

W00208 and W00233

NOAA FORM 76-35A

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

DESCRIPTIVE REPORT

Type of Survey Hydrographic Survey

Field No.

Registry No. W00208 and W00233

LOCALITY

State Commonwealth of the Northern Mariana Islands

General Locality Saipan Island

Sublocality Tanapag Harbor, Channel and Approach

2009 - 2010

CHIEF OF PARTY

Charles A. Baptiste and Jessica Burt

LIBRARY & ARCHIVES

DATE

<p style="text-align: center;">U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION</p> <p style="text-align: center;">HYDROGRAPHIC TITLE SHEET</p>	<p>REGISTRY No</p> <p style="text-align: center;">W00208 and W002%%</p>
<p>INSTRUCTIONS – The Hydrographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.</p>	<p>FIELD No:</p>
<p>State <u>Commonwealth of the Northern Mariana Islands</u></p> <p>General Locality <u>Saipan Island</u></p> <p>Sub-Locality <u>Tanapag Harbor, Channel and Approach</u></p> <p>Scale <u>1:10,000</u> Date of Survey <u>May 23, 2009 to January 25, 2010</u></p> <p>Instructions dated _____ Project No. <u>OSD-PHB-09</u></p> <p>Vessel <u>FST Vessel, Swamp Fox and SG RHIB</u></p> <p>Chief of party <u>Charles A. Baptiste and Jessica Burt</u></p> <p>Surveyed by <u>U.S. Naval Oceanographic Office, Fleet Survey Team</u></p> <p>Soundings by <u>Reson 7125, Odom ES3-M</u></p> <p>SAR by <u>N. Forfinski, J. Tegeder</u> Compilation by <u>K. Brown</u></p> <p>Soundings compiled in <u>Feet</u></p>	
<p>REMARKS: <u>All times are UTC. UTM Projection 55N</u></p> <p><u>All separates are filed with the hydrographic data. Revisions and end notes in red were generated during office processing. Page numbering may be interrupted or non sequential.</u></p> <p>_____</p> <p>_____</p> <p>_____</p>	

REPORT OF SURVEY
TANAPAG HARBOR, CHANNEL AND APPROACH,
SAIPAN ISLAND
COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS
ARCHIVE # 09CQ01
MAY THROUGH JUNE 2009

Charles A. Baptiste
Hydrographer in Charge

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FLEET SURVEY TEAM
STENNIS SPACE CENTER, MISSISSIPPIREPORT OF SURVEY
ARCHIVE # 09CQ01

Country: Commonwealth of the Northern Mariana Islands (CNMI), USA

Area: Tanapag Harbor, Saipan Island

Dates of Survey: 23 May 2009 – 27 June 2009

Archive #: 09CQ01

Chart: NOAA 81076, 12th Ed., Aug./07

Sailing Directions: NGA PUB 126, Pacific Islands

World Port Index: Port of Saipan 56520

U.S. Coast Guard
Light List: Volume VI, Pacific Coast and Pacific Islands, 2009

NGA
List of Lights: PUB. 111, 2008

Horizontal Datum: World Geodetic System 1984 (WGS 84)

Projection: Transverse Mercator

Grid: Universal Transverse Mercator (UTM)
Central Meridian = 147° E
UTM Zone 55N

Sounding Datum: Mean Lower Low Water (MLLW)

Vertical Datum: Mean Sea Level (MSL)

Survey Team

Name	Qualification	Dates (2009)	Position
Charles A. Baptiste	Hydrographer M1	22 May – 30 June	Hydrographer in Charge
Jessica Burt	Hydrographer M1	22 May – 01 July	Hydrographer in Charge U/I
Barry Sysak	Hydrographer M2	7 June – 27 June	Hydro Lead
LT Kyle Baden	Hydrographer M2	7 June – 24 July	Hydrographer
AG3 Daniel Brashear	Hydrographer M2	7 June – 24 July	Hydrographer
AG3 Jason Herron	Hydrographer M2	7 June – 18 July	Hydrographer
Henry Stout	Electronic Technician	7 June – 27 June	Electronic Technician

STATISTICS

PRIMARY DATA COLLECTION	MILEAGE	REMARKS
Multibeam	82.05nm	
Singlebeam	82.05nm	
Side Scan	20.46nm	

DATA TYPE	GOOD	BAD	TOTAL	REMARKS
XBT Drops	0	0	0	
Bottom Samples	7	0	7	
CTD	23	5	28	
OPTICS	0	0	0	
WATER SAMPLES	0	0	0	
ADCP Points	0	0	0	
TIDAL DATA Stations	1	0	33 Days	

DATA DELIVERED	NUMBER	SCALE	REMARKS
Fully edited and validated multibeam dataset BASE surface	1	N/A	Delivered to NAVO for update of field chart and NOAA for update of official chart

Action	NUMBER	REMARKS
Bathymetric Data Collection Days	15	On water days collecting data
Ancillary Data Collection Days	16	Tide Gauge Install, Bottom Samples
Days Lost to Bad Weather	0	Days when Bathy Data was not collected
Pre Collection / Post Collection Setup	4	
Total Days On Site	35	

General

1.1. Requirements: A detachment of the Fleet Survey Team (FST) conducted a hydrographic survey of Tanapag Harbor, Channel and Approach to support a validated requirement approved by Commander, U.S. Seventh Fleet (C7F) and tasked by the Naval Meteorology and Oceanography Command.

1.2. Survey Area and Objectives¹: The area surveyed is within the territorial waters of the Commonwealth of the Northern Mariana Islands (CNMI). The survey main objective was to collect high-resolution, high-density multibeam and side scan sonar data to provide informational awareness of objects shallower than 36 feet deep that lie in the harbor, channel and approach while meeting or exceeding International Hydrographic Organization (IHO) Order 1a standards as defined in the IHO Special Publication No. 44, 5th Edition, Feb. 2008. See *Appendix A* for coordinates, area graphic and a 3D coverage depiction.

1.3. Elements Affecting Survey Operations:

1.3.1. Weather: Weather conditions had negligible impact on survey operations. Warm temperatures, mid 80s to the mid 90s and a light breeze resulted in calm to 3-foot seas for the majority of survey operations.

1.3.2. Local Elements: Port of Tanapag has low to moderate shipping activity, resulting in minimal survey disruption. Pleasure craft and commercial operators infrequently crossed in front of or sped past the survey platform causing the survey team to deviate from the survey line.

1.3.3. Marine Elements: Marine elements did not influence operations.

2. Datums and Geodetic Control

2.1. Datums:

2.1.1. Horizontal Datum: World Geodetic System 1984 (WGS84).

2.1.2. Projection Grid: Universal Transverse Mercator (UTM) Zone 55 – North.

2.1.3. Vertical Datum Mean Sea Level (MSL).

2.1.4. Sounding Datum Mean Lower Low Water (MLLW).

2.2. Geodetic Control: This survey utilized a GPS system that received differential corrections via satellite; thus, the survey party was not required to establish an accurate horizontal control point. However, the survey party did

establish a rudimentary control point with a NAVCOM SF-2040G GPS system for the purpose of checking the horizontal accuracy of the survey platform's principle positioning system, a NAVCOM SF-2050M GPS receiver. The control point, FST-TPG, is marked by a bolt glued to the cement sidewalk located between docks Charlie and Delta. Nine hours of 30-second GPS data was collected and then processed using NOAA's OPUS program. See *Appendix J* for the OPUS solution.

2.3. Station Description: FST-TPG is located between Charlie and Delta Docks along the sidewalk between the two docks and is approximately 15 meters West of the Southwest corner of Delta Dock or 13 meters East of the Southeast corner of Charlie Dock. See *Appendix J* for a detailed description.

2.4. Shoreline: The team utilized a NAVCOM SF-2040G GPS receiver to position shoreline areas formed by fabricated construction, but areas of natural shoreline and rock breakwaters were not surveyed. See *Appendix M* for a graphical depiction of surveyed area as compared to the DNC shoreline.

3. Digital Surveying System

3.1. Data Collection and Processing Systems: No significant hardware problems were encountered. *Appendix H* lists equipment utilized for this project.

3.2. Data Collection and Processing Software: No significant software problems were encountered. *Appendix I* list software utilized for this project.

3.3. Performance: On several occasions, survey operations were suspended due to suspected heat-related problems with the collection and/or Reson computers.

4. Side Scan Sonar

4.1. Equipment: Klein 3000/Edgetech 4125.

4.2. Confidence Check: No confidence check was performed to determine the sonars' ability to detect 2-meter cube objects.

4.3. Line Orientation and Spacing: Line orientation varied depending on location. For the channel and approach areas, lines were oriented parallel to the areas' boundaries, and for the harbor, lines were oriented 90°/270°. The team utilized a Klein 3000 and an Edgetech 4125 side scan system in all three areas. Line spacing for Klein 3000 operations was 60 meters for a range scale of 75 meters, providing 200% coverage. Both high and low frequencies were collected, although the collected high frequency data was degraded due to multibeam

interference. For Edgetech operations, line spacing was 35 meters for a 50-meter range scale, resulting in 200% coverage.

5. Calibrations

5.1. Horizontal Positioning: The horizontal positioning system utilized on the vessel was a NAVCOM SF-2050M GPS system. To test static accuracy, the system was set up over geodetic point FST-TPG for seven hours. Results indicate an accuracy of 0.1m at 95% confidence. See *Appendix J* for additional information.

5.2. Motion Sensor: This survey employed a POS/MV 320 motion sensor system that is equipped with a GPS Azimuth Measurement Subsystem (GAMS) feature and Kalman filter. The GAMS feature improves heading data accuracies from a manufacturer-stated 0.25° RMS to 0.02° RMS after calibrations, which the team completed prior to commencement of data collection.

5.3. Multibeam Echosounder: Prior to sounding data collection, the team performed multibeam echosounder calibrations, which involved patch tests to determine position latency, roll bias, pitch bias and yaw bias values. Patch test results are provided in *Appendix G*. Additionally, the team performed lead line measurements to compare with nadir depth readings.

5.4. Survey Platform: Survey operations were performed onboard a 9-meter RHIB equipped with dual outboard motors capable of propelling the RHIB in excess of 30kts; however, vessel speed was limited between 3kts and 7kts for data collection operations. To account for transducer draft changes resulting from surveying at different speeds, the team performed a squat and settlement test utilizing a leveling instrument and a level rod which was placed next to the transducer mount. A shore team member read and recorded the level rod value with the vessel stationary and at various speeds. For each reading, another team member read the tide staff to account for tidal influences. The resulting draft corrections were entered into the draft section of the vessel configuration file that is part of the CARIS HIPS program. Results are provided in *Appendix G* as well as sensor offset measurements.

6. Bathymetry

6.1. Sounding Development:

6.1.1. Harbor: Development survey lines were oriented 90°/270° and spaced 15m. HYPACK 2008 data collection software was set to record all information received from each device. Multibeam sonar was set to output every ping; motion data output was limited to 20 times per second;

gyro data output was limited to 10 times per second; and navigation data output was limited to 15 times per second. These settings were used for the duration of survey operations.

6.1.2. Channel: Development survey lines were oriented parallel to the channel boundary and spaced 15m. HYPACK 2008 was set to record data at the same settings established for collection of harbor data.

6.1.3. Approach: Original survey lines were oriented 40°/220° and spaced 15m. However, due to the numerous rocks present in this area, additional split lines were run between the original line file, effectively running lines 7.5 meters apart.

6.2. Sounding Selection: Sounding selection was performed with CARIS HIPS version 6.1, SP2. The program selected shoalest soundings based on a user-defined bin size of 1 meter and exported the selected soundings along with user-selected designated soundings into a CARIS map where additional suppression was performed through CARIS GIS 4.4a, SP5. Through each iteration of suppression, the program retained the shoalest soundings while masking the other soundings. Rounding rule was set to the NOAA option for GIS and HIPS. Note: This routine was utilized only for internal FST QC procedure as a full resolution dataset was provided to NOAA.²

6.3. Cross Check Lines³:

6.3.1. Harbor: Two cross check lines were run in the harbor and were compared against a 50cm-resolution base surface. Results indicate that the data passes IHO Special Order and Order 1a standards for depth accuracy. See *Appendix L* for additional information.

6.3.2. Channel: Two cross check lines were also run in the channel area and compared against a 50cm-resolution base surface. Results indicate that the data passes IHO Special Order and Order 1a standards for depth accuracy. See *Appendix L* for additional information.

6.3.3. Approach: Again, two cross check lines were run in the approach area and were compared against a 50cm-resolution base surface. Results indicate that the data passes IHO Order 1a standards for depth accuracy. See *Appendix L* for additional information.

6.4. Agreement with Existing Charts: NOAA Chart 81076 was referenced for data comparison. In general, 09CQ01 data compared favorably.⁴

6.5. Agreement with Prior Surveys: A base surface of 09CQ01 data was compared to base surfaces from a 2007 NOAA survey and a 2009 NAVO survey. A difference surface was generated in CARIS BASE Editor between the 09CQ01

dataset and each of the two prior datasets. Comparison results with NOAA data indicate a standard deviation of 0.197 meters, 0.110 meters and 0.234 meters for the harbor, channel and approach areas, respectively.⁵ Comparisons to the 2009 NAVO survey yielded standard deviations of 0.168 meters, 0.135 meters and 0.321 meters for the harbor, channel and approach areas, respectively. See *Appendix L* for additional information.

6.6. Reports of Dangers/Hydrographic Notes: NOAA Chart 81076 shows that the approach and channel areas are clear to a depth of 34 feet except in the vicinity of buoy 2A.⁶ Our data supports this information; however, the depth of interest for this entire survey area is 36 feet. Sixteen contacts with a least depth of less than 36 feet were found in the area that is encompassed by the delineation of the approach, channel and harbor as it appears on NOAA Chart 81076.⁷ More information about these contacts can be found in *Appendix C*.

7. Oceanography

7.1. CTD Stations: Sound velocity profiles were taken throughout the survey area using a Sea Bird SBE 19 CTD. Locations varied spatially and temporally. From a spatial perspective, casts were taken in proximity of multibeam data collection areas for that day. Temporally, the casts were taken at the beginning, middle and end of the survey period for that day. See *Appendix K* for a graphical representation of cast locations and a plot of the sound velocity recorded profiles.

7.2. Oceanographic Parameters: No additional oceanographic parameters were collected.

7.3. ADCP: No system was deployed.

8. Sailing Directions and Nomenclature

8.1. Sailing Direction Changes: No changes to the current information published in NGA Pub. 126 or NOAA Coast Pilot 7 were required.⁸

8.2. Prominent Features: Prominent features descriptions in Coast Pilot 7 are accurate.⁹

8.3. Warnings and Cautions: Warnings and cautions stated on NOAA Chart 81076 and in the Coast Pilot remain applicable. Additionally, current survey data indicates the presence of a pipeline not depicted on the latest NOAA Chart 81076, 12th Ed., Aug. / 07. The portion of the pipeline detected by multibeam and side scan data starts approximately 75 meters West of the corner formed by Able and Baker Docks and extends to the Northwest approximately 275 meters. The pipeline rises approximately 1 meter off the seafloor.¹⁰

8.4. Anchorage Area: The team did not confer with Saipan Port Authority officials concerning anchorage areas.

8.5. Photography: An aerial photograph of Saipan Harbor found on the internet and buoy pictures that include coastline in the background can be seen in *Appendix M*.

9. Tides, Tide Gauges and Sounding Datum

9.1. Tide Gauge Location: The tide gauge was installed on the pier wall where Delta Dock meets the parking lot of the Commonwealth Port Authority office building near Benchmark UH-2C. See *Appendix F* for locations and photographs.¹¹

9.2. Tide Gauge Comparison: Tide data was compared to observations of the tide staff on five occasions. The lengths of tide staff observations were 1 one-hour observation, 2 three-hour observations and 2 six-hour observations. The results of the comparisons show that the gauge data drifted approximately 5 cm for the collection period. This 5 cm value was entered in the “measured value” tide section of the HIPS Compute TPE routine for all lines.

9.3. Tide Gauge Type: In-Situ Mini Troll.

9.4. Tide Gauge Malfunctions: The tide gauge remained operational for the entire collection period; however, the accuracy of the gauge’s pressure transducer deteriorated as compared to tide staff observations by the aforementioned amount of 5 cm over the entire survey period.

9.5. Standard Port: Guam.

10. Tidal Streams and Currents

10.1. Tidal Streams and Currents: Tidal streams and currents were not observed.

11. Seabed Topography and Texture

11.1. Seabed Topography and Texture: The team collected seven bottom samples using a lightweight clamshell grabber.¹² The harbor area consisted of silt and sand. The channel area was made up of sand. The approach area has a very hard, rocky bottom which was difficult to sample. More information and NAVO lab analysis results can be found in *Appendix E*.

- 11.2. Sonar Trace Interpretation: All data was collected digitally.
- 11.3. Dredging Activities: No dredging activity was noted during the survey period.
- 11.4. Previous Survey Comparison: Not applicable.

12. Charted and Uncharted Wrecks and Obstructions

12.1. Charted Wrecks and Obstructions: There are numerous wrecks and obstructions depicted on NOAA Chart 81076, but none were located within the Tanapag Harbor Channel survey area. Due to time constraints, the search was limited to the main channel using the EdgeTech 4125 Side Scan Sonar. The depth of interest for this survey was 36 feet. All features within the approach, channel and harbor, as delineated on the chart, with depths of less than 36 feet are noted in *Appendix C*.

12.2. Uncharted Wrecks and Obstructions: Side scan operations conducted inside the harbor identified a pipeline not depicted on NOAA Chart 81076. The pipeline is located near the Southern end of Baker Dock and extends approximately 275 meters at a bearing of 309°. ¹³

12.3. Wrecks and Obstructions Least Depth: Least depth for all obstructions was determined from multibeam data. See *Appendix C* for more information.

13. Charted and Uncharted Lights, NAVAIDs, Buoys and Piers

13.1. Light Characteristics: Light and buoy characteristics were observed during the survey. See *Appendix D* for results. ¹⁴

13.2. Uncharted/New Lights: No new lights were observed.

13.3. Fixed NAVAIDs: Fixed NAVAIDs on land and delineated shoreline were positioned with the NAVCOM SF-2040G GPS receiver. The mobile antenna was placed as close as possible to the center of each NAVAID before observing its position. Characteristics of each NAVAID, such as type of structure, color, color of light, type of light, period of light, height, etc. were collected. For piers, wharves and other shoreline areas, the mobile antenna was moved to the corners of man-made structures. See *Appendix D* for fixed NAVAID positions, descriptions and photos. ¹⁵

13.4. Floating NAVAIDs: Floating NAVAIDs located in water deep enough for the survey launch were positioned with the NAVCOM SF-2050M GPS Receiver.

The boat maneuvered alongside each buoy and recorded each position using HYPACK software. The NAVCOM SF-2040G GPS receiver was also used for positioning floating NAVAIDs. The mobile antenna was placed as close as possible to the center of each NAVAID before recording its position. Characteristics of the floating NAVAIDs were also logged. See *Appendix D* for floating NAVAID positions, descriptions and photos.¹⁶

13.5. Charted NAVAIDs: Most of the charted NAVAIDs in the Tanapag Harbor Channel area seen on NOAA Chart 81076, 12th Ed. Aug/07 (1:12,000) were accurate. However, there were some changes. These changes are shown in red in *Appendix D*.

13.5.1. Mooring Buoys: Chart 81076 shows a cluster of 3 mooring buoys located on the North side of the channel plus another mooring buoy Northeast of the cluster. See *Appendix D* for the positions. According to the Port Authority, they were placed there temporarily for a dredging operation and were subsequently removed upon completion of the dredging operation.¹⁷ There was no Notice to Mariners written to remove them from the chart. During this mid-June 2009 survey, 3 additional mooring buoys were added. They are also temporary.¹⁸ Barges were observed tied to the buoys to avoid dockage fees for tying up to the wharf. See *Appendix D* for positions, descriptions and photos.

13.5.2. Smiling Cove Fixed Light: Moving WSW of the main wharf is a small craft harbor which has a light at the end of a small peninsula. The light period has changed from 2.5 seconds (per Chart 81076) to 4 seconds. There were no Notice to Mariners written to make the change. According to the U.S. Coast Guard (as reported by the Coastal Resources Management Office), the name of the light is “Smiling Cove Light”. This light is not listed in NGA Pub. 111 List of Lights, 2008 or the U.S. Coast Guard Light List, 20009. It is a private aid.¹⁹ See *Appendix D* for position, description and photo.

13.5.3. Garapan Channel Light and Buoys: On Chart 81076, just north of Garapan Channel, is a lighted buoy which does not exist. The chart also shows 5 nun buoys and 4 can buoys which do not exist.²⁰ There were no Notice to Mariners written to remove or change them on the chart. See *Appendix D* for charted positions and descriptions.

13.5.4. Ownership of NAVAIDs: All of the above-mentioned non-existent lights and buoys were reported on Chart 81076 and the List of Lights as being privately maintained. However, the responsibility of maintenance has recently been transferred to the Coastal Resource Management (CRM) Office according to the Port Authority and the CRM. This took place in mid-June 2009. CRM is a CNMI government office funded by NOAA. The two previous overseers of the “private” NAVAIDs

were also government entities. The U.S. Coast Guard (USCG) is responsible for the maintenance of Tanapag Harbor and main channel buoys and lights.

13.6. Uncharted NAVAIDs: The only new uncharted NAVAIDs were the 3 temporary mooring buoys mentioned in paragraph 13.5.1. See *Appendix D* for positions, descriptions and photos.

14. Coastline, Topography, Conspicuous Objects

14.1. Coastline Positioning: The team used the NAVCOM SF-2040G GPS receiver to position manmade harbor inflection points.²¹ Neither areas of natural shoreline nor breakwater areas were positioned. See *Appendix M* for a graphical representation of areas positioned.

14.2. Conspicuous Objects: There were no objects to report.

15. Ancillary Observations

15.1. Water Clarity Observations: Seven water clarity observations were performed using a Secchi disk. See *Appendix O* for locations and results.

15.2. Biological Observations: No scientific observations were conducted.

16. Accuracy of Soundings

16.1 Total Vertical Uncertainty: CARIS HIPs 6.1 SP2 was used to generate an uncertainty surface from the final 09CQ01 multibeam dataset. Total Propagated Error (TPE) values from the manufacturers' technical specifications for the various devices were entered into the vessel configuration file and the "Compute TPE" function was utilized. The minimum uncertainty was 0.201 meter and the maximum uncertainty was 0.337 meter with an average uncertainty of about 0.213 meter for the entire survey area. The allowable vertical uncertainty to meet IHO Order 1a in this depth of water is 0.52 meter.

