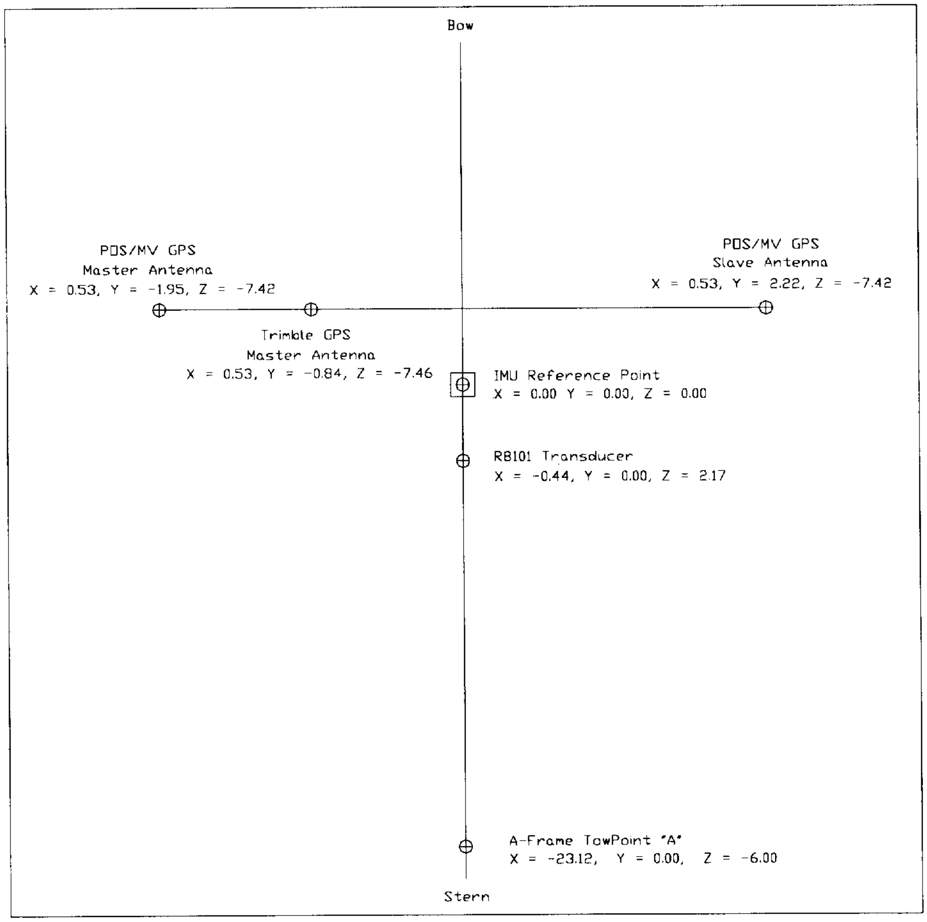
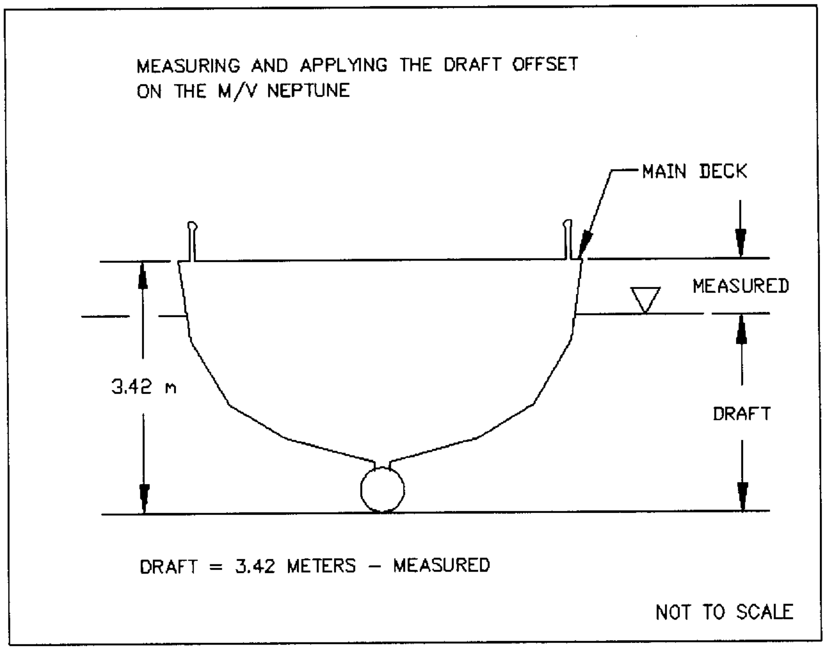


Table C-2. R/V Neptune Antenna and Transducer Locations Relative To the POS/MV IMU Vessel Reference Point, measurements in meters

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 utilize 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 - Sealax Evaluation Report

Data acquisition was carried out using 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** also 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 50 meters. The data acquisition rate for the R8101 was set at 8 pings per second. 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 and 8 per pings second, the average alongtrack coverage was 4.37 pings per 3 meters. In all instances, the specified average of 3.2 pings per 3 meters was met.

The side scan sonar equipment used throughout the H10874 survey was the Klein 5500 System. The 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 75-meters throughout the survey. 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 locate 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. Interactive editing was then performed to remove noise, fish, etc. The editing process used the geoswath geo-referenced editor which allows 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, TX (877-1081) station 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 H10874 multibeam data were reprocessed using verified tide data from the Sabine Offshore, TX (877-1081) station as downloaded from the NOAA/CO-OPS web page.

Depth data were then gridded to 1.5-meter cells for quality evaluation and for comparing to side scan sonar contacts. When anomalies were seen in the 1.5-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 H10874 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.

*Data filed with field records.

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 performed 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 created, verified, and corrected to ensure data coverage and to also check for navigation errors. Next, outer beams of the multibeam data, exceeding the 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 noted 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 H10874 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

Due to the split watch bill discussed above, there would always be at least two surveyors available at all times. While one technician was operating the real-time data acquisition system, the previous watchstander was usually located in the near vicinity processing the data collected during his data acquisition watch. Thus assistance was available for conducting CTD casts as well as other tasks. A minimum of four people was used during towfish deployment and recovery operations.

Side scan operations were conducted in water depths ranging from 53 to 86 feet. The side scan towfish altitude off the bottom was maintained between 26 and 50 feet. The MacArtney Sheave used to fairlead the side scan tow cable was equipped with a cable payout indicator, which automatically transmitted the cable out data to the **iss2000** system where layback and fish position was calculated. The system operator manually adjusted the cable length to maintain the proper fish altitude using a remote controller for the SeaMac winch. The operator appended an entry to a side scan annotation file whenever changes were made to the cable out length. These annotation files were later merged with the XTF data using proprietary software.

A proprietary software program, which graphically displays the towfish and water depths, combined with the convenience of a winch remote control allowed the operator to maintain the proper towfish height above the bottom with relative ease. Adjustments to the length of cable deployed were required several times during each survey line.

The use of a hydrodynamic depressor with the side scan sonar towfish allowed the towfish to tow deeper for a given amount of cable out than during surveys previously conducted without the use of a depressor. Because the normal operating cable out was usually less than the water depth, this allowed turns to be made tighter and faster without the danger of the towfish impacting the bottom. This also allowed the survey vessel to come to a stop in order to conduct CTD casts without requiring the operator to haul in and then re-deploy the side scan towfish. In addition, the depressor allowed the towfish to ride well below the propwash, even at higher survey speeds of 9 knots.

Survey lines were spaced 80-meters apart and were oriented on an azimuth of 126°/306°. Navigation and side scan file names were manually changed by the operator at the conclusion of each survey line. Due to the high data rates of the Klein 5500 side scan, the Klein data logging software automatically changes the file name every ten minutes. The range scale was set to 100-meters.

Watchstanders created digital annotation files that were later merged with XTF side scan data during processing.

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 and surface wind waves often made it difficult to collect high quality side scan sonar data. Because the AGC on the Klein 5500 locks on to the strongest signal, this often resulted in the system locking on to the surface reflection in depths of less than 60 feet whenever surface waves or Sargasso weeds were 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.

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 the eXtended Triton Format (XTF) which is readable by the Triton ISIS Sonar Processing System. These XTF files were then copied to 4mm tape in tar format and will be delivered for use with CARIS SIPS.

A side scan processing technician then examined each record using the Triton ISIS to review the data. A spreadsheet database was created which was used to log times where data gaps were caused by seaweed interference, biota in the water column, or other factors. Other data entered into this database included survey line, corresponding multibeam filename, start/end time of line, side scan filename, watch id number, line azimuth, and data gap information. This information was subsequently used to set the bad data off-line so that they were ignored during processing and coverage analysis.

After data collection began, it was discovered that the Klein TPU clock that time-stamps the ping data was drifting at an excessive rate. This resulted in an erroneous position being recorded for each ping. However, because the 1-PPS fix time and position were being correctly recorded in the Klein 5kd data files, SAIC's xtf_io software was able to adjust the ping times to the correct time as determined from the fix times. SAIC's navup (navigation update) software was then used to correct the ping positions in all XTF data collected through June 16, 1999 when a slave IRIG-B card was installed in the TPU. This solution subsequently provided accurate time stamping of the ping data in synchronization with the **iss2000**, which is synchronized, to UTC using the GPS signal.

After the IRIG-B card was installed on June 16th, numerous incorrect dates, times and positions were discovered in the raw Klein data. The duration of these events was typically 2 to 3 seconds but could be as large as 6 seconds. The xtf_io program was modified to perform an interpolation over these gaps in order to resolve the problem.

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

A time window file, which listed the on-line times of all valid data, was created for each 100% of coverage in order to create trackline, coverage, and mosaic plots using 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.

Side scan sonar contact information was stored by the ISIS using a Triton proprietary "CON" file format. These files were subsequently converted into **iss2000** readable "CTV" files using a SAIC proprietary utility called isis2ctv. During the conversion, a postscript image file was created of each sonar contact. The "CTV" file was directly loaded into the **iss2000** as a separate data layer and contacts were correlated by position and height with the one-meter multibeam data grid 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 versus 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 from June 5, 1999 through August 5, 1999. For the days of this survey in which the ODOM was operational, the results are also summarized in*Appendix G.

G. CORRECTIONS TO SOUNDINGS

1. Speed of Sound

A total of three Sea-Bird Electronics, Inc.(SBE), Model 19 CTDs were used to create sound velocity profiles for corrections to multibeam sonar soundings.

Unit	Serial Number	Calibration Date
A	193607-0565	23 February 1999
B	2710	15 October 1998
C	1915869-2389	02 September 1998

The primary unit was SBE19 #193607-0565(Unit "A"). Daily confidence checks were obtained from simultaneous casts with Unit "A" and either Unit "B"or Unit "C". After downloading CTD casts, both were computed, converted and compared to each other and to the previously applied cast. All profiles were computed using SBE proprietary software **Term19** and converted using the SBE **DatCnv** software. Computed profiles were copied to the **iss2000** where they were graphically displayed on the screen and visually compared with each other and with the previously applied cast. Based on this comparison, one of the new profiles was selected by the operator and 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. In the instances where sounding depths exceeded the cast depth, the 6042 used the bottom of the table to extend correctors below the table.

* Data filed with field records.

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 CTD 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 describing all CTD casts including dates, location, 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 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 taking measurements 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 measured upon return to port and any change in draft was prorated on a daily basis. The measured and prorated draft results are reported in *Appendix G, Table App. G-4.

* Data filed with field records.

5. Settlement and Squat

Measurements of settlement were conducted on day 138, May 19, 1999 in fifteen meters of water near 29° 11' 42"N 094° 28' 48"W. 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 RPMs 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 represent 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 manually entered into the **iss2000** system by the real-time system operator. The computer then 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 published accuracy of the POS/MV is ± 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 also used for heading. The dynamic heading accuracy of the unit is better than 0.05°.

Heading, roll, and pitch biases were determined during 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, which was 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

* Data filed with field records.

directions. The data from parallel lines run 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. During 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 or was unmeasurable. 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 could be seen in trawl marks which crossed 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 H10874 are shown in Table G-1.

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

Julian Days	151-209
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 (http://www.ngs.noaa.gov/).

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

* Data filed with field records

- Trimble Differential Beacon Receiver
- Leica MX-41R Differential Beacon Receiver, Serial Number 3508-102-18550

The primary hydrographic positioning equipment used during this survey 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 in Galveston 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, differential GPS navigation data were also being logged. Comparison of the navigation center position computed from the control station and the average position as determined by the DGPS navigation system 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 an independent Trimble DGPS receiver using differential correctors received 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 while the USCG Port Aransas, TX DGPS station was used for daily positioning confidence checks. The primary DGPS receiver automatically locked onto the strongest DGPS signal. When the Galveston DGPS station was off the air for upgrades, primary navigation automatically switched to the Port Aransas, TX DGPS station. Conversely, when the Galveston DGPS station came back online, the primary DGPS receiver automatically resumed using the Galveston station for DGPS corrections.

