

W00006

NOAA FORM 78-35A

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

DESCRIPTIVE REPORT

Type of Survey Hydrographic

Field No.

Registry No. W00006

LOCALITY

State Micronesia - Northern Marianas Islands

General Locality Guam

Sublocality Apra Inner Harbor

2001

CHIEF OF PARTY
Scott Ebrite

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DATE

NOAA FORM 77-28 (11-72)	U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	REGISTER NO. W00006
HYDROGRAPHIC TITLE SHEET		FIELD NO.
INSTRUCTIONS The hydrographic sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the office.		
State	Micronesia - Northern Marianas Islands	
General Locality	Guam	
Sublocality	Apra Inner Harbor	
Scale	1:5,000	Date of Survey Jan. 8 - Mar. 20, 2001
Instructions Dated	Project No.	
Vessel	LIDAR (SHOALS), USNS SUMNER and Fleet Survey Team	
Chief of Party	Scott Ebrite	
Surveyed by	U. S. Naval Oceanographic Office	
Soundings taken by echo sounder, hand lead, pole LIDAR, SWMB, VBES and SSS		
Graphic record scaled by	Fleet Survey Team	
Graphic record checked by	Fleet Survey Team	
Evaluation by	S. Rooney	Automated plot by HP Designjet 1050C
Verification by	S. Rooney	Cartographer - R. Davies
Soundings in	Meters and tenths	at MLLW
REMARKS:	Office revisions appearing as endnotes were generated by the	
	cartographer during office processing.	
	All depths listed in this report are referenced to	
	mean lower low water unless otherwise noted.	

Outside Source Data Evaluation Survey W00006

Naval Oceanographic Office
Micronesia- Northern Marianas Islands- Guam
Scale 1:5,000
January 8 – March 20, 2001

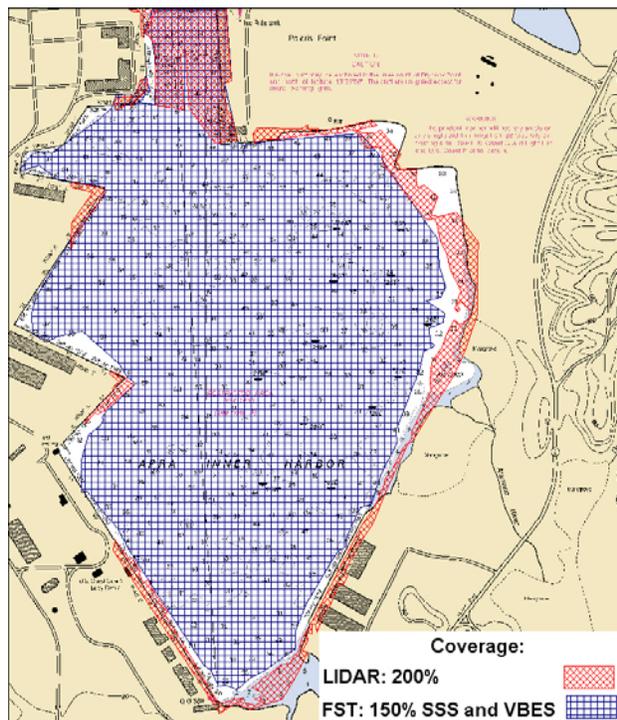
A. GENERAL INFORMATION

A.1 Background

This hydrographic survey was conducted by the U.S. Naval Oceanographic Office (NAVO or NAVOCEANO) to, according to the *Guam ROS*, support a “Navy initiative to increase naval activity and usage of Naval Station Guam as a safe haven for major surface and sub-surface fleet units.” The survey area is located at Apra Inner Harbor, Guam. This survey was conducted using a combination of the Scanning Hydrographic Operational Airborne LIDAR Survey system (“SHOALS”), the NAVO Fleet Survey Team (FST) utilizing side-scan sonar, single beam sonar and post-processed kinematic GPS for detached positions.

Data acquisition was conducted by the FST from January 13 - February 7, 2001 (DN 13 to 38), by LIDAR from January 8 - March 20, 2001 (DN 8 to 79).¹

A.2 Area Surveyed



This survey was conducted in Apra Inner Harbor, Guam. The approximate extents of the survey are:²

Northeast corner:
13°28'17.88" N, 144°40'59.06" E

Southwest corner:
13°23'58.59" N, 144°36'54.5" E

A.3 Data and Reports

The following data and documentation were received from the Naval Oceanographic Office:³

Data:

Aprafinal_00.asc	Full density XYZ soundings	ASCII
Agatfinal.asc	Full density XYZ soundings	ASCII
Inner_harbor.dgn	Smooth Sheet	MicroStation DGN

Plots:

Apra Harbor, 00601/01US02	Smooth Sheet	Hard Copy
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Reports:

hss003	Draft Project Instructions	Word
Guam ROS	Descriptive Report	Word
WESTPAC LIDAR ROS	Draft LIDAR Project Report	Word
Geodetic Survey Report Guam	Horizontal Control Report	Word
APNDX A: SURV AREAS	Guam ROS appendix	Word
APNDX B: TIDE ZONES	Guam ROS appendix	Word
APNDX C: TIDE STATIONS	Guam ROS appendix	Word
APNDX D: COVERAGE	Guam ROS appendix	Word
APNDX E: NAVAIDS	Guam ROS appendix	Word

Supporting Data:

Offset diagram for COMNAV MAR DIVE BOAT		Word
NIMA Guam targets	Side-scan sonar contacts	Excel
CTD, Digibar, Secchi disk locations		Excel
Final_Navaids	Detached positions	Excel
Bottom samples		Excel
Digital photos		JPEG
Lessons Learned in Multi-Platform Hydrographic Surveys		PDF

B. DATA ACQUISITION AND PROCESSING

A complete description of data acquisition and processing systems, quality control procedures and data processing methods can be found in the *Guam ROS* and *WESTPAC LIDAR ROS* for the Fleet Survey Team, and LIDAR, respectively.⁴ The Evaluator's summary and discussions of methods follows.

B1. Data Acquisition

This project was intended to be conducted and directed primarily by LIDAR (SHOALS), but water depth and water clarity severely restricted the use of LIDAR in portions of the survey area. In order to ensure one hundred percent coverage of the survey area and assistance was obtained from the NAVO Fleet Survey Team (FST).⁵ See the following appropriate sections for a

summary of each system used.

Fleet Survey Team

Vessel:

A re-configured landing craft mechanized (LCM), was used by the FST as the primary survey platform for the operation. The vessel was 20 meters long, and with a draft of approximately 1.2 meters.



LCM8-6.jpg: LCM used by the FST

Vertical-beam echo sounder (VBES):

An Odom Hydrotrac Single Beam Echosounder and a 200Khz transducer with a 9 degree beam angle were used for this survey. The transducer was pole-mounted and secured to the starboard side of the LCM, roughly amidships. HYPACK MAX version 00.5A was the data collection software used. Raw sounding data was ingested by HYPACK MAX from the Odom Hydrotrac echosounder. The Hydrotrac was operated with no offsets and a standard 1500m/s assumed sound speed. HYPACK was configured to append draft to the raw data collected.

Vertical-beam echo sounder (VBES) data were acquired by the FST in depths from 2 to 180 feet. In general main scheme line spacing was 40 meters for the Inner Harbor and 50 meters in Outer Harbor. Additional lines were run to develop shoals and other side-scan sonar contacts.

Side-scan Sonar:

An EdgeTech 272T digital dual frequency side-scan sonar (SSS) system was used during this survey. Side-scan sonar data were collected using Triton-Elics Isis software. The side-scan sonar towfish was towed from the stern of the FST vessel at speeds not in excess of 6 knots. Bottom contacts were regularly identified and compared on consecutive side-scan sonar passes.

According to the *Guam ROS*, side-scan sonar was collected by the FST within the navigational constraints of the vessel. Within Apra Inner Harbor the sonar was operated at 100 and 400 KHz on the 50 meter range scale with line spacing at 80 meters, which would effectively provide slightly better than 100% coverage. Refer to section 4.0 of the *Guam ROS* for complete information on side scan sonar operations. No side-scan sonar imagery or side-scan sonar

mosaic was provided by the Navy, so the Evaluator was unable to independently review for coverage or data quality.

Velocity:

A Sea-Bird Electronics (SBE) Model 19 conductivity, temperature and depth (CTD) profiler or ODOM Digibar were used to collect all sound velocity readings. CTD casts were processed using SEASOFT version 4.235.

CTD or Digibar casts were performed on a daily basis. Digibar readings were compared to CTD values during the first two occasions on which bathymetric data was collected. The comparison proved accurate (within +/- 0.3m/s) for the purpose of the survey. The Digibar was used thereafter when general depths were 20 meters or less. Little or no diurnal variation was apparent during the survey. On days when the Digibar was used, corrections were applied at 1541m/s for the entire survey period. This value was a mean value, and due to the great stability of the temperature and salinity gradient noted during the survey, the Evaluator agrees that this is an acceptable practice.

GPS:

Survey vessel positions were obtained using a Trimble 4700 GPS receiver. The receiver was set up in the DGPS mode and correctors were received via VHF radio modem from station EOD Tower (refer to section C.1 for horizontal control information). No formal calibrations of the receivers operating in the DGPS mode were conducted during this survey; however, internal precision of the system was monitored by the HYPACK-MAX system (HDOP, PDOP, SNR data).

Positions of navigational features were positioned using post-processed kinematic (PPK) GPS. Refer to the *Geodetic Survey Report Guam* for further information.

Bottom Samples:

A total of 51 samples were obtained between the Inner and Outer Harbors, approximately 500 meters apart. The bottom samples were obtained throughout the survey area in depths ranging from 10–55 meters, and they are depicted on the Navy's smooth sheet.

LIDAR:

The LIDAR portion of the survey was conducted using the SHOALS Airborne system mounted on a DeHaviland Twin Otter aircraft. The LIDAR system was calibrated prior to survey operations and whenever major system components effecting data accuracy were changed or adjusted.

Positioning was provided by Ashtech Z-12 receivers. At the start of the survey problems with the DGPS-UHF system beacon at EOD Tower made it necessary to utilize VHF broadcast beacons (US Coast Guard Hawaii DGPS beacons) with the SHOALS system utilizing them in Kinematic-OTF mode. Near the end of the survey, correctors received utilizing DGPS-UHF beacons, for station EOD Tower. No formal calibrations of the receivers were conducted during this survey. Internal precision of the system was monitored by the SHOALS system utilizing standard positional quality control (HDOP, PDOP, SNR data) techniques.

NAVOCEANO assessed that the Navy areas were surveyed at 4x4 meter spot density (110-meter swath) and with greater than 200% coverage to ensure a very high confidence of target detection. See the *WESTPAC LIDAR ROS* for additional information. The Evaluator was unable to independently confirm LIDAR coverage. However, the Evaluator believes that the use of side-scan sonar provides an independent check to LIDAR object detection in areas of overlap. See section D.2 of this report for further analysis of LIDAR data quality.

However, a series of factors including water clarity limitations, poor circulation and large amounts of freshwater runoff prohibited attaining full coverage in the inner harbor. Therefore, LIDAR coverage in the inner portion of Apra Harbor was limited to the channel between the inner and outer harbor where water clarity was its greatest. In addition limited LIDAR soundings were retained in the extreme shoreward edge where water clarity proved adequate. See the *WESTPAC LIDAR ROS* for additional information.

B2. Corrections to Echo Soundings

Vertical Beam Echosounder:

Draft Correction - (Draft settings, Squat and Settlement)

The squat and settlement values for the Dive Boat LCM were not measured or applied for this survey. However, due to the combination of boat design (wide, flat bottom), least depth and slow speed, it was opined by the FST that squat and settlement did not significantly affect survey accuracy. The Evaluator agrees with the above assessment. See section **D.2** of this report for further discussion of this topic, and its impact on the quality of this survey. Static draft for the transducer was determined by measuring the physical distance from the transducer head along the pole. The water level was measured against the pole markings daily prior to sailing and this setting was applied to the raw soundings in HYPACK (and independently in CARIS). See digital photographs (*Xducer-3.JPG* and *Xducer-4.JPG*) for details of the transducer mount.