17. Positional Accuracy

17.1. Vessel Reference Point and Offsets: All offsets are referenced to the Inertial Measurement Unit (IMU), which is located near the vessel's center of gravity. Offset measurements were made using a steel tape. See *Appendix G* for additional information.

17.2. Establishment of Reference Point: From the manufacturer's vessel drawings and center of gravity marks located on either side of the vessel cabin, the IMU was placed in close proximity to vessel centerline and inline with the center of gravity marks.

17.3. Positional Accuracy: A NAVCOM SF-2050M GPS system was utilized as the positioning system on the RHIB throughout this survey. A static test was performed to evaluate system accuracy. Results indicated an accuracy of 0.1 meter at the 95% confidence level.

18. Weekly Summary

18.1. Weekly Summary: See *Appendix N*.

19. Summary/Closing Remarks

The main purposes of SURVOP 09CQ01 were to collect high-resolution, high-density multibeam and side scan sonar data in the vicinity of Tanapag Port, Saipan, and to identify features whose depth was less than 36 feet at Chart Datum, MLLW. These objectives were accomplished in the boundary limits as defined on NOAA Chart 81076 for the approach, channel and harbor areas. Within these boundary limits, survey data indicates the existence of eight features in the approach area, seven features in the channel area and five features in the harbor area. *Appendix C* of this Report of Survey contains side scan images and multibeam 2D and 3D data snapshots of each feature. Survey data depth accuracy meets IHO Special Order requirements for the harbor and channel areas and meets IHO Order 1a requirements for the approach area.

The survey team would like to thank the Port Authority of the Commonwealth of the Northern Mariana Islands for its outstanding support during this SURVOP and especially Ms. MaryAnn Lizama for her assistance with our efforts.

MEMORANDUM

From: Charles A. Baptiste, Hydrographer in Charge

To: Commanding Officer Fleet Survey Team

Via: Plans Department

SUBJ: INTERNATIONAL HYDROGRAPHIC ORGANIZATION SURVEY ORDER
RECOMMENDATION FOR SURVEY 09CQ01

1. Recommend that survey 09CQ01 be accepted as meeting International Hydrographic Organization (IHO) Order 1a survey standards in accordance with IHO Special Publication 44, 5th Edition dated February 2008. All data as noted in the following report meets or exceeds the requirements for IHO Order 1a Survey.



Mr. Charles A. Baptiste
Hydrographer in Charge

2. After reviewing survey 09CQ01, Fleet Survey Team Plans Department Quality Review Team concurs with above recommendation.



Mr. I. A. Fergusson
Plans Department Head

3. Concur with recommendation.



CDR R. R. DELGADO
Commanding Officer
Fleet Survey Team

Revisions Compiled During Office Processing and Certification

¹ After completion of survey W00208, several dangers (defined as depths shoaler than 36 ft.) were identified and removed in the approach to the channel. Survey W00211 was subsequently completed in this area and supersedes W00208 in the common area. As the surveys were compiled concurrently, the portion of W00208 that is superseded by W00211 was not compiled and the M_QUAL layer of W00208 excludes the common area.

² This sounding set were not used for compilation

³ Only 1.6% XLs were acquired, but there is ample redundant data to verify internal consistency.

⁴ Concur

⁵ Concur.

⁶ The survey data shows that the charted 33 ft soundings in the channel near buoy 2A no longer exist and therefore should be removed from the chart. Depths in the area range from 35 to 40 feet based on survey W00211.

⁷ Five of the dangers in the approach have been removed and the area resurveyed. See descriptive report endnotes for Survey W00211 for charting recommendations.

⁸ Concur

⁹ Concur

¹⁰ An uncharted pipeline is visible in the multibeam data and is bluenoted in the HCell. The extents of the pipeline are shown using a \$LINE. Compiler recommends charting a new pipeline as depicted by this line. Retain all other charted pipelines.

¹¹ A separate report completed in February 2010 is also attached. The report, "Recovery of Mean Lower Low Water at Tanapag Harbor, Saipan, CNMI" describes in more detail the process of tidal reduction and applies to both survey W00208 and W00211.

¹² Two bottom samples were imported into the HCell. The remaining bottom samples fell within the limits of the channel and therefore not used.

¹³ See endnote 7.

¹⁴ Chart according to latest ATONIS database.

¹⁵ Chart according to latest ATONIS database.

¹⁶ Chart according to latest ATONIS database.

¹⁷ Concur. Bluenoted in HCell

¹⁸ As these are temporary mooring buoys, they are not included in the HCell and should not be charted.

¹⁹ Concur. Included in HCell.

²⁰ These ATONs have been removed from the latest chart.

²¹ The new shoreline for the pier has been junctioned with existing shoreline from the ENC and is included in the HCell.

09CQ01

Tanapag Harbor, Saipan

Appendix A:

Survey Area Coordinates and Graphics

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DISTRIBUTION STATEMENT A:

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Tanapag Harbor and Channel, Saipan Island	
Latitude	Longitude
15° 13' 29" N	145° 53' 55" E
15° 13' 38" N	145° 44' 06" E
15° 13' 39" N	145° 44' 11" E
15° 13' 53" N	145° 44' 11" E
15° 13' 52" N	145° 43' 45" E
15° 13' 48" N	145° 43' 45" E
15° 13' 46" N	145° 41' 58" E
15° 13' 23" N	145° 41' 39" E
15° 13' 17" N	145° 41' 46" E
15° 13' 38" N	145° 42' 02" E
15° 13' 41" N	145° 43' 45" E
15° 13' 31" N	145° 43' 45" E

Table A-1: Coordinates of Survey Area.



Figure A-1: Outline of Survey Area.

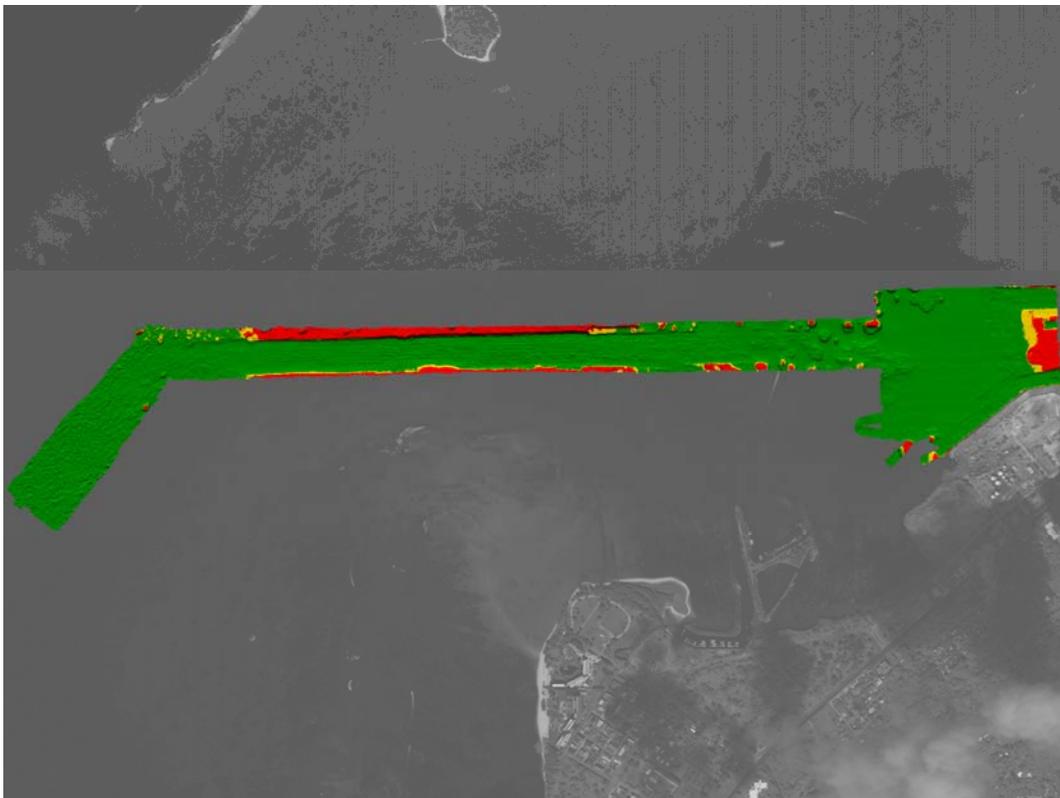


Figure A-2: Image of Actual Data Collected.

09CQ01

Tanapag Harbor, Saipan

Appendix B:

Daily Weather Log

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DISTRIBUTION STATEMENT A:

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WEATHER													
TANAPAG HARBOR, SAIPAN 10 - 21 JUNE 2009													
MONTH	DAY	SKY	WEATHER	VISIBILITY NM	PRESSURE		TEMPERATURE		RELATIVE HUMIDITY		WIND		SEAS (FT)
					LOW	HIGH	LOW	HIGH	HIGH	LOW	DIRECTION	SPEED	
					INCHES	INCHES	° F	° F	%	%		KNOTS	
June	10	Partly Cloudy	SCT	10	29.69	29.76	80.1	86.3	72	91	SSE	11	2
	11	Few	SCT	10	29.74	29.87	79.6	85.9	88	63	N	6	2
	12	Mostly Cloudy	SCT	10	29.68	29.76	80.1	86.1	84	69	S	8	2
	13	Partly Cloudy	SCT	9	29.74	29.76	78	84	90	79	E	6	2
	14	Clear	Clear	10	29.8	29.91	82	87	85	67	E	12	2
	15	Partly Cloudy	Few	10	29.71	29.78	78.3	85.5	93	76	N	0	2
	16	Clear	Clear	10	29.67	29.75	80.3	87.2	89	69	N	14	2
	17	Partly Cloudy	Few	10	29.61	29.65	80.9	87	90	72	N	0	2
	18	Partly Cloudy	Few	10	29.68	29.74	79	86	90	65	E	11	2
	19	Partly Cloudy	Few	10	29.68	29.75	79.4	87.6	89	68	N	0	2
	20	Partly Cloudy	Few	10	29.68	29.74	81.1	86.7	84	70	N	0	2
21	Partly Cloudy	SCT	10	29.65	29.74	79.4	87.4	69	92	N	0	2	

09CQ01

Tanapag Harbor, Saipan

Appendix C:

Contact Report and Images

UNCLASSIFIED

DISTRIBUTION STATEMENT A:

**APPROVED FOR PUBLIC RELEASE
DISTRIBUTION UNLIMITED**

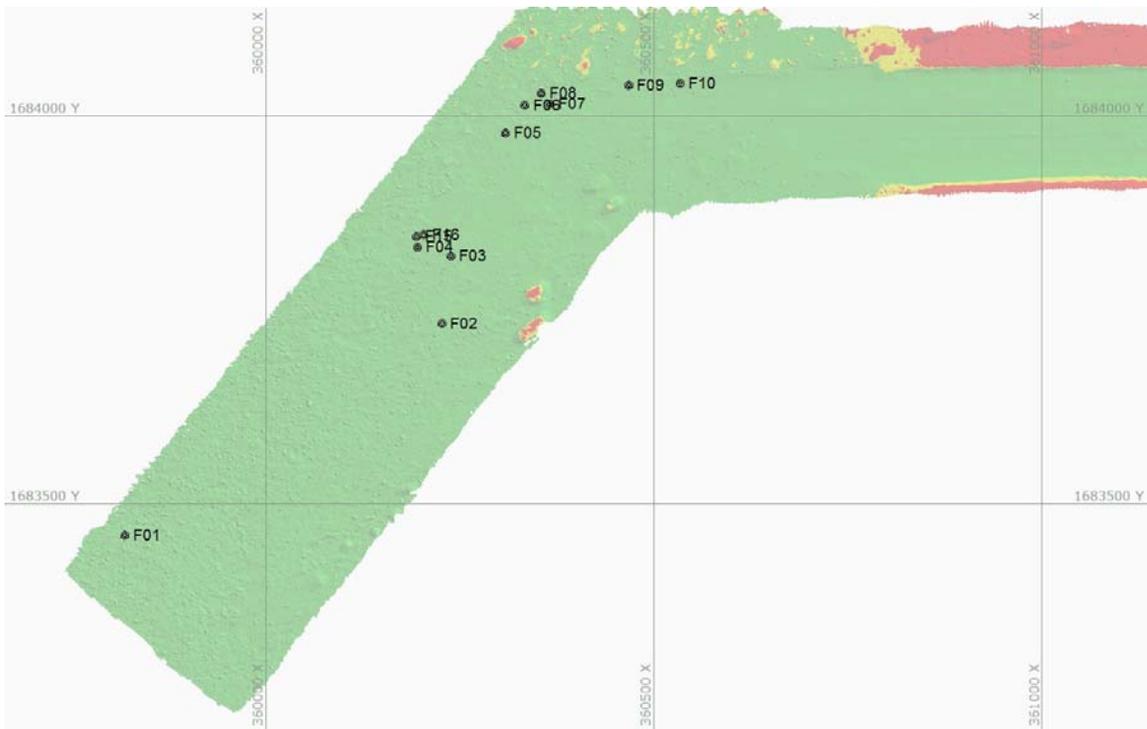


Figure C-1: FST contact locations in the Approach Area - Multibeam data

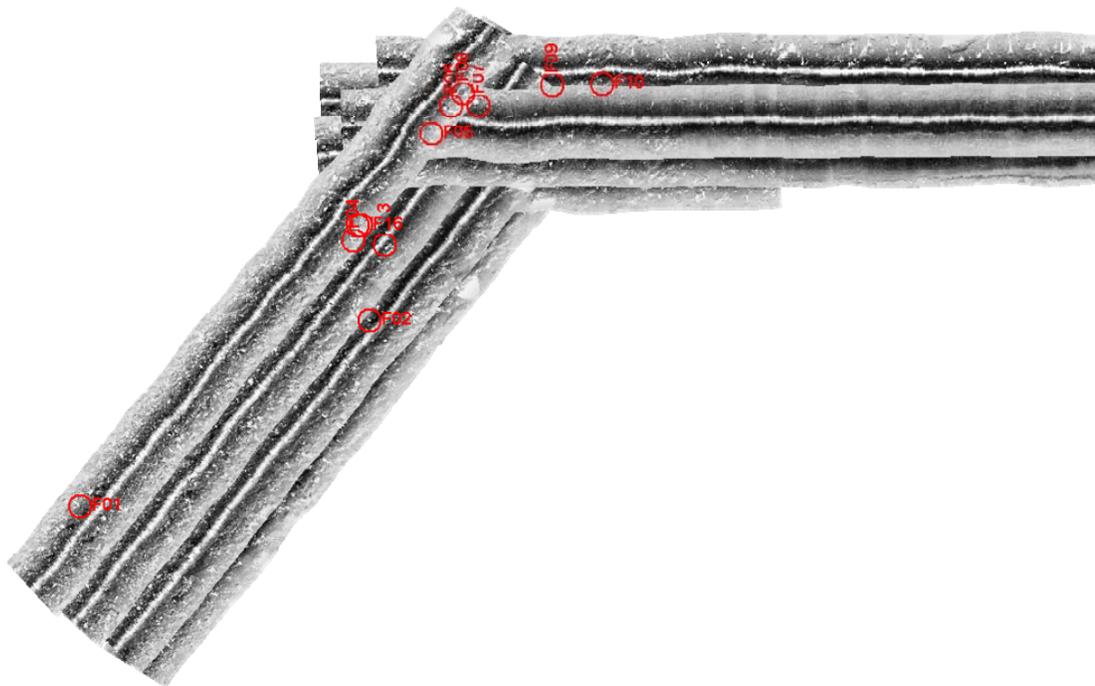


Figure C-2: FST contact locations in the Approach Area - Side Scan Sonar data.



Figure C-3: FST contact locations in the Channel Area - Multibeam data.



Figure C-4: FST contact locations in the Channel Area - Side Scan Sonar data.

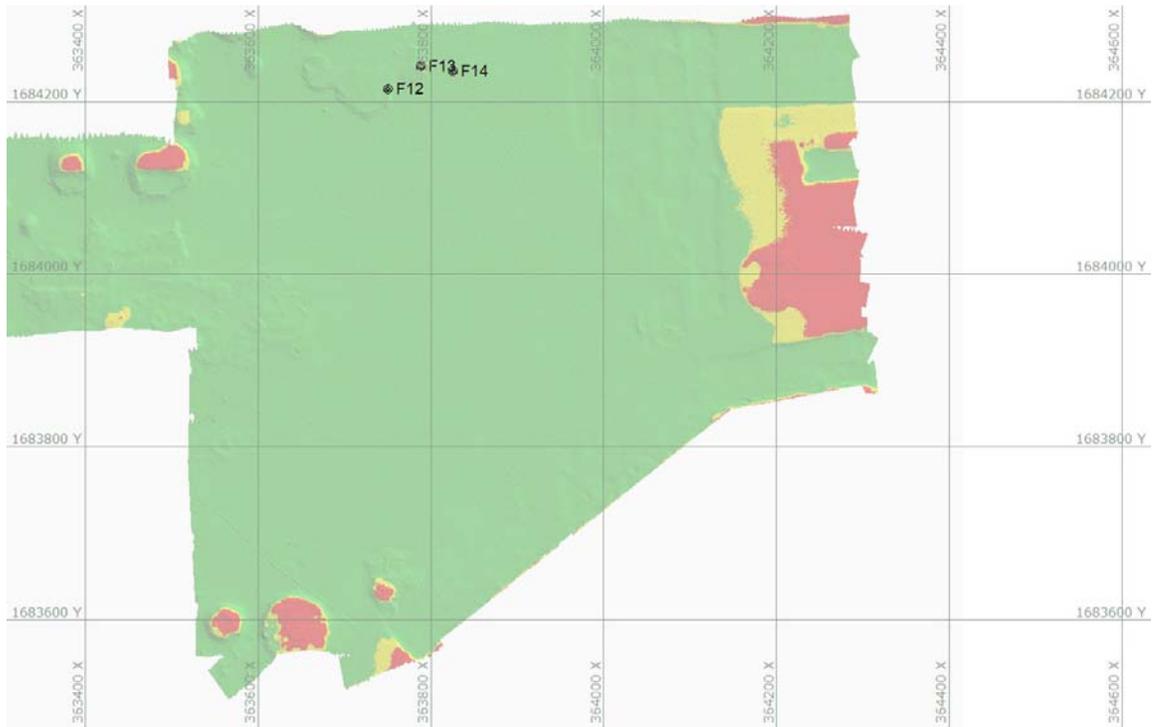


Figure C-5: FST contact locations in the Harbor Area - Multibeam data.

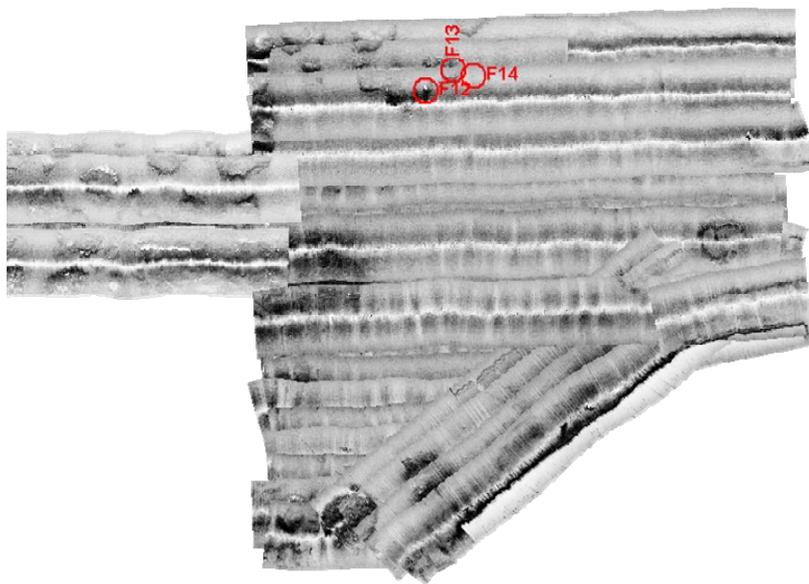


Figure C-6: FST contact locations in the Harbor Area - Side Scan Sonar data.

FST 01 aka NAVO CID 358
15° 13' 24.39" N / 145° 41' 41.32" E
Least Depth: 36.030 ft

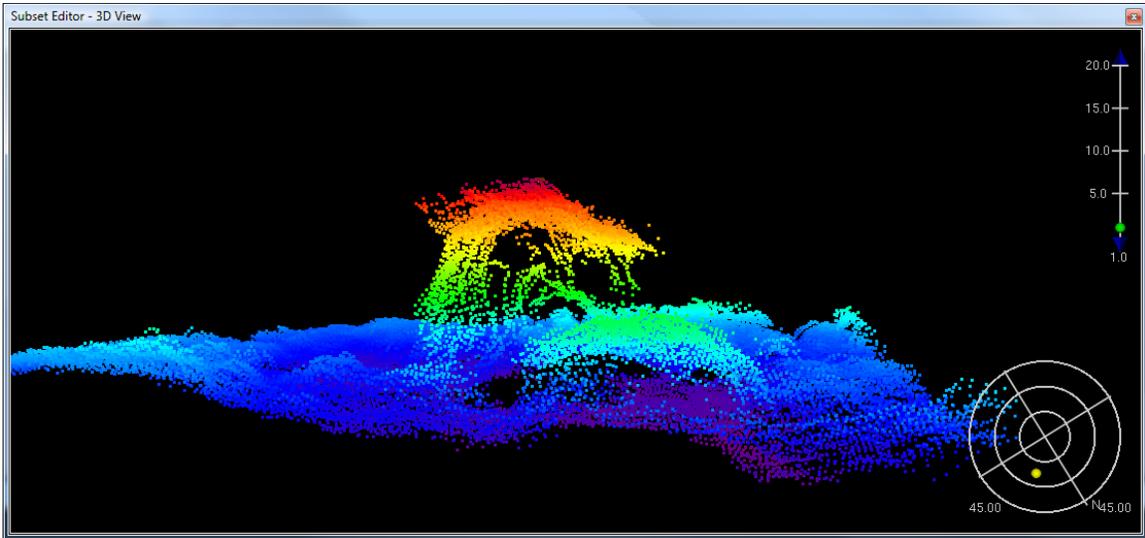


Figure C-7: 3D view of Multibeam data in CARIS HIPs Subset Editor of FST 01.