All antenna, transducer, towpoint, and towfish offsets were measured relative to the POS/MV's IMU. Two independent teams of two people each 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 catenary lookup table based on the value of tow cable paid out relative to the towpoint configuration or offsets measured previously.

J. SHORELINE

Not applicable.

K. CROSSLINES

There were 86 linear nautical miles of crosslines surveyed and 1356 linear nautical miles of mainscheme lines surveyed resulting in 6.0 percent coverage by crosslines.

Comparisons of all crossing data show that more than 98 percent of comparisons are within 30 centimeters and more than 99.99 percent of comparisons are within 50 centimeters. The comparisons that exceeded 60 centimeters were from two crossings in the deepest area of the survey where two sharp mounds were in the crossings. Position difference of 2 to 5 meters between the swaths would easily account for the large comparisons.

Table K-1. Junction Analysis Main Scheme vs. Cross Lines

Depth Difference Range			All Difference		Positive Difference		Negative Difference		Zero Difference
From		To	Count	Cumulative Percent	Count	Cumulative Percent	Count	Cumulative Percent	Count
00.0cm	->	10.0cm	1,412,312	47.20	796,228	38.72	549,880	67.51	73,146
10.0cm	->	20.0cm	1,117,659	84.55	905,052	80.45	213,392	93.95	
20.0cm	->	30.0cm	428,371	98.87	360,186	98.56	47,417	99.84	
30.0cm	->	40.0cm	33,041	99.97	29,585	99.96	1,209	100	
40.0cm	->	50.0cm	819	100	791	100	28	100	
50.0cm	->	60.0cm	3	100	0	100	3	100	
60.0cm	->	70.0cm	2	100	1	100	1	100	
70.0cm	->	80.0cm	0	100	0	100	0	100	
100.0cm	->	110.0cm	0	100	0	100	0	100	
		sub-totals ->	2,992,207		2,091,843		811,930		73,146
			100.00%		69.91%		27.14%		2.45%
H10874 Main Scheme Sounding minus Cross Line Sounding.									

*L. **JUNCTIONS** - See also Evaluation Report

Of the 458,145 comparisons with H10874, 98.14% were within 30 centimeters, and more than 99.99% were within 50 centimeters. No differences exceeded 60 centimeters

Table L-1. Junction Analysis H10873, Sheet S vs. H10874, Sheet T

Depth Difference Range			All Difference		Positive Difference		Negative Difference		Zero Difference
From		To	Count	Cumulative Percent	Count	Cumulative Percent	Count	Cumulative Percent	Count
00.0cm	->	10.0cm	199,898	43.63	126,768	47.82	57,866	32.55	15,264
10.0cm	->	20.0cm	172,978	81.39	109,084	88.97	63,894	68.49	
20.0cm	->	30.0cm	76,727	98.14	24,943	98.38	51,784	97.61	
30.0cm	->	40.0cm	7,517	99.78	3,291	99.62	4,226	99.99	
40.0cm	->	50.0cm	1,015	100	996	100	19	100	
50.0cm	->	60.0cm	10	100	10	100	0	100	
60.0cm	->	70.0cm	0	100	0	100	0	100	
		sub-totals ->	458,145		265,092		177,789		15,264
			100.0%		57.86%		38.81%		3.33%
H10873 Sounding Minus H10874 Sounding Junction Analysis									

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

H10874 was compared to Chart 11323, 57th edition, 27 March 1999, 1:80,000, in lieu of the specified 55th edition, and to Chart 11330, 12th Edition, 08 August 1998, 1:250,000, both corrected through Notice to Mariners 39/99.

Charted wreck PA at 28° 58' ~~36~~ 04.8"N 094° 00' ~~54~~ 56"W, reported to be a sunken 57 foot fishing boat, was not seen in the 200% side scan coverage or in the multibeam coverage. Recommend additional investigation of that portion of a 1500 meter radius circle around the charted position that falls outside the limits of the H10874 area using 200% side scan coverage at 75 meter range scale, and multibeam orthogonal lines over any one detected contact. Concur [See also p. 17 Item #6 of Additional Work Descriptive Report]

Charted wreck PA at 28° 54' 39"N 094° 02' 41"W was not seen in the 200% side scan coverage or in the multibeam coverage. Recommend additional investigation of that portion of a 1500 meter radius circle around the charted position that falls outside the limits of the H10874 area using 200% side scan coverage at 75 meter range scale, and multibeam orthogonal lines over any one detected contact. Concur [See also p. 18 Item # 7 of Additional Work Descriptive Report]

There are no charted pipelines within H10874, and no new pipelines were detected. Concur

In the southeastern half of H10874, depths are one to three feet deeper than charted depths. At the north corner of H10874 the 60-foot depth curve is very near the charted 60-foot curve. Soundings within the charted 60-foot curve are one to ~~eleven~~ three feet deeper than charted soundings. The southern sections of the 60-foot depth curve are much more complex than the charted 60-foot curves.

Recommend the entire common areas of Charts 11323 and 11330 be reconstructed with data from H10874. Concur

Table N-1 lists 15 new features discovered in H10874. Recommend these features be charted as determined in this survey.

Table N-1. New Features Discovered

Latitude	Longitude	Feature Number	Depth Feet	Related Side Scan Contacts	Category	1 or 0 = Meets Standards
28 50 03.035N	093 53 25.943W	1	77.79	34	OBSTR	1 do not chart
28 50 30.119N	093 53 20.803W	2	77.76	46, 68, 70	OBSTR	1 do not chart
28 50 12.726N	093 53 48.883W	3	78.02	49, 80, 124, 129	OBSTR	1 "
28 50 16.550N	093 53 49.516W	4	78.18	54, 130	OBSTR	1 "
28 50 01.116N	093 53 27.802W	5	78.48	55, 56, 82, 123	OBSTR	1 "
28 49 52.775N	093 52 51.971W	6	76.90	57, 81, 91, 122	OBSTR	1 chart 77' SND w/ obstn
28 49 53.286N	093 52 54.958W	7	78.94	58	OBSTR	1 do not chart
28 49 59.654N	093 52 57.942W	8	77.13	59, 110	OBSTR	1 "

28 50 14.633N	093 53 25.084W	9	78.15		OBSTR	1 Do Not Chart
28 50 18.198N	093 53 24.431W	10	79.53	65, 108, 116	OBSTR	1 "
28 50 06.696N	093 53 01.660W	11	80.61	106	OBSTR	1 "
28 50 33.329N	093 53 20.932W	12	79.66	71, 104	OBSTR	1 "
28 50 34.259N	093 53 20.440W	13	79.69		OBSTR	1 "
28 54 13.422N	094 00 11.180W	14	77.17	79, 114	OBSTR	1 "
28 50 05.486N	093 52 53.905W	15	78.31	95, 105, 111	OBSTR	1 "

O. NOT USED BY CONTRACTOR – See Evaluation Report

* P. AIDS TO NAVIGATION - See also Evaluation Report

There are no aids to navigation within this survey. Concur

There are no charted pipelines within this survey, and no new pipelines were detected Concur

Q. STATISTICS

Survey statistics are as follows:

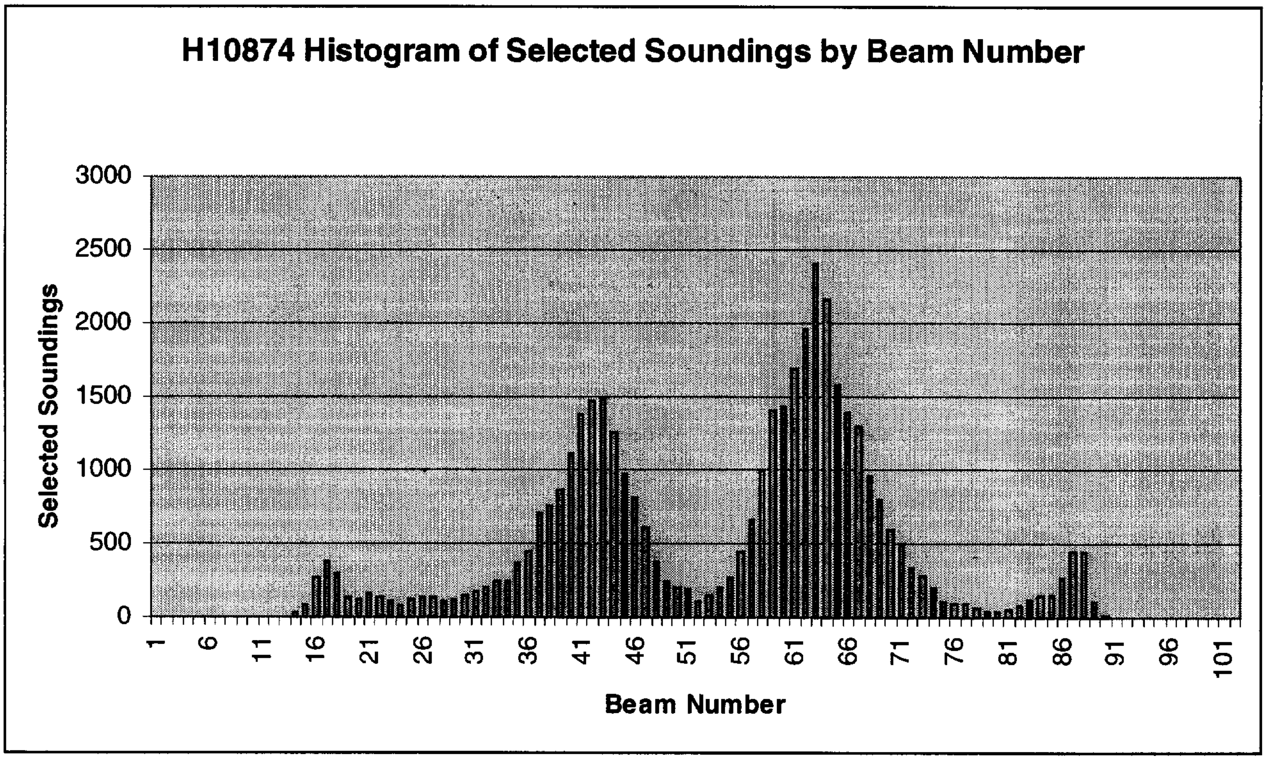
1913 nm	Linear nautical miles of sounding lines (multibeam and side scan)
60.0 nm^2	Square nautical miles of multibeam and side scan
71	Number of sound velocity casts
0	Number of items investigated

*R. MISCELLANEOUS - See also Evaluation Report

Side scan contact #19 from H10873 was within the survey area of H10874. Upon evaluation against H10874 data, contact #19 was determined to be non-significant. ✓

Figure R-1 shows the distribution by beam number of the 40,804 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

Recommend the entire common area of charts 11323 and 11330 be reconstructed with data from this survey. See Section N for additional recommendations.

Additional items recommended for investigation are shown in the Table S-1. These side scan contacts, identified as ACTIVE, are between the multibeam swaths.