Sound Velocity Correction

Daily sound speed observations were made using the SEABIRD ELECTRONICS Model 19-03 conductivity, temperature and depth (CTD) instrument or Digibar. On days when the general operating depths were less than 20 meters the Odom Digibar instrument was used to calculate sound velocity. Raw sounding data was ingested by HYPACK MAX from the Odom Hydrotrac echosounder. The Hydrotrac was operated with a standard 1500m/s assumed sound speed. In post-processing CARIS used an (uncorrected) raw dataset to which correct sound velocity was applied.

Heave Corrections

Soundings were not corrected for heave, pitch and roll on the survey platform. The Evaluator feels that this would have a minimal impact on the survey, given the protected nature of the survey area and the size and stability of the survey platform.

Tide corrections

Tides were obtained from the NOAA tide gauge, 1630000 (GUAM, Apra Harbor). Six-minute tides were obtained via direct-dial from the gauge. Email communications with Steve Farr of NAVOCEANO stated that NOAA-derived tidal zoning was applied.

Offsets

All sounding positions were corrected for the antenna offsets (see *OFFSET DIAGRAM FOR COMNAVMAR DIVE BOAT*). However, due to the lack of a gyro input to the navigation solution, heading was calculated using the most recent positional events in HYPACK (i.e. course made good). Further discussion of this can be found in the *Guam ROS* section 15.1. The Evaluator feels that this is an acceptable practice for single-beam soundings and should have a minimal impact on the data accuracy.

*Side-scan Sonar:*Offsets

All sounding positions were corrected for the antenna offset (refer to *OFFSET DIAGRAM FOR COMNAVMAR DIVE BOAT*). However, due to the lack of a gyro, azimuth was derived from the most recent positional events in HYPACK (i.e. course made good). Further discussion of this can be found in the *Guam ROS* section 15.1. The Evaluator believes that this is an acceptable procedure, and should have a minimal impact on the data. In the past this practice has been considered adequate on NOAA platforms, although it does degrade the positional accuracy of side-scan sonar contacts possibly by several meters.

Layback was taken into account using “standard NAVOCEANO procedures.” No additional documentation was provided on these procedures. The Evaluator was unable to determine if offsets were applied when computing side-scan sonar contact positions. However, the Evaluator feels that it is of minimal impact on data quality, since positions for least depths on features are based on single beam positions, and not side-scan sonar.

*LIDAR:*Draft Correction

Not applicable for LIDAR

Heave Corrections

The aircraft platform motion was compensated for by an aircraft-mounted inertial navigation system. This resolved undulations in the flight path. Aircraft movement outside of normal parameters resulted in “jerk” flags and rejected data.

Tide corrections

Tides were obtained via direct-dial from the NOAA tide gauge, 1630000 (GUAM, Apra Harbor). Email communications with Steve Farr of NAVOCEANO stated that NOAA derived tidal zoning was applied.

Offsets No offsets were apparently applied to the LIDAR data. The Evaluator was unable to determine if any offsets existed for the system configuration. The Evaluator feels all appropriate correctors have been applied to the data.

See *WESTPAC LIDAR ROS* for specific information on LIDAR.

B3. Data Processing and Quality Control

Hydrographer

VBES:

Acquired data was processed using CARIS HIPS (version unknown). Sound velocity, draft settings and tides were applied. The paper Hydrotrac record was compared to the digital record. When necessary features not digitized were manually inserted into the appropriate location on the digital file.

Side-scan Sonar:

NAVO personnel used the following criteria were used in picking contacts: all man-made features identified were investigated and the least depth found by close sounding; all natural features which protruded from the seabed by approximately 10% of the surrounding general depth were also investigated. Since no side-scan sonar imagery was provided, the Evaluator was unable to determine if all significant contacts were picked for investigation. The Evaluator believes the described practice described seems adequate, and follows NOAA standard procedures.

LIDAR:

The SHOALS proprietary data processing suite was used for processing LIDAR data. Time-tagged position and depth and laser waveform files were then transferred to the NAVOCEANO system Bathy-Hydro Post-Processing suite (BHPP). Data quality control and validation was carried out using the NAVOCEANO Area Based Editor (ABE).

According to the paper *Lessons Learned in Multi-Platform Hydrographic Surveys*, a comparison between LIDAR data collected using the Kinematic-OTF mode, a test LIDAR data set collected using the DGPS mode, and 200 leadline observations was conducted during post processing. All three data sets were processed and validated using the BHPP suite of software tools and then statistically compared, individually and to each other, in areas of overlap. NAVOCEANO personnel found good agreement between adjacent LIDAR lines, as well as between crosslines and main scheme lines. Sounding measurements collected using LIDAR were also noted as being statistically consistent with sounding measurements from the FST, as well as with LIDAR data collected using Kinematic-OTF. The Evaluator was unable to determine which sounding were acquired using Kinematic-OTF mode versus DGPS mode. Through visual examination of crosslines, overlapping coverage of other system, and with charted soundings, the Evaluator is confident that the LIDAR coverage is of adequate positional and depth accuracy for charting purposes, except where noted in this report. See section D.2 of this report for specific charting recommendations.

Evaluator

The Naval Oceanographic Office provided PHB with an excessed data set in XYZ format. See section **B.4** of this report for specific data decimation specifications. The Evaluator was unable to independently confirm that tides and sound velocity correctors was loaded to each line and that all lines were merged. As per verbal and email communications with Steve Farr of NAVOCEANO all data was corrected for sound velocity (except LIDAR data) and reduced to MLLW. All soundings for all platforms were corrected for offsets, and tides. The Evaluator imported the XYZ data into MapInfo and compared it to the largest scale chart in the area. In general agreement was good. See section **D.3** of this report for specific chart comparison findings and recommendations. Comparison between the full density and reduced data sets did not reveal any least depths more shoal than the reduced data set. Because no raw data or full density data sets were provided to NOAA, it was difficult to more fully assess the quality of the data; however, documentation provided to NOAA was thorough and leads the Evaluator to believe that the Navy's methods of data quality assurance are sound.

Internal Data Consistency

VBES:

Single beam sonar cross lines were run in all areas where possible. Cross line comparison was conducted by the Naval Oceanographic Office. They reported good agreement between the main scheme and crosslines. The overall majority of crossline deviations were noted as being well within IHO Order 1 standards. The Evaluator through visual comparison of the main scheme and crossing line found differences to be generally less than one foot, which meets IHO standards.

LIDAR:

Crossline comparison for the LIDAR data was conducted by the Naval Oceanographic Office. LIDAR soundings were compared to single beam sonar cross lines when possible. Additionally, adjacent LIDAR swath overlap provides an excellent data check capability. It was reported by NAVOCEANO (refer to *WESTPAC LIDAR ROS*) that good agreement with the main development lines was generally observed, and the vast majority of crossline deviations were well within IHO Order 1 standards. The Evaluator conducted visual examinations of areas where single beam and LIDAR met. In general soundings compared well, with difference being generally within one foot. However, this comparison can only be considered cursory, because in areas around the edges of LIDAR coverage, the Evaluator lacked the ability to definitively differentiate between soundings obtained from single beam and those from LIDAR. This was due to the high density of LIDAR soundings. No anomalous soundings were noted in these areas, however, which might indicate that one dataset disagreed with the other. The Evaluator does believe that in general LIDAR soundings meets IHO Order 1 standards for positioning and depth accuracy (refer to *WESTPAC LIDAR ROS* for a further assessment of data accuracy).

According to the paper *Lessons Learned in Multi-Platform Hydrographic Surveys*, a comparison between LIDAR data collected using the Kinematic-OTF mode, a test LIDAR data set collected using the DGPS mode, and 200 leadline observations was conducted during post processing. All three data sets were processed and validated using the BHPP suite of software tools and then

statistically compared both individually, and to each other, in areas of overlap. NAVOCEANO personnel determined that there was good agreement between adjacent LIDAR lines, as well as between crosslines and main scheme lines. Sounding measurements collected using LIDAR were statistically consistent with sounding measurements from the FST, as well as LIDAR data collected using Kinematic-OTF.

Data quality factors:

According to the *WESTPAC LIDAR ROS* depth and water clarity limitations of the LIDAR system prohibited attaining 100% coverage of the entire survey area. LIDAR coverage in the inner portion of Apra Harbor was limited to the shorelines and reef areas to depths of 20 to 35 meters. In depths deeper than 20 meters signal-to-noise ratio limitations greatly reduce target detection capability, particularly for small objects. Multiple flight coverage will theoretically improve the confidence of target detection capability in the depth range of 2-7 meters, and possibly down to 20 meters. The Evaluator believes that while theoretical detection of objects within this depth range may be possible, it is not sufficient to merit disproval of charted items or to provide definitive least depths on point features without additional supporting data.

No additional documentation on data quality factors was provided by Naval Oceanographic Office. The Evaluator did not find any additional data quality factors.

B4. Data Decimation

Sounding Selection: Data was decimated using a NAVOCEANO standard shoal biased sounding selection algorithm. No additional information was provided as to the specifics of this algorithm.

The Naval Oceanographic Office provided PHB with a decimated, shoal-biased dataset and a full-density dataset. The sounding density of the final decimated data set was 1.5 meters at the scale of survey (1:5,000), where supported by acquired sounding coverage. Visual examination of the complete sounding data set at the Pacific Hydrographic Branch did not reveal any least depths more shoal than the excessed data set. PHB did not further decimate the data.

C. VERTICAL AND HORIZONTAL CONTROL

C.1 Horizontal Control

The horizontal datum for survey W00006 was North American Datum 1983 (NAD 83). Data were provided in Universal Transverse Mercator, zone 55, based on the WGS 1984 spheroid.

A new base receiver station was established (station ID: **EOD TOWER**) for differential correction generation and post-processed kinematic (PPK) positioning. Survey vessel positions were obtained using DGPS. Differential correctors were obtained from station EOD TOWER, unless otherwise noted. No formal calibrations of the Trimble receivers were conducted during

the survey. However, internal precision of the system was monitored by the HYPACK-MAX system utilizing standard positional quality control (HDOP, PDOP, SNR data) techniques.

A post-processed kinematic (PPK) GPS survey was run along the secure limits of Naval Station Guam and the Ammunition Pier. This included all shore-based and floating aids-to-navigation in the survey area. Mean solutions were then determined over the occupation interval of each item positioned. Evaluation by the Naval Oceanographic Office (refer to *Geodetic Survey Report Guam*) determined that, “based on 95% probability, centimeter accuracies were achieved during the geodetic survey and features were positioned within the IHO standards for Order 1 surveys (fixed features 2 meters, floating features 10 meters).” Based on the described methodologies the Evaluator believes that positioning standards as set forth in the HSSDM appear to have been met. Observed positions were compared to the largest scale chart (81054) in the area. In general the soundings and positioned features compared well to the chart. This gave the Evaluator a high degree of confidence in the data quality.

LIDAR positions were obtained from an Ashtech Z-12 GPS receiver onboard the survey aircraft. For most of the survey the receiver was set up in the DGPS mode and received correctors via VHF radio modem (i.e. from the US Coast Guard Hawaii beacons¹) with the SHOALS system utilizing them in Kinematic-OTF mode. Near the end of the survey correctors were received utilizing DGPS-UHF beacon from station EOD Tower. No calibrations of this receiver were conducted during the survey, but HDOP, PDOP, and SNR were monitored for data quality purposes.

C.2 Vertical Control

The Vertical Datum for survey W00006 was Mean Lower-Low Water (MLLW). Tides were obtained via direct-dial from NOAA tide gauge, 1630000 (GUAM, Apra Harbor). The observed tidal data was plotted and compared to the predicted tides for this station, by NAVOCEANO personnel. No significant differences were observed. In addition, a simple non-integrating water level logger, was installed adjacent to the NOAA tide gauge. No additional information was provided regarding the use of this instrument. No tidal data was provided to the Evaluator for this survey. An examination of the verified tides on the NOAA CO-OPS website did not reveal any data gaps during the period of survey, and the data appear to be internally consistent.