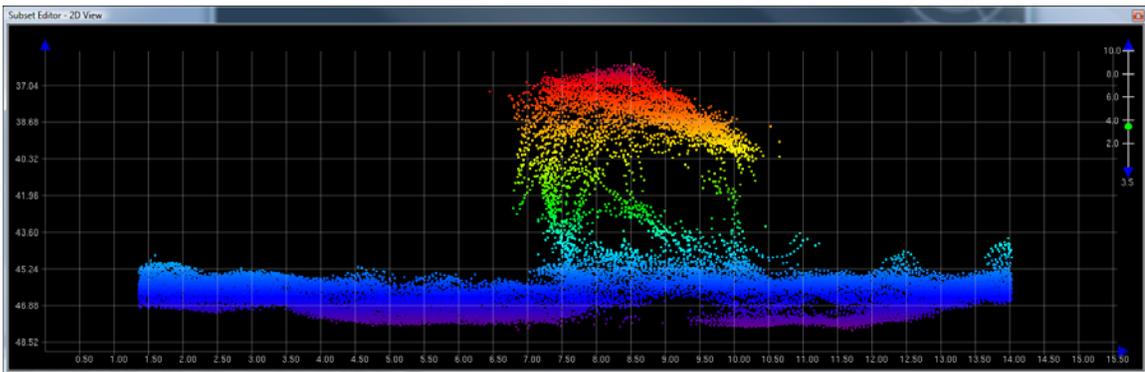
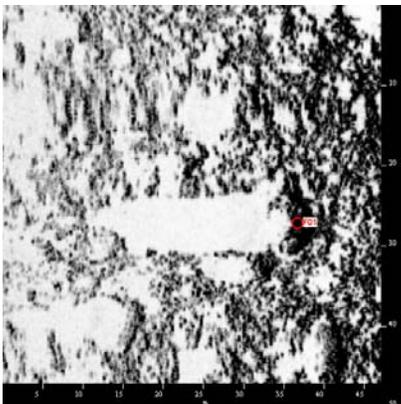


Figure C-8: 2D view of Multibeam data in CARIS HIPs Subset Editor of FST 01.



F01

- Sonar Time at Target: 06/24/2009 02:38:06
- Click Position (Lat WGS84): 15° 13.40741' N
- Click Position (Lon WGS84): 145° 41.68980' E
- Map Proj: WGS 1984 UTM, Zone 55 North, Meter
- Click Position (X): 359,820.74
- Click Position (Y): 1,683,460.86
- Acoustic Source File:
D:\09CQ01_Saipan\caris_hips\preprocess\sidescan\
edgetech_SSS_Data\jd175\20090624023655.xtf
- Ping Number: 52103
- Range to Target: 19.59 Meters
- Fish Height: 7.72 Meters
- Event Number: 0
- Line Name: 20090624023655

Dimensions

- Target Height = 2.92 Meters
- Target Length: 5.85 Meters
- Target Shadow: 12.13 Meters
- Target Width: 3.11 Meters
- Mag Anomaly:
- Avoidance Area:
- Classification 1:
- Classification 2:
- Area:
- Block:
- Description:

Figure C-9: Side Scan Sonar data information for FST 01.

FST 02 aka NAVO CID 987
15° 13' 33.36" N / 145° 41' 54.96" E
Least Depth: 35.751 ft

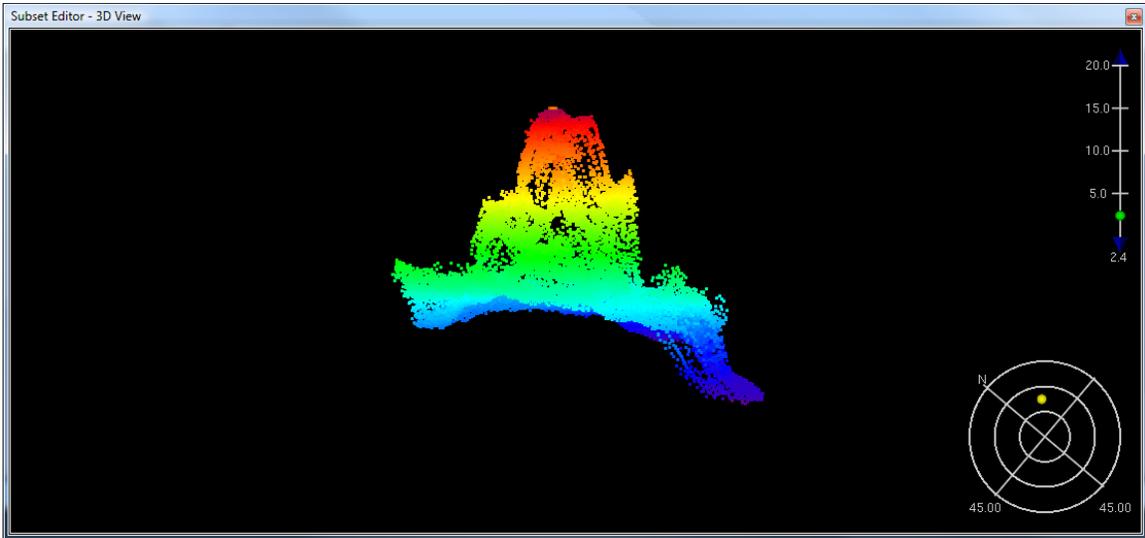


Figure C-10: 3D view of Multibeam data in CARIS HIPs Subset Editor of FST 02.

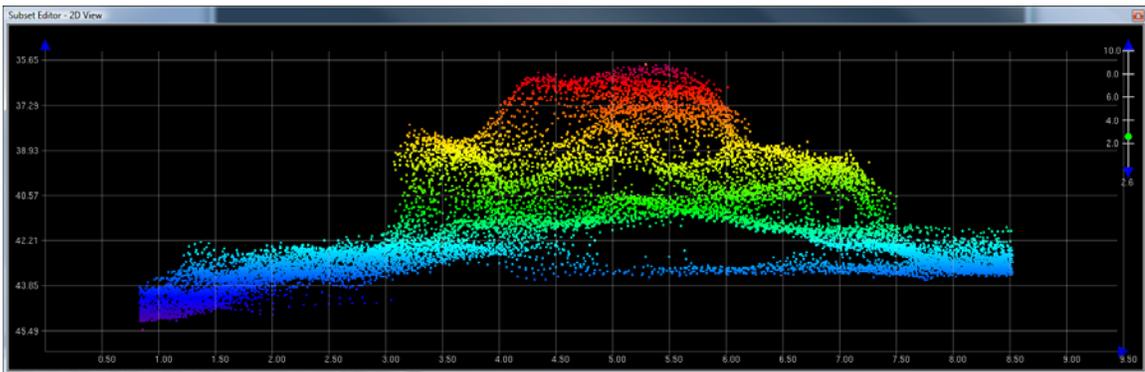
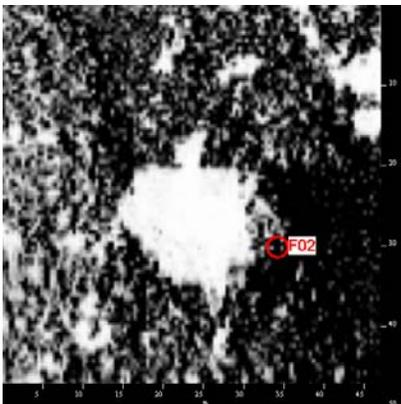


Figure C-11: 2D view of Multibeam data in CARIS HIPs Subset Editor of FST 02.



F02

- Sonar Time at Target: 06/24/2009 01:58:14
- Click Position (Lat WGS84): 15° 13.54775' N
- Click Position (Lon WGS84): 145° 41.91147' E
- Map Proj: WGS 1984 UTM, Zone 55 North, Meter
- Click Position (X): 360,219.14
- Click Position (Y): 1,683,717.25
- Acoustic Source File:
D:\09CQ01_Saipan\caris_hips\preprocess\sidescan\edgetech_SSS_Data\jd175\20090624015254.xtf
- Ping Number: 16996
- Range to Target: 11.02 Meters
- Fish Height: 7.23 Meters
- Event Number: 0
- Line Name: 20090624015254

Dimensions

- Target Height = 1.60 Meters
- Target Length: 4.27 Meters
- Target Shadow: 4.02 Meters
- Target Width: 1.70 Meters
- Mag Anomaly:
- Avoidance Area:
- Classification 1:
- Classification 2:
- Area:
- Block:
- Description:

Figure C-12: Side Scan Sonar data information for FST 02.

FST 03 aka NAVO CID 425
15° 13' 36.18" N / 145° 41' 55.33" E
Least Depth: 34.655 ft

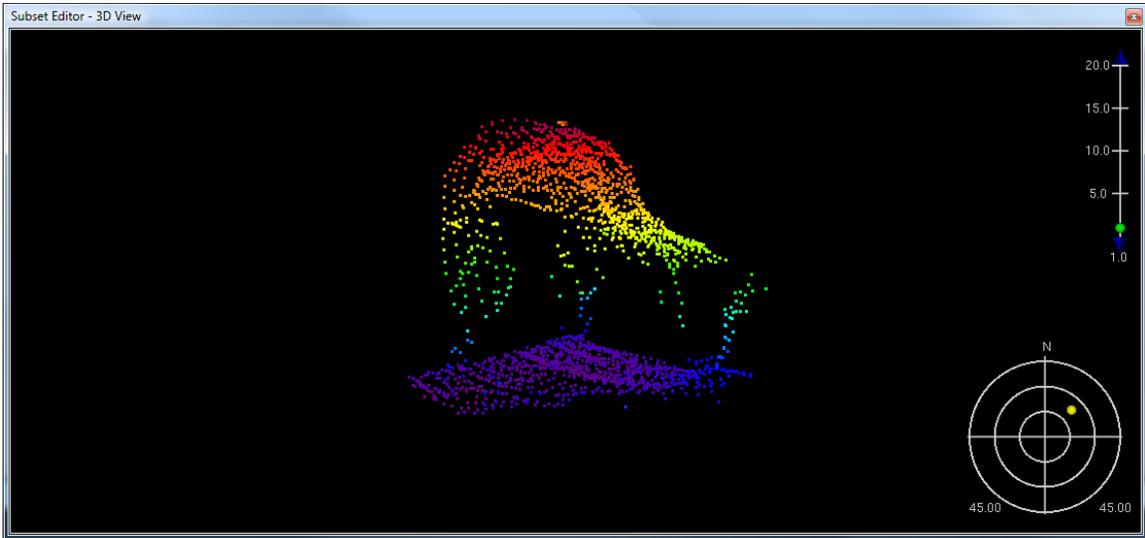


Figure C-13: 3D view of Multibeam data in CARIS HIPs Subset Editor of FST 03.

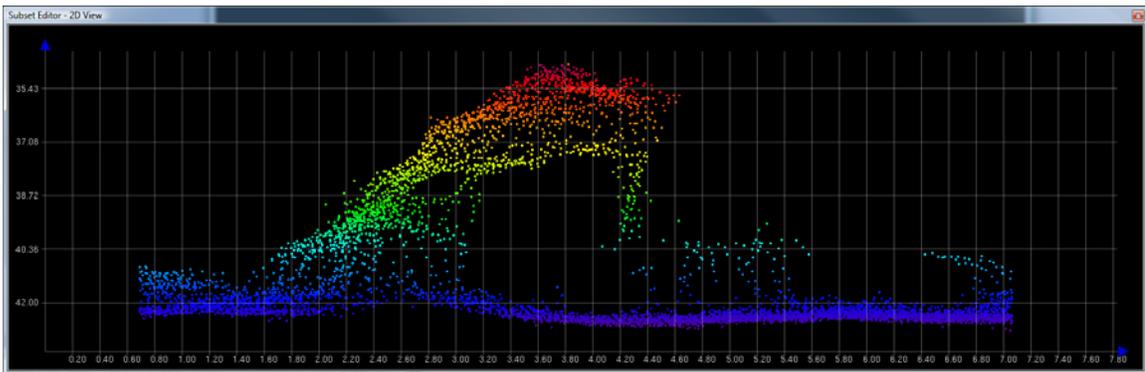
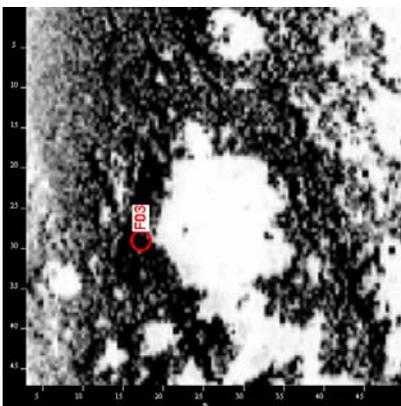


Figure C-14: 2D view of Multibeam data in CARIS HIPs Subset Editor of FST 03.



F03

- Sonar Time at Target: 06/24/2009 02:21:13
- Click Position (Lat WGS84): 15° 13.60397' N
- Click Position (Lon WGS84): 145° 41.92205' E
- Map Proj: WGS 1984 UTM, Zone 55 North, Meter
- Click Position (X): 360,238.70
- Click Position (Y): 1,683,820.80
- Acoustic Source File:
D:\09CQ01_Saipan\caris_hips\preprocess\sidescan\edgetech_SSS_Data\jd175\20090624021458.xtf
- Ping Number: 37239
- Range to Target: 8.73 Meters
- Fish Height: 5.76 Meters
- Event Number: 0
- Line Name: 20090624021458

Dimensions

- Target Height = 1.82 Meters
- Target Length: 4.93 Meters
- Target Shadow: 3.96 Meters
- Target Width: 2.24 Meters
- Mag Anomaly:
- Avoidance Area:
- Classification 1:
- Classification 2:
- Area:
- Block:
- Description:

Figure C-15: Side Scan Sonar data information for FST 03.

FST 04 aka NAVO CID 1279 aka Priority 14
15° 13' 36.54" N / 145° 41' 53.88" E
Least Depth: 34.751 ft

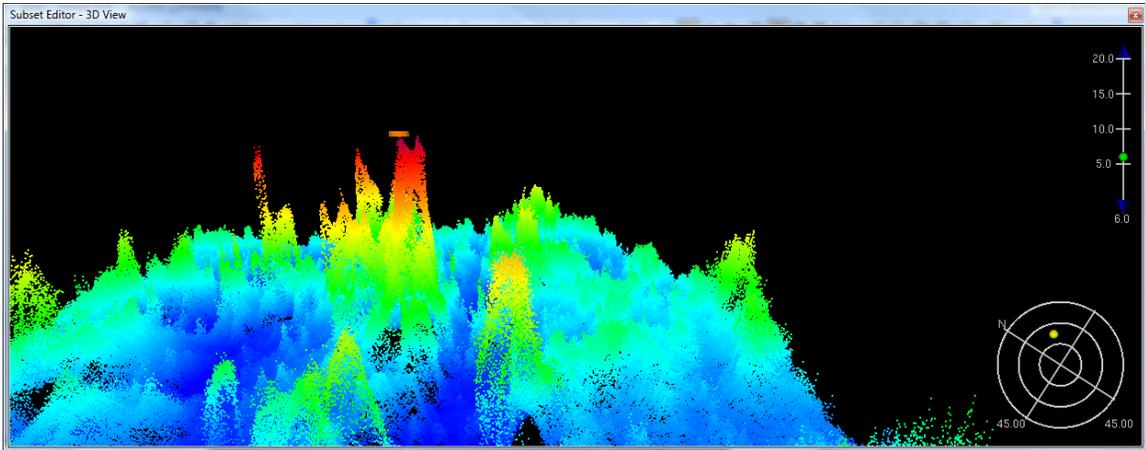


Figure C-16: 3D view of Multibeam data in CARIS HIPs Subset Editor of FST 04.

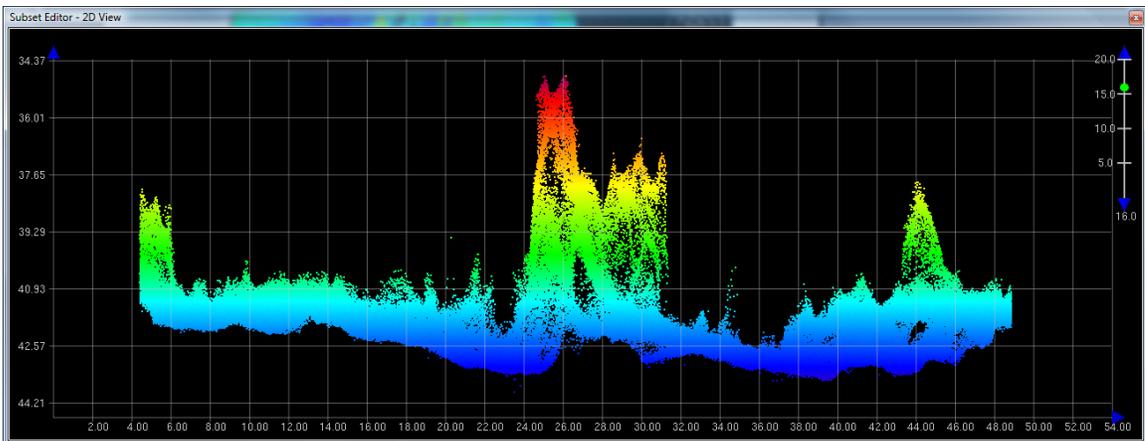
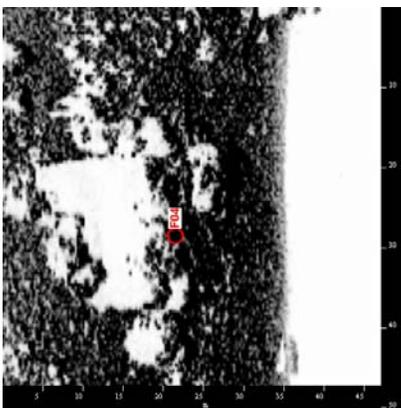


Figure C-17: 2D view of Multibeam data in CARIS HIPs Subset Editor of FST 04.



F04

- Sonar Time at Target: 06/24/2009 02:29:27
- Click Position (Lat WGS84): 15° 13.60717' N
- Click Position (Lon WGS84): 145° 41.89724' E
- Map Proj: WGS 1984 UTM, Zone 55 North, Meter
- Click Position (X): 360,194.32
- Click Position (Y): 1,683,826.97
- Acoustic Source File:
D:\09CQ01_Saipan\caris_hips\preprocess\sidescan\
edgetech_SSS_Data\jd175\20090624022637.xtf
- Ping Number: 44482
- Range to Target: 10.54 Meters
- Fish Height: 7.03 Meters
- Event Number: 0
- Line Name: 20090624022637

Dimensions

- Target Height = 2.17 Meters
- Target Length: 7.62 Meters
- Target Shadow: 5.55 Meters
- Target Width: 2.97 Meters
- Mag Anomaly:
- Avoidance Area:
- Classification 1:
- Classification 2:
- Area:
- Block:
- Description:

Figure C-18: Side Scan Sonar data information for FST 04.

FST 05 aka NAVO CID 1170
15° 13' 41.35" N / 145° 41' 57.65" E
Least Depth: 35.873 ft

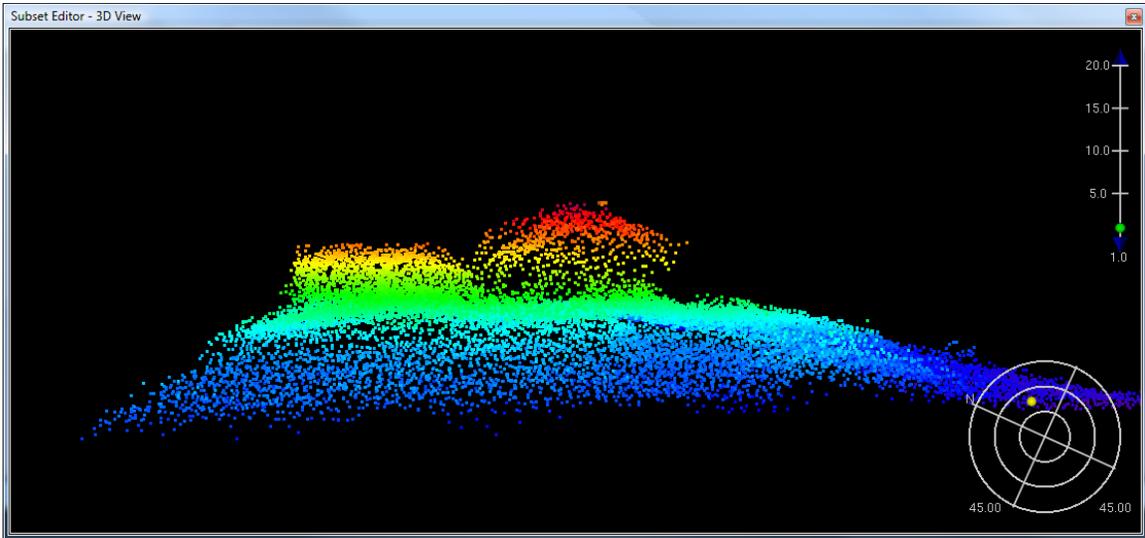


Figure C-19: 3D view of Multibeam data in CARIS HIPs Subset Editor of FST 05.

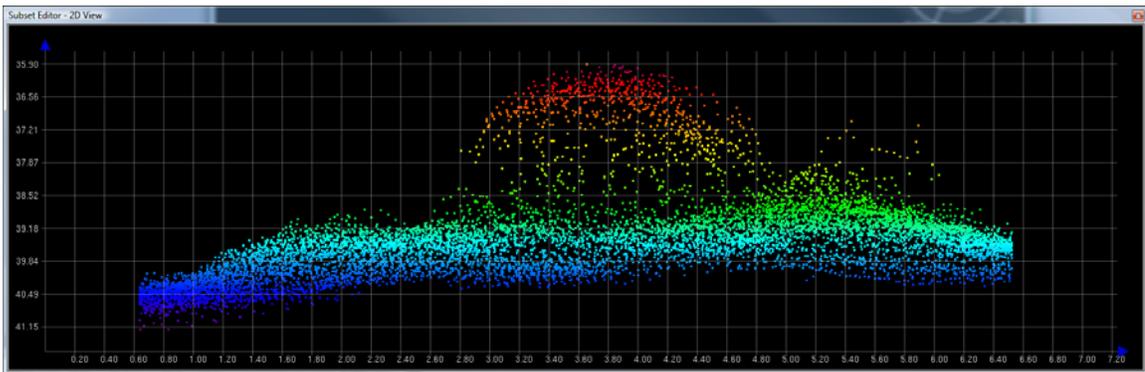
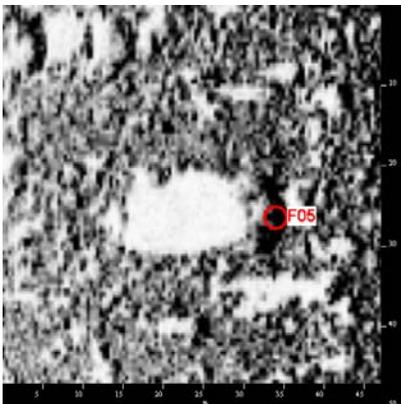


Figure C-20: 2D view of Multibeam data in CARIS HIPs Subset Editor of FST 05.