Table S-1. H10874 Items Recommended for Investigation

yyyy/ddd	Time	Latitude		Longitude		Contact Number	Contact Height m	Related Contacts	Status
1999/152	16:38:10	28	55 21.375N	094	04 25.198W	3	1.58	4	ACTIVE
1999/152	20:53:35	28	55 21.367N	094	04 24.948W	4	2.41	3	ACTIVE
1999/153	9:14:15	28	51 05.803N	093	56 41.254W	10	1.10		ACTIVE
1999/153	17:30:36	28	49 14.376N	093	53 31.519W	20	0.99		ACTIVE
1999/153	20:49:53	28	49 18.151N	093	53 24.450W	24	1.08		ACTIVE
1999/153	21:44:12	28	49 16.471N	093	53 30.046W	26	1.07		ACTIVE
1999/154	4:34:25	28	49 19.727N	093	53 20.440W	27	0.87		ACTIVE
1999/155	20:06:27	28	49 55.990N	093	53 23.517W	35	0.99	83, 51	ACTIVE

1999/155	20:10:08	28	50 11.267N	093	53 52.270W	37	1.06	48	ACTIVE	
1999/166	1:04:22	28	57 14.152N	094	01 34.739W	41	0.73	98	ACTIVE	
1999/166	21:25:02	28	57 23.125N	094	01 08.500W	45	1.11		ACTIVE	Non
1999/173	18:21:33	28	50 11.293N	093	53 53.124W	48	0.85	37	ACTIVE	Significant
1999/173	18:25:23	28	49 56.137N	093	53 24.112W	51	0.93	35, 83	ACTIVE	
1999/173	22:24:13	28	50 20.785N	093	53 58.582W	52	0.00	125	ACTIVE	
1999/173	23:18:24	28	50 14.776N	093	53 27.861W	61	0.62		ACTIVE	
1999/174	1:16:36	28	50 23.476N	093	53 27.075W	64	0.72	115	ACTIVE	
1999/174	1:20:20	28	50 06.314N	093	53 04.367W	66	0.84	117, 109	ACTIVE	
1999/174	1:21:11	28	50 02.477N	093	52 58.568W	67	0.90	118	ACTIVE	
1999/189	2:57:34	28	57 39.531N	094	00 28.440W	74	0.49	75	ACTIVE	Item4
1999/189	7:15:16	28	57 39.694N	094	00 28.472W	75	0.67	74	ACTIVE	
1999/189	7:15:16	28	57 40.484N	094	00 24.721W	76	1.81	77	ACTIVE	Item5
1999/189	11:22:52	28	57 40.637N	094	00 24.856W	77	2.38	76	ACTIVE	
1999/189	15:17:34	28	56 51.425N	094	03 24.931W	78	1.19		ACTIVE	
1999/198	7:16:49	28	49 56.312N	093	53 23.621W	83	1.15	35, 51	ACTIVE	
1999/198	8:43:06	28	49 17.366N	093	53 28.739W	84	1.07		ACTIVE	
1999/198	12:13:26	28	51 18.101N	093	58 09.054W	85	1.38	128	ACTIVE	Non
1999/199	4:29:57	28	53 21.138N	093	57 23.053W	87	0.12	92	ACTIVE	Significant
1999/199	5:17:27	28	54 33.016N	093	59 28.511W	88	0.17	93	ACTIVE	
1999/199	7:39:37	28	50 13.725N	093	53 26.300W	89	0.90	119,121	ACTIVE	
1999/199	10:27:41	28	53 21.181N	093	57 22.796W	92	0.11	87	ACTIVE	
1999/199	10:43:22	28	54 32.963N	093	59 27.992W	93	0.17	88	ACTIVE	
1999/199	15:22:53	28	49 27.904N	093	50 36.712W	96	2.25		ACTIVE	
1999/201	18:53:29	28	57 13.835N	094	01 34.227W	98	0.91	41	ACTIVE	Item3
1999/203	21:49:15	28	54 13.388N	093	56 18.955W	99	0.00		ACTIVE	Non Significant
1999/205	19:31:43	28	56 52.021N	094	03 26.702W	102	1.20	112	ACTIVE	Item1
1999/205	19:40:09	28	56 08.551N	094	02 17.247W	103	0.66		ACTIVE	Non
1999/205	21:40:57	28	50 23.267N	093	53 25.898W	107	1.02		ACTIVE	Significant
1999/205	0:46:12	28	50 06.344N	093	53 04.667W	109	1.05	66, 117	ACTIVE	
1999/205	3:21:58	28	56 51.951N	094	03 26.687W	112	0.69	102	ACTIVE	Item1
1999/205	3:27:11	28	56 25.918N	094	02 48.986W	113	0.72		ACTIVE	
1999/205	11:50:02	28	50 23.655N	093	53 27.520W	115	0.67	64	ACTIVE	
1999/205	11:53:07	28	50 06.446N	093	53 04.729W	117	0.96	66, 109	ACTIVE	Non
1999/205	11:53:53	28	50 02.593N	093	52 59.117W	118	0.88	67	ACTIVE	Significant
1999/205	13:38:32	28	50 13.663N	093	53 25.351W	119	1.03	121, 89	ACTIVE	
1999/211	9:12:56	28	50 13.652N	093	53 26.006W	121	0.90	89, 119	ACTIVE	
1999/211	14:52:21	28	50 20.499N	093	53 57.893W	125	0.00	52	ACTIVE	
1999/211	14:52:54	28	50 21.384N	093	54 03.244W	126	0.90	131	ACTIVE	
1999/211	18:19:46	28	51 17.486N	093	58 07.770W	128	1.22	85	ACTIVE	
1999/211	20:42:34	28	50 21.437N	093	54 03.311W	131	0.86	126	ACTIVE	

T. REFERRAL TO REPORTS

None.

October 12, 1999

LETTER OF APPROVAL

REGISTRY NUMBER H10874

This report and the accompanying smooth sheet are respectfully submitted.

Field operations contributing to the accomplishment of survey H10874 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

Walter S. Simmons
Hydrographer
October 12, 1999

NOAA FORM 77-28 (11-72)

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

REGISTRY NO. **H10874**

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. **T**

State: TEXAS

General locality: GULF OF MEXICO

Locality: 48 nautical MILES SSW OF SABINE PASS

Scale: 1:20,000

Date of survey: 31 May 1999 – 30 July 1999
04 Feb 2000 – 08 Feb 2000

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, R. Nadeau, L. Gates, A. Quintal, J. Infantino, L. McAuliffe, B. Andrews, E. Tobey, S. Lemke, B. Ramaswamy, M. Estaphan

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: HP1055CM – field; HP DesignJet 2500CP – office

Verification by: Hydrographic Survey 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 made during office processing.

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

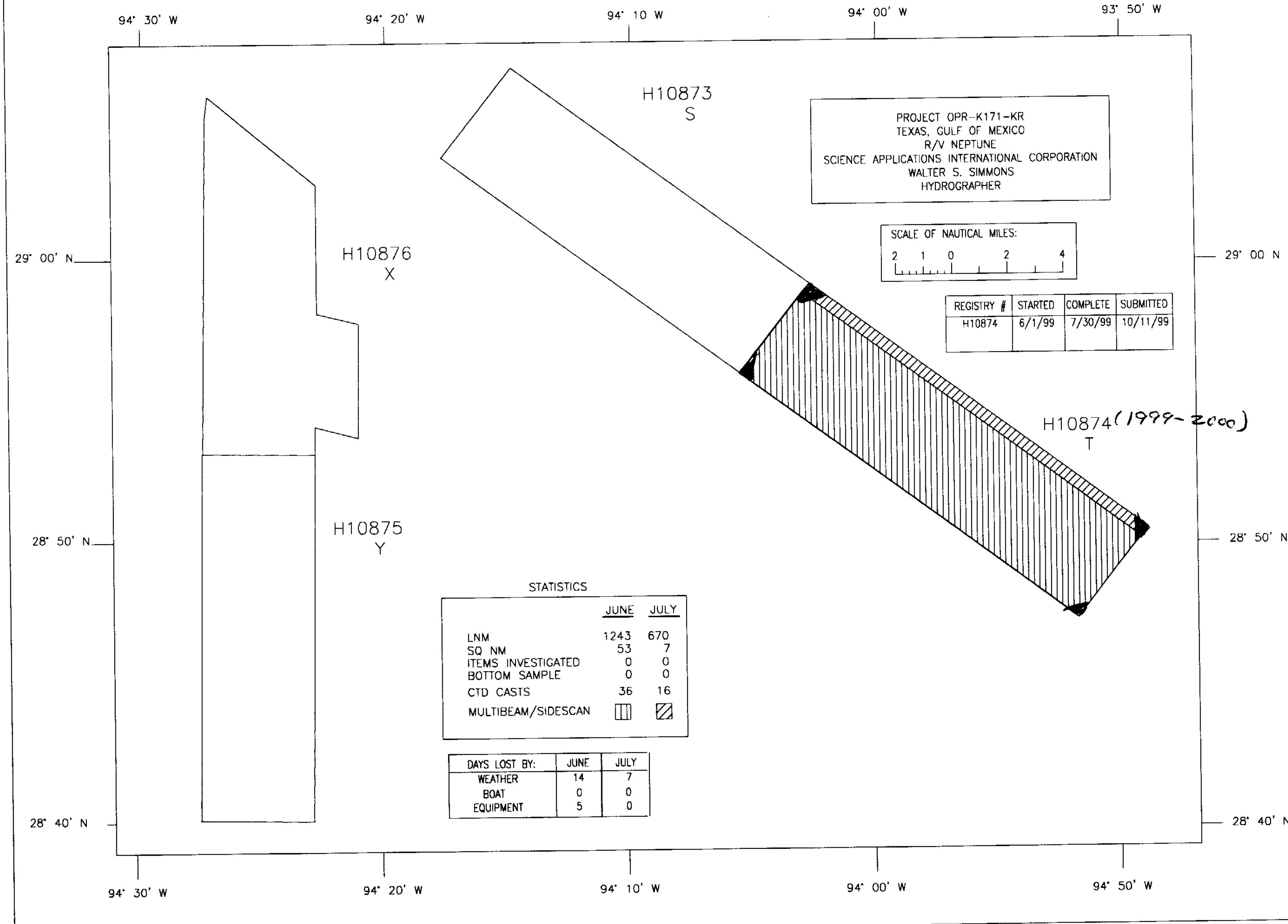
☆ U.S. GOVERNMENT PRINTING OFFICE: 1976—665-661/1222 REGION NO. 6

INDEX OF SHEETS

The Progress Sketch on the following page indicates:

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

PROGRESS SKETCH
H10874
MULTIBEAM SONAR – SIDESCAN SONAR



PROJECT OPR-K171-KR
TEXAS, GULF OF MEXICO
R/V NEPTUNE
SCIENCE APPLICATIONS INTERNATIONAL CORPORATION
WALTER S. SIMMONS
HYDROGRAPHER

REGISTRY #	STARTED	COMPLETE	SUBMITTED
H10874	6/1/99	7/30/99	10/11/99

STATISTICS

	JUNE	JULY
LNM	1243	670
SQ NM	53	7
ITEMS INVESTIGATED	0	0
BOTTOM SAMPLE	0	0
CTD CASTS	36	16
MULTIBEAM/SIDESCAN	▥	▨

DAYS LOST BY:	JUNE	JULY
WEATHER	14	7
BOAT	0	0
EQUIPMENT	5	0

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.

* Data filed with field records.

*Data filed with field records

List of Figures

List of Tables

Descriptive Report to Accompany
Hydrographic Survey H10874
Scale 1:20,000 Surveyed 1999 - 2000
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
	04 January 2000	Modification #7:56-DGNC-0-24007/SAIC

Dates of Supplemental Instructions: 4 August 1998, 25 May 1999
Sheet Letter: T
Registry Number: H10874
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 Shipping Safety Fairway at the Approach to Galveston, Texas. The following coordinates bound the survey approximately:

28.985523 N	094.044740 W	28-59-07.9N, 94-02-41.06W
28.841806 N	093.815283 W	28-50-30.5N, 93-48-55.02W
28.788846 N	093.862524 W	28-47-19.84N, 93-51-45.08W
28.932596 N	094.091899 W	28-55-57.34N, 94-05-30.83W
28.985523 N	094.044740 W	28-59-07.9N, 94-02-41.06W

Dates of multibeam data acquisition (UTC):

05/31/99 – 06/04/99	JD 151 – 155
06/09/99 – 06/16/99	JD 160 – 167
06/20/99	JD 171
06/22/99 – 06/23/99	JD 173 – 174
07/07/99 – 07/08/99	JD 188 – 189
07/11/99	JD 192
07/17/99 – 07/20/99	JD 198 – 201
07/22/99 – 07/24/99	JD 203 – 205
07/27/99	JD 208
07/29/99 – 07/30/99	JD 210 – 211
02/04/00	JD 035
02/06/00 – 02/08/00	JD 037 – 039

Dates of side scan data acquisition (UTC):

05/31/99 – 06/04/99	JD 151 – 155
06/09/99 – 06/15/99	JD 160 – 166
06/20/99	JD 171
06/22/99 – 06/23/99	JD 173 – 174
07/07/99 – 07/08/99	JD 188 – 189
07/11/99	JD 192
07/17/99 – 07/20/99	JD 198 – 201
07/22/99 – 07/24/99	JD 203 – 205
07/29/99 – 07/30/99	JD 210 – 211
02/04/00	JD 035
02/06/00 – 02/07/00	JD 037 – 038

C. SURVEY VESSEL

The R/V Neptune was the platform utilized 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 was 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