NOAA CO-OPS provided zoning to NAVOCEANO (refer to *APNDX B: TIDE ZONES*). Email communications with Steve Farr of NAVOCEANO indicated that NOAA provided zoning was applied to all sounding data.

NAVOCEANO personnel ran vertical levels between the tide station and the closest benchmark to ensure that the gauge was operating properly and collecting data to the MLLW datum. Agreement was noted as being within approximately 5 centimetres; are therefore tide gauge levels were accepted as being accurate for the purposes of the survey. Refer to *Guam ROS*, section 8, for further details.

¹ In the NAVOCEANO survey reports, DGPS correctors from U.S. Coast Guard beacons were reported to have been received via VHF. While USCG beacons do not typically transmit on the VHF band, the Evaluator believes that correctors received via “VHF” are actually meant to mean via USCG DGPS beacons.

D. ANALYSIS AND RECOMMENDATIONS

D.1 Error Analysis

Please see *Guam ROS* and *WESTPAC LIDAR ROS* for NAVOCEANO's analysis of errors. The Evaluator agrees in general that the NAVOCEANO analysis of errors is complete and accurate, and that the data meet specifications as noted in the NAVOCEANO reports. Specific discussions of data accuracy and error issues are discussed below in section D.2.

D.2 Discussion of Data Quality and Suitability for Charting

An evaluation of the data has determined that with the exceptions noted below this survey meets minimum IHO specifications for an Order 1 survey. The data have also been evaluated to determine suitability for use in revising the specified nautical chart(s). With the exceptions noted below these data are considered to be acceptable to supersede the charted information within the common area.

Single beam:

As discussed in the *Guam ROS* the calculated error for the single beam portion of this survey do not meet the IHO depth accuracy limits for Order 1 surveys. However the Evaluator believes through independent calculation that positional accuracy standards for IHO Order 1 surveys have been met, and that the depth accuracy requirements for IHO Order 1 surveys were miscalculated in the *Guam ROS*. Sound velocity, instrumental accuracy and draft errors were all assessed as having minimal errors. The lack of a heave or motion sensor, combined with the steep seabed slopes, were noted to produce significant error (0.471 meters at 50 meters depths and 0.320 meters in the shallower margins). In addition no corrections for dynamic draft were taken into account. The Evaluator believes that these errors are acceptable and are within allowable depth accuracy limits for IHO Order 1. The Evaluator believes that despite these errors the survey data is of sufficient quality for charting purposes. The Evaluator also recommends that due to the lack of recent hydrography in the survey area charted soundings be replaced with the survey's soundings, unless the charted soundings are shoaler than surveyed soundings, or in cases specifically addressed by the Evaluator.

Side-scan Sonar:

The Evaluator agrees with the NAVO assessment that the side-scan sonar portion of this survey meets IHO Order 1 specification for both positional as well as ensonification aspects. However, NOAA standards require 200% side-scan coverage to ensure object detection, and for disproval of items. In areas where merely 150% side-scan coverage was reported to have been obtained along with only single-beam soundings, this should be considered insufficient for item disproval. In areas where greater than 200% side-scan sonar coverage was obtained, or in areas where side-scan sonar coverage was augmented with 200% LIDAR coverage, this should be considered adequate to disprove charted items, unless specifically discussed in this report.

LIDAR:

As discussed in the *WESTPAC LIDAR ROS* the instrumental accuracy error was assessed as being minimal (0.1 meters). Positional accuracy was stated as meeting IHO Order 1 specifications. The Evaluator agrees with these statements. The *WESTPAC LIDAR ROS* states: “*Theoretically, all navy areas meet IHO Order 1 target/object detection requirements for depths from 7m to 20m with single flight coverage. While at depths deeper than 20m signal-to-noise ratio limitations greatly reduce target detection capability, particularly for small objects.*”

While it was noted that multiple flights would improve the confidence in the data, due to NOAA’s limited experience with LIDAR and lack of standard specifications and procedures for utilizing LIDAR for item investigations, the Evaluator cannot confidently say that object detection standards were met in areas with merely 200% LIDAR. However, in areas with both 150% or greater SSS coverage and 200% LIDAR coverage, the Evaluator does have confidence that object detection criteria have been met and all significant shoals or objects would have been located in navigationally significant waters.

The LIDAR data, due to water clarity limitations, was discarded in the inner harbor, and only retained in the narrow entrance. Therefore, with only 100% side-scan sonar coverage in the inner harbor, this survey should not be considered adequate to disprove charted items, and data from this survey should only supersede charted soundings when shoaler, unless specifically addressed in this report.

Detached Positions:

As discussed in the *Guam ROS* and *Geodetic Survey Report Guam* the differential correction station (**EOD TOWER**) was established for this survey was positioned using PPK-GPS and tied into to the Continuously Operating Reference Station (CORS). The NAVOCEANO evaluation of the positional accuracy of this site states that it meets IHO Order 1 specifications. The Evaluator agrees with this assessment, based on the described procedures and the high accuracy of this form of surveying. The Evaluator believes that GPS correctors produced from this station are suitable for use during this survey.

All positioned shore-based and floating navigation aids in the survey were positioned using PPK-GPS, and meet IHO Order 1 survey specifications. After reviewing the procedures used during this survey it is the Evaluator’s belief that surveyed positions meet IHO Order 1 specifications and recommends that all positioned features be charted based on their surveyed position. ⁶

D.3 Automated Wreck and Obstruction Information System (AWOIS) Items

No AWOIS items were located within the limits of survey W00006. All charted and new items discussed in sections **D.4** and **D.5** of this report should be added to the AWOIS database. ⁷

D.4 Chart Comparison

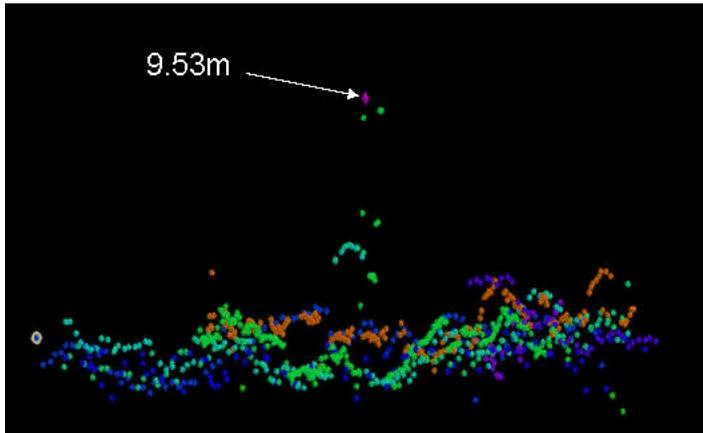
Survey W00006 was compared with chart 81054 (13th Ed.; Feb. 2003, 1:10,000), the largest scale chart which covered the entire survey area.

Chart: 81054

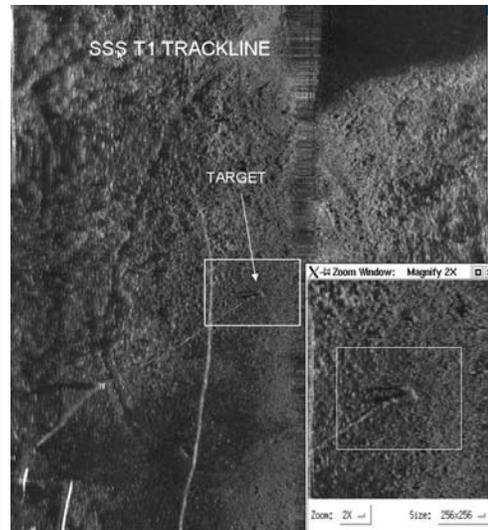
Comparison between surveyed and charted (81054) bathymetry found acceptable general agreement, with most soundings comparing within 2-5 feet. There were some areas of greater differences (6-10 feet), but in general the Evaluator attributes these to natural changes in the bottom. A description of areas of significant disagreement follows.

The eastern portion of Inner Apra Harbor has shoaled significantly. This area of shoaling is centered around 13°25'54.07" N 144°40'27.31" E, and is about 800 meters long by 300 meters wide. Charted (81054) soundings range from 32-37 feet in this area. Surveyed soundings in this area range from 27-33 feet. This shoaling was reported as being caused by a land slump near the adjacent mangroves and silting following the super typhoon of 1998. See the *Guam ROS* for additional information.

The charted (81054) 31 foot sounding ("reported 2000") located at 13°26'30.39" N 144°39'55.73" E originated from preliminary data from this survey provided to Marine Chart Division in 2001. Email conversations with Scott Ebrite of NAVOCEANO describe the investigation methods used: *"Three different FST single beam tracklines run on three different days over a one week period converge and all show a series of hits at this location. The presence of an object/target is confirmed with side scan sonar data collected along two adjacent survey lines run on different days. It appears the target and the source of the sounding may be a mooring and/or mooring line off the NE corner of the drydock."* See below images and *"Data Review power point"* by Scott Ebrite for additional information. In addition Dick Riddle (US Navy Port Operations, Guam) conducted a dive investigation on the sounding's position. While no objects were located during the dive and the least depth observed was 33 feet, it should be noted that the search area plotted south of the charted 33 foot sounding's position, and the dive methodology used was inconsistent with NOAA field procedures, and is insufficient to disprove the existence of the sounding. The Evaluator recommends that item be charted as an obstruction 31 feet. The Evaluator also recommends removal of the "reported 2000" note. Additional email communications with Dick Riddle (US Navy Port Operations, Guam) identified *"the 31 foot mark in the inner harbor has been identified as a coral head, mixture of live and dead coral, and is scheduled to be removed within 4 months under an on-going dredge program."* When complete this survey information will be forwarded to PHB. ⁸ NOAA has no additional information to support this statement.



View of the sounding in question in Caris, image from the Data Review Power Point Multiple hits on the object are color coded by track line. The object was detected on three different passes on three different days.



SSS image of the sounding in question.

The charted (81054) 21 foot sounding (“reported 2000”) located at 13°26’24.95” N 144°39’53.96” E was determined to be a in fact, a chart compilation error. Email conversations with Captain Nick Perugini, NOAA, Chief Marine Chart Division indicated that an issuance of a NIMA Notice to Mariners and a USCG Local Notice to Mariners was issued recommending removal of this sounding. ⁹

The charted (81054) 2 foot obstruction (“reported 2000”) at 13°25’47.43” N 144°40’29.63” E originated from preliminary data from this survey provided to Marine Chart Division in 2001. This area was covered by LIDAR only. A depth of 1 foot was recorded. The Evaluator recommends removal of the charted 2 foot sounding, and charting an obstruction with a depth of 1 foot. The Evaluator also recommends removing the “reported 2000” note. ¹⁰

Many of the wharfs along Apra Inner Harbor have clearance depths reported from 1983. These areas were covered during this survey by LIDAR, single beam sonar or not at all. While in most cases the limited surveyed soundings are deeper than charted, they should not be considered adequate to determine a new wharf face depth. Unless specifically addressed below these notations should be retained as charted. ¹¹

The “31 feet reported 1983” along wharf B (13°26’18.51” N 144°40’01.16” E) was covered extensively by LIDAR along with limited single beam. A least depth of 31 feet was recorded. The Evaluator recommends charting depths from this survey and removing the notation. ¹²

The “29 feet reported 1983” along the L1 wharf face (13°26’31.24” N 144°39’52.57” E) was covered by 200% LIDAR. The depths at the charted location ranged 34-38 feet. A 28 foot sounding was located approximately 30 meters to the north at 13°26’32.13” N 144°39’52.18” E. The Evaluator recommends removing the charted remark and charting “28 feet reported 2001.” ¹³

The “26 feet reported 1983” along the wharf U1 face (13°25'42.12" N 144°39'46.86" E) was covered by LIDAR. The depths at the charted location ranged 31-33 feet. A 22 foot sounding was located at 13°25'44.03" N 144°39'48.67" E. The Evaluator recommends revising the notation to “22 feet reported 2001.”¹⁴

New Features

The coralline nature of the area generated a great many shoals and obstructions which were not charted. According to the *Guam ROS* all shoals identified by sonar were investigated by echosounder; and from the data it does appear that most targets were investigated, albeit some more comprehensively than others. A database of these contacts is available in *NIMA Guam targets.xls*. Numerous uncharted small wrecks were found scattered throughout outer Apra Harbor. These small wrecks are the remains of aircraft, LCMs, tracked military and commercial vehicles chiefly from WWII and post-WWII eras. The vast majority of these wrecks were not considered dangerous to surface navigation; nevertheless, the *Guam ROS* recommends that their existence should be annotated on the chart. The Evaluator agrees with this statement for the most part; however very insignificant wrecks and obstructions, found by the Navy yet not depicted on the smooth sheet, should not be added to the chart. The Evaluator has reviewed the smooth sheet and the database of target and specific charting recommendations are made below.