F05

- Sonar Time at Target: 06/24/2009 03:00:06
- Click Position (Lat WGS84): 15° 13.68695' N
- Click Position (Lon WGS84): 145° 41.95731' E
- Map Proj: WGS 1984 UTM, Zone 55 North, Meter
- Click Position (X): 360,302.74
- Click Position (Y): 1,683,973.42
- Acoustic Source File:
D:\09CQ01_Saipan\caris_hips\preprocess\sidescan\edgetech_SSS_Data\jd175\20090624025843.xtf
- Ping Number: 5949
- Range to Target: 19.74 Meters
- Fish Height: 6.84 Meters
- Event Number: 0
- Line Name: 20090624025843

Dimensions

- Target Height = 1.11 Meters
- Target Length: 3.57 Meters
- Target Shadow: 4.13 Meters
- Target Width: 1.28 Meters
- Mag Anomaly:
- Avoidance Area:
- Classification 1:
- Classification 2:
- Area:
- Block:
- Description:

Figure C-21: Side Scan Sonar data information for FST 05.

FST 06 aka NAVO CID 930 aka Priority 4
15° 13' 42.52" N / 145° 41' 58.47" E
Least Depth: 35.636 ft

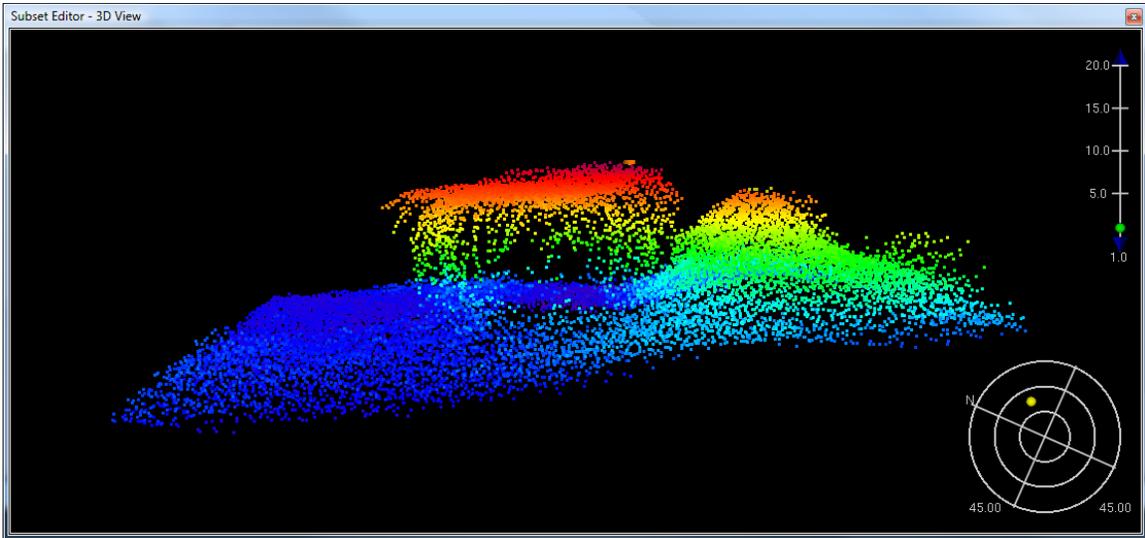


Figure C-22: 3D view of Multibeam data in CARIS HIPs Subset Editor of FST 06.

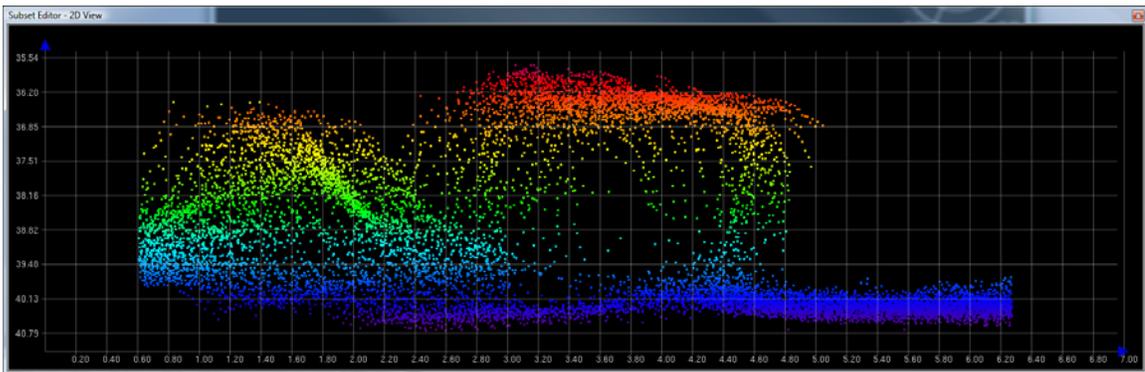
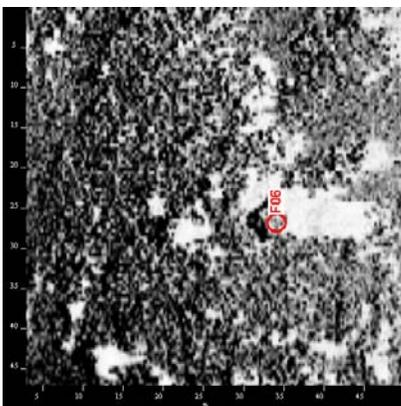


Figure C-23: 2D view of Multibeam data in CARIS HIPs Subset Editor of FST 06.



F06

- Sonar Time at Target: 06/24/2009 03:54:20
- Click Position (Lat WGS84): 15° 13.70850' N
- Click Position (Lon WGS84): 145° 41.97242' E
- Map Proj: WGS 1984 UTM, Zone 55 North, Meter
- Click Position (X): 360,330.03
- Click Position (Y): 1,684,013.01
- Acoustic Source File:
D:\09CQ01_Saipan\caris_hips\preprocess\sidescan\edgetech_SSS_Data\jd175\20090624033041.xtf
- Ping Number: 53707
- Range to Target: 18.48 Meters
- Fish Height: 6.93 Meters
- Event Number: 0
- Line Name: 20090624033041

Dimensions

- Target Height = 1.10 Meters
- Target Length: 1.95 Meters
- Target Shadow: 4.18 Meters
- Target Width: 1.66 Meters
- Mag Anomaly:
- Avoidance Area:
- Classification 1:
- Classification 2:
- Area:
- Block:
- Description:

Figure C-24: Side Scan Sonar data information for FST 06.

FST 07 aka NAVO CID 888
15° 13' 42.57" N / 145° 41' 59.56" E
Least Depth: 35.193 ft

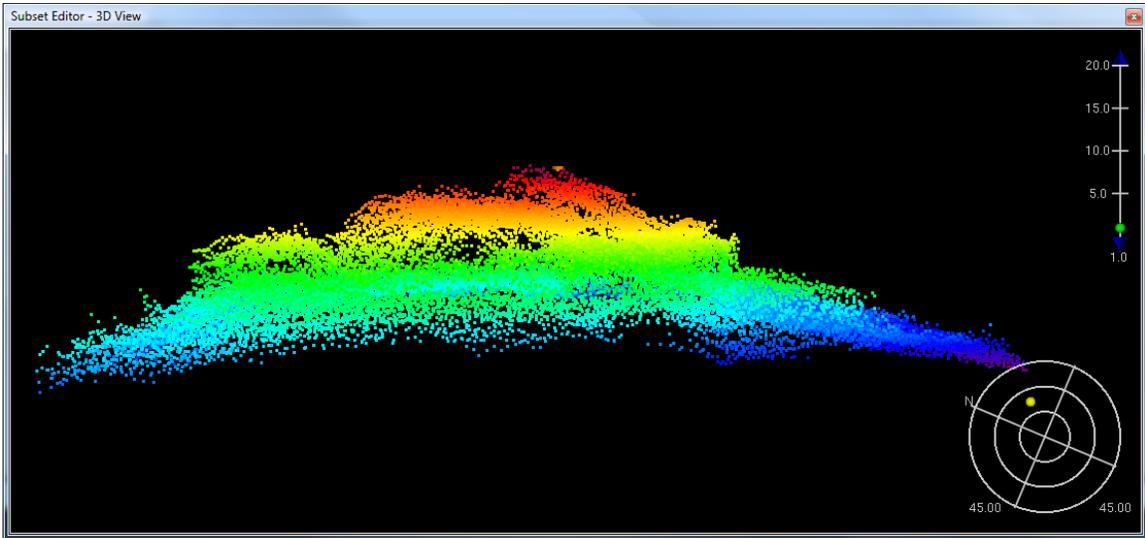


Figure C-25: 3D view of Multibeam data in CARIS HIPs Subset Editor of FST 07.

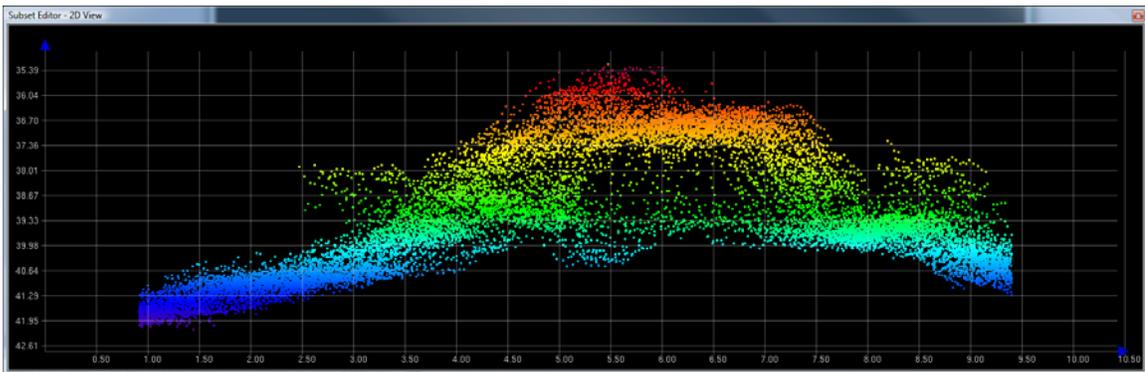
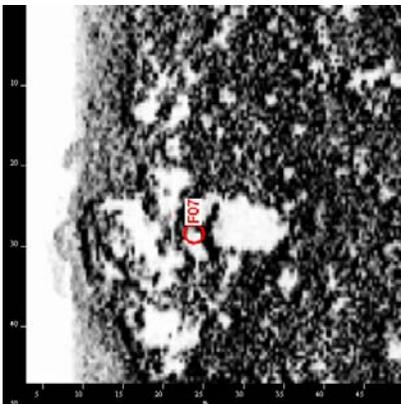


Figure C-26: 2D view of Multibeam data in CARIS HIPs Subset Editor of FST 07.



F07

- Sonar Time at Target: 06/24/2009 03:59:21
- Click Position (Lat WGS84): 15° 13.70847' N
- Click Position (Lon WGS84): 145° 41.99336' E
- Map Proj: WGS 1984 UTM, Zone 55 North, Meter
- Click Position (X): 360,367.52
- Click Position (Y): 1,684,012.72
- Acoustic Source File:
D:\09CQ01_Saipan\caris_hips\preprocess\sidescan\
edgetech_SSS_Data\jd175\20090624035728.xtf
- Ping Number: 58139
- Range to Target: 9.40 Meters
- Fish Height: 6.25 Meters
- Event Number: 0
- Line Name: 20090624035728

Dimensions

- Target Height = 1.24 Meters
- Target Length: 3.47 Meters
- Target Shadow: 2.75 Meters
- Target Width: 1.32 Meters
- Mag Anomaly:
- Avoidance Area:
- Classification 1:
- Classification 2:
- Area:
- Block:
- Description:

Figure C-27: Side Scan Sonar data information for FST 07.

FST 08 aka NAVO CID 1113 aka Priority 6
15° 13' 43.03" N / 145° 41' 59.18"E
Least Depth: 35.095 ft

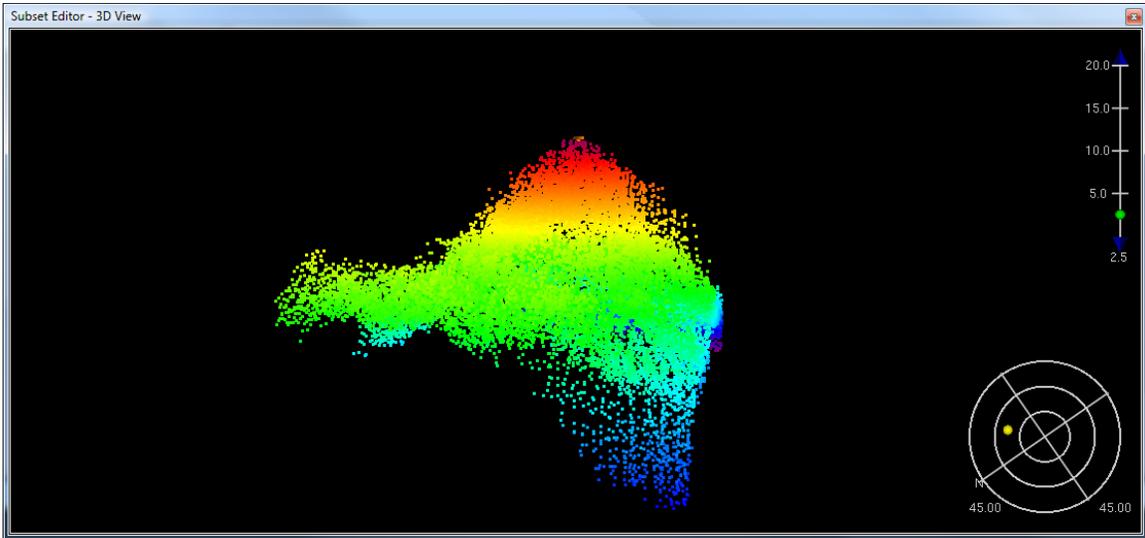


Figure C-28: 3D view of Multibeam data in CARIS HIPs Subset Editor of FST 08.

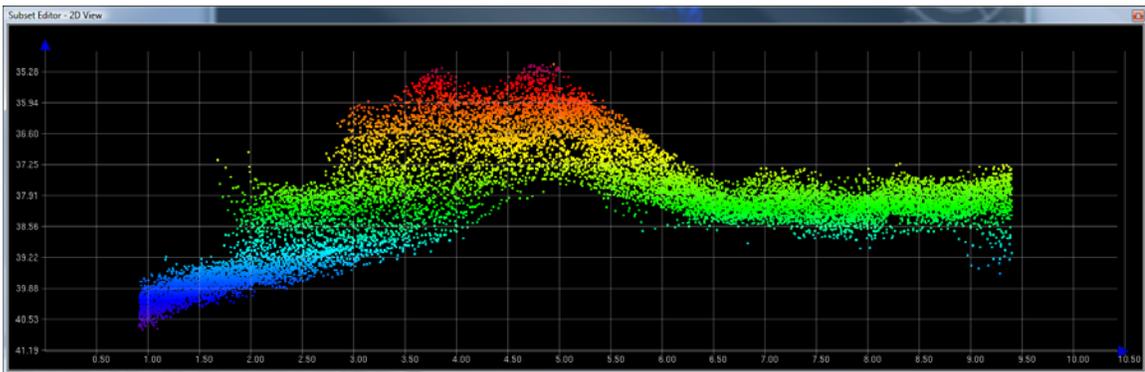
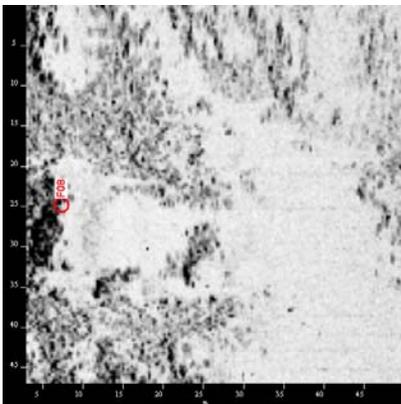


Figure C-29: 2D view of Multibeam data in CARIS HIPs Subset Editor of FST 08.



F08

- Sonar Time at Target: 06/24/2009 02:45:23
- Click Position (Lat WGS84): 15° 13.71754' N
- Click Position (Lon WGS84): 145° 41.98101' E
- Map Proj: WGS 1984 UTM, Zone 55 North, Meter
- Click Position (X): 360,345.51
- Click Position (Y): 1,684,029.58
- Acoustic Source File:
D:\09CQ01_Saipan\caris_hips\preprocess\sidescan\edgetech_SSS_Data\jd175\20090624023655.xtf
- Ping Number: 58524
- Range to Target: 31.17 Meters
- Fish Height: 5.47 Meters
- Event Number: 0
- Line Name: 20090624023655

Dimensions

- Target Height = 1.66 Meters
- Target Length: 7.43 Meters
- Target Shadow: 13.70 Meters
- Target Width: 2.46 Meters
- Mag Anomaly:
- Avoidance Area:
- Classification 1:
- Classification 2:
- Area:
- Block:
- Description:

Figure C-30: Side Scan Sonar data information for FST 08.

FST 09 aka Priority A
15° 13' 43.38"N / 145° 42' 02.96" E
Least Depth: 34.029 ft

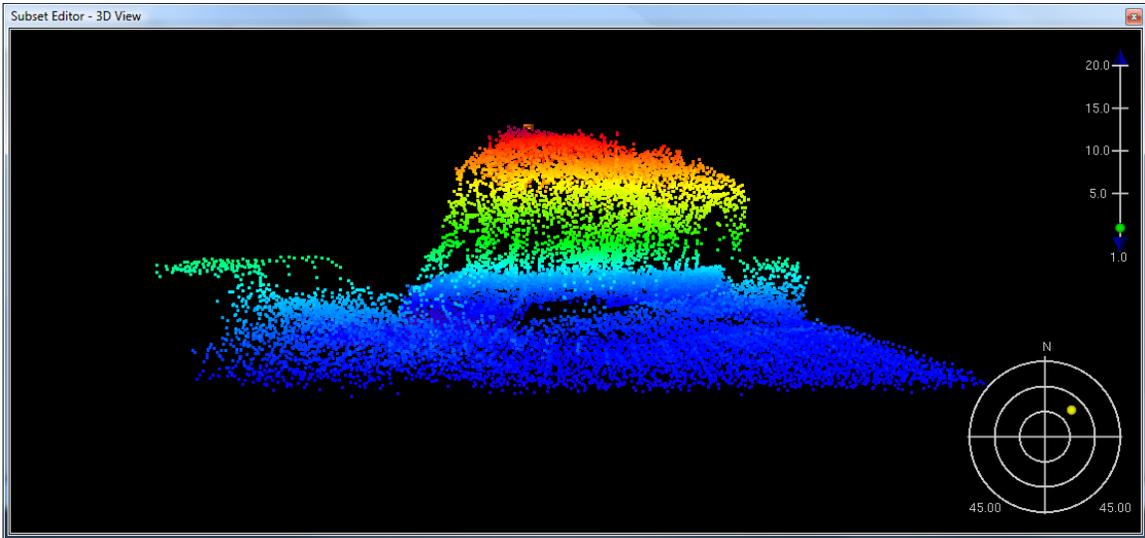


Figure C-31: 3D view of Multibeam data in CARIS HIPs Subset Editor of FST 09.

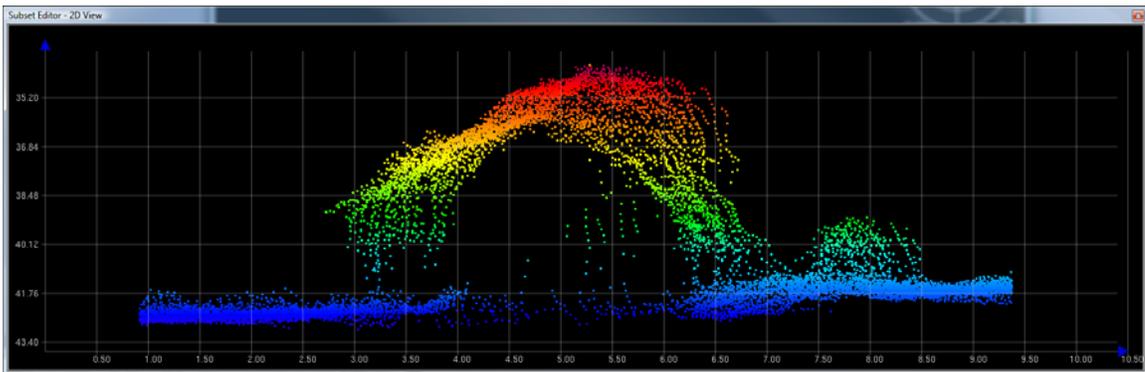
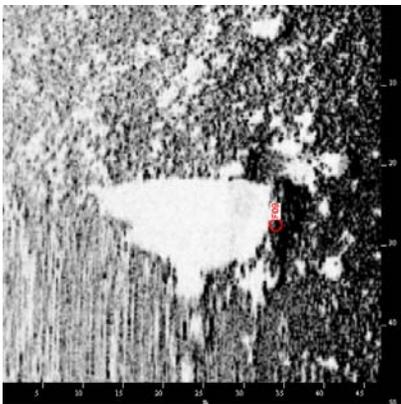


Figure C-32: 2D view of Multibeam data in CARIS HIPs Subset Editor of FST 09.



F09

- Sonar Time at Target: 06/24/2009 04:00:13
- Click Position (Lat WGS84): 15° 13.72389' N
- Click Position (Lon WGS84): 145° 42.04900' E
- Map Proj: WGS 1984 UTM, Zone 55 North, Meter
- Click Position (X): 360,467.30
- Click Position (Y): 1,684,040.56
- Acoustic Source File:
 D:\09CQ01_Saipan\caris_hips\preprocess\sidescan\edgetech_SSS_Data\jd175\20090624035728.xtf
- Ping Number: 58899
- Range to Target: 19.84 Meters
- Fish Height: 6.84 Meters
- Event Number: 0
- Line Name: 20090624035728

Dimensions

- Target Height = 2.20 Meters
- Target Length: 4.80 Meters
- Target Shadow: 10.20 Meters
- Target Width: 1.70 Meters
- Mag Anomaly:
- Avoidance Area:
- Classification 1:
- Classification 2:
- Area:
- Block:
- Description:

Figure C-33: Side Scan Sonar data information for FST 09.