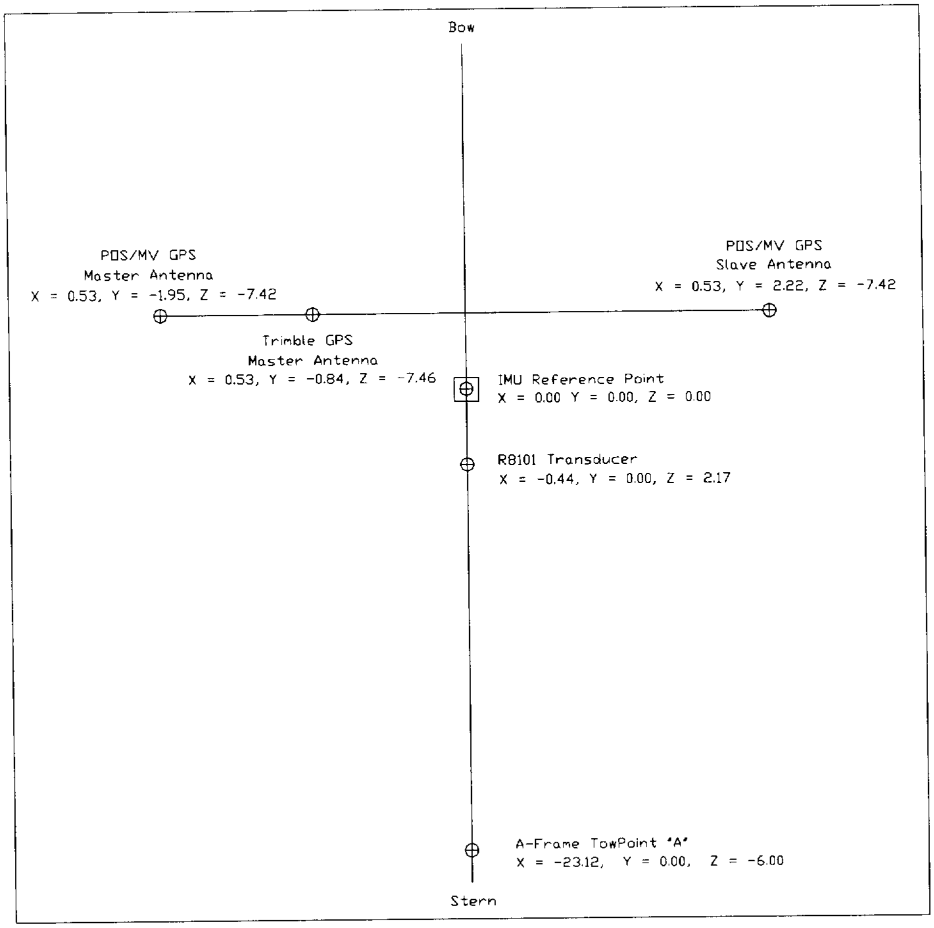
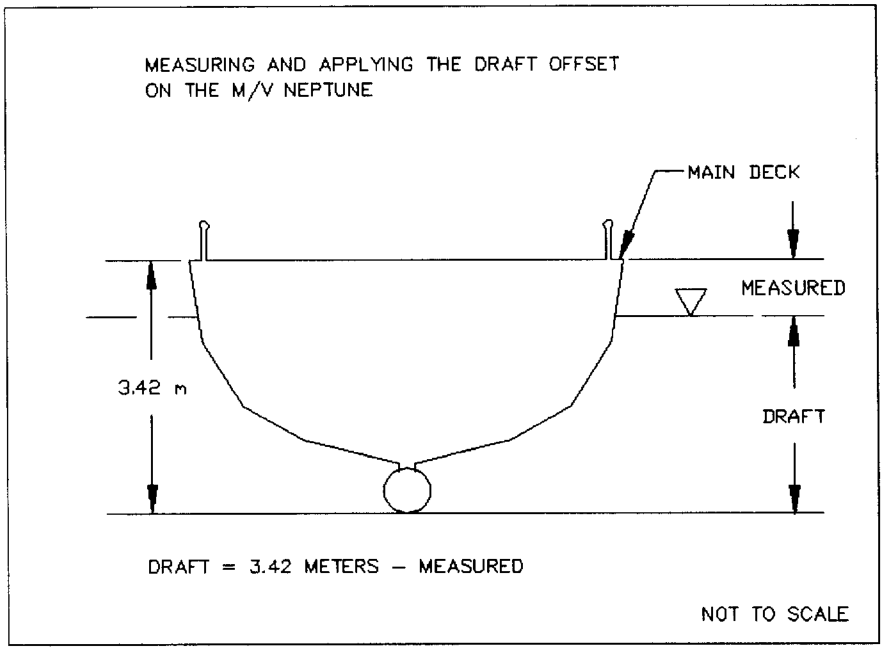


Table C-2. R/V Neptune Antenna and Transducer Locations Relative To the POS/MV IMU Vessel Reference Point, measurements in meters

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 utilize 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 carried out using 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** also 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 50 meters. The data acquisition rate for the R8101 was set at 8 pings per second. 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 and 8 per pings second, the average alongtrack coverage was 4.37 pings per 3 meters. In all instances, the specified average of 3.2 pings per 3 meters was met.

The side scan sonar equipment used throughout the H10874 survey was the Klein 5500 System. The 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 75-meters throughout the survey. 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 locate 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. Interactive editing was then performed to remove noise, fish, etc. The editing process used the geoswath geo-referenced editor which allows 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, TX (877-1081) station 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 X Appendix F. All H10874 multibeam data were reprocessed using verified tide data from the Sabine Offshore, TX (877-1081) station as downloaded from the NOAA/CO-OPS web page.

Depth data were then gridded to 1.5-meter cells for quality evaluation and for comparing to side scan sonar contacts. When anomalies were seen in the 1.5-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 X Appendix K.

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

The real time multibeam acquisition system used for the H10874 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.

X Data Filed with field records

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 performed 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 created, verified, and corrected to ensure data coverage and to also check for navigation errors. Next, outer beams of the multibeam data, exceeding the 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 noted 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 H10874 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

Due to the split watch bill discussed above, there would always be at least two surveyors available at all times. While one technician was operating the real-time data acquisition system, the previous watchstander was usually located in the near vicinity processing the data collected during his data acquisition watch. Thus assistance was available for conducting CTD casts as well as other tasks. A minimum of four people was used during towfish deployment and recovery operations.

Side scan operations were conducted in water depths ranging from 53 to 86 feet. The side scan towfish altitude off the bottom was maintained between 26 and 50 feet. The MacArtney Sheave used to fairlead the side scan tow cable was equipped with a cable payout indicator, which automatically transmitted the cable out data to the **iss2000** system where layback and fish position was calculated. The system operator manually adjusted the cable length to maintain the proper fish altitude using a remote controller for the SeaMac winch. The operator appended an entry to a side scan annotation file whenever changes were made to the cable out length. These annotation files were later merged with the XTF data using proprietary software.

A proprietary software program, which graphically displays the towfish and water depths, combined with the convenience of a winch remote control allowed the operator to maintain the proper towfish height above the bottom with relative ease. Adjustments to the length of cable deployed were required several times during each survey line.

The use of a hydrodynamic depressor with the side scan sonar towfish allowed the towfish to tow deeper for a given amount of cable out than during surveys previously conducted without the use of a depressor. Because the normal operating cable out was usually less than the water depth, this allowed turns to be made tighter and faster without the danger of the towfish impacting the bottom. This also allowed the survey vessel to come to a stop in order to conduct CTD casts without requiring the operator to haul in and then re-deploy the side scan towfish. In addition, the depressor allowed the towfish to ride well below the propwash, even at higher survey speeds of 9 knots.

Survey lines were spaced 80-meters apart and were oriented on an azimuth of 126°/306°. Navigation and side scan file names were manually changed by the operator at the conclusion of each survey line. Due to the high data rates of the Klein 5500 side scan, the Klein data logging software automatically changes the file name every ten minutes. The range scale was set to 100-meters.

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 and surface wind waves often made it difficult to collect high quality side scan sonar data. Because the AGC on the Klein 5500 locks on to the strongest signal, this often resulted in the system locking on to the surface reflection in depths of less than 60 feet whenever surface waves or Sargasso weeds were 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.

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 the eXtended Triton Format (XTF) which is readable by the Triton ISIS Sonar Processing System. These XTF files were then copied to 4mm tape in tar format and will be delivered for use with CARIS SIPS.

A side scan processing technician then examined each record using the Triton ISIS to review the data. A spreadsheet database was created which was used to log times where data gaps were caused by seaweed interference, biota in the water column, or other factors. Other data entered into this database included survey line, corresponding multibeam filename, start/end time of line, side scan filename, watch id number, line azimuth, and data gap information. This information was subsequently used to set the bad data off-line so that they were ignored during processing and coverage analysis.

After data collection began, it was discovered that the Klein TPU clock that time-stamps the ping data was drifting at an excessive rate. This resulted in an erroneous position being recorded for each ping. However, because the 1-PPS fix time and position were being correctly recorded in the Klein 5kd data files, SAIC's xtf_io software was able to adjust the ping times to the correct time as determined from the fix times. SAIC's navup (navigation update) software was then used to correct the ping positions in all XTF data collected through June 16, 1999 when a slave IRIG-B card was installed in the TPU. This solution subsequently provided accurate time stamping of the ping data in synchronization with the **iss2000**, which is synchronized, to UTC using the GPS signal.

After the IRIG-B card was installed on June 16th, numerous incorrect dates, times and positions were discovered in the raw Klein data. The duration of these events was typically 2 to 3 seconds but could be as large as 6 seconds. The xtf_io program was modified to perform an interpolation over these gaps in order to resolve the problem.

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

A time window file, which listed the on-line times of all valid data, was created for each 100% of coverage in order to create trackline, coverage, and mosaic plots using 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.

Side scan sonar contact information was stored by the ISIS using a Triton proprietary "CON" file format. These files were subsequently converted into **iss2000** readable "CTV" files using a SAIC proprietary utility called isis2ctv. During the conversion, a postscript image file was created of each sonar contact. The "CTV" file was directly loaded into the **iss2000** as a separate data layer and contacts were correlated by position and height with the one-meter multibeam data grid 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 versus 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 from June 5, 1999 through August 5, 1999. For the days of this survey in which the ODOM was operational, the results are also summarized in *Appendix G.

G. CORRECTIONS TO SOUNDINGS

1. Speed of Sound

A total of three Sea-Bird Electronics, Inc.(SBE), Model 19 CTDs were used to create sound velocity profiles for corrections to multibeam sonar soundings.

- "A" - Sea-Bird Electronics, Inc., Model 19 CTD, Serial Number 193607-0565,
  Calibration Dates: 23 February 1999, 14 September 1999.
- "B" - Sea-Bird Electronics, Inc., Model 19 CTD, Serial Number 2710,
  Calibration Dates: 15 October 1998, 14 September 1999.
- "C" - Sea-Bird Electronics, Inc., Model 19 CTD, Serial Number 1915869-2389,
  Calibration Dates: 02 September 1998.

The primary unit was SBE19 #193607-0565(Unit "A"). Daily confidence checks were obtained from simultaneous casts with Unit "A" and either Unit "B"or Unit "C". After downloading CTD casts, both were computed, converted and compared to each other and to the previously applied cast. All profiles were computed using SBE proprietary software **Term19** and converted using the SBE **DatCnv** software. Computed profiles were copied to the **iss2000** where they were graphically displayed on the screen and visually compared with each other and with the previously applied cast. Based on this comparison, one of the new profiles was selected by the operator and 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. In the instances where sounding depths exceeded the cast depth, the RESON 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 CTD 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

*Data filed with field records

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 describing all CTD casts including dates, location, 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 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 taking measurements 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 measured upon return to port and any change in draft was prorated on a daily basis. The measured and prorated draft results are reported in*Appendix G, Table App. G-5.

5. Settlement and Squat

Measurements of settlement were conducted on day 138, May 19, 1999 in fifteen meters of water near 29° 11' 42"N 094° 28' 48"W. 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 RPMs to zero and drifted down the line while recording soundings over the flat bottom.

*Data filed with field records.

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 represent 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 manually entered into the **iss2000** system by the real-time system operator. The computer then 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-6.

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 published accuracy of the POS/MV is ± 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 also used for heading. The dynamic heading accuracy of the unit is better than 0.05°.

Heading, roll, and pitch biases were determined during 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, which was 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 run 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-4a, G-4b.

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. Pitch bias results are shown in *Appendix G, Table App. G-3.

Following the roll and pitch bias tests, a heading bias test was conducted. During 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

*Data filed with field records

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 or was unmeasurable. 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 could be seen in trawl marks which crossed through numerous swaths with perfect alignment.

Table*App. G-7 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 H10874 are shown in Table G-1.

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

Julian Days	151-209
Roll	0.40
Pitch	0.00
Heading	0.00

Julian Days	296 - 039
Roll	0.13
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 (http://www.ngs.noaa.gov/).