A new wreck was positioned at 13°26'06.6" N 144°40'24.27" E. A least depth of 27 feet was scaled from side-scan sonar, and a very limited single-beam investigation indicated a shallow depth of 31 feet. The new wreck was 8 meters long and 1 meter high, based on side scan sonar. This wreck does not appear on the Navy's smooth sheet but was included in their database of features (*NIMA_Guam_targets.xls*). The Evaluator recommends charting the new wreck, with the remark “27 feet reported 2001.”¹⁵

A new coral head was positioned at 13°26'15.31" N 144°39'57.69" E. This appears on the Navy's smooth sheet and the source of it is unapparent. A few lines of single-beam varying from 7-13 meters apart were run over the position. A least depth of 43 feet appears in the full density dataset (but not on the smooth sheet). The Evaluator believes that the investigation was insufficient to determine the least depth of this feature and recommends charting a new obstruction, with the remark “43 feet reported 2001,” and also annotating a bottom characteristic of “Coral” on the chart.¹⁶

A new obstruction was positioned at 13°25'14.78" N 144°40'08.92" E. A least depth of 27 feet was scaled from side-scan sonar, and two single-beam lines over the object reveal a shoal depth of 33 feet. The remark from the *NIMA_Guam_targets.xls* indicate this is a “debris field,” while the Navy smooth sheet has a “coral head” note next to it. The Evaluator recommends charting an obstruction, with the annotation “27 feet reported 2001.”¹⁷

A new wreck is portrayed on the Navy's smooth sheet at 13°25'29.97" N 144°39'49.78". The position of the new wreck was scaled from side-scan sonar. Review of the single beam sonar soundings and side-scan imagery with NAVOCEANO personnel showed the contact to be an extensive wreck (123 meters long by 17 meters wide) which extended approximately 1 meter

above the seafloor. The Evaluator recommends charting a dashed limit line that portrays the extents of wreckage based on side scan sonar positions.¹⁸

See section **D.4** of this report for additional charting recommendations.

D.5 Shoreline

The shoreline portrayed on the NAVOCEANO smooth sheet was generated from the vector shoreline used in the DNC of the area. The high resolution shoreline data mentioned in the *Guam ROS* was not applied to the survey data. The Evaluator recommends retaining the shoreline as charted except where specifically addressed below.¹⁹

Charted Features

The front range marker on Polaris Point charted (81054) at 13°26'32.98" N 144°40'00.98" E was positioned using kinematic PPS. The marker was positioned at 13°26'32.33" N 144°40'01.88" E approximately 30 meters to the southeast of its charted position (digital photos *P0000092.JPG*). The Evaluator recommends removal of the charted (81054) range mark and charting a new range mark at the surveyed position.²⁰

Along the shoreline in the vicinity of 13°26'35.53" N 144°40'06.09" W are three charted (81054) dolphins and one charted submerged dolphin. The Navy's smooth sheet depicts five dolphins in close proximity to the three charted dolphins, and two of the dolphins were confirmed with LIDAR soundings. The Evaluator recommends removing the three charted dolphins and charting the five dolphins from the Navy's smooth sheet.²¹ The Evaluator also recommends retaining the submerged dolphin as charted since it was not disproved.²²

Twelve charted (81054) mooring buoys were positioned in the inner harbor during this survey, using PPK GPS. The buoys were on station and served their intended purpose. The Evaluator recommends retaining them as charted.²³

New Features

A large mobile dry-dock, appeared to be "semi-permanently" moored alongside Wharf L, was positioned at 13°26'24.66" N 144°39'53.61" E. It was therefore impossible to obtain depths close to this wharfage, although the seabed under the platforms was fully ensonified with side scan sonar. No significant contacts were detected. Positional information for new drydock was obtained using LIDAR data. The Evaluator recommends charting the new drydock as it appears on the Navy smooth sheet.²⁴

Two new mooring buoys were positioned at 13°26'07.31" N 144°40'06.8" E, and 13°26'07.56" N 144°40'08.35" E, using PPK GPS. The Evaluator recommends charting these new buoys at their surveyed positions.²⁵

The Evaluator recommends modifying the existing chart Note A, to add a cautionary note for the nature of restricted access to the Inner Harbor. The note should reflect the latest version of the CFR, including sections: 33CFR165.1401, 33CFR165.1402, and 33CFR165.1404.²⁶

D.5 Dangers to Navigation

Twenty six²⁷ Dangers to Navigation were found during the evaluation of survey W00005 and W00006. These Dangers to Navigation were forwarded to MCD on September 22, 2003. See copy of submitted letter in this report.

D.6 Aids to Navigation

According to the *Guam ROS*, all aids to navigation (AtoN's), man-made coastline, and significant features were positioned using post-processed kinematic techniques and photographed. The listing provided by NAVOCEANO (*Final Nav aids.xls*) was described as being definitive and was recommended to be used to update the chart. However, because no features were specifically disproved, any AtoN not positioned should be retained as charted.²⁸ Light characteristics were confirmed for all AtoN's in the harbors on the evening of the 5th February using binoculars, a hand-held compass, a stopwatch and the current chart. It was opined that the existing AtoN's throughout the area were generally in good condition and fit for purpose, but that their geographic positions and characteristics were in need of updating.

Comparisons were made between surveyed positions and the most recent copy of the US Coast Guard Light List. Several lights and buoys were found to be significantly different from their listed position. In addition, some items in the Light List had no position given. The Evaluator recommends that these surveyed positions be passed along to the US Coast Guard to update the Light List.²⁹ A letter was submitted on September 25, 2003 to Steve Hill, N/CS29 with an updated list of ATON positions.³⁰

E. APPROVAL**Hydrography**

All obtained records, reports, and data have been evaluated with regard to survey coverage, survey accuracy, and suitability for nautical charting.

Evaluated by:

Sean C. Rooney
Sean C. Rooney
Physical Scientist (Hydrographer)
Pacific Hydrographic Branch

Reviewed by:

E. J. Van Den Aamele
Lieutenant Edward J. Van Den Aamele, NOAA
Hydrographic Team Leader
Pacific Hydrographic Branch

Cartography

The evaluated survey has been inspected with regard to delineation of the depth curves, development of critical depths, cartographic symbolization, comparison with prior surveys and verification or disproof of charted data.

Compiled by:

Russ Davies
Russ Davies
Cartographer
Pacific Hydrographic Branch

Reviewed by:

Bruce Olmstead
Bruce Olmstead
Cartographer
Pacific Hydrographic Branch

Approval

I have reviewed the data and reports. Data are suitable for nautical charting except where specifically recommended in this report.

Approved by:

John E. Lowell, Jr. *SEPT 29, 2003*
Commander John E. Lowell, Jr., NOAA
Chief,
Pacific Hydrographic Branch

¹ Cartographer revision – These dates represent data collection for surveys W00005 and W00006.

² Cartographer revision – Survey limits are the following:

North latitude - 13/26/35.58N

South - latitude 13/25/5.51N

West – longitude 144/39/37.01E

East – longitude – 144/40/33.38E

³ Cartographer revision – filed with the hydrographic data

⁴ Cartographer revision – filed with the hydrographic data

⁵ Cartographer revision – See survey area on page one for LIDAR, SSS and echo sounder coverage

⁶ Cartographer revision – Concur

⁷ Cartographer revision – Concur

⁸ Cartographer revision – In the interim, before dredging, chart a 31 foot obstruction at latitude 13/26/30.58N, longitude 144/39/55.51E.

⁹ Cartographer revision – This sounding, *21 ft rep 2000*, has been removed from chart 81054, corrected through NM Feb.8, 2003 and LNM, Jan. 28, 2003.

¹⁰ Cartographer revision – Concur, chart 1 foot obstruction at latitude 13/25/47.61N, longitude 144/40/29.79E

¹¹ Cartographer revision – Concur

¹² Cartographer revision – Concur with clarification, remove *31 ft rep 1983*, and chart *31ft 2001*.

¹³ Cartographer revision – Concur with clarification, remove *29 ft rep 1983* and chart *28ft 2001*.

¹⁴ Cartographer revision – Concur with clarification, remove *26 ft rep 1983* and chart *22ft 2001*.

¹⁵ Cartographer revision – Concur with clarification, chart *27 Wk PA rep 2001* at the above position.

¹⁶ Cartographer revision – Concur with clarification, chart *Co Hd PA 43ft rep 2001*

¹⁷ Cartographer revision – Concur with clarification, chart, *27 ft obstn rep 2001*

¹⁸ Cartographer revision – Concur, chart limit line with a note *wreckage*.

¹⁹ Cartographer revision – Concur

²⁰ Cartographer revision – Concur

²¹ Cartographer revision – Concur

²² Cartographer revision – Concur

²³ Cartographer revision – Do not concur, chart mooring buoys as positioned by this survey.

²⁴ Cartographer revision – Concur

²⁵ Cartographer revision – Concur

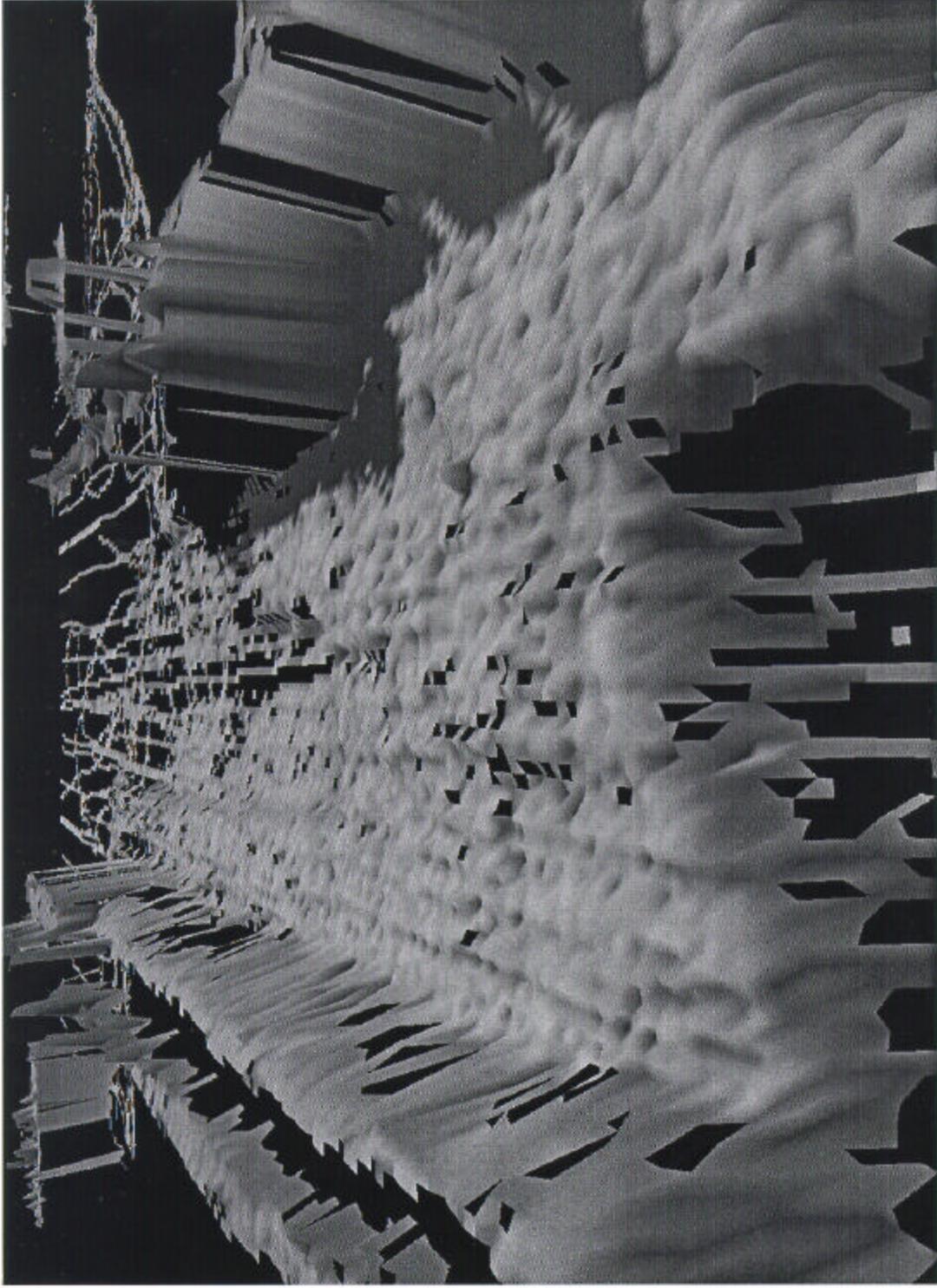
²⁶ Cartographer revision – Concur

²⁷ Cartographer revision – Ten dangers to navigation fall within W00006 survey area.