FST 10 aka NAVO CID 1163 aka Priority 19
15° 13' 43.48" N / 145° 42' 05.18" E
Least Depth: 34.445 ft

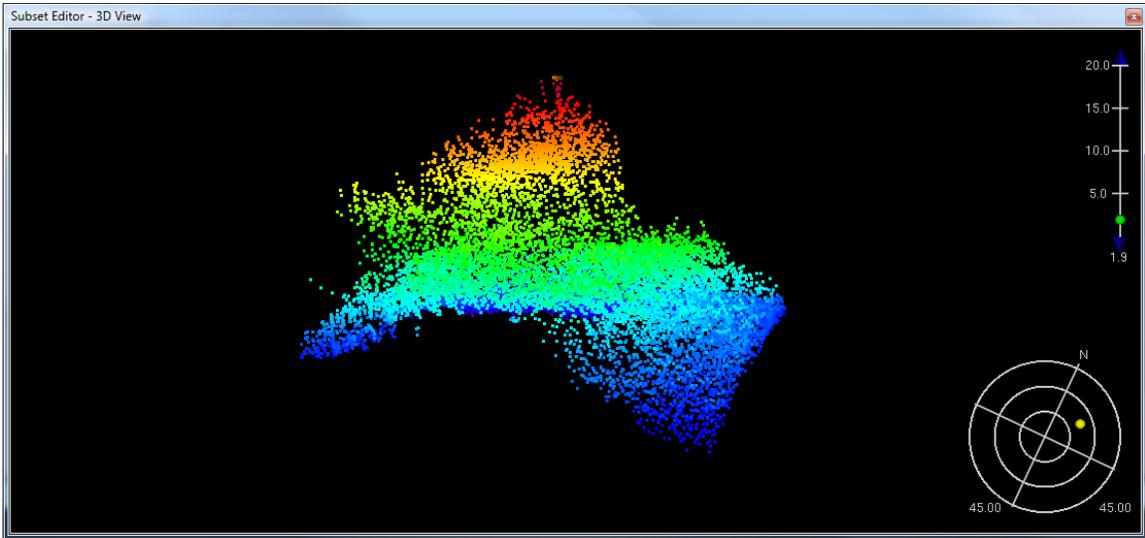


Figure C-34: 3D view of Multibeam data in CARIS HIPs Subset Editor of FST 10.

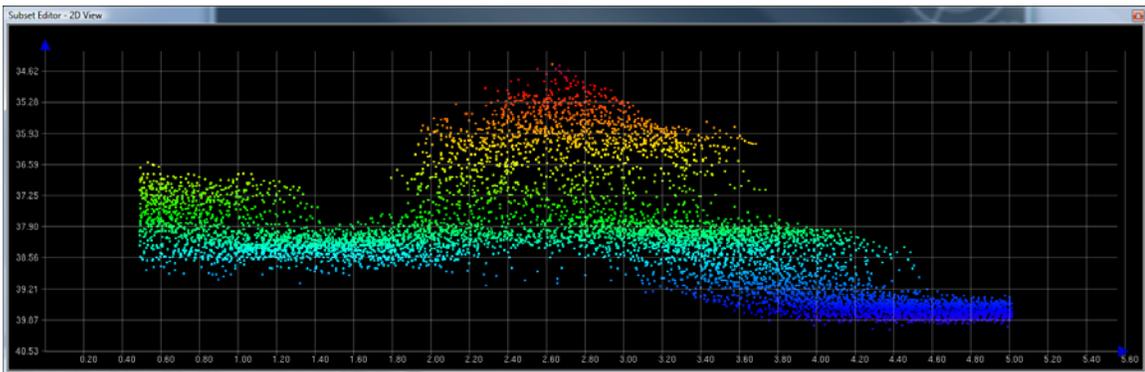
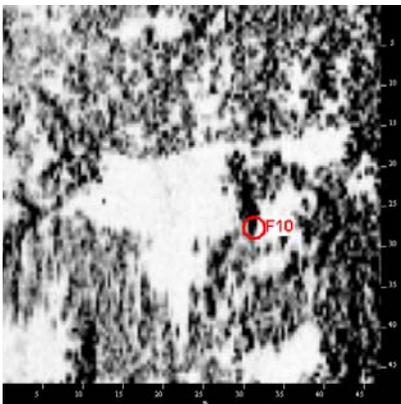


Figure C-35: 2D view of Multibeam data in CARIS HIPs Subset Editor of FST 10.



F10

- Sonar Time at Target: 06/24/2009 04:00:48
- Click Position (Lat WGS84): 15° 13.72499' N
- Click Position (Lon WGS84): 145° 42.08760' E
- Map Proj: WGS 1984 UTM, Zone 55 North, Meter
- Click Position (X): 360,536.41
- Click Position (Y): 1,684,042.17
- Acoustic Source File:
D:\09CQ01_Saipan\caris_hips\preprocess\sidescan\
edgetech_SSS_Data\jd175\20090624035728.xtf
- Ping Number: 59410
- Range to Target: 20.19 Meters
- Fish Height: 7.33 Meters
- Event Number: 0
- Line Name: 20090624035728

Dimensions

- Target Height = 1.55 Meters
- Target Length: 3.23 Meters
- Target Shadow: 5.99 Meters
- Target Width: 1.12 Meters
- Mag Anomaly:
- Avoidance Area:
- Classification 1:
- Classification 2:
- Area:
- Block:
- Description:

Figure C-36: Side Scan Sonar data information for FST 10.

FST 11
15° 13' 40.566" N / 145° 42' 38.071" E
Least Depth: 35.581 ft

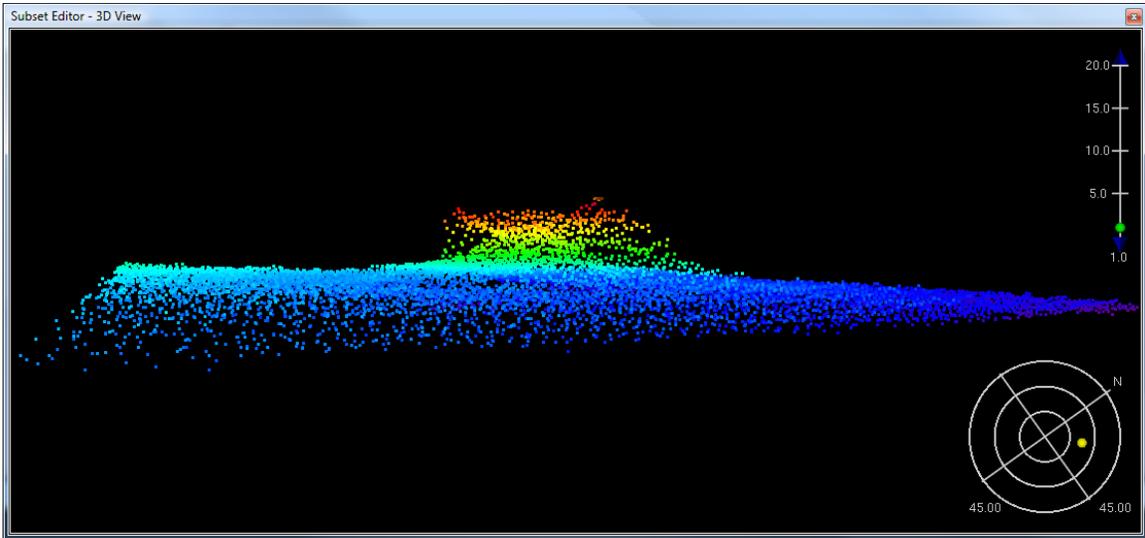


Figure C-37: 3D view of Multibeam data in CARIS HIPs Subset Editor of FST 11.

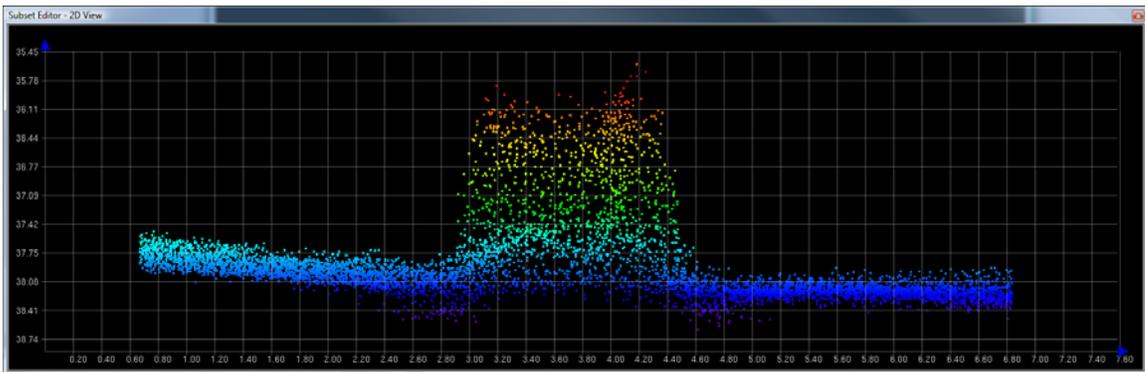
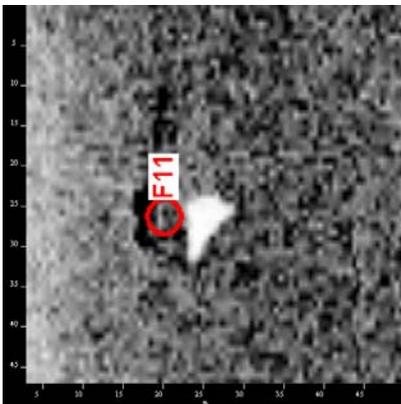


Figure C-38: 2D view Multibeam data in CARIS HIPs Subset Editor of FST 11.



F11

- Sonar Time at Target: 06/24/2009 03:10:49
- Click Position (Lat WGS84): 15° 13.67555' N
- Click Position (Lon WGS84): 145° 42.63718' E
- Map Proj: WGS 1984 UTM, Zone 55 North, Meter
- Click Position (X): 361,519.76
- Click Position (Y): 1,683,945.19
- Acoustic Source File:
D:\09CQ01_Saipan\caris_hips\preprocess\sidescan\edgetech_SSS_Data\jd175\20090624025843.xtf
- Ping Number: 15385
- Range to Target: 7.27 Meters
- Fish Height: 6.06 Meters
- Event Number: 0
- Line Name: 20090624025843

Dimensions

- Target Height = 0.52 Meters
- Target Length: 1.47 Meters
- Target Shadow: 1.02 Meters
- Target Width: 0.96 Meters
- Mag Anomaly:
- Avoidance Area:
- Classification 1:
- Classification 2:
- Area:
- Block:
- Description:

Figure C-39: Side Scan Sonar data information for FST 11.

FST 12 aka NAVO CID 341
15° 13' 49.715" N / 145° 43' 52.926" E
Least Depth: 35.305 ft

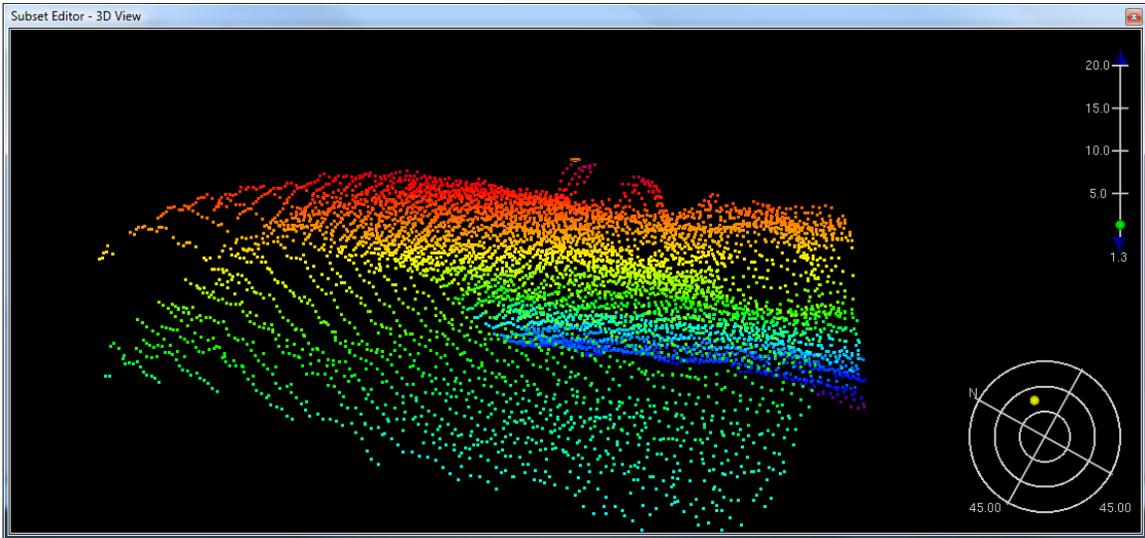


Figure C-40: 3D view of Multibeam data in CARIS HIPs Subset Editor of FST 12.

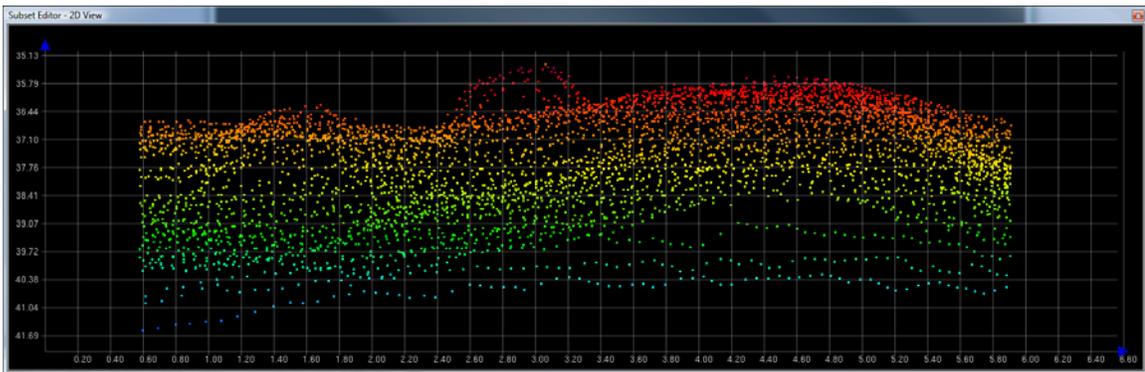
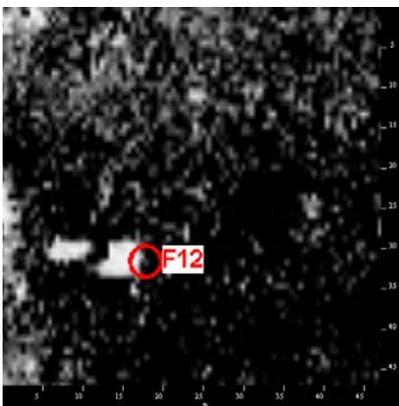


Figure C-41: 2D view of Multibeam data in CARIS HIPs Subset Editor of FST 12.



F12

- Sonar Time at Target: 06/24/2009 05:45:16
- Click Position (Lat WGS84): 15° 13.82780' N
- Click Position (Lon WGS84): 145° 43.88513' E
- Map Proj: WGS 1984 UTM, Zone 55 North, Meter
- Click Position (X): 363,755.57
- Click Position (Y): 1,684,212.81
- Acoustic Source File:
D:\09CQ01_Saipan\caris_hips\preprocess\sidescan\edgetech_SSS_Data\jd175\20090624054304.xtf
- Ping Number: 36026
- Range to Target: 15.62 Meters
- Fish Height: 8.01 Meters
- Event Number: 0
- Line Name: 20090624054304

Dimensions

- Target Height = 0.54 Meters
- Target Length: 1.53 Meters
- Target Shadow: 1.12 Meters
- Target Width: 0.53 Meters
- Mag Anomaly:
- Avoidance Area:
- Classification 1:
- Classification 2:
- Area:
- Block:
- Description:

Figure C-42: Side Scan Sonar data information for FST 12.

FST 13 aka NAVO CID 383
15° 13' 50.586" N / 145° 43' 54.195" E
Least Depth: 32.648 ft

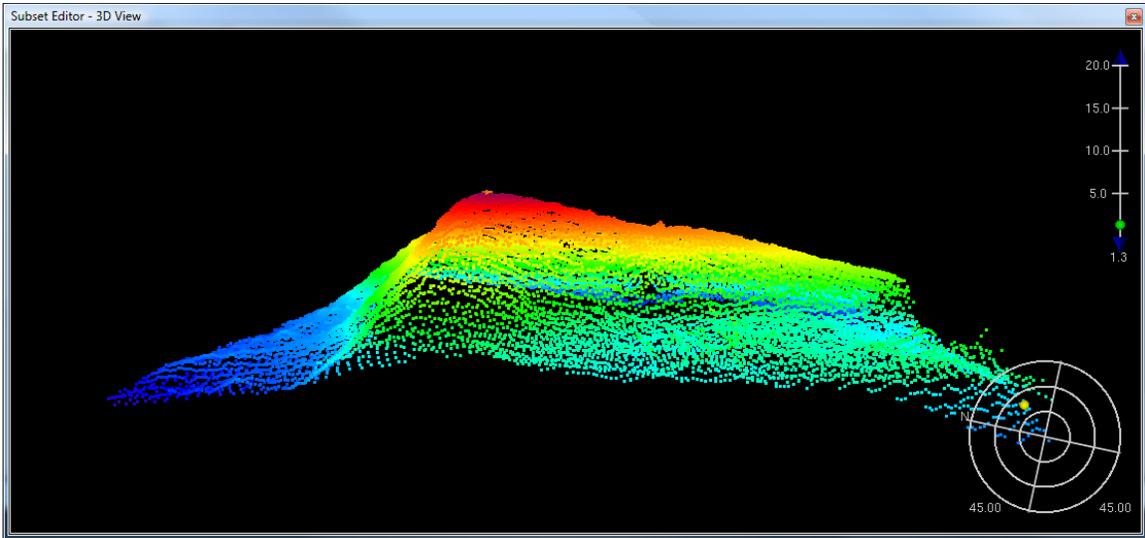


Figure C-43: 3D view of Multibeam data in CARIS HIPs Subset Editor of FST 13.

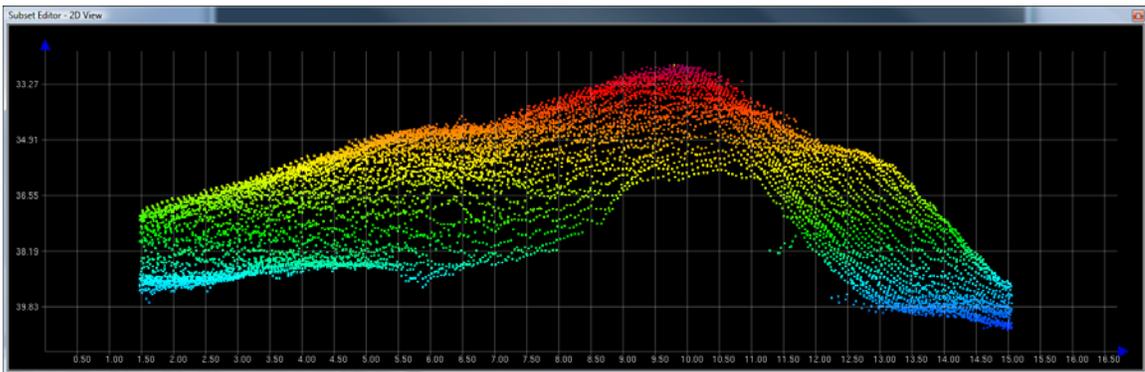
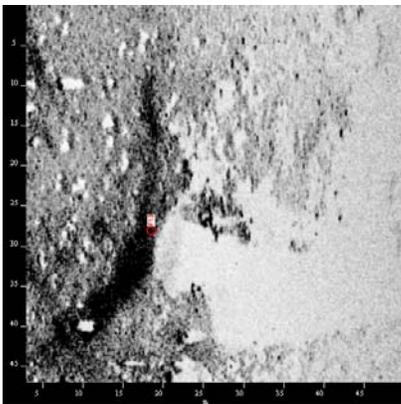


Figure C-44: 2D view of Multibeam data in CARIS HIPs Subset Editor of FST 13.



F13

- Sonar Time at Target: 06/24/2009 05:24:49
- Click Position (Lat WGS84): 15° 13.84422' N
- Click Position (Lon WGS84): 145° 43.90768' E
- Map Proj: WGS 1984 UTM, Zone 55 North, Meter
- Click Position (X): 363,796.11
- Click Position (Y): 1,684,242.85
- Acoustic Source File:
D:\09CQ01_Saipan\caris_hips\preprocess\sidescan\
edgetech_SSS_Data\jd175\20090624052216.xtf
- Ping Number: 18010
- Range to Target: 21.18 Meters
- Fish Height: 7.03 Meters
- Event Number: 0
- Line Name: 20090624052216

Dimensions

- Target Height = 2.08 Meters
- Target Length: 23.58 Meters
- Target Shadow: 10.91 Meters
- Target Width: 5.13 Meters
- Mag Anomaly:
- Avoidance Area:
- Classification 1:
- Classification 2:
- Area:
- Block:
- Description:

Figure C-45: Side Scan Sonar data information for FST 13.

FST 14
15° 13' 50.410" N / 145° 43' 55.442" E
Least Depth: 35.512 ft

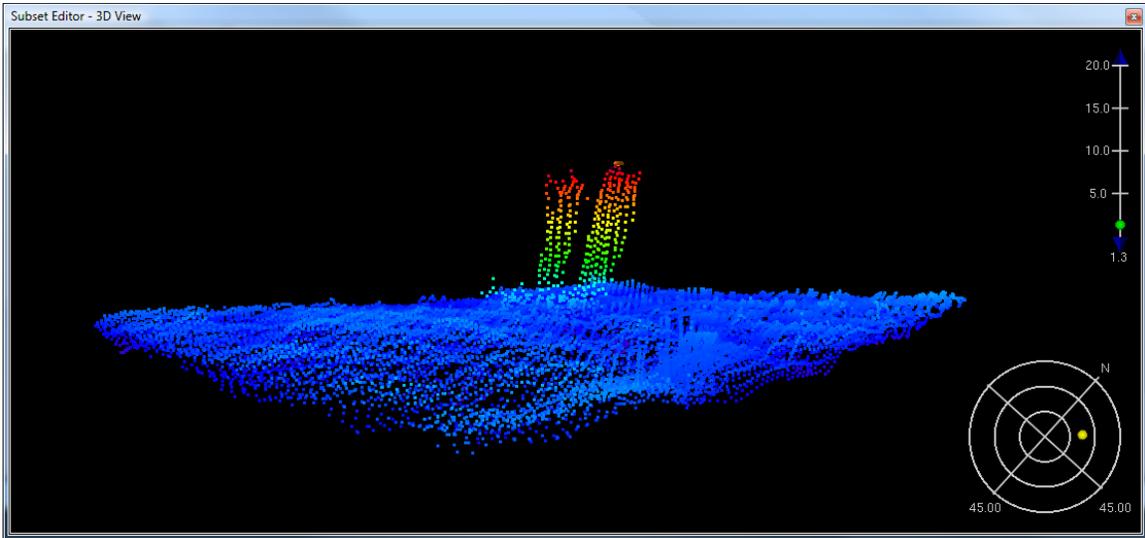


Figure C-46: 3D view of Multibeam data in CARIS HIPs Subset Editor of FST 14.