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 Probeacon Differential Beacon Receiver, Serial Number 0220159406
- Leica MX-41R Differential Beacon Receiver, Serial Number 3508-102-18550

The primary hydrographic positioning equipment used during this survey 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 in Galveston where measurements were made to calculate the offset between the hydrographic navigation position and horizontal control station CG-20, 1974 or CG-21, 1974. While measurements were being made, differential GPS navigation data were also

* Data filed with field records

being logged. Comparison of the navigation center position computed from the control station and the average position as determined by the DGPS navigation system 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 an independent Trimble DGPS receiver using differential correctors received 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 while the USCG Port Aransas, TX DGPS station was used for daily positioning confidence checks. The primary DGPS receiver automatically locked onto the strongest DGPS signal. When the Galveston DGPS station was off the air for upgrades, primary navigation automatically switched to the Port Aransas, TX DGPS station. Conversely, when the Galveston DGPS station came back online, the primary DGPS receiver automatically resumed using the Galveston station for DGPS corrections.

All antenna, transducer, towpoint, and towfish offsets were measured relative to the POS/MV's IMU. Two independent teams of two people each 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 catenary lookup table based on the value of tow cable paid out relative to the towpoint configuration or offsets measured previously.

J. SHORELINE

Not applicable.

K. CROSSLINES

There were 86 linear nautical miles of crosslines surveyed and 1356 linear nautical miles of mainscheme lines surveyed resulting in 6.0 percent coverage by crosslines.

Comparisons of all crossing data show that more than 98 percent of comparisons are within 30 centimeters and more than 99.99 percent of comparisons are within 50 centimeters. The comparisons that exceeded 60 centimeters were from two crossings in the deepest area of the survey where two sharp mounds were in the crossings. Position difference of 2 to 5 meters between the swaths would easily account for the large comparisons.

Table K-1. Junction Analysis Mainscheme vs. Cross Lines

Depth Difference Range			All Difference		Positive Difference		Negative Difference		Zero Difference
From		To	Count	Cumulative Percent	Count	Cumulative Percent	Count	Cumulative Percent	Count
00.0cm	->	10.0cm	1,412,312	47.20	796,228	38.72	549,880	67.51	73,146
10.0cm	->	20.0cm	1,117,659	84.55	905,052	80.45	213,392	93.95	
20.0cm	->	30.0cm	428,371	98.87	360,186	98.56	47,417	99.84	
30.0cm	->	40.0cm	33,041	99.97	29,585	99.96	1,209	100	
40.0cm	->	50.0cm	819	100	791	100	28	100	
50.0cm	->	60.0cm	3	100	0	100	3	100	
60.0cm	->	70.0cm	2	100	1	100	1	100	
70.0cm	->	80.0cm	0	100	0	100	0	100	
100.0cm	->	110.0cm	0	100	0	100	0	100	
sub-totals ->			2,992,207		2,091,843		811,930		73,146
			100.00%		69.91%		27.14%		2.45%
H10874 Main Scheme Sounding minus Cross Line Sounding.									

✓L. **JUNCTIONS** - See also Evaluation Report

Of the 458,145 comparisons with H10874, 98.14% were within 30 centimeters, and more than 99.99% were within 50 centimeters. No differences exceeded 60 centimeters

Table L-1. Junction Analysis H10873, Sheet S vs. H10874, Sheet T

Depth Difference Range			All Difference		Positive Difference		Negative Difference		Zero Difference
From		To	Count	Cumulative Percent	Count	Cumulative Percent	Count	Cumulative Percent	Count
00.0cm	->	10.0cm	199,898	43.63	126,768	47.82	57,866	32.55	15,264
10.0cm	->	20.0cm	172,978	81.39	109,084	88.97	63,894	68.49	
20.0cm	->	30.0cm	76,727	98.14	24,943	98.38	51,784	97.61	
30.0cm	->	40.0cm	7,517	99.78	3,291	99.62	4,226	99.99	
40.0cm	->	50.0cm	1,015	100	996	100	19	100	
50.0cm	->	60.0cm	10	100	10	100	0	100	
60.0cm	->	70.0cm	0	100	0	100	0	100	
sub-totals ->			458,145		265,092		177,789		15,264
			100.0%		57.86%		38.81%		3.33%
H10873 Sounding Minus H10874 Sounding Junction Analysis									

*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

H10874 was compared to Chart 11323, 57th edition, 27 March 1999, 1:80,000, in lieu of the specified 55th edition, and to Chart 11330, 12th Edition, 08 August 1998, 1:250,000, both corrected through Notice to Mariners 39/99.

Charted wreck PA at 28° 54' 39"N 094° 02' 41"W was not seen in the 200% side scan coverage or in the multibeam coverage. Recommend additional investigation of that portion of a 1500 meter radius circle around the charted position that falls outside the limits of the H10874 area using 200% side scan coverage at 75 meter range scale, and multibeam orthogonal lines over any one detected contact. Concur – See Item #7 page 18

There are no charted pipelines within H10874, and no new pipelines were detected.

In the southeastern half of H10874, depths are one to three feet deeper than charted depths. In this survey, the 60-foot depth curve generally outlines the sand waves in the area. At the north corner of H10874 the 60-foot depth curve is very near the charted 60-foot curve. Soundings within the charted 60-foot curve are one to ~~eleven~~ three feet deeper than charted soundings. The southern sections of the 60-foot depth curve are much more complex than the charted 60-foot curves, and the sand waves extend 58 foot and 59 foot soundings further to the southwest.

At 28° 54' 13.42"N 094° 00' 11.18"W is a non-significant obstruction with least depth ~~77~~ 78 feet in depths of 78 feet, and at 28° 54' 17.60"N 094° 00' 19.96"W is a non-significant obstruction with least depth ~~76~~ 77 feet in depths of 77 and 78 feet. These obstructions are not highlighted on the smooth sheet. Concur - Do Not chart

Recommend the entire common areas of Charts 11323 and 11330 be reconstructed with data from H10874 using a more dense selection of soundings from this survey to more completely depict the shape of the bottom. Concur

Item 1:

I-1 originates in SAIC's table S-1 and is the correlation of side scan contacts #102 and #112 (heights 1.19m, 1.2m). These contacts were not covered within the multibeam swath, and are recommended by SAIC for an additional investigation. Contact #102 is located at 28° 56' 52.021"N, 094° 03' 26.702"W, and contact #112 is located at 28° 56' 51.951"N, 094° 03' 26.687"W. Upon inspection of the side scan images, NOAA has determined that these contacts justify 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 crossing the contact near nadir.

Results of investigation: Multibeam coverage revealed a single obstruction designated as Feature #3 with least depth of 59 feet in charted 62 feet. Surrounding area on this survey is ~~59~~ 58 feet to 62 feet. This is an individual obstruction between sand waves. See Danger to Navigation report in Appendix A, which includes this obstruction and sand wave least depths to the southwest of this position. The 60 foot curve generally outlines sand waves in the area. - Concur

ATTACHED

Recommendation: Chart a 59-foot obstruction as follows: Concur w/conditions: This 59' obstn is surrounded by 58' sand wave depths. We will chart the 59 obstn because hydrographer says this item is a hard target and should be charted.

Least depth:	59 feet ✓
Latitude:	28° 56' 51.79"N .82
Longitude:	094° 03' 25.87"W .85
File:	hbmba00037.d24

Also chart sufficient soundings from this survey to depict the change in depths on the sand waves. Concur

~~Chart 59' Obstn in present survey location~~ Delete this item from the chart. Shoaler snds surround this item. It poses no DANGER to navigation.

Item 2:

I-2 originates in SAIC's table S-1 and is the correlation of side scan contacts #3 and #4 (heights 1.58m, 2.41m). These contacts were not covered within the multibeam swath, and are recommended by SAIC for an additional investigation. Contact #3 is located at 28° 55' 21.375"N, 094° 04' 25.198"W, and contact #4 is located at 28° 55' 21.367"N, 094° 04' 24.948"W. Upon inspection of the side scan images, NOAA has determined that these contacts justify 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 crossing the contact near nadir.

Results of investigation: Multibeam coverage revealed an obstruction designated as Feature #4 with least depth of 69 feet in charted 71 feet. Surrounding area on this survey is 71 feet to 73 feet.

Recommendation: Recommend charting a 69-foot obstruction as follows: Chart 69 obstn (Non-dangerous)

Least depth:	69 feet	82
Latitude:	~~28° 55' 20.81"N~~	28-55-20.822 N
Longitude:	~~094° 04' 25.86"W~~	94-04-25.866 W
File:	hbmba99152.d20	

Item 3:

I-3 originates in SAIC's table S-1 and is the correlation of side scan contacts #41 and #98 (heights 0.73m, 0.91m). These contacts were not covered within the multibeam swath, and are recommended by SAIC for an additional investigation. Contact #41 is located at 28° 57' 14.152" N, 094° 01' 34.739"W, and contact #98 is located at 28° 57' 13.835"N, 094° 01' 34.227"W. Upon inspection of the side scan images, NOAA has determined that these contacts justify 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 crossing the contact near nadir.

Results of investigation: Multibeam coverage revealed a bump in a depression. This object was within 50 meters of shoaler depths in the survey. Therefore, this object is not a ~~n~~ significant obstruction. Concur - DO NOT chart

Item 4:

I-4 originates in SAIC's table S-1 and is the correlation of side scan contacts #74 and #75 (heights 0.49m, 0.67m). These contacts were not covered within the multibeam swath, and are recommended by SAIC for an additional investigation. It should be noted that these contacts are in the vicinity of a charted wreck PA (1000m away). Contact #74 is located at 28° 57' 39.531" N, 094° 00' 28.440"W, and contact

#75 is located at 28° 57' 39.694"N, 094° 00' 28.472"W. Upon inspection of the side scan images, NOAA has determined that these contacts justify 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 crossing the contact near nadir.

Results of investigation: Multibeam coverage revealed a single obstruction designated as Feature #1 with least depth of 57 feet in charted 58 feet. Surrounding area on this survey is 59 feet to 60 feet. This object appears to be a container. It is not the charted fishing boat.

Recommendation: Chart obstruction as follows: Circle w/conditions. Because of location of this obstn in relation to Item #5 (below), both cannot be charted. Chart '53' Obstns include the 58 obstn inside the danger curve.

Least depth:	57 feet (58)	
Latitude:	28° 57' 39.37"N	28°57' 39.366
Longitude:	094° 00' 27.64"W	94°00' 27.654
File:	hbmba00039.d26	

Item 5:

I-5 originates in SAIC's table S-1 and is the correlation of side scan contacts #76 and #77 (heights 1.81m, 3.28m). These contacts were not covered within the multibeam swath, and are recommended by SAIC for an additional investigation. It should be noted that these contacts are in the vicinity of a charted wreck PA (1000m away). Contact #76 is located at 28° 57' 40.484" N, 094° 00' 24.721"W, and contact #77 is located at 28° 57' 40.637"N, 094° 00' 24.856"W. Upon inspection of the side scan images, NOAA has determined that these contacts justify 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 crossing the contact near nadir.

Results of investigation: Multibeam coverage revealed a group of obstructions designated as Feature #2 with least depth of 55 feet in charted 58 feet. Surrounding area on this survey is 59 feet to 60 feet. These objects appear to be several containers and other debris. They are not the charted fishing boat.

Recommendation: Chart with label "Obstns" as follows: Circle Chart '53' Obstns

Least depth:	55 feet (53)	
Latitude:	28° 57' 40.45"N (.33)	28°57'40.335
Longitude:	094° 00' 23.76"W (.93)	94°00' 23.926
File:	hbmba00039.d08	

Item 6:

I-6 is a charted dangerous wreck PA located at 28° 58' 04.8"N, 094° 00' 56.0"W, at the northeast edge of the survey limits. A feature was detected in the vicinity of this charted item (see items 4 and 5 above), however, the search radius extends beyond the original survey limits. 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 a 2000 meter search radius around the charted position, extending into the area beyond the original survey limits. If the item in question is detected with side scan, multibeam data shall be acquired, specifically two orthogonal lines crossing the contact near nadir.

Method of investigation: 200% side scan coverage encompassing a 2000 meter search radius around the charted position, extending into the area beyond the original survey limits.

Results of investigation: Charted dangerous wreck PA located at 28° 58' 04.8"N, 094° 00' 56.0"W, reported to be a sunken 57 foot fishing boat, was not seen in the 200% side scan coverage or in the multibeam coverage of the main survey, or in the 200% side scan coverage of the additional investigation. See items 4 and 5 for obstructions found within the 2000-meter circle.

Recommendation: Remove the charted dangerous wreck PA. CONCUR Delete (++) PA

Item 7: (Same as p.15 Section N, paragraph 2) of original Report - Descriptive)

I-7 is a charted wreck PA located at 28° 54' ~~40.0~~ 39.0"N, 094° 02' ~~42.0~~ 41.0"W, in the northwest portion of the survey area. The search radius extends beyond the original survey limits for this feature. This item was not detected in the original 200% side scan and 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 2000m radius around 28° 54' 40.0"N, 094° 02' 42.0"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.