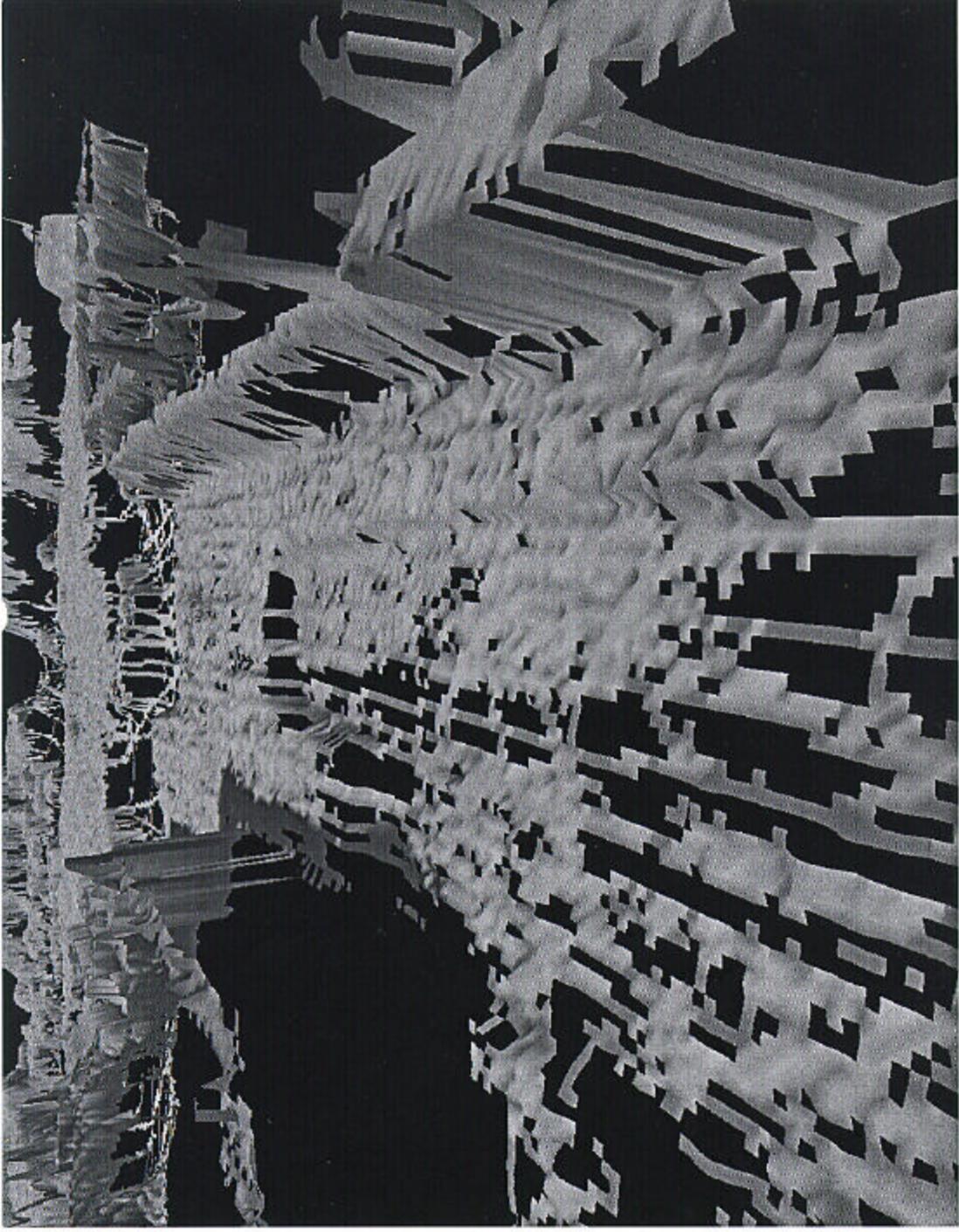
²⁸ Cartographer revision – Concur

²⁹ Cartographer revision – Concur

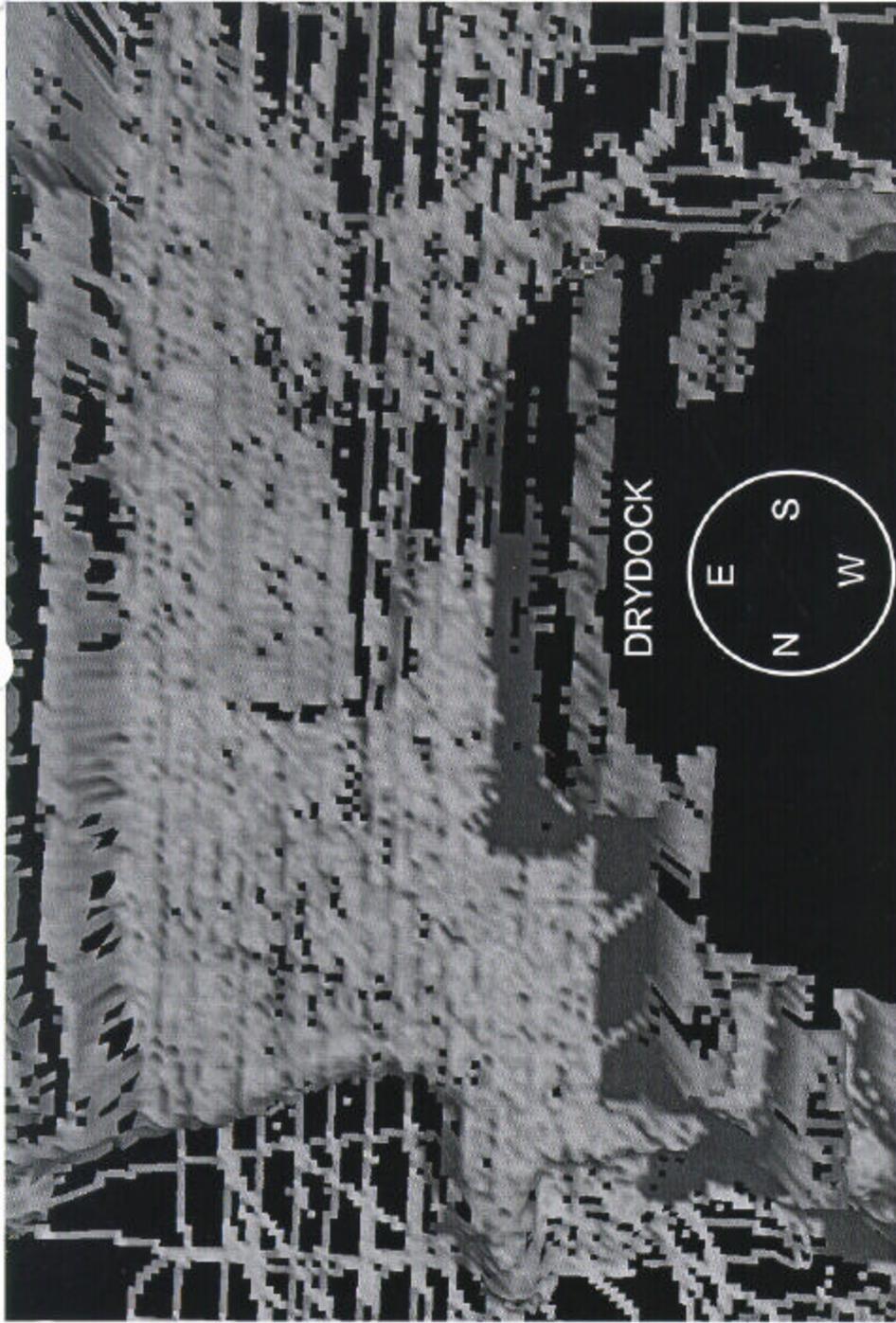
³⁰ Cartographer revision – A copy of the letter, dated September 25, 2003 is attached to this report.



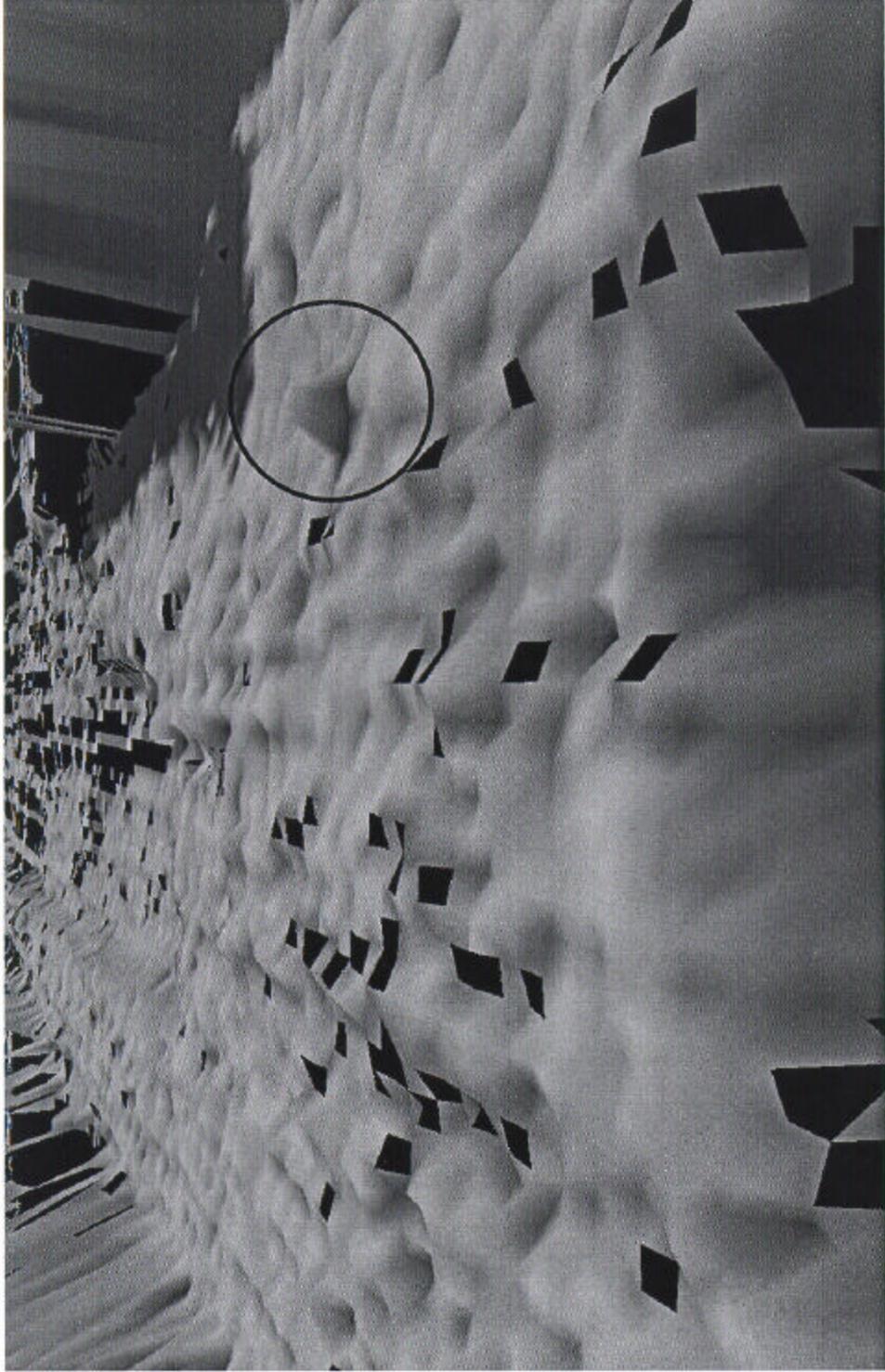
FLEDERMAUS PERSPECTIVE VIEW OF APRA OUTER TO INNER HARBOR CHANNEL. LOOKING SOUTH.