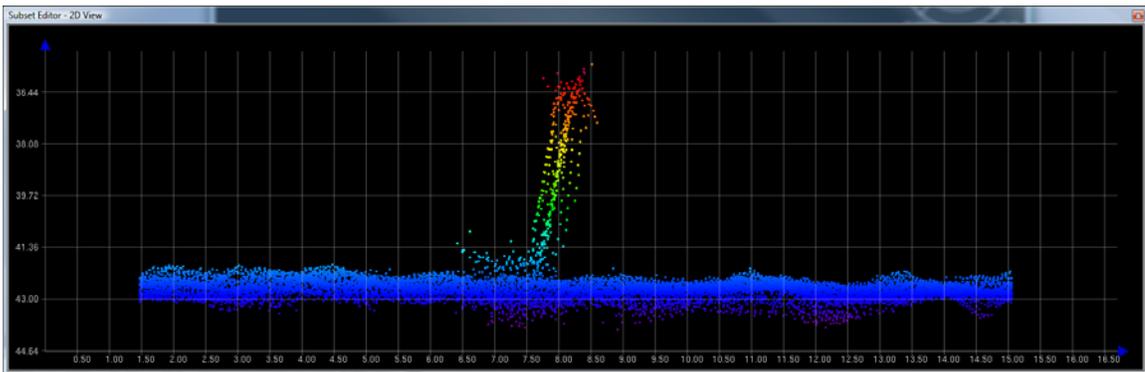
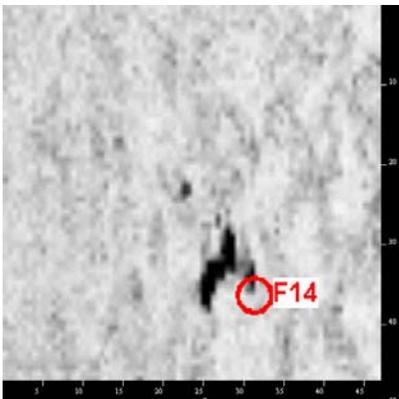


Figure C-47: 2D view of Multibeam data in CARIS HIPs Subset Editor of FST 14.



F14

- Sonar Time at Target: 06/24/2009 05:45:54
- Click Position (Lat WGS84): 15° 13.83996' N
- Click Position (Lon WGS84): 145° 43.92487' E
- Map Proj: WGS 1984 UTM, Zone 55 North, Meter
- Click Position (X): 363,826.84
- Click Position (Y): 1,684,234.82
- Acoustic Source File:
 D:\09CQ01_Saipan\caris_hips\preprocess\sidescan\edgetech_SSS_Data\jd175\20090624054304.xtf
- Ping Number: 36575
- Range to Target: 33.05 Meters
- Fish Height: 8.20 Meters
- Event Number: 0
- Line Name: 20090624054304

Dimensions

- Target Height = 0.16 Meters
- Target Length: 1.97 Meters
- Target Shadow: 0.66 Meters
- Target Width: 1.01 Meters
- Mag Anomaly:
- Avoidance Area:
- Classification 1:
- Classification 2:
- Area:
- Block:
- Description:

Figure C-48: Side Scan Sonar data information for FST 14.

FST 15
15° 13' 36.989" N / 145° 41' 53.829" E
Least Depth: 35.167 ft

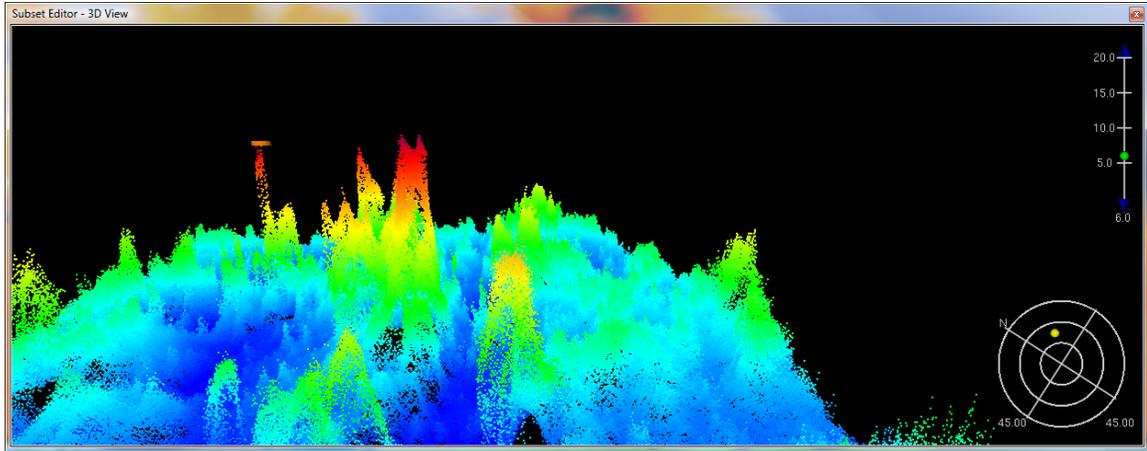


Figure C-49: 3D view of Multibeam data in CARIS HIPs Subset Editor of FST 15.

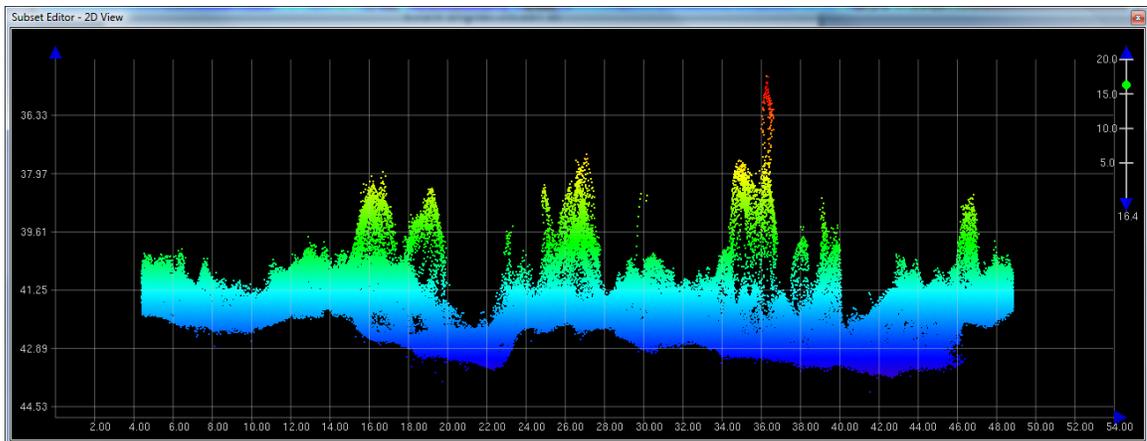
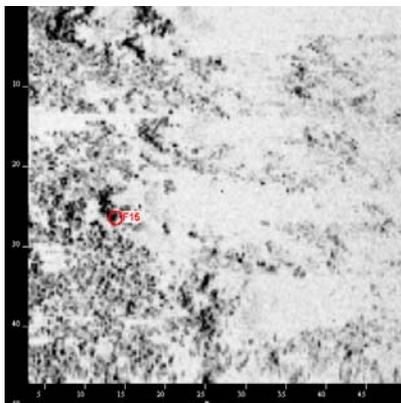


Figure C-50: 2D view of Multibeam data in CARIS HIPs Subset Editor of FST 15.



F15

- Sonar Time at Target: 06/24/2009 02:43:09
- Click Position (Lat WGS84): 15° 13.61849' N
- Click Position (Lon WGS84): 145° 41.90044' E
- Map Proj: WGS 1984 UTM, Zone 55 North, Meter
- Click Position (X): 360,200.17
- Click Position (Y): 1,683,847.80
- Acoustic Source File:
D:\09CQ01_Saipan\caris_hips\preprocess\sidescan\edgetech_SSS_Data\jd175\20090624023655.xtf
- Ping Number: 56553
- Range to Target: 33.93 Meters
- Fish Height: 6.15 Meters
- Event Number: 0
- Line Name: 20090624023655

Dimensions

- Target Height = 1.38 Meters
- Target Length: 1.43 Meters
- Target Shadow: 9.57 Meters
- Target Width: 1.29 Meters
- Mag Anomaly:
- Avoidance Area:
- Classification 1:
- Classification 2:
- Area:
- Block:
- Description:

Figure C-51: Side Scan Sonar data information for FST 15.

FST 16 aka NAVO CID 1125
15° 13' 37.064" N / 145° 41' 54.141" E
Least Depth: 35.407 ft

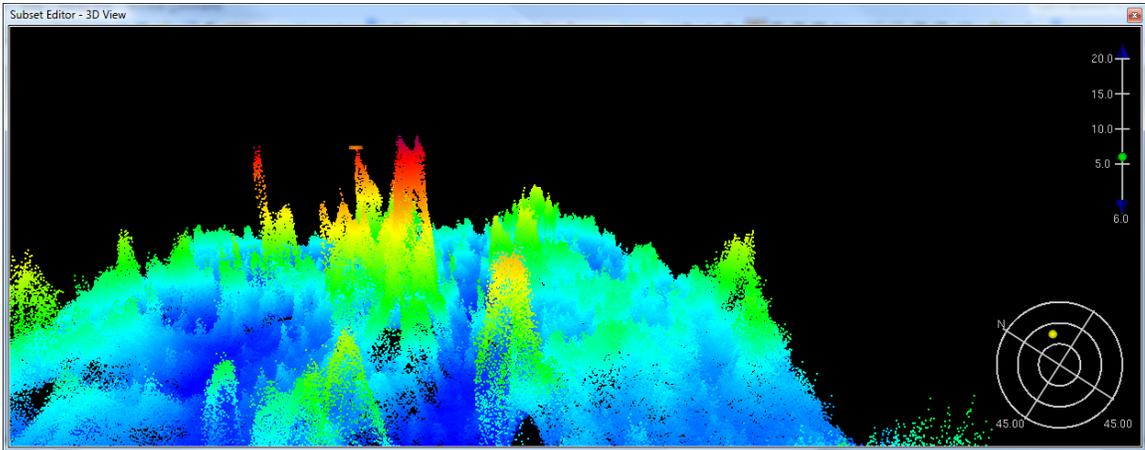


Figure C-52: 3D view of Multibeam data in CARIS HIPs Subset Editor of FST 16.

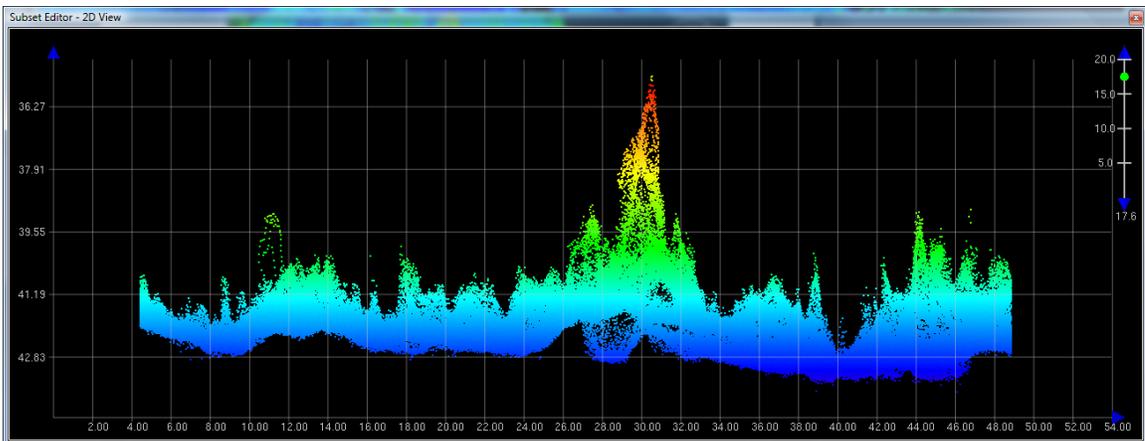
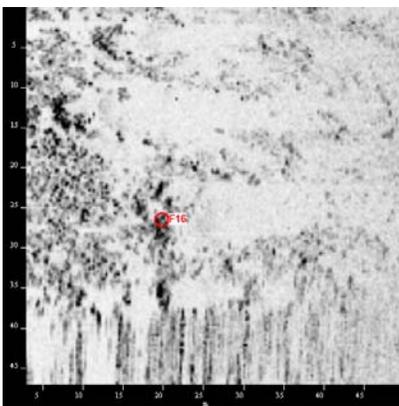


Figure C-53: 2D view of Multibeam data in CARIS HIPs Subset Editor of FST 16.



F16

- Sonar Time at Target: 06/24/2009 02:43:11
- Click Position (Lat WGS84): 15° 13.61855' N
- Click Position (Lon WGS84): 145° 41.90330' E
- Map Proj: WGS 1984 UTM, Zone 55 North, Meter
- Click Position (X): 360,205.30
- Click Position (Y): 1,683,847.89
- Acoustic Source File:
D:\09CQ01_Saipan\caris_hips\preprocess\sidescan\edgetech_SSS_Data\jd175\20090624023655.xtf
- Ping Number: 56590
- Range to Target: 38.34 Meters
- Fish Height: 5.57 Meters
- Event Number: 0
- Line Name: 20090624023655

Dimensions

- Target Height = 0.92 Meters
- Target Length: 2.13 Meters
- Target Shadow: 7.03 Meters
- Target Width: 2.05 Meters
- Mag Anomaly:
- Avoidance Area:
- Classification 1:
- Classification 2:
- Area:
- Block:
- Description:

Figure C-54: Side Scan Sonar data information for FST 16.

09CQ01

Tanapag Harbor, Saipan

Appendix D:

Navigation Aids Log and Photographs

UNCLASSIFIED

DISTRIBUTION STATEMENT A:

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FIXED AIDS TO NAVIGATION														
NGA Publication 111 - List of Lights - 2008									Observed					
		Position							GPS Position					
Light No.	Name & Location	Latitude	Longitude	Characteristic	Height	Range	Structure	Remarks	Latitude	Longitude	Characteristic	Height	Structure	
10955 F 8364	Maniagassa (Managaha) Island	15° 14.4' N	145° 42.6' E	Fl. W. period 6s	75 ft 23 m	6 NM	Pile, Red and White Diamond Daymark		Not Observed	Not Observed	Fl RWG period 6s	N/O	Daymark, Black and White Diamonds, Sector Light Photo D-1	
10955.5 F 8367	Garapan Channel	15° 11.7' N	145° 42.3' E	Fl. G. period 2.5s	20 ft 6 m	-	Concrete Structure	Private light. Aero Radiobeacon 4.1 miles SSW	Not Observed	Not Observed	Extinguished	N/O	Concrete Pillar Beacon, located on reef edge, gray, old structure, light fixture missing Photo D-2	
10956 F 8366	Puetton Tanapag (Tanapag Harbor) Range, front	15° 13.7' N	145° 44.4' E	Q. G.	50 ft 15 m	-	Framework tower, red rectangular daymark, white stripe	Range lights visible 004° each side of range line. F.R. on radio masts 1.2 miles SW	15° 13' 45.509" N	145° 44' 25.530" E	Q G 60 flashes per minute	N/O	Metal Skeletal Framework Tower with Vertical Red/White/Red Stripes on Daymark Photos D-3, D-4 and D-6	
10960 F 8366.1	Rear, 1,033 meters 087° 54' from front	15° 13.8' N	145° 45.0' E	Iso. G. period 6s	97 ft 30 m	-	Framework tower, red rectangular daymark, white stripe	Range light visible 004° each side of range line.	15° 13' 46.445" N	145° 44' 58.787" E	Iso G period 6s fl. 3s ec. 3s	N/O	Metal Skeletal Framework Tower with Vertical Red/White/Red Stripes on Daymark Photos D-3, D-5 and D-7	
Not in NGA List of Lights	Smiley Cove Light	-	-	-	-	-	-	-	15° 13' 20.338" N	145° 43' 24.262" E	Fl R 4s fl. 0.5s ec. 3.5s	12 ft 4 m	Red Concrete Pillar with Red Concrete Platform on top supporting light, Private Photo D-8	

Red = Change from NOAA Chart 81076, NGA DNC 12 and/or NGA List of Lights

FLOATING AIDS TO NAVIGATION								
Observed								
Buoy Type	Marked with	GPS Position		Color	Light Characteristic	Topmark	Photo #	Remarks
		Latitude	Longitude					
Pillar Buoy	'T'	15° 12' 11.723" N	145° 40' 28.460" E	Red & White, Vertical	Fl W Mo (A) 	None	D-9	Charted on NOAA Chart 81076
Nun Buoy	'1'	15° 12' 43.138" N	145° 41' 44.950" E	Green	None	None	D-10	Charted on NOAA Chart 81076
Pillar Buoy	'2'	15° 13' 12.791" N	145° 41' 24.455" E	Red	Q R 60 flashes per minute	None	D-11	Charted on NOAA Chart 81076
Pillar Buoy	'2A'	15° 13' 44.997" N	145° 42' 00.540" E	Red	Fl R 2.5s fl. 0.5s ec. 2.0s	None	D-12	Charted on NOAA Chart 81076
Pillar Buoy	'3'	15° 13' 39.033" N	145° 42' 05.144" E	Green	Fl G 2.5s fl. 0.5s ec. 2.0s	None	D-13	Charted on NOAA Chart 81076
Can Buoy	'4'	15° 13' 44.926" N	145° 42' 36.984" E	Red	None	None	D-14	Charted on NOAA Chart 81076
Nun Buoy	'5'	15° 13' 40.650" N	145° 42' 37.508" E	Green	None	None	D-15	Charted on NOAA Chart 81076
Pillar Buoy	'6'	15° 13' 45.837" N	145° 43' 02.702" E	Red	Fl R 4s fl. 0.5s ec. 3.5s	None	D-16	Charted on NOAA Chart 81076
Pillar Buoy	'7'	15° 13' 41.459" N	145° 43' 02.303" E	Green	Fl G 4s fl. 1.0s ec. 3.0s	None	D-17	Charted on NOAA Chart 81076
Can Buoy	'8'	15° 14' 06.268" N	145° 43' 27.806" E	Red	None	None	D-18	Charted on NOAA Chart 81076
Can Buoy	'10'	15° 13' 45.803" N	145° 44' 10.509" E	Red	None	None	D-19	Charted on NOAA Chart 81076

Red = Change from NOAA Chart 81076 and/or NGA DNC 12

UNCHARTED FLOATING AIDS TO NAVIGATION								
Observed								
Buoy Type	Marked with	GPS Position		Color	Light Characteristic	Topmark	Photo #	Remarks
		Latitude	Longitude					
Mooring Buoy	-	15° 13' 52.3" N	145° 43' 29.4" E	Rust	None	None	D-20	Buoy is Temporary, for Construction, Not on Chart 81076
Mooring Buoy, Barrel	-	15° 13' 58.8" N	145° 43' 29.8" E	Red and Rust	None	None	D-21	Buoy is Temporary, for Construction, Not on Chart 81076
Mooring Buoy, Spherical	-	15° 13' 27.8" N	145° 43' 43.0" E	Rust	None	None	D-22	Buoy is Temporary, for Construction, Not on Chart 81076

Red = Change from NOAA Chart 81076 and/or NGA DNC 12

CHARTED FLOATING AIDS TO NAVIGATION								
From NOAA Chart 81076, 12th Ed., Aug. 2007								
Buoy Type	Marked with	Charted Position		Color	Light Characteristic	Topmark	Photo #	Remarks
		Latitude	Longitude					
Mooring Buoy	-	15° 13' 47.5" N	145° 43' 18.4" E		None	None	None	Does Not Exist
Mooring Buoy	-	15° 13' 50.0" N	145° 43' 18.1" E		None	None	None	Does Not Exist
Mooring Buoy	-	15° 13' 49.0" N	145° 43' 26.7" E		None	None	None	Does Not Exist
Mooring Buoy	-	15° 14' 08.8" N	145° 43' 53.1" E		None	None	None	Does Not Exist
Lighted Buoy	'2'	15° 11' 53.0" N	145° 42' 30.0" E	Red	Fl R 2.5s	None	None	Does Not Exist
Can Buoy	'4'	15° 11' 55.0" N	145° 42' 33.5" E	Red	None	None	None	Does Not Exist
Nun Buoy	'3'	15° 11' 52.8" N	145° 42' 34.1" E	Green	None	None	None	Does Not Exist
Can Buoy	'6'	15° 12' 01.0" N	145° 42' 40.4" E	Red	None	None	None	Does Not Exist
Nun Buoy	'5'	15° 12' 00.8" N	145° 42' 42.4" E	Green	None	None	None	Does Not Exist
Can Buoy	'8'	15° 12' 07.1" N	145° 42' 46.2" E	Red	None	None	None	Does Not Exist
Nun Buoy	'7'	15° 12' 05.9" N	145° 42' 48.0" E	Green	None	None	None	Does Not Exist
Can Buoy	'10'	15° 12' 08.7" N	145° 42' 50.9" E	Red	None	None	None	Does Not Exist
Nun Buoy	'9'	15° 12' 06.8" N	145° 42' 51.8" E	Green	None	None	None	Does Not Exist
Nun Buoy	'11'	15° 12' 06.0" N	145° 42' 54.1" E	Green	None	None	None	Does Not Exist



Photo D-1: Managaha (Maniagassa) Island Sector Light

Location: Not Observed

Light: Flashing RWG 6 seconds (Fl RWG 6s)

Daymark: Black and White Diamonds



Photo D-2: Garapan Channel Beacon

Location: Not Observed

Light: Extinguished

Daymark: None



Photo D-3: Tanapag Harbor, Saipan Front and Rear Range Lights

Front Range Light:

Location: 15° 13' 45.509" N 145° 44' 25.530" E

Light: Quick Green (Q G)

Daymark: Red / White / Red Vertical Stripes

Rear Range Light:

Location: 15° 13' 46.445" N 145° 44' 58.787" E

Light: Isophase Green (Iso G)

Daymark: Red / White / Red Vertical Stripes



Photo D-4: Tanapag Harbor, Saipan Front Range Light



Photo D-5: Tanapag Harbor, Saipan Rear Range Light



Photo D-6: Front Range Light Structure
Tanapag Harbor, Saipan



Photo D-7: Rear Range Light Structure
Tanapag Harbor, Saipan



Photo D-8: Smiling Cove Light

Location: 15° 13' 20.338" N 145° 43' 24.262" E

Light: Flashing Red 4 seconds (Fl R 4s)