Method of investigation: 200% side scan coverage encompassing a 2000 meter search radius around the charted position, extending into the area beyond the original survey limits of H10874 and H10942, and shallow water multibeam orthogonal lines over a detected contact..

Results of investigation: Charted dangerous wreck PA, located at 28° 54' ~~40.0~~ 39.0"N, 094° 02' ~~42.0~~ 41.0"W , was not seen in the 200% side scan coverage or in the multibeam coverage of the main survey, or in the 200% side scan coverage of the additional investigation. One side scan contact was seen in the additional investigation. Shallow water multibeam orthogonal lines over the contact revealed it non-significant.

Recommendation: Remove the charted dangerous wreck PA. Concur Delete ~~(+)~~ ++ PA

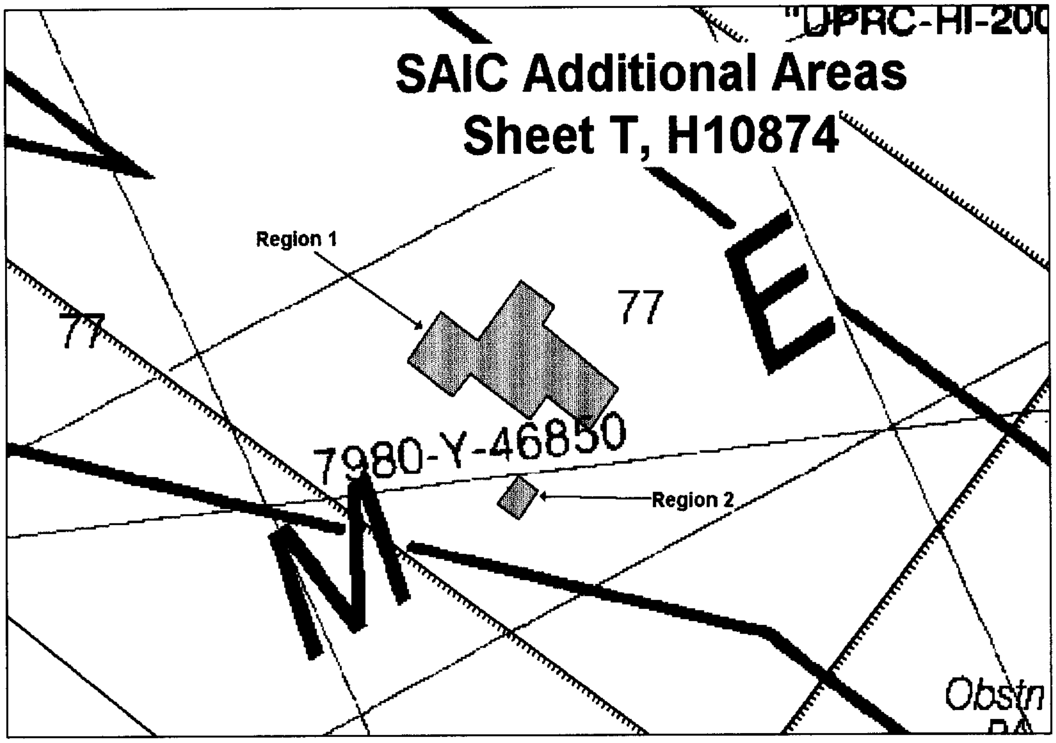
Additional Multibeam Coverage:

Defined below are 2 regions which cover significant least depths and contacts determined by side scan sonar. Additional multibeam shall be acquired within these regions, filling in the original multibeam to ensure 100% multibeam coverage within these areas. In addition, a diagram is attached depicting these areas within the original survey limits.

Region 1:
28.83639N, 93.90472W 28-50-11.00, 93-54-16.99
28.84167N, 93.90028W 28-50-30, 93-54-01.00
28.83861N, 93.89556W 28-50-19.00, 93-53-44.02
28.84500N, 93.89000W 28-50-42.00, 93-53-24.00
28.84222N, 93.88555W 28-50-31.99, 93-53-07.98
28.84028N, 93.88722W 28-50-25.01, 93-53-13.99
28.83333N, 93.87750W 28-49-59.99, 93-52-39.00
28.82889N, 93.88111W 28-49-44.00, 93-52-52.00
28.83250N, 93.88667W 28-49-57, 93-53-12.01
28.83000N, 93.88889W 28-49-48, 93-53-20.00
28.83500N, 93.89645W 28-50-00, 93-53-47.22
28.83250N, 93.89889W 28-49-57, 93-53-56.00
28.83639N, 93.90472W 28-50-11.00, 93-54-16.99

Region 2:
28.82083N, 93.89306W 28-49-14.99, 93-53-35.02
28.82389N, 93.89028W 28-49-26.00, 93-53-25.01
28.82222N, 93.88778W 28-49-19.99, 93-53-16.01
28.81917N, 93.89028W 28-49-09.01, 93-53-34.08
28.82083N, 93.89306W 28-49-14.99, 93-53-35.02

Figure N-1: Regions 1 and 2



Method of investigation: Shallow water multibeam to provide 100% multibeam coverage of the regions when combined with the original surveys.

Results of investigation: Both regions are in charted depths of 77 feet. General surrounding depths from this survey are 78 feet to 79 feet. Within the regions are survey depths of 82 to 84 feet. Within these deeps are numerous obstructions with least depths 77 feet and 78 feet. These obstructions have an appearance similar to coral heads.

Recommendation: Chart soundings to represent the bottom. CONCUR

***O. ADEQUACY OF SURVEY** - See E+A Report

Not used by Contractor.

***P. AIDS TO NAVIGATION** - See also Evaluation Report

There are no aids to navigation within this survey.

There are no charted pipelines within this survey, and no new pipelines were detected

Q. STATISTICS

Survey statistics are as follows:

1913 nm	Linear nautical miles of sounding lines (multibeam and side scan)
60.0 nm^2	Square nautical miles of multibeam and side scan
71	Number of sound velocity casts
9	Number of items investigated

*R. MISCELLANEOUS – See also Evaluation Report

Side scan contact #19 from H10873 was within the survey area of H10874. Upon evaluation against H10874 data, contact #19 was determined to be non-significant.

Figure R-1 shows the distribution by beam number of the 40,804 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

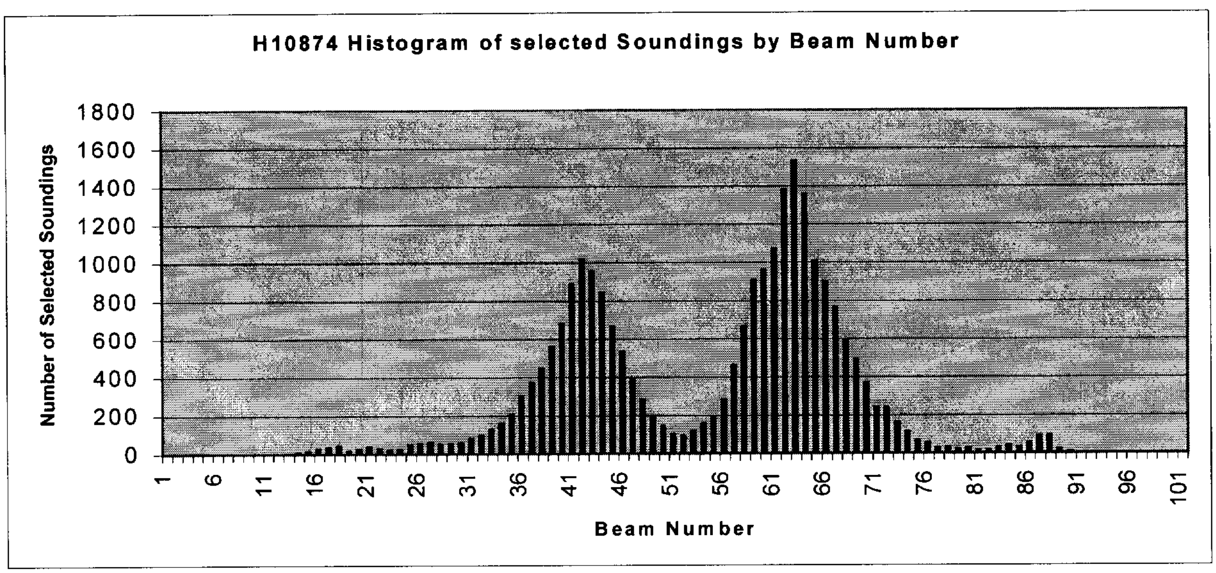
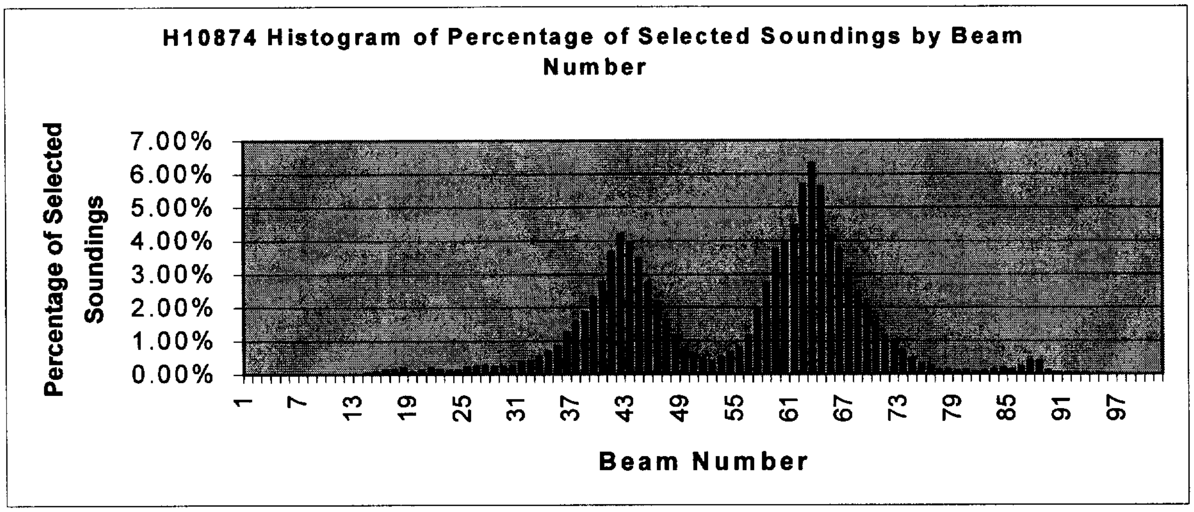


Figure R-2. Histogram of Percentage of Selected Soundings by Beam Number



S. RECOMMENDATIONS – See also Section O. of the Evaluation Report

Recommend the entire common area of charts 11323 and 11330 be reconstructed with data from this survey using a more dense selection of soundings to represent the bottom. See Section N for additional recommendations. Concur.

There are no additional items recommended for additional investigation.

*T. **REFERRAL TO REPORTS** - See also Evaluation Report

Danger to Navigation Report. See Appendix A..

* Data appended to this Report.

APPENDIX A: DANGER TO NAVIGATION REPORT

From: "Walter Simmons" <wsimmons@mtg.saic.com>
To: "Andrew L. Beaver" <Andrew.L.Beaver@noaa.gov>
Cc: "George Ghiorse" <ghiorse@mtg.saic.com>; "Dave Neander" <dave.neander@noaa.gov>
Subject: Danger to Navigation
Date: Friday, March 31, 2000 10:44 AM

During review of H10874, SAIC determined that the attached Danger to Navigation Report should be sent. Even though this is a sand wave area, the obstruction was observed as a distinct feature between the waves. Depths over the sand waves also justify reporting.

Walter S. Simmons
SAIC 221 Third Street, Newport RI 02840
401-847-4210 ext. 4766
FAX 401-849-1585

REPORT OF DANGER TO NAVIGATION

State: Texas

General Locality: Gulf of Mexico

Sublocality: 37 miles ESE of Galveston

Survey: H10874

The following obstruction found in 62-foot depths during hydrographic survey H10874. Positioning was from POS/MV Differential GPS. Sounder was shallow water multibeam RESON 8101. Side scan was Klein 5500. Object covered 59 feet corrected to MLLW using observed tides.

In addition, a sand wave field extends to the southwest with least depths of 58 feet and 59 feet corrected to MLLW using observed tides. These depths are between charted depths of 62 feet and 66 feet.

Affected nautical charts: Chart 11323, 57th edition, 27 March 1999

Chart Number	Edition		Class	Reported Depth MLLW	Charted Horizontal Datum	Geographic Position	
	No	Date		Observed		Latitude	Longitude
11323	57	27 Mar 1999	OBSTN	*59 ft	NAD 83	28° 56' 51.~~79~~" N .82	094° 03' 25.~~87~~" W .85
			Sand wave	58	NAD 83	28° 56' 23" N	094° 03' 48" W
			Sand wave	58	NAD 83	28° 56' 42" N	094° 03' 19" W
			Sand wave	59	NAD 83	28° 56' 29" N	094° 03' 55" W

* See Section N, Item 1 of this Report.