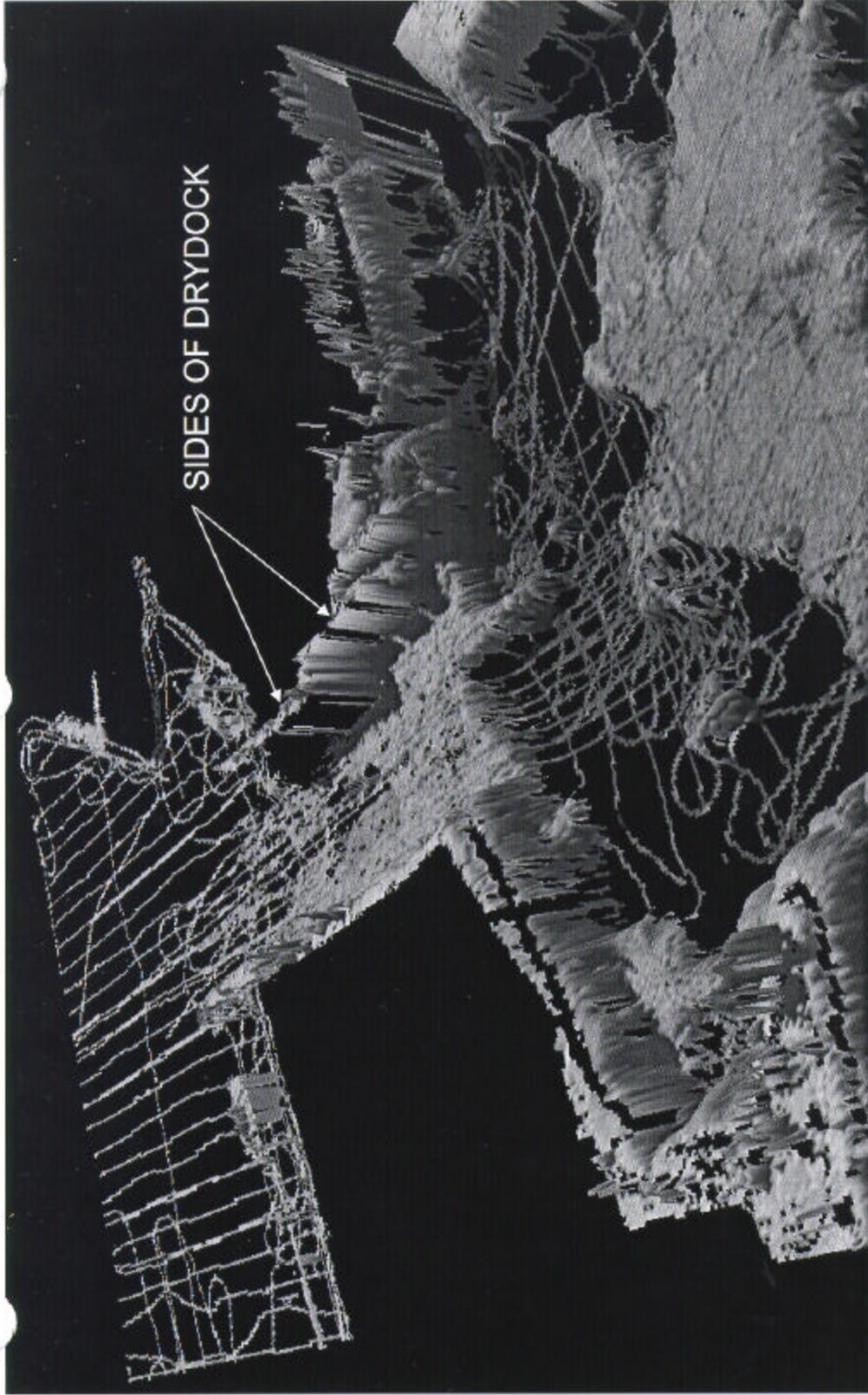
FLEDERMAUS PERSPECTIVE VIEW OF APRA OUTER TO INNER HARBOR CHANNEL. LOOKING NORTH.



FLEDERMAUS BIRDSEYE VIEW OF APRA OUTER TO INNER HARBOR CHANNEL WITH DRYDOCK ALONG WEST SIDE OF CHANNEL (BOTTOM).

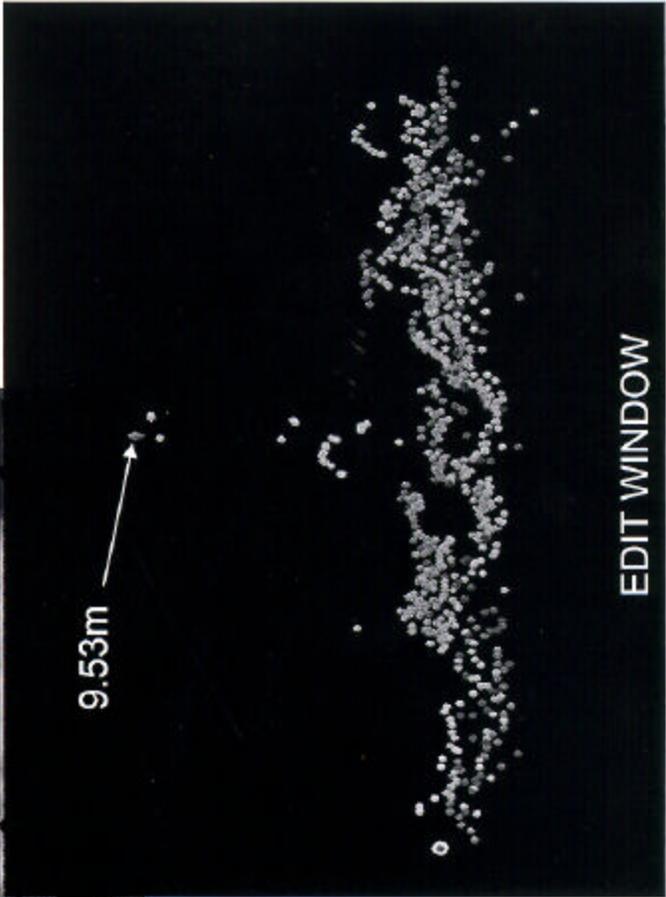
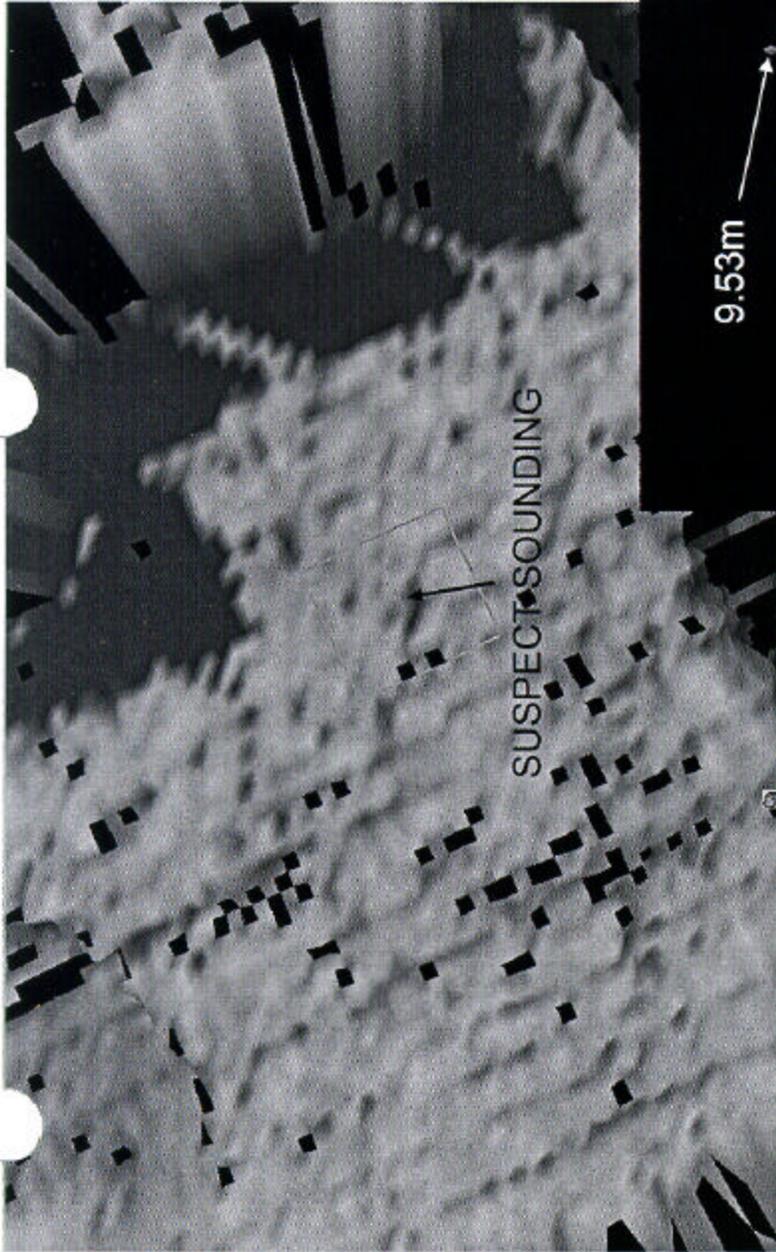


PERSPECTIVE VIEW OF SUSPECT SOUNDING. LOOKING SOUTH.