Daymark: None



Photo D-9: Pillar Buoy 'T', Pilot Buoy

Location: 15° 12' 11.723" N 145° 40' 28.460" E

Color: Red & White, Vertical

Light: Flashing White Morse Code (A -) [Mo (A)]

Topmark: None



Photo D-10: Nun Buoy '1'

Location: 15° 12' 43.138" N 145° 41' 44.950" E

Color: Green

Light: None

Topmark: None



Photo D-11: Pillar Buoy '2'

Location: 15° 13' 12.791" N 145° 41' 24.455" E

Color: Red

Light: Quick Red (Q R)

Topmark: None



Photo D-12: Pillar Buoy '2A'

Location: 15° 13' 44.997" N 145° 42' 00.540" E

Color: Red

Light: Flashing Red 2.5 seconds (Fl R 2.5s)

Topmark: None



Photo D-13: Pillar Buoy '3'

Location: 15° 13' 39.033" N 145° 42' 05.144" E

Color: Green

Light: Flashing Green 2.5 seconds (Fl G 2.5s)

Topmark: None



Photo D-14: Can Buoy '4'

Location: 15° 13' 44.926" N 145° 42' 36.984" E

Color: Red

Light: None

Topmark: None



Photo D-15: Nun Buoy '5'

Location: 15° 13' 40.650" N 145° 42' 37.508" E

Color: Green

Light: None

Topmark: None



Photo D-16: Pillar Buoy '6'

Location: 15° 13' 45.837" N 145° 43' 02.702" E

Color: Red

Light: Flashing Red 4 seconds (Fl R 4s)

Topmark: None



Photo D-17: Pillar Buoy '7'

Location: 15° 13' 41.459" N 145° 43' 02.303" E

Color: Green

Light: Flashing Green 4 seconds (Fl G 4s)

Topmark: None



Photo D-18: Can Buoy '8'

Location: 15° 14' 06.268" N 145° 43' 27.806" E

Color: Red

Light: None

Topmark: None



Photo D-19: Can Buoy '10'

Location: 15° 13' 45.803" N 145° 44' 10.509" E

Color: Red

Light: None

Topmark: None



Photo D-20: Mooring Buoy, Temporary

Located: 15° 13' 52.3" N 145° 43' 29.4" E

Color: Rust



Photo D-21: Mooring Buoy, Barrel, Temporary
Located: 15° 13' 58.8 N 145° 43' 29.8" E
Color: Red and Rust



Photo D-22: Mooring Buoy, Spherical, Temporary

Located: 15° 13' 27.8" N 145° 43' 43.0" E

Color: Rust

09CQ01

Tanapag Harbor, Saipan

Appendix E:

Bottom Sample Locations, Station Sheet and Analysis Results

UNCLASSIFIED

DISTRIBUTION STATEMENT A:

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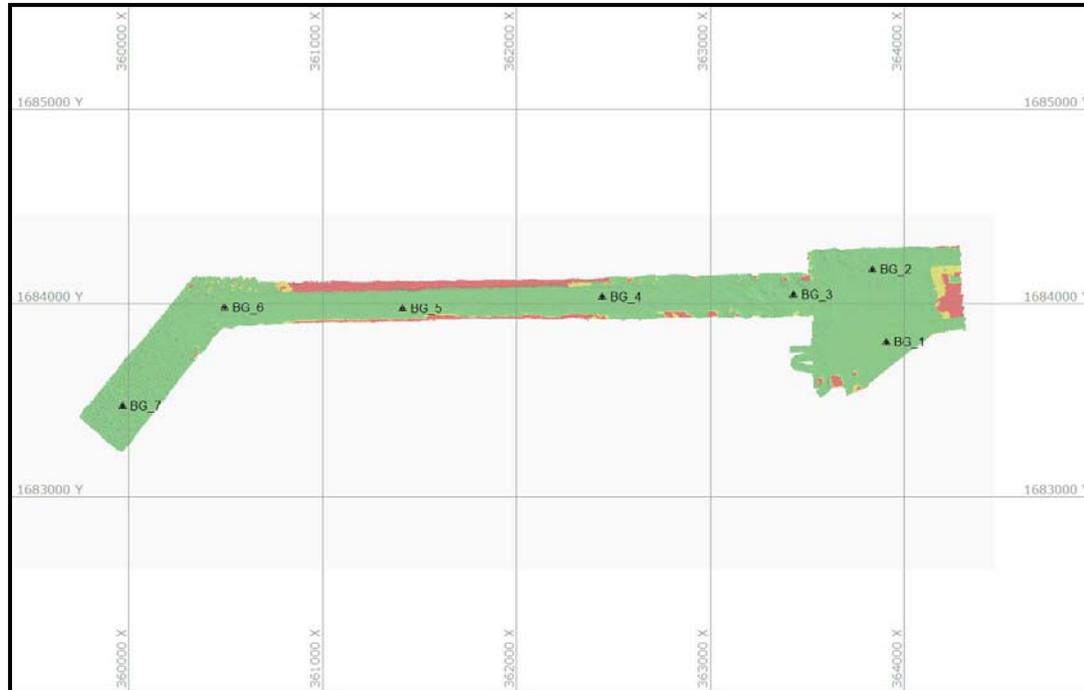


Figure E-1: Bottom Grab Locations.

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OCEANOGRAPHIC LOG SHEET - BOTTOM SEDIMENT DATA										RETURN TO: NAVAL OCEANOGRAPHIC OFFICE CODE NP64 STENNIS SPACE CENTER, MS 39522	
DISTRIBUTION STATEMENT A: APPROVED FOR PUBLIC RELEASE DISTRIBUTION UNLIMITED											
SHIP: SWAMP FOX				CRUISE: 09CQ01			SNR / NAVO POC: CHARLES BAPTISTE			AREA: TANAPAG HARBOR, SAIPAN	
BOTTOM SEDIMENT NO.	DATE (ddmmyy)	SAMPLE POSITION		DEPTH (MTRS)	GEOMORPHOLOGY OF IMMEDIATE AREA	TYPE OF SAMPLER	WEIGHT OF SAMPLER (lbs)	LENGTH OF CORE (CM)	APPROX. PENETRA- TION (CM)	FIELD DESCRIPTION OF CORE AND REMARKS	OBS. INIT.
		LATITUDE (N)	LONGITUDE (E)								
001	180609	15° 13' 36.3"	145° 43' 58.2"	12.3	SMOOTH	<u>Petite Ponar</u>		N/A	Surface	MUD	CAB
002	180609	15° 13' 48.4"	145° 43' 55.7"	12.1	SMOOTH	<u>Petite Ponar</u>		N/A	Surface	CLAY	CAB
003	180609	15° 13' 44.1"	145° 43' 42.1"	13.4	ROCKY	<u>Petite Ponar</u>		N/A	Surface	SAND, SHELL FRAGMENTS	CAB
004	180609	15° 13' 43.6"	145° 43' 09.1"	12.2	ROCKY	<u>Petite Ponar</u>		N/A	Surface	SAND, SHELL FRAGMENTS	CAB
005	180609	15° 13' 41.5"	145° 42' 34.6"	11.1	ROCKY	<u>Petite Ponar</u>		N/A	Surface	SAND, SHELL FRAGMENTS	CAB
006	180609	15° 13' 41.5"	145° 42' 03.8"	12.7	ROCKY	<u>Petite Ponar</u>		N/A	Surface	SAND, CORAL	CAB
007	180609	15° 13' 24.6"	145° 41' 46.3"	13.7	ROCKY	<u>Petite Ponar</u>		N/A	Surface	N/A	CAB

UNCLASSIFIED

 SEDIMENT SIZE AND COMPOSITION DATA for GRAB SAMPLES FROM SURVOP NUMBER 09CQ01, Tanapag Harbor, Saipan WEIGHT PERCENT OF SEDIMENT IN EACH PHI CLASS								
			GRAB 1	GRAB 2	GRAB 3	GRAB 4	GRAB 5	GRAB 6
Particle Diameter		Latitude (N)	15° 13' 36.3"	15° 13' 48.4"	15° 13' 44.1"	15° 13' 43.6"	15° 13' 41.5"	15° 13' 41.5"
(Phi)	(mm)	Longitude (E)	145° 43' 58.2"	145° 43' 55.7"	145° 43' 42.1"	145° 43' 09.1"	145° 42' 34.6"	145° 42' 03.8"
		Depth (m)	12.3	12.1	13.4	12.2	11.1	12.7
< -4	>16		21.107	0.000	0.000	0.000	0.000	90.259
-4 to -3	16.000 to 8.000		0.874	0.000	4.465	0.000	0.000	0.000
-3 to -2	8.000 to 4.000		0.515	0.000	2.118	0.000	0.071	1.335
-2 to -1	4.000 to 2.000		0.403	0.000	2.089	0.322	1.474	1.414
-1 to 0	2.000 to 1.000		0.381	0.024	2.204	1.933	2.497	3.849
0 to 1	1.000 to .500		0.560	0.049	5.409	17.637	13.056	2.200
1 to 2	.500 to .250		1.613	0.245	6.754	28.614	56.813	0.628
2 to 3	.250 to .125		4.145	1.591	9.874	34.221	25.922	0.236
3 to 4	.125 to .063		4.549	12.237	14.110	12.223	0.095	0.079
4 to 5	.063 to .031		6.453	28.047	16.027	0.687	0.071	0.000
5 to 6	.031 to .016		13.578	30.543	17.258	0.559	0.000	0.000
6 to 7	.016 to .008		10.778	10.157	6.382	0.344	0.000	0.000
7 to 8	.008 to .004		7.394	3.182	3.034	0.279	0.000	0.000
8 to 9	.004 to .002		5.579	1.297	1.717	0.129	0.000	0.000
9 to 10	.002 to .001		4.549	1.224	1.345	0.172	0.000	0.000
> 10	< .001		17.522	11.405	7.212	2.879	0.000	0.000
Gravel (>2.0mm)			22.899	0.000	8.672	0.322	1.546	93.009
Sand (2.0 - .063 mm)			11.248	14.146	38.351	94.629	98.383	6.991
Silt (.063 - .004 mm)			38.203	71.929	42.702	1.869	0.071	0.000
Clay (< .004 mm)			27.650	13.926	10.275	3.179	0.000	0.000
Wentworth Size Class (from Mean Phi)			Coarse Silt	Medium Silt	V. F. Sand	Fine Sand	Medium Sand	Medium Sand
Shepard Sediment Class			Gr-Silt-Cly	Silt	Sandy Silt	Sand	Sand	Gravel
Mean (mm)			0.050	0.019	0.064	0.215	0.345	17.225
Mean (phi)			4.327	5.737	3.961	2.221	1.536	-4.106
Standard Deviation (in phi units)			5.304	2.076	3.290	1.854	0.802	1.258
Skewness			-0.328	0.599	-0.086	1.332	-0.540	1.591
Kurtosis			-0.917	0.729	0.187	9.687	2.601	9.166
GSA Color								
Dominant Constituent								
Secondary Constituent								
Calcium Carbonate %			88.0	27.0	94.0	96.0	100.0	
Total Organic Carbon %								
Remarks								Insufficient smp for sp. gr. & CaCO3

		SEDIMENT SIZE AND COMPOSITION DATA					
		for GRAB SAMPLES FROM SURVOP NUMBER 09CQ01, Tanapag Harbor, Saipan					
		WEIGHT PERCENT OF SEDIMENT IN EACH PHI CLASS					
		GRAB 7					
		Latitude (N)	15° 13' 24.6"				
		Longitude (E)	145° 41' 46.3"				
		Depth (m)	13.7				
< -4	>16		0.000				
-4 to -3	16.000 to 8.000		44.000				
-3 to -2	8.000 to 4.000		38.400				
-2 to -1	4.000 to 2.000		12.800				
-1 to 0	2.000 to 1.000		3.200				
0 to 1	1.000 to .500		0.800				
1 to 2	.500 to .250		0.400				
2 to 3	.250 to .125		0.400				
3 to 4	.125 to .063		0.000				
4 to 5	.063 to .031		0.000				
5 to 6	.031 to .016		0.000				
6 to 7	.016 to .008		0.000				
7 to 8	.008 to .004		0.000				
8 to 9	.004 to .002		0.000				
9 to 10	.002 to .001		0.000				
> 10	< .001		0.000				
Gravel (>2.0mm)			95.200				
Sand (2.0 - .063 mm)			4.800				
Silt (.063 - .004 mm)			0.000				
Clay (< .004 mm)			0.000				
Wentworth Size Class (from Mean Phi)			Medium Sand				
Shepard Sediment Class			Gravel				
Mean (mm)			6.444				
Mean (phi)			-2.688				
Standard Deviation (in phi units)			0.947				
Skewness			0.841				
Kurtosis			4.630				
GSA Color							
Dominant Constituent							
Secondary Constituent							
Calcium Carbonate %							
Total Organic Carbon %							
Remarks			Insufficient smp for sp. gr. & CaCO3				

09CQ01

Tanapag Harbor, Saipan

Appendix F:

Tide Station Descriptive Report

UNCLASSIFIED

DISTRIBUTION STATEMENT A:

**APPROVED FOR PUBLIC RELEASE
DISTRIBUTION UNLIMITED**

FLEET SURVEY TEAM (FST)**TIDE STATION - DESCRIPTION
INSTALLATION - LEVELING RECORD**

Country: Commonwealth of the Northern Mariana Islands, USA
Saipan Island

Specific Location: Tanapag Harbor
(aka Saipan Harbor)

Vessel: FST SWAMP FOX

HIC: Charles A. Baptiste

Date: 23 May 2009

Station Number:

09CQ01

ARCHIVE NUMBER

0691-LL-000-3605

NAVOCEANO 3140/68 (07-00)

BENCH MARK LABELING

Bench mark disks should be stamped with steel dies, using a ten-digit IHO Identification Number, the Year of Installation and a Bench mark number BM1, BM2, etc. The IHO Number is constructed as follows:

Q	LATITUDE	LONGITUDE
#	DDMM	DDMM

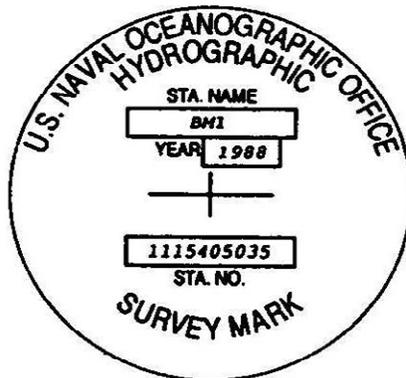
Where Q is the quadrant of the world,

- 1 for North-East
- 2 for North-West
- 3 for South-West
- 4 for South-East

LATITUDE in degrees-minutes
 LONGITUDE in degrees-minutes

The values of minutes of a degree should be rounded to the nearest minute. Marks without disks should have their Identification Numbers etched in concrete while it is still wet.

**EXAMPLE
 BENCH MARK DISK**



**NOTE: "1115405035 1988 BM1"
 WOULD BE STAMPED IN THE FIELD
 FOR N11°54' E050°35'**

"C" CHECK INSTRUCTIONS



Place rods approximately 100m apart with the instrument setups about 10m from each point. Record rod readings to three decimal points for all three wires, if the difference is greater than 0.003m, reobserve. Determine the mean centerwire reading to four decimal places and sum the intervals for each observation. Multiply the sum interval for each foresight times 100 (stadia interval factor) to determine the shot length in meters. Use this distance to find the rod corrections in Table 1 for each foresight. Use the formula below to calculate the value of "C" to four decimals. Values greater than ± 0.004 require instrument adjustment.

$$"C" = \frac{(\text{sum of BS means} - \text{sum of corrected FS means})}{(\text{sum of FS intervals} - \text{sum of BS intervals})}$$

DISTANCE METERS	CORRECTION TO ROD IN METERS
0 to 27	0.0000
28 to 47	-0.0001
48 to 60	-0.0002
61 to 72	-0.0003
73 to 81	-0.0004
82 to 90	-0.0005
91 to 98	-0.0006
99 to 105	-0.0007

TABLE 1

LEVELING INSTRUCTIONS

- 1) Make all entries in ball point pen.
- 2) Record wire readings to three decimal places.
- 3) Always start a level run with the tide staff as the first backsight.
- 4) Pace all distances between rod placements before setting up the instrument. Balance all foresight and backsight distances (shots). Keep the total foresight and backsight distances within 10 meters. The maximum shot distance should not exceed 90 meters. The same person should pace all the distances for a level run and know the length of his/her pace before starting.
- 5) Individual unbalanced shots can be corrected by algebraically adding the collimation and curvature corrections to the observed height difference between turning points.
 - a) The collimation correction is determined using the formula:
 Coll. Corr. = "C"(Sum F.S. Intervals - Sum B.S. Intervals)
 For a lengthened foresight where:
 C = "C" Check value (Instrument collimation error)
 - b) Curvature corrections ® are computed using the formula:

$$r = -(\Delta s^2/d)$$

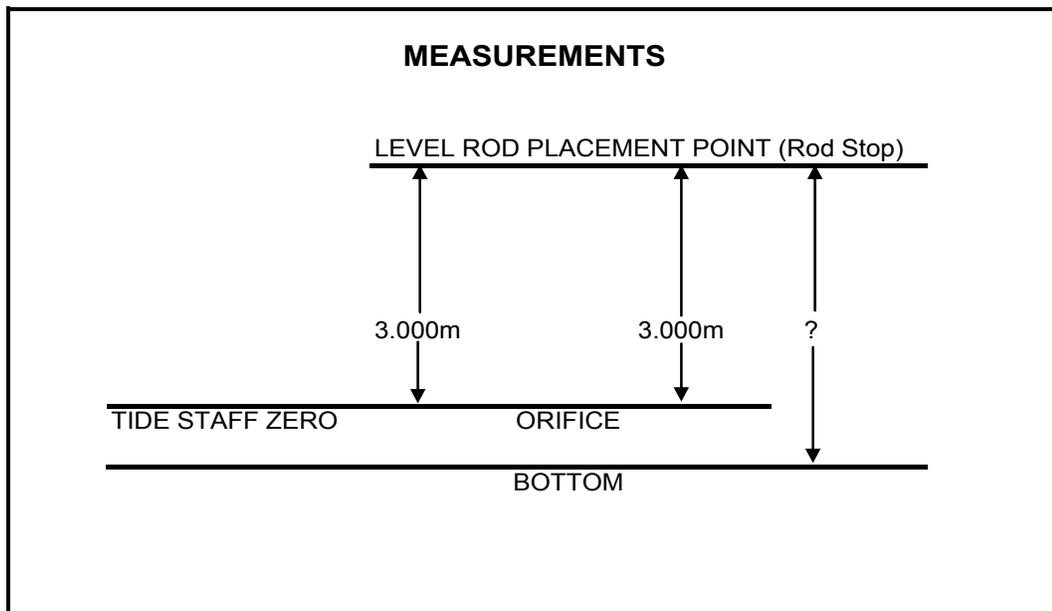
Where: Δs = The distance of the shot imbalance in meters

d = 12,756,000m the diameter of the earth.

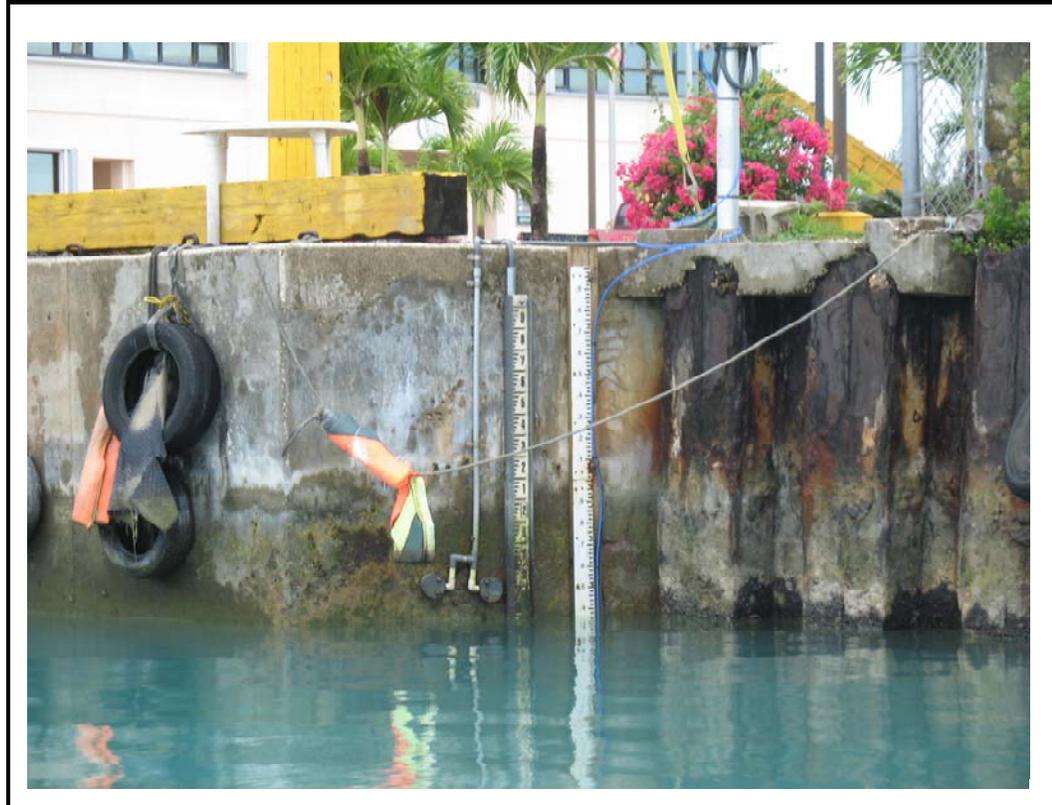
- 6) Subtract the total elevation difference for the forward run from the reverse run to determine the error of closure (E.C.). Calculate the allowable error (A.E.) with the following formula:

$$\text{A.E.} = \pm 0.012\text{m} \sqrt{k} \text{ where } k \text{ is the distance in kilometers of the shortest leg of the transit.}$$