April 5, 2000

LETTER OF APPROVAL

REGISTRY NUMBER H10874

This report and the accompanying smooth sheet are respectfully submitted.

Field operations contributing to the accomplishment of survey H10874 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

Walter S. Simmons
Hydrographer
April 5, 2000

NOAA FORM 76-155
(11-72)

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

GEOGRAPHIC NAMES

SURVEY NUMBER

H-10874

Name on Survey	A ON CHART NO. 11323, 11330, 11340	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	
GULF OF MEXICO	X		X							1
SABINE PASS (title)	X		X							2
TEXAS (title)	X		X							3
										4
										5
				[illegible signature]						6
						AUG 15 2000				7
										8
										9
										10
										11
										12
										13
										14
										15
										16
										17
										18
										19
										20
										21
										22
										23
										24
										25

NOAA FORM 76-155 SUPERSEDES C&GS 197

NOAA FORM 61-29
(12-71)

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

LETTER TRANSMITTING DATA

REFERENCE NO.

N/CS33- -2000

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

- [ ] ORDINARY MAIL
- [ ] AIR MAIL
- [ ] REGISTERED MAIL
- [X] 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

OCT , 2000

NUMBER OF PACKAGES

ONE TUBE

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.

H10874

TEXAS, GULF OF MEXICO, 48 NM SOUTH SOUTHWEST OF SABINE PASS

ONE TUBE CONTAINING THE FOLLOWING:

1 SMOOTH SHEET FOR H10874
1 ORIGINAL DESCRIPTIVE REPORT FOR H10874
2 DRAWING HISTORY FORMS - ONE EACH FOR NOS CHARTS 11323 AND 11330
1 RECORD OF APPLICATION TO CHART FOR SURVEY H10874
2 H-DRAWINGS - ONE EACH FOR NOS CHARTS 11323 AND 11330
2 COMPOSITE DRAWINGS - ONE EACH FOR NOS CHARTS 11323 AND 11330
1 CONTRACTOR SMOOTH SHEET

FROM: (*Signature*)

DEBORAH A. BLAND Deborah A. Bland

RECEIVED THE ABOVE
(*Name, Division, Date*)

Return receipted copy to:

ATLANTIC HYDROGRAPHIC BRANCH
N/CS33
439 WEST YORK STREET
NORFOLK, VA 23510-1114

NOAA FORM 61-29 SUPERSEDES FORM C & GS 413 WHICH MAY BE USED. *U.S.GPO:1983-0-664-006/1192

This form was electronically produced by ELite Federal Forms' Forms Manager

ATLANTIC HYDROGRAPHIC BRANCH
EVALUATION REPORT FOR H10874 (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. <u>AUTOMATED DATA ACQUISITION AND PROCESSING</u>

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

NADCON, version 2.10
MicroStation 95, version 5.05
I/RAS B, version 5.01
Caris HIPS/SIPS
AutoCAD, Release 14

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

H. <u>CONTROL STATIONS</u>

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

To place this survey on the NAD 27, move the projection lines 0.892 seconds (27.477 meters or 1.374 mm at the scale of the survey) north in latitude, and 0.609 seconds (16.514 meters or 0.826 mm at the scale of the survey) west in longitude.

L. <u>JUNCTIONS</u>

H10873 (1999-2000) to the west
H10941 (1999-2000) to the east
H10942 (1999) to the south

A standard junction was effected between the present survey and surveys H10873 (1999-2000), H10941 (1999-2000) and H10942 (1999). There are no junctional surveys to the north. Present survey depths are in harmony with the charted hydrography to the north.

M. COMPARISON WITH PRIOR SURVEYS

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

N. COMPARISON WITH CHART 11323 (58th Edition, Jun 24/00)
11330 (12th Edition, Aug 08/98)

Hydrography

The charted hydrography originates with the prior surveys and requires no further consideration. The hydrographer makes adequate chart comparisons in Section N. of the Descriptive Report.

The present survey is adequate to supersede the charted hydrography within the common area.

O. ADEQUACY OF SURVEY

This is an adequate multibeam/side scan sonar survey. No additional work is recommended.

R. MISCELLANEOUS

Chart compilation was done by Atlantic Hydrographic Branch personnel, in Norfolk, Virginia. Compilation data will be forwarded to the Marine Chart Division, Silver Spring, Maryland.

The following NOS Charts were used for compilation of the present survey:

11323 (58th Edition, Jun 24/00) 1: 80,000
11330 (12th Edition, Aug 08/98) 1:250,000

T. REFERRAL TO REPORTS

During office processing, one Danger to Navigation was identified. A Danger to Navigation Report containing one item was submitted to Commander (oan), Eighth Coast Guard District, Hale Boggs Federal Building, 501 Magazine Street, New Orleans, Louisiana for inclusion in the Local Notice to Mariners, and to the Marine Chart Division, Silver Spring, Maryland. A copy of the report is appended to the Descriptive Report.

The item listed in the Danger to Navigation Report has been charted on the 58th edition on NOS Chart 11323, dated June 24, 2000.

Deborah A. Bland

Deborah A. Bland
Cartographer
Verification of Field Data
Evaluation and Analysis

H10874

APPROVAL SHEET
H10874

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: 10/3/00

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.

Andrew L. Beaver Date: 10/3/00

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

****

Final Approval:

Approved: Samuel P. De Bow Date: 11/8/00

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. H10874

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	10-4-2000	D.A. Blaze	Full [redacted] After Marine Center Approval Signed Via
			Drawing No.
11330	10-4-2000	D.A. Blaze	Full [redacted] 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.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE, Office of Coast Survey
Atlantic Hydrographic Branch
439 W. York Street
Norfolk, VA 23510-1114

April 11, 2000

Commander (oan)
Eighth Coast Guard District
Hale Boggs Federal Building
501 Magazine Street
New Orleans LA 70130-3396

Dear Sir,

During office processing of hydrographic survey operations, 37 NM SE of Galveston, Texas (Project OPR-K171-KR, 1999/00 Registry H10874) by Science Applications International Corporation (SAIC), one item has been identified as a hazard to navigation. I recommend the item be included in the next Local Notice to Mariners. The item was located using Differential GPS and is based on NAD83 datum. The sounding have been reduced to Mean Lower Low Water (MLLW). All depth data is preliminary pending final office verification.

Object Addressed:

Feature	Latitude	Longitude
59-ft Obstn	28°56'51.~~79~~"N .82	94°03'25.~~87~~"W .85

Affected Nautical Charts:

Chart	Edition No.	Date
11323	57th	Mar 27/99
11330	12TH	Aug 08/98

Questions concerning this report should be directed to the Atlantic Hydrographic Branch, by calling (757) 441-6746.

Sincerely,

Andrew L. Beaver, LCDR, NOAA
Chief, Atlantic Hydrographic Branch

Attachment

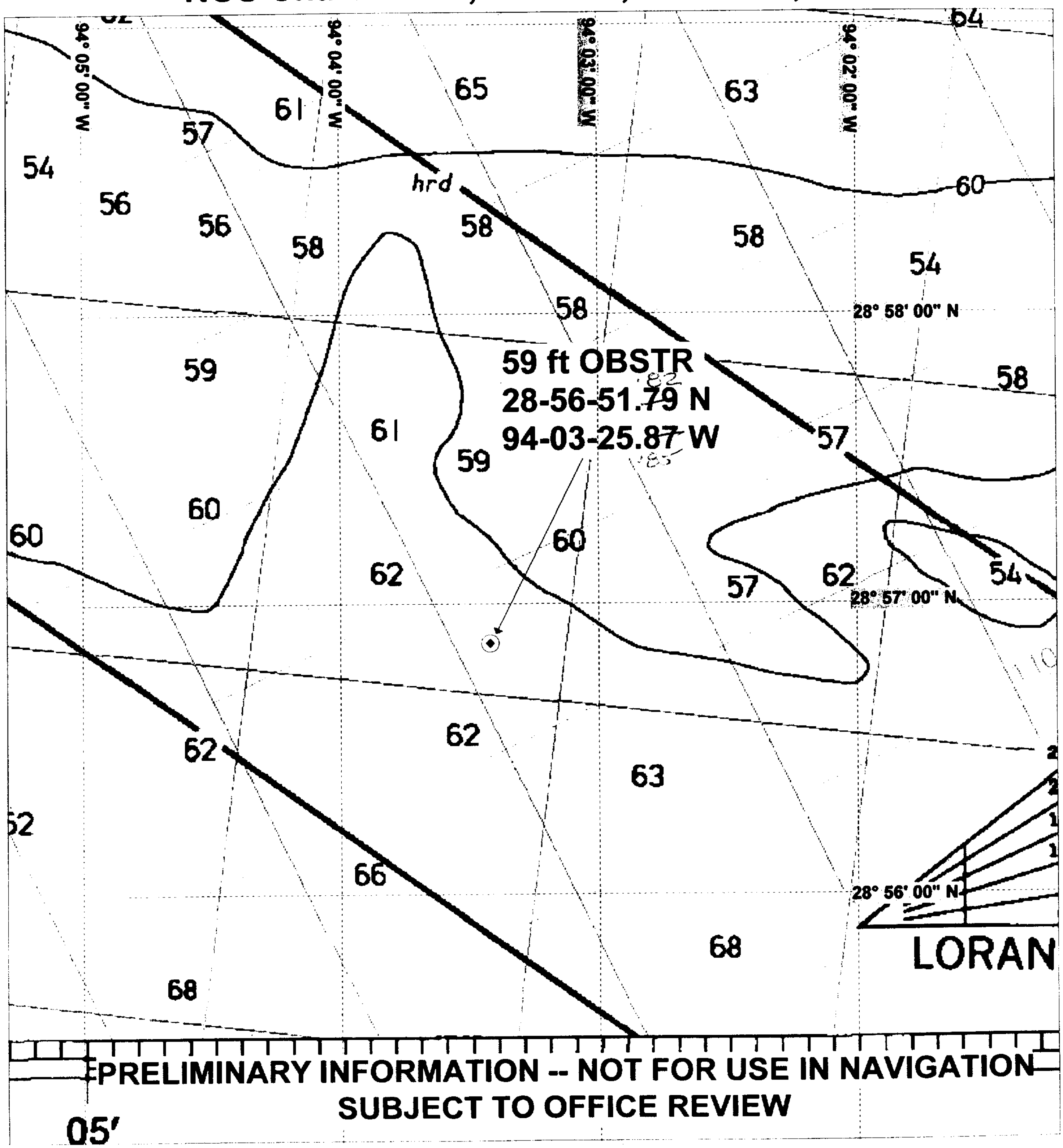
cc: NIMA-NIS
N/CS26
N/CS31

D. NGER TO NAVIGATIO..

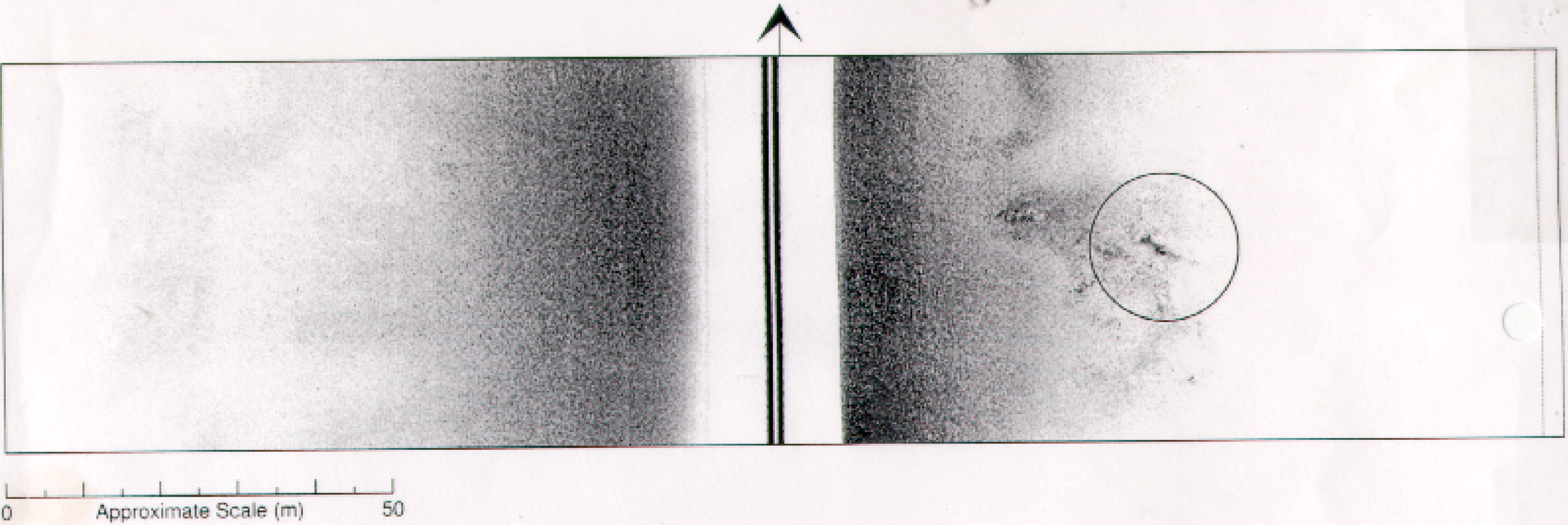
NOAA Survey: H10874 Contractor: SAIC

All depths were obtained using multibeam echosounder and are referenced to MLLW using NOS verified tides. All positions were obtained using DGPS and are referenced in NAD 83