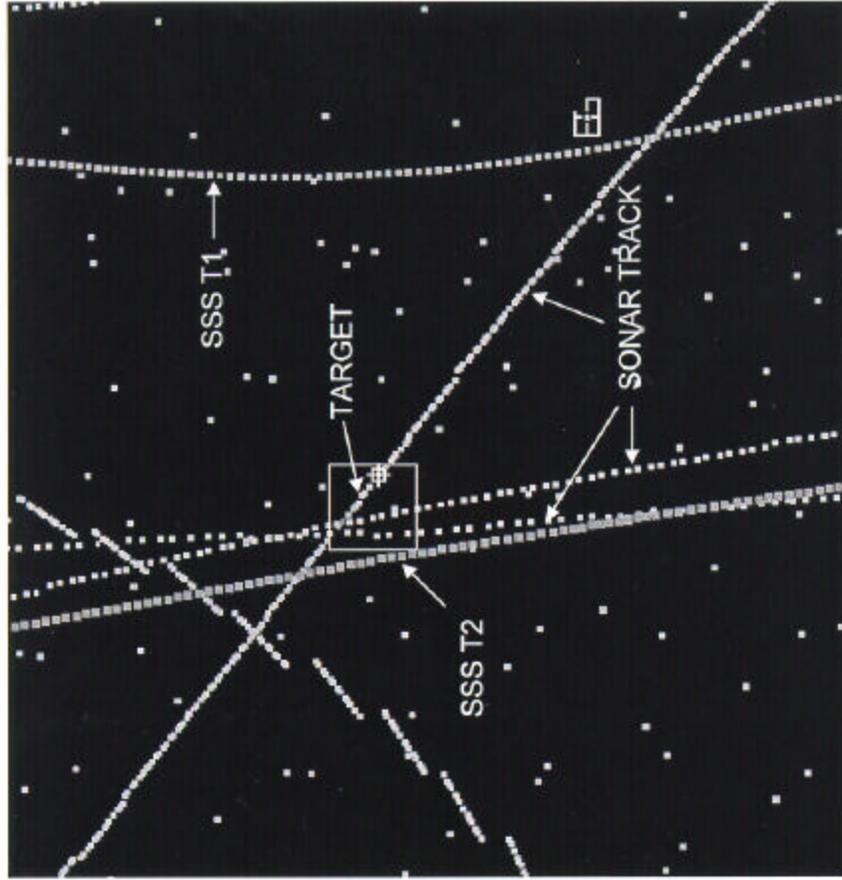


SIDES OF DRYDOCK

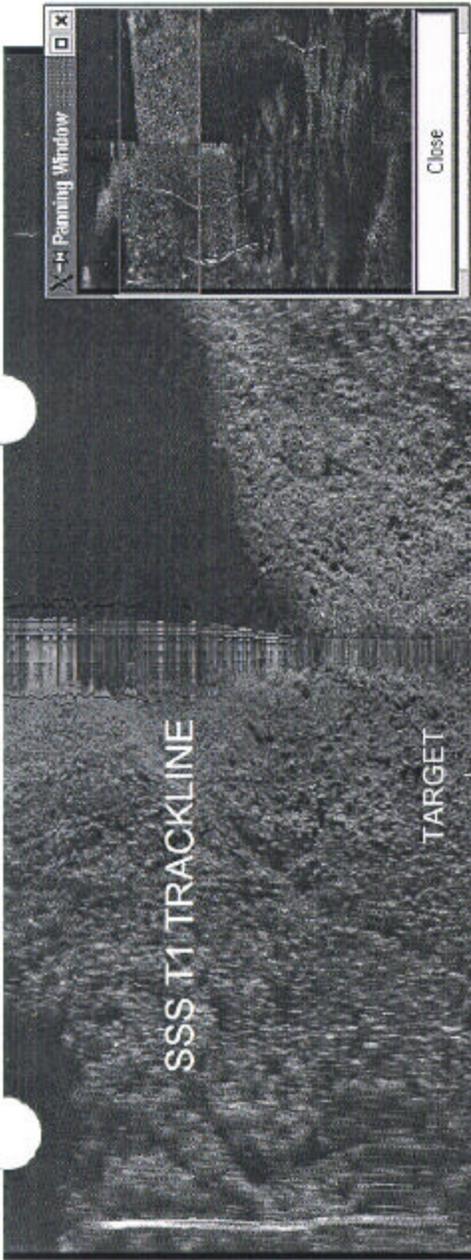
FLEDERMAUS VIEW OF THE CHANNEL BETWEEN APRA'S INNER HARBOR (TOP) AND THE OUTER HARBOR (BOTTOM). VIEW LOOKING SOUTH WEST.



EDIT WINDOW SHOWS MULTIPLE SONAR HITS COLOR CODED BY TRACKLINE. SHOWN IS THE OBJECT IN QUESTION, DETECTED ON THREE DIFFERENT TRACKS, ON THREE DIFFERENT DAYS OVER A ONE WEEK TIME PERIOD. THE BLUE DIAMOND IS THE SELECTED SOUNDING



EDIT WINDOW SHOWING THREE SONAR TRACKS OVER THE SUSPECT SOUNDING/TARGET AND TWO ADJACENT SIDE SCAN SONAR TRACKS PAST THE TARGET.



X-4 Panning Window

Close

X-4 Zoom Window: Magnify 2X

Zoom: 2X Size: 256x256

Close

X-4 Target Information Dialog

Get Information Save Information

Query Info

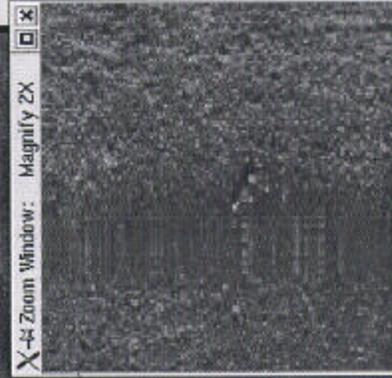
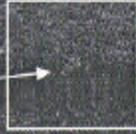
Latitude:	+13 26.5097796141
Longitude:	+144 39.9238525863
Time:	01-25-2001 06:58:57.57
Depth(m):	12.2612
Heading:	6.0552
Roll:	0.0000
Pitch:	0.0000
Pixel Value:	32
Row:	2447

Measurement Info

Length(m):	
Width (m):	
Height(m):	

SSS T2 TRACKLINE

TARGET



X-4 Target Information Dialog

Get Information | Save Information

Query Info

Latitude:	13 26.5073426103
Longitude:	144 39.9265616968
Time:	01-25-2001 02:01:49.76
Depth(m):	15.5585
Heading:	346.8493
Roll:	0.0000
Pitch:	0.0000
Pixel Value:	84
Row:	1680

Measurement Info

Length(m):	
Width(m):	
Height(m):	

Query Target	Measure Shadow
Length	Width
Clear	Display Graphs
Close	

Wrapping up Guam 1.txt

Subject: resend Wrapping up Guam
Date: Thu, 10 Jul 2003 17:18:05 -0500
From: "Ebrite, Scott" <ebrites@navo.navy.mil>
To: "Farr, Steve" <FarrS@NAVO.NAVY.MIL>,
 "'Sean.C.Rooney@noaa.gov'"
 <Sean.C.Rooney@noaa.gov>
CC: "'Edward.J.Vandenameele@noaa.gov'"
 <Edward.J.Vandenameele@noaa.gov>,
 "Van Norden, Maxim" <vannordenm@navo.navy.mil>,
 "Clough, Marian"
 <cloughm@navo.navy.mil>

> With respect to question 1 concerning the questionable 9.5 meter
sounding;
> After a thorough review of relevant data the conclusion is that the
> sounding is valid. Three different FST single beam tracklines run
on
> three different days over a one week period converge and all show a
series
> of hits at this location. The presence of an object/target is
confirmed
> with side scan sonar data collected along two adjacent survey lines
run on
> different days. It appears the target and the source of the
sounding may
> be a mooring and/or mooring line off the NE corner of the drydock.
I
> don't know where divers looked, but it apparently wasn't where the
object
> is located. The Lidar group and FST stand by the data pending
confirmation
> of the objects non-existence.

See the attached ppt file.

> <<DATA REVIEW.ppt>>
>
> Question 2 has been previously answered.
>
> Question 3 has been previously answered but is clarified here. Apra
> Harbor Guam was zoned by NOAA. All of the harbor fell in one zone.
The
> areas outside the harbor and Agat Bay fell in another zone. Zone
> boundaries, NOAA tides from the Apra harbor gauge and the
appropriate
> amplitude and time corrections as per NOAA and were applied.
>
> Question 4 previously answered.

Wrapping up Guam 1.txt

>
> Question 5. Sumner data was all cleaned and edited in house and all
> correctors including tides applied.
>
> Question 6. USNS Sumner used the Fugro wide area DGPS corrections.
> However, system modeling of the system the the locations around Guam
> indicated the corrections would degrade the positioning accuracy to
> less
> than the accuracy achieved using PPS. My understanding is that
> Sumner
> used the Fugro system and , as a result, the Sumner positioning
> accuracy
> does not meet first order requirements and is degraded to second
> order.
> Sumner maximum positioning error is approximately 12 meters.
> Furthermore,
> Sumner data is NOT used within Apra harbor and should not be
> included in
> the data for the harbor.. Sumner data is only used outside the
> harbor
> along the NW side of the jetty
>
> -----Original Message-----
> From: Farr, Steve
> Sent: Monday, June 23, 2003 1:03 PM
> To: Ebrite, Scott; Pope, Robert
> Subject: FW: Wrapping up Guam
>
> Bob, Scott
>
> Can either of you answer questions 2 and 4? Possible 3 also, if you
> have
> any knowledge of the
> tide zoning used. Thanks. Send your answers to me or you can
> repond
> directly to Sean, but still
> CC your answers to me so I'll know. If you have no input let me
> know
> also. Thanks again.
> Hopefully these are the last issues with Guam.
>
> Steve
>
> -----Original Message-----
> From: Sean C. Rooney [SMTP:Sean.C.Rooney@noaa.gov]
> Sent: Thursday, May 29, 2003 12:33 PM
> To: Farr Steve
> Subject: Wrapping up Guam

Wrapping up Guam 1.txt

>
>
> Hi Steve, just about finished up with my evaluation of the Guam data.
> Just wanted to check up on a few last things:
>
> 1. Did you ever find anything else out about these soundings?
> [Farr,Steve] Some preliminary info on question 12. I've done some investigation on these soundings. The 9.5 meter (31 foot) sounding may be
> suspect. There is a 9.6 meter sounding next to it from the data I used to
> produce my contours and shoal soundings. Both of these soundings came
> from FST single-beam data with little or no data around to support. The
> 9.8 and 9.9 also are from the single beam data - I have not investigated
> these soundings yet. The 10.0 further north seems to have the most chance
> of being correct. There are multiple hits of 10.1, 10.2 and 10.3 meter
> depths near and around that area. They could still be incorrect however.
> All of these suspect soundings came from the FST single-beam data. I need
> to do further investigation on the data to come to some firm conclusion.
> I'll let you what I determine once I have found the full resolution data
> and checked it out.
>
> 2. The smooth sheet states Lidar portion of the survey used KGPS in addition to DGPS. What was the KGPS used for? The smooth sheet also
> states the FST only used DGPS. Is it possible that the LIDAR claim of
> KGPS was really the PPKGPS work conducted by the FST?
>
> 3. Were co-tidal zones used? If so for which data sets?
[Farr,Steve]
> Tides were applied, but I cannot find the tide files that were used.
> Will ask the data processors.
>
> 4. In the Lidar documentation a pressure recording gauge is mentioned
> in addition to the NOAA tide gauge, I am unclear was this instrument

Wrapping up Guam 1.txt

used

> in Guam? If so how was this data applied?

>

> 5. The cruise report for the USNS Sumner, states that the Nav. data was

> not cleaned for Guam (page 9, section 3). And that data was not cleaned

> using area based editor (page 9-10, section 4). I assume that this was

> done in the office, can you confirm?

>

> 6. The cruise report for the Sumner states that wide area DGPS was used

> for positing, but it also states in the notes (page 10, section 5) that

> wide area DGPS was not installed on the vessel at the the time of survey.

> What was used? We are seeing some very significant difference between

> surveyed and charted depths.

>

> Thank you Steve for all you help. You have been very responsive to my

> questions, and I know there have been a lot. I appreciate you taking the

> time to track them all down.

>

> Sean

>

>

>

DATA REVIEW.ppt

Name: DATA REVIEW.ppt

Type: Microsoft PowerPoint Show

(application/vnd.ms-powerpoint)

Encoding: base64

Download Status: Not downloaded with message

Wreck in navy anchorage8.txt

Subject: [Fwd: RE: Wreck in Navy Anchorage]
Date: Tue, 12 Aug 2003 15:34:37 -0700
From: "Edward J Van Den Ameele" <Edward.J.Vandenameele@noaa.gov>
To: "Sean C. Rooney" <Sean.C.Rooney@noaa.gov>

Be sure to mention in your report....probably under "Miscellaneous", plus e-mail attached.

EJ

----- Original Message -----

Subject: RE: Wreck in Navy Anchorage
Date: Wed, 13 Aug 2003 08:25:40 +1000
From: "Riddle, Dick" <n3@guam.navy.mil>
To: Edward J Van Den Ameele <Edward.J.Vandenameele@noaa.gov>, Riddle Dick <n3@guam.navy.mil>
CC: "Sean C. Rooney" <Sean.C.Rooney@noaa.gov>, "Tasheuras, LT Nic" <tasheurasd@guam.navy.mil>, "McNair, CDR Daniel" <McNairD@guam.navy.mil>

Roger. When we're all complete I'll put together everything I can and send to you.

Nic, can I have a separate package of the dredge project to forward to NIMA or do you want to do that? This info goes into updating our Harbor Chart 81054.

Dick Riddle
CNM N3
DSN: 671-339-4670
Cell: 671-777-4684

-----Original Message-----

From: Edward J Van Den Ameele [mailto:Edward.J.Vandenameele@noaa.gov]
Sent: Wednesday, August 13, 2003 8:04 AM
To: Riddle Dick
Cc: Sean C. Rooney
Subject: Re: Wreck in Navy Anchorage

Ideally, we would like copies of all materials related to the post-dredge survey - blueprints, sounding plots, surveyor's reports of systems and methods used. Thanks.

"Riddle, Dick" wrote:

>

> I'll tickle this for action to notify you. Do you require results

Wreck in navy anchorage8.txt

from
the
> survey???

>
> Dick Riddle
> CNM N3
> DSN: 671-339-4670
> Cell: 671-777-4684

>
> -----Original Message-----
> From: Edward J Van Den Aneele
[mailto:Edward.J.Vandenameele@noaa.gov]
> Sent: Wednesday, August 13, 2003 7:42 AM
> To: Riddle Dick
> Cc: Sean C. Rooney
> Subject: Re: Wreck in Navy Anchorage

>
> Thank you for confirming the wreck, would hate to chart it in the
> anchorage if it didn't exist.

>
> Where could I obtain results of the dredging project once complete?
We
> would like to update the chart with this data once available.

>
> Many thanks,
> EJ

>
> "Riddle, Dick" wrote:
> >
> > Regret to inform you the wreck still exists with the masts showing
above
> > water. The owner has not been pressed to raise the thing so he
has done
> > nothing with it.
> > For other info, the 31 foot mark in the inner harbor has been
identified
> as
> > a coral head, mixture of live and dead coral, and is scheduled to
be
> removed
> > within 4 months under an on-going dredge program.

> >
> > Dick Riddle
> > CNM N3
> > DSN: 671-339-4670
> > Cell: 671-777-4684
> >
> > -----Original Message-----

Wreck in navy anchorage8.txt

> > From: Edward J Van Den Ameerle
[mailto:Edward.J.Vandenameele@noaa.gov]
> > Sent: Wednesday, August 13, 2003 12:18 AM
> > To: Dick Riddle
> > Cc: Sean C. Rooney
> > Subject: Wreck in Navy Anchorage
> >
> > Mr. Riddle,
> >
> > We (NOAA) are wrapping up applying the NAVOCEANO survey data to
our Guam
> > charts and have a few items which require some local knowledge to
clear
> > up. One is a wreck which the NAVOCEANO survey team located in
Naval
> > Anchorage B at 13°26'49.07" N 144°40'13.08" E (please see
attached
> > graphic). Given that this was a 65-foot yacht, with the mast
showing,
> > positioned in 2001, I feel there could be a high likelihood that
this
> > wreck is no longer in this position. Before we place a new wreck
on the
> > chart -- can you provide any information about the disposition of
this
> > wreck? An image of the wreck (from NAVOCEANO) is also attached.
Any
> > documentation which would indicate that this wreck was
definitively
> > salvaged or otherwise proven not to exist would be ideal.
> >
> > Thank you in advance,
> >
> > EJ

Danger to Navigation Report

ADVANCE
INFORMATION

Hydrographic Survey Registry Number: W00005 and W000006

Survey Title: State: Marianas Islands
Locality: Guam
Sub-locality: Apra Harbor

Project Number: 00601 01US02 and 00602 01US02 (U.S. Naval Oceanographic Office)

Survey Dates: January - February 2001

Depths are reduced to Mean Lower Low Water using verified tides.
Positions are based on the WGS84 horizontal datum.

CHARTS AFFECTED:

Chart	Scale	Edition	Date
81048	1:100,000	8 th	02/27/93
81054	1:10,000	13 th	02/03

DANGERS:

Feature	Depth(ft)	Latitude (N)	Longitude (E)
Sounding	27 feet	13°27'15.85" N	144°37'35.16" E
Sounding	57 feet	13°27'01.02" N	144°38'55.8" E
Sounding	12 feet	13°27'39.91" N	144°39'42.43" E
Sounding	17 feet	13°27'36.16" N	144°40'22.36" E
Sounding	9 feet	13°27'31.86" N	144°40'20.16" E
Sounding	10 feet	13°27'31.35" N	144°40'18.22" E
Sounding	5 feet	13°27'12.56" N	144°39'55.1" E
Sounding	45 feet	13°27'00.55" N	144°39'54.84" E
Sounding	12 feet	13°26'53.34" N	144°39'32.5" E
Sounding	38 feet	13°26'46.76" N	144°39'58.62" E
Sounding	27 feet	13°26'51.91" N	144°40'18.98" E
Sounding	15 feet	13°27'01.29" N	144°40'18.69" E
Sounding	32 feet	13°26'31.91" N	144°39'56.78" E
Sounding	27 feet	13°26'12.79" N	144°39'41.85" E
Sounding	29 feet	13°26'00.85" N	144°40'26.72" E
Sounding	29 feet	13°25'56.01" N	144°40'23.51" E
Sounding	26 feet	13°25'53.63" N	144°40'26.94" E
Sounding	27 feet	13°25'49.99" N	144°40'25.98" E

Danger to Navigation Report

**ADVANCE
INFORMATION**

Sounding	28 feet	13°25'46.95" N 144°40'20.97" E
Sounding	32 feet	13°25'52.8" N 144°40'03.57" E
Wreck	38 feet	13°27'34.08" N 144°37'58.4" E
Wreck	58 feet	13°27'32.55" N 144°39'43.64" E
Wreck	exposed	13°26'49.07" N 144°40'13.12" E
Wreck	27 feet	13°26'06.59" N 144°40'24.26" E
Obstruction	27 feet	13°25'14.78" N 144°40'08.92" E
Obstruction	unknown	13°25'15.59" N 144°38'19.3" E

COMMENTS:

These soundings and features are from Outside Source Data hydrographic surveys conducted by the U.S. Naval Oceanographic Office. Features contained in this danger to navigation report were evaluated by the Pacific Hydrographic Branch and deemed to meet NOAA standards for hydrographic surveys, unless otherwise noted.

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



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
OFFICE OF COAST SURVEY
Pacific Hydrographic Branch
Seattle, Washington 98115-6349

September 25, 2003

MEMORANDUM FOR: Steven Hill
Marine Chart Division

FROM: Commander John E. Lowell, NOAA
Chief, Pacific Hydrographic Branch

SUBJECT: Updated ATON positions from hydrographic surveys W00005 and W00006.

Attached you will find updated positions for aids to navigation located in the Northern Marianas Islands, Guam. These aids were positioned during outside source hydrographic surveys W00005 (Apra Outer Harbor), and W00006 (Apra Inner Harbor). These surveys were conducted from 13 January – 07 February 2001 by the U.S. Naval Oceanographic Office. The Pacific Hydrographic Branch reviewed these positions for data quality purposes, and found that they meet NOAA standards for positioning fixed and floating aids-to-navigation. The distances off-station listed below are referenced from NOAA chart 81054, 13th edition (February 2003), with LNM updates through August 8, 2003.

Latitude (N)	Longitude (E)	Description	Light List #	Characteristics	Distance off station
13:26:58.264	144:38:25.039	Mooring Buoy "951"			100 M
13:27:00.848	144:38:48.831	Mooring Buoy "704"			138 M
13:26:47.046	144:39:08.420	Mooring Buoy			40 M
13:26:45.973	144:39:15.184	Mooring Buoy			45 M
13:26:52.915	144:39:22.852	Mooring Buoy			123 M
13:27:04.355	144:39:50.757	Mooring Buoy "F"			80 M
13:27:32.366	144:39:20.109	Cabras Channel Entrance Buoy #2 (red)	30735	R "2" Fl R 2.5s	35 M
13:26:48.875	144:40:01.389	Mooring Buoy "SM"		702	55 M
13:27:41.103	144:39:48.634	Hansen Concrete Silo			24 M
13:26:29.095	144:40:04.552	Apra Inner Harbor Approach Rear Range Marker	30795	Iso R 6s 24ft	11 M
13:26:32.330	144:40:01.880	Apra Inner Harbor Approach Fwd Range Marker	30790	Q R 15 Ft	35 M

Several new mooring buoys were also positioned during this survey:

Latitude (N)	Longitude (E)	Description
13:26:50.497	144:40:27.100	Mooring Buoy
13:27:37.952	144:39:30.311	Mooring Buoy
13:26:44.209	144:39:22.983	Mooring Buoy

Positions of navigational features were obtained using a Trimble 4700 receiver, affixed to a 2-meter antenna pole. All features were positioned using post-processed kinematic (PPK) GPS. Light characteristics were



confirmed for all navigational aids in the harbors; using binoculars, hand-held compass, stopwatch and the current chart.

Comparisons were made to the most recent copy of the Light List. Several lights and buoys were found to be significantly different from their charted position. In addition some items in the light list had no position. It is recommended that the attached positions also be used to update the Light List positions.

Because these positions originate from a survey conducted in early 2001, it is possible that many of these aids-to-navigation may have been repositioned since this survey. It is not recommended that the positions listed above supersede any information of a more recent date than February 7, 2001.

HYDROGRAPHIC SURVEY STATISTICS

W00006

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

RECORD DESCRIPTION		AMOUNT	RECORD DESCRIPTION			AMOUNT
SMOOTH SHEET		1	SMOOTH OVERLAYS: POS., ARC, EXCESS			
DESCRIPTIVE REPORT		1	FIELD SHEETS AND OTHER OVERLAYS			
DESCRIPTION	DEPTH/POS RECORDS	HORIZ. CONT. RECORDS	SONAR-GRAMS	PRINTOUTS	ABSTRACTS/SOURCE DOCUMENTS	
ACCORDION FILES						
ENVELOPES						
VOLUMES						
CAHIERS						
BOXES						
SHORELINE DATA						
SHORELINE MAPS (List):						
PHOTOBATHYMETRIC MAPS (List):						
NOTES TO THE HYDROGRAPHER (List):						
SPECIAL REPORTS (List):						
NAUTICAL CHARTS (List):						
OFFICE PROCESSING ACTIVITIES						
<i>The following statistics will be submitted with the cartographer's report on the survey</i>						
PROCESSING ACTIVITY				AMOUNTS		
				VERIFICATION	EVALUATION	TOTALS
POSITIONS ON SHEET						
POSITIONS REVISED						
SOUNDINGS REVISED						
CONTROL STATIONS REVISED						
				TIME-HOURS		
				VERIFICATION	EVALUATION	TOTALS
PRE-PROCESSING EXAMINATION						
VERIFICATION OF CONTROL						
VERIFICATION OF POSITIONS						
VERIFICATION OF SOUNDINGS						
VERIFICATION OF JUNCTIONS						
APPLICATION OF PHOTOBATHYMETRY						
SHORELINE APPLICATION/VERIFICATION						
COMPILATION OF SMOOTH SHEET						
COMPARISON WITH PRIOR SURVEYS AND CHARTS						
EVALUATION OF SIDE SCAN SONAR RECORDS						
EVALUATION OF WIRE DRAGS AND SWEEPS						
EVALUATION REPORT						162
GEOGRAPHIC NAMES						
OTHER (Chart Compilation)						29
USE OTHER SIDE OF FORM FOR REMARKS						
TOTALS						191
Pre-processing Examination by				Beginning Date		Ending Date
Verification of Field Data by S. Rooney				Time (Hours)		Ending Date
Evaluation Check by				Time (Hours)		Ending Date
Evaluation and Analysis by S. Rooney, R. Davies				Time (Hours) 162		Ending Date 09/25/2003
Inspection by B. Olmstead				Time (Hours) 8		Ending Date 09/25/2003