NOS Chart 11323, 57th ed., March 27, 1999

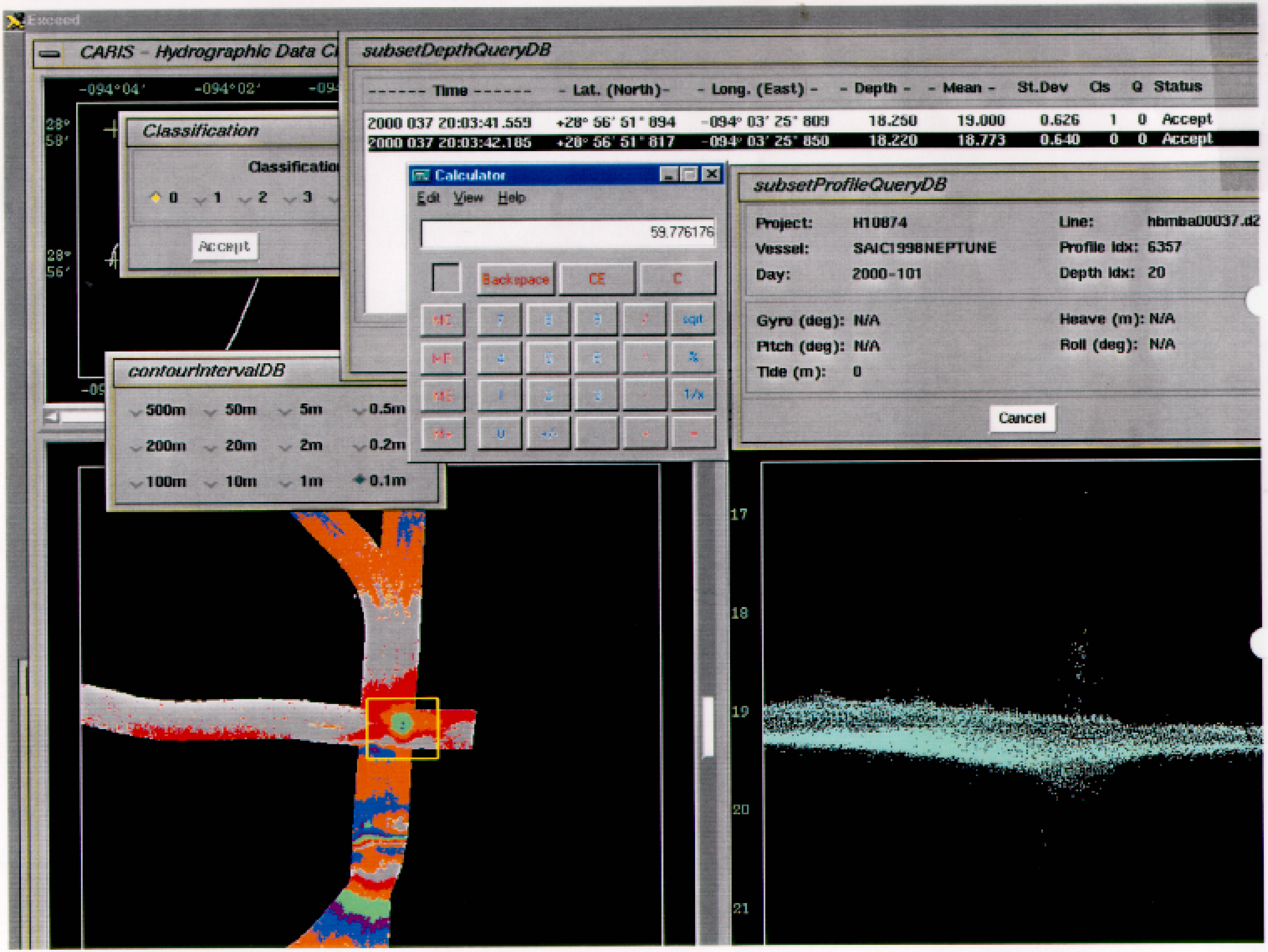


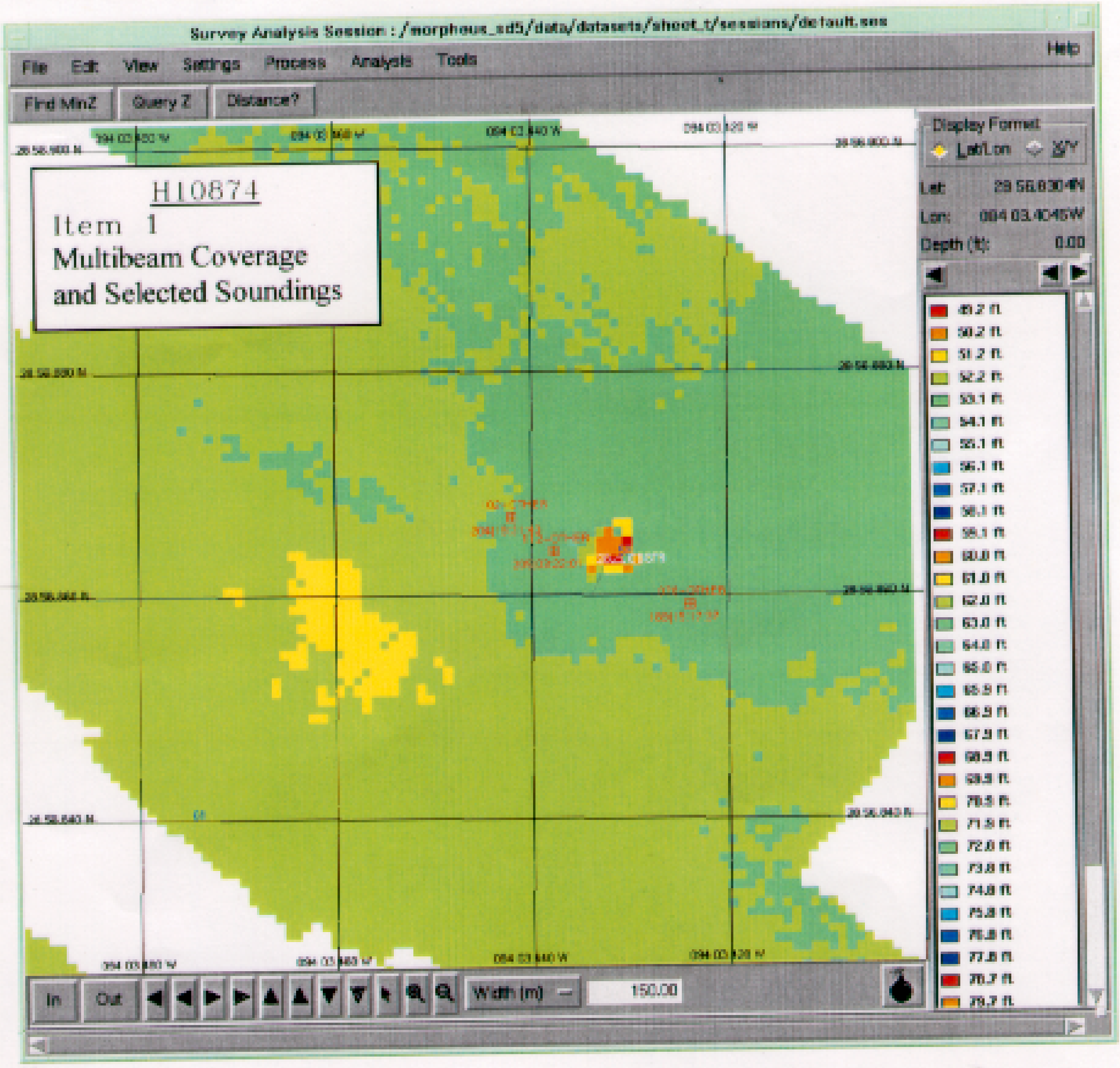
PRELIMINARY INFORMATION -- NOT FOR USE IN NAVIGATION
SUBJECT TO OFFICE REVIEW



Contact: 078-OTHER (78.con)
XTF File: 9907081509.XTF
Position: 28 56.85910N 94 03.42392W
Time: 1999/189 15:17:37
Comment: Possible Geology

LWH(ShL): 1.79m, 1.22m, 1.59m, (11.46m)
Range: 50.40m
Fish Hdg: 305.5 deg


Exceed
CARIS - Hydrographic Data C
-094°04'
-094°02'
28° 58'
28° 56'
Classification
Classification
0
1
2
3
Accept
contourIntervalDB
500m
50m
5m
0.5m
200m
20m
2m
0.2m
100m
10m
1m
0.1m
subsetDepthQueryDB
------ Time ------ - Lat. (North)- - Long. (East) - - Depth - - Mean - St.Dev Cls Q Status
2000 037 20:03:41.559 +28° 56' 51" 894 -094° 03' 25" 809 18.250 19.000 0.626 1 0 Accept
2000 037 20:03:42.185 +28° 56' 51" 817 -094° 03' 25" 850 18.220 18.773 0.640 0 0 Accept
Calculator
Edit View Help
59.776176
Backspace
CE
C
subsetProfileQueryDB
Project: H10874
Vessel: SAIC1998NEPTUNE
Day: 2000-101
Line: hbmba00037.d2
Profile Idx: 6357
Depth Idx: 20
Gyro (deg): N/A
Pitch (deg): N/A
Tide (m): 0
Heave (m): N/A
Roll (deg): N/A
Cancel
17
18
19
20
21


Survey Analysis Session : /morpheus_sd5/data/datasets/shoot_t/sessions/default.ses
File
Edit
View
Settings
Process
Analysis
Tools
Help
Find MinZ
Query Z
Distance?
H10874
Item 1
Multibeam Coverage
and Selected Soundings
Display Format
Lat/Lon
X/Y
Lat: 29.56.8304N
Lon: 094 03.4045W
Depth (ft): 0.00
49.2 ft.
50.2 ft.
51.2 ft.
52.2 ft.
53.1 ft.
54.1 ft.
55.1 ft.
56.1 ft.
57.1 ft.
58.1 ft.
59.1 ft.
60.0 ft.
61.0 ft.
62.0 ft.
63.0 ft.
64.0 ft.
65.0 ft.
65.9 ft.
66.9 ft.
67.9 ft.
68.9 ft.
69.9 ft.
70.9 ft.
71.9 ft.
72.8 ft.
73.8 ft.
74.8 ft.
75.8 ft.
76.8 ft.
77.8 ft.
78.7 ft.
79.7 ft.
In
Out
Width (m)
150.00

H

REPORT OF DANGER TO NAVIGATION

State: Texas

General Locality: Gulf of Mexico

Sublocality: 37 miles ESE of Galveston

Survey: H10874

The following obstruction found in 62-foot depths during hydrographic survey H10874. Positioning was from POS/MV Differential GPS. Sounder was shallow water multibeam RESON 8101. Side scan was Klein 5500. Object covered 59 feet corrected to MLLW using observed tides.

In addition, a sand wave field extends to the southwest with least depths of 58 feet and 59 feet corrected to MLLW using observed tides. These depths are between charted depths of 62 feet and 66 feet.

Affected nautical charts: Chart 11323, 57th edition, 27 March 1999

Chart Number	Edition		**Class**	**Reported Depth MLLW**	**Charted Horizontal Datum**	Geographic Position	
	No	Date		**Observed**		Latitude	Longitude
11323	57	27 Mar 1999	OBSTN	59 ft	NAD 83	28° 56' 51.~~79~~" N .82	094° 03' 25.~~87~~" W .89
			Sand wave	58	NAD 83	28° 56' 23" N	094° 03' 48" W
			Sand wave	58	NAD 83	28° 56' 42" N	094° 03' 19" W
			Sand wave	59	NAD 83	28° 56' 29" N	094° 03' 55" W