TIDE STATION REPORT			
STATION NAME Tanapag Harbor (aka Saipan Harbor)		STATION # N/A	
STATION LOCATION Tanapag Harbor (aka Saipan Harbor)	LATITUDE 15° 13' 35" N	LONGITUDE 145° 44' 14" E	TIME ZONE UTC + 10
INSTALLED BY Naval Oceanographic Office/Fleet Survey Team Charles A. Baptiste, Jessica Burt		TIME	DATE 23 May 2009
GAUGE TYPE/MANUFACTURER Mini-Troll/In-Situ	SERIAL # 18849	RANGE/SCALE 3.5m	
BRIEF DESCRIPTION OF GAUGE SHELTER/SECUREMENT The gauge was secured to the 2" by 6" wooden plank tide staff with 2 rubber insulated stainless steel clamps. Zip ties secured the gauge cable approximately every 0.5m to the plank. Three 1m graduated plates were screwed onto the board. The board was then bolted to the concrete wharf with 2 anchor bolts.		POSTED NOTICE (Y / N) N	
TIDE STAFF: PRECISE LOCATION, METHOD OF SECUREMENT, TYPE OF STAFF DESCRIPTION OF RODSTOP AND ADDITIONAL REMARKS The tide gauge and staff are located in the Northeast corner of the Capt. George F. Flemming Memorial Building (Port of Saipan bldg.) main parking lot beside the chainlink fence at the Mobil fueling wharf and is installed beside the University of Hawaii tide gauge (See Level Line graphic). The gauge is fairly secure since it is in a gated pay for parking area beside the Port Authority Police facility.			
LIMITS OF STAFF GRADUATIONS 0.0 - 3.0m Staff, 1cm graduations	POSITION OF RODSTOP Screw set into wooden tide staff at the 3.0m mark		
DATE OF LEVELS TO TIDE STAFF Leveled In 5/23/09 (5 BM's) and 5/27/09 (6 BM's), Leveled Out 6/26/09 (6 BM's)	CONNECTED TO LOCAL DATUM (Y / N) Y		
NO. OF MARKS CONNECTED 1 Rod Stop Staff, 6 Benchmarks	NO. OF MARKS ESTABLISHED 1 Rod Stop, 1 Benchmark (FST-TPG)		
NO. OF MARKS RECOVERED 5 Established by the University of Hawaii	DATES OF OTHER LEVEL RUNS N/A		
REMARKS ON LEVELING Closed Loop 3-Wire Level Line using a Topcon AT-3			
ADDITIONAL INFORMATION			



INSTALLATION SKETCH



DESCRIPTION OF BENCH MARK - BM1	
1. B.M. No.:	163 3227 UH-2C
2. Established by:	University of Hawaii (UH)
Date:	Not Available
3. Recovered by:	Fleet Survey Team (FST)
4. Type of Mark:	14mm diameter (9/16") Center Punched Stainless Steel Hex Head Bolt set in the concrete wharf deck, the Bolt is raised approximately 5mm (13/64") above concrete surface
5. How Stamped:	Bolt Head is Not Stamped but is Center Punched, Not Marked, Stainless Steel Bolt only
6. Location and Detailed Description:	UH-2C is located where the East face of Delta Dock (Delta -3) meets the East face of the parking lot (CPA-2) fronting the port building, located at the Commonwealth Port Authority (CPA) facility in Tanapag Harbor (aka Saipan Harbor), 2.83m (9.3 ft) SSE of the SE corner of a diesel (white tanks) containment wall, 2.56 m (8.4 ft) NNE of utility pole # 7 and 1.13m (3.7 ft) West of the East pier face (CPA-2). See Graphic.
PHOTOS	
	

DESCRIPTION OF BENCH MARK - BM2	
1. B.M. No.:	<u>163 3227 UH-1</u>
2. Established by:	<u>University of Hawaii (UH)</u>
Date:	<u>Not Available</u>
3. Recovered by:	<u>Fleet Survey Team (FST)</u>
4. Type of Mark:	<u>Circular Stainless Steel disk (Pin Marker) approximately 40mm (1 1/2") diameter and approximately 5mm (13/64") high at the raised center above the concrete deck</u>
5. How Stamped:	<u>Not Stamped or Marked, Stainless Steel Disk only</u>
6. Location and Detailed Description:	<u>UH-1 is embedded in the NE corner of Delta Dock, located at the Commonwealth Port Authority (CPA) facility in Tanapag Harbor (aka Saipan Harbor), 18.71m (61.4 ft) East of the NW corner of Delta Dock, 0.47m (1.5 ft) West of the East pier face (Delta '-3) of Delta Dock and 0.42 m (1.4 ft) South of the North pier face (Delta '-2) of Delta Dock. See Graphic.</u>
PHOTOS	
<div style="display: flex; justify-content: space-around;">   </div>	

DESCRIPTION OF BENCH MARK - BM3	
1. B.M. No.:	<u>163 3227 UH-3B</u>
2. Established by:	<u>University of Hawaii (UH)</u>
Date:	<u>Not Available</u>
3. Recovered by:	<u>Fleet Survey Team (FST)</u>
4. Type of Mark:	<u>32mm X 32mm (1 1/4" X 1 1/4") Stainless Steel Square Head Pin Marker with raised round center approximately 5mm (13/64") high set in concrete</u>
5. How Stamped:	<u>Not Stamped or Marked, Square Head Pin Marker only</u>
6. Location and Detailed Description:	<u>UH-3B is located at the Commonwealth Port Authority (CPA) facility in Tanapag Harbor (aka Saipan Harbor), below the Mobil Gas sign, near the SW corner of Delta Dock, where the West face of Delta Dock (Delta '1) meets the North face of the parking lot (CPA '1) fronting the Port of Saipan building. At time of Benchmark recovery the Mobil Gas sign was not attached to the sign base. See Graphic.</u>
PHOTOS	
<div style="display: flex; justify-content: space-around;">   </div>	

DESCRIPTION OF BENCH MARK - BM4	
1. B.M. No.:	<u>FST-TPG</u>
2. Established by:	<u>Fleet Survey Team (FST)</u>
Date:	<u>25 May 2009</u>
3. Recovered by:	<u>Not Applicable</u>
4. Type of Mark:	<u>Circular Stainless Steel Bolt, Center Punched, 15mm diameter (9/16"), epoxyed into the concrete wharf deck</u>
5. How Stamped:	<u>Not Stamped, Center Punched, No other Markings, Bolt only</u>
6. Location and Detailed Description:	<u>Benchmark FST-TPG is located directly in the center of the Southside wharf halfway between Charlie and Delta Docks on the concrete deck. The Bolt can be recovered by walking straight out of the Port of Saipan building past the flag poles and parking lot to the wharf. It will be about 0.8m from the edge of the wharf. See Graphic.</u>
PHOTOS	
<div style="display: flex; justify-content: space-around;">   </div>	

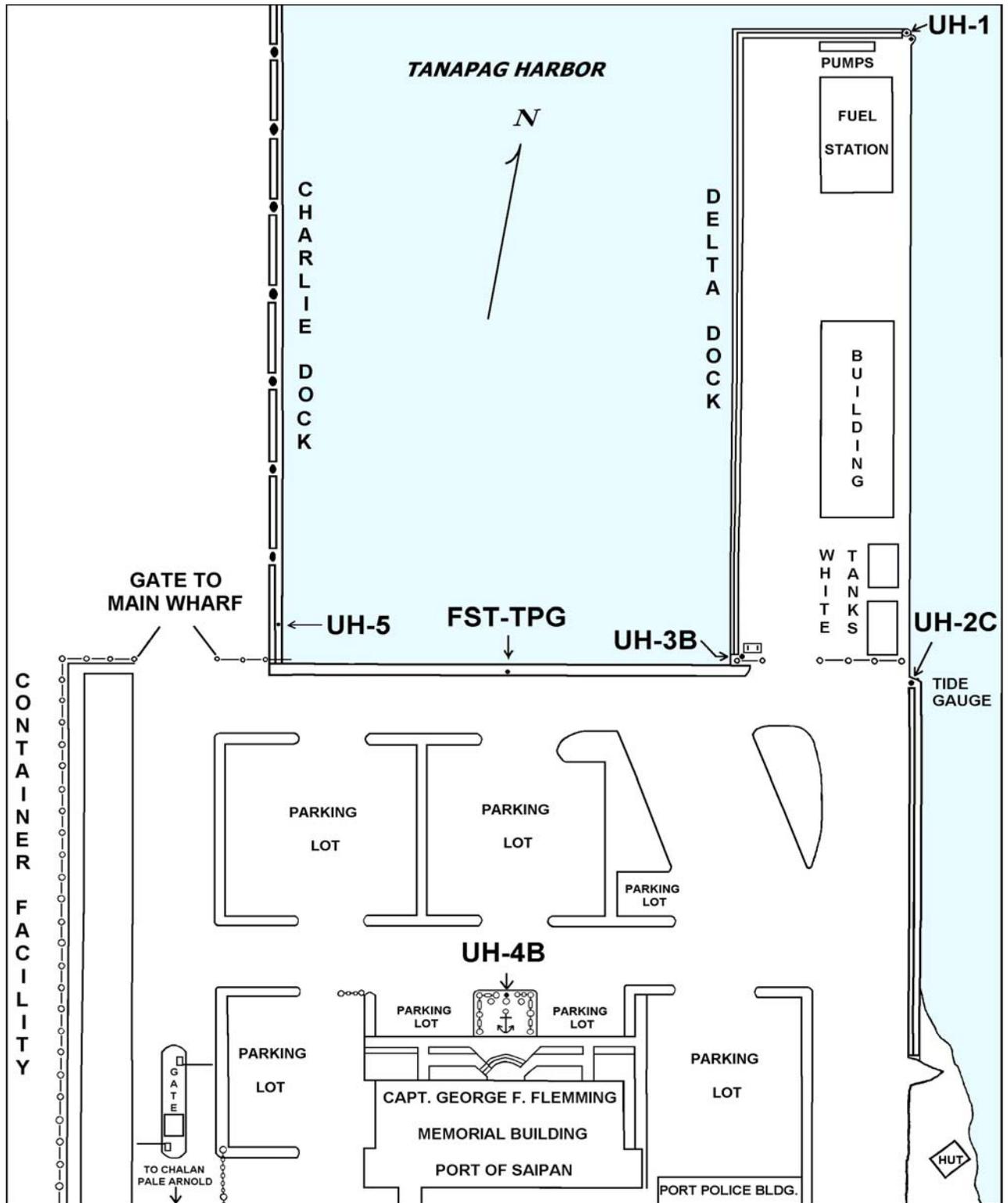
DESCRIPTION OF BENCH MARK - BM5	
1. B.M. No.:	<u>163 3227 UH-5B</u>
2. Established by:	<u>University of Hawaii (UH)</u>
Date:	<u>Not Available</u>
3. Recovered by:	<u>Fleet Survey Team (FST)</u>
4. Type of Mark:	<u>32mm X 32mm (1 1/4" X 1 1/4") Stainless Steel Square Head Pin Marker set into the concrete wharf deck, marker has round raised 8mm (5/16") center above concrete deck</u>
5. How Stamped:	<u>Not Stamped or Marked, Square Head Pin Marker only</u>
6. Location and Detailed Description:	<u>UH-5B is located near the SE corner of Charlie Dock where the East face of Charlie Dock (Charlie-2) meets the North face of the parking lot (CPA-1) fronting the port building, located at the Commonwealth Port Authority (CPA) facility in Tanapag Harbor (aka Saipan Harbor), 20.56m (67.5 ft) South of the SE largest bollard on Charlie Dock, 5.35m (17.6 ft) North of Charlie-2 and CPA -1 corner and 0.19m (0.6 ft) West of the East face (Charlie-2) of Charlie Dock. See Graphic.</u>
PHOTOS	
<div style="display: flex; justify-content: space-around;">   </div>	

DESCRIPTION OF BENCH MARK - BM6	
1. B.M. No.:	163 3227 UH-4B
2. Established by:	University of Hawaii (UH)
Date:	Not Available
3. Recovered by:	Fleet Survey Team (FST)
4. Type of Mark:	14mm (9/16") Stainless Steel Hex Head Bolt set in the concrete foundation for the center flagpole, the Bolt sits approximately 5mm (13/64") above the concrete deck
5. How Stamped:	Not Stamped or Marked, Bolt only
6. Location and Detailed Description:	UH-4B is set in the concrete flag pole base North of the port building located at the Commonwealth Port Authority (CPA) facility at Tanapag Harbor (aka Saipan Harbor), 46.53m (152.7 ft) West of the East pier face (CPA-2), 42.21m (138.5 ft) South of the North pier face (CPA-1) and 0.67m (2.2 ft) North of the center flag pole. See Graphic.
PHOTOS	
<div style="display: flex; justify-content: space-around;">   </div>	

NOTES

The first Level In level line was run on 23 May 2009. The Benchmarks were UH-2C, UH-1, UH-3B, UH-5B and UH 4B. This was before the establishment of Benchmark FST-TPG on 25 May 2009. After the new Benchmark was established the Level In level line was re-run using all 6 Benchmarks on 27 May 2009.

The Level Out level line was run on 27 Jun 2009 using all 6 Benchmarks.



Graphic - Tanapag Harbor, Saipan

Level-In, C-Check

"C" CHECK						"C" CHECK							
TOPCON 486357	Date	5/22/09 UTC, 5/23/09 Local				Observer:	J. Burt		Recorder:	J. Burt			
Partly Cloudy	Time:	23:00 UTC, 09:00 Local				Rodman:	C. Baptiste		Int. X 100	Distance in Meters			
	BACKSIGHT	MEAN	INTERVAL	SUM OF INT	REMARKS	FORESIGHT	MEAN	INTERVAL	SUM OF INT	DISTANCE	CORR.		
	1.570		0.050			2.085		0.450					
A	1.520	1.5200		0.100		1.635	1.6350		0.900	90.000	-0.0005		
	1.470		0.050			1.185		0.450					
	1.484		0.051			1.770		0.445					
B	1.433	1.4330		0.102		1.325	1.3233		0.895	89.500	-0.0005		
	1.382		0.051			0.875		0.450					
A =		2.9530	B =		0.202	C =		2.9583	D =		1.795	E =	-0.001

$$"C" = \frac{A - (C + E)}{D - B}$$

"C" = -0.00272023

"C" MUST BE LESS THAN ±0.004 0.002720234 < ±0.004 **PASS**

Level-In, 1st Level Line

THREE WIRE LEVELING						THREE WIRE LEVELING				
Project:	09CQ01	Location:	Tanapag Hbr, Saipan			Observer:	J. Burt	Recorder:	J. Burt	
Date:	5/23/2009 UTC& L	Time:	1500 Local, 0500 UTC			Rodman:	C. Baptiste	Instr #:	486357	
From:	Rod Stop	To:	UH-4B			Weather:	Hot, Humid, Partly Cloudy			
STATION	BACKSIGHT	MEAN	INTERVAL	SUM OF INT		FORESIGHT	MEAN	INTERVAL	SUM OF INT	REMARKS
Rod Stop	1.755		0.200			1.611		0.213		
TO	1.555	1.5550		0.400		1.398	1.3980		0.426	
UH-1	1.355		0.200			1.185		0.213		
		1.5550		0.400			1.3980		0.426	
UH-1	1.505		0.050			1.334		0.052		
TO	1.455	1.4550		0.100		1.282	1.2817		0.105	
TP	1.405		0.050			1.229		0.053		
		3.0100		0.500			2.6797		0.531	
TP	1.363		0.160			1.676		0.193		
TO	1.203	1.2030		0.320		1.483	1.4830		0.386	
UH-3B	1.043		0.160			1.290		0.193		
		4.2130		0.820			4.1627		0.917	
UH-3B	1.679		0.126			1.855		0.140		
TO	1.553	1.5530		0.252		1.715	1.7150		0.280	
UH-5B	1.427		0.126			1.575		0.140		
		5.7660		1.072			5.878		1.197	

Level-In, 1st Level Line

THREE WIRE LEVELING					THREE WIRE LEVELING				
Project:	09CQ01	Location:	Tanapag Hbr, Saipan		Observer:	J. Burt	Recorder:	J. Burt	
Date:	5/23/2009 UTC & L	Time:	1500 Local, 0500UTC		Rodman:	C. Baptiste	Instr #:	486357	
From:	Rod Stop	To:	UH-4B		Weather:	Hot, Humid, Partly Cloudy			
STATION	BACKSIGHT	MEAN	INTERVAL	SUM OF INT	FORESIGHT	MEAN	INTERVAL	SUM OF INT	REMARKS
UH-5B	1.895		0.127		1.365		0.140		
TO	1.768	1.7677		0.255	1.225	1.2250		0.280	
UH-4B	1.640		0.128		1.085		0.140		
		7.5337		1.327		7.1027		1.477	
								1.477	F.S. INTERVAL
								1.327	B.S. INTERVAL
B.S. MEAN	7.5337							2.804	100=TRANSIT LENGTH
-F.S. MEAN	7.1027						F DIST. (meters)	280.400	
Δ ELEVATION	0.4310 = FDE						F DIST (Km)	0.2804	
FOR FORWARD RUN		FDE =	0.4310						
		BDE =	-0.4303			A.E.	0.006353	PASS	
		EC =	0.0007						

Level-In, 1st Level Line

THREE WIRE LEVELING					THREE WIRE LEVELING				
Project:	09CQ01	Location:	Tanapag Hbr, Saipan		Observer:	J. Burt	Recorder:	J. Burt	
Date:	5/23/2009 UTC & L	Time:	1500 Local, 0500 UTC		Rodman:	C. Baptiste	Instr #:	486357	
From:	UH-4	To:	Rod Stop		Weather:	Hot, Humid, Partly Cloudy			
STATION	BACKSIGHT	MEAN	INTERVAL	SUM OF INT	FORESIGHT	MEAN	INTERVAL	SUM OF INT	REMARKS
UH-4B	1.390		0.140		1.922		0.129		
TO	1.250	1.2500		0.280	1.793	1.7933		0.257	
UH-5B	1.110		0.140		1.665		0.128		
		1.2500		0.280	5.380	1.7933		0.257	
UH-5B	1.888		0.138		1.713		0.125		
TO	1.750	1.7500		0.276	1.588	1.5880		0.250	
UH-3B	1.612		0.138		1.463		0.125		
		3.0000		0.556		3.3813		0.507	
UH-3B	1.720		0.195		1.406		0.160		
TO	1.525	1.5250		0.390	1.246	1.2460		0.320	
TP	1.330		0.195		1.086		0.160		
		4.5250		0.946		4.6273		0.827	
TP	1.364		0.052		1.536		0.051		
TO	1.312	1.3120		0.104	1.485	1.4850		0.102	
UH-1	1.260		0.052		1.434		0.051		
		5.8370		1.050		6.1123		0.929	

Level-In, 2nd Level Line

THREE WIRE LEVELING					THREE WIRE LEVELING				
Project:	09CQ01	Location:	Tanapag Hbr, Saipan		Observer:	J. Burt	Recorder:	J. Burt	
Date:	5/27/2009 UTC, 5/28 L	Time:	2100 UTC, 0700 Local		Rodman:	C. Baptiste	Instr #:	486357	
From:	Rod Stop	To:	UH-4B		Weather:	Windy, Hot			
STATION	BACKSIGHT	MEAN	INTERVAL	SUM OF INT	FORESIGHT	MEAN	INTERVAL	SUM OF INT	REMARKS
Rod Stop	1.739		0.021		1.623		0.020		
TO	1.718	1.7180		0.042	1.603	1.6030		0.040	
UH-2C	1.697		0.021		1.583		0.020		
		1.7180		0.042		1.6030		0.040	
UH-2C	1.706		0.204		1.676		0.214		
TO	1.502	1.5020		0.408	1.462	1.4623		0.427	
UH-1	1.298		0.204		1.249		0.213		
		3.2200		0.450		3.0653		0.467	
UH-1	1.521		0.048		1.355		0.055		
TO	1.473	1.4730		0.096	1.300	1.2997		0.111	
TP	1.425		0.048		1.244		0.056		
		4.6930		0.546		4.3650		0.578	
TP	1.360		0.159		1.675		0.195		
TO	1.201	1.2010		0.318	1.480	1.4800		0.390	
UH-3B	1.042		0.159		1.285		0.195		
		5.8940		0.864		5.845		0.968	

Level-In, 2nd Level Line

THREE WIRE LEVELING					THREE WIRE LEVELING				
Project:	09CQ01	Location:	Tanapag Hbr, Saipan		Observer:	J. Burt	Recorder:	J. Burt	
Date:	5/27/2009 UTC, 5/28 L	Time:	2100 UTC, 0700 Local		Rodman:	C. Baptiste	Instr #:	486357	
From:	Rod Stop	To:	UH-4B		Weather:	Windy, Hot			
STATION	BACKSIGHT	MEAN	INTERVAL	SUM OF INT	FORESIGHT	MEAN	INTERVAL	SUM OF INT	REMARKS
UH-3B	1.530		0.078		1.461		0.060		
TO	1.452	1.4520		0.156	1.401	1.4010		0.120	
FST-TPG	1.374		0.078		1.341		0.060		
		7.3460		1.020		7.2460		1.088	
FST-TPG	1.375		0.055		1.609		0.077		
TO	1.320	1.3200		0.110	1.532	1.5320		0.154	
UH-5B	1.265		0.055		1.455		0.077		
		8.6660		1.130		8.7780		1.242	
UH-5B	1.881		0.126		1.354		0.140		
TO	1.755	1.7550		0.252	1.214	1.2140		0.280	
UH-4B	1.629		0.126		1.074		0.140		
		10.4210		1.382		9.9920		1.522	F.S. INTERVAL
								1.382	B.S. INTERVAL
B.S. MEAN	10.4210							2.904	100=TRANSIT LENGTH
-F.S. MEAN	9.9920						F DIST. (meters)	290.400	
Δ ELEVATION	0.4290	= FDE					F DIST (Km)	0.2904	
FOR FORWARD RUN		FDE =	0.4290						
		BDE =	-0.4297		A.E.	0.006467	PASS		
		EC =	0.0007						

Level-In, 2nd Level Line

THREE WIRE LEVELING					THREE WIRE LEVELING					
Project:	09CQ01		Location:	Tanapag Hbr, Saipan		Observer:	J. Burt		Recorder:	J. Burt
Date:	5/27/2009 UTC, 5/28 L		Time:	2100 UTC, 0700 Local		Rodman:	C. Baptiste		Instr #:	486357
From:	UH-4		To:	Rod Stop		Weather:	Windy, Hot			
STATION	BACKSIGHT	MEAN	INTERVAL	SUM OF INT	FORESIGHT	MEAN	INTERVAL	SUM OF INT	REMARKS	
UH-4B	1.371		0.140		1.901		0.127			
TO	1.231	1.2310		0.280	1.774	1.7737		0.255		
UH-5B	1.091		0.140		1.646		0.128			
		1.2310		0.280		1.7737		0.255		
UH-5B	1.634		0.079		1.398		0.054			
TO	1.555	1.5550		0.158	1.344	1.3437		0.109		
FST-TPG	1.476		0.079		1.289		0.055			
		2.7860		0.438		3.1173		0.364		
FST-TPG	1.463		0.061		1.531		0.078			
TO	1.402	1.4020		0.122	1.453	1.4530		0.156		
UH-3B	1.341		0.061		1.375		0.078			
		4.1880		0.560		4.5703		0.520		
UH-3B	1.678		0.194		1.365		0.160			
TO	1.484	1.4840		0.388	1.205	1.2050		0.320		
TP	1.290		0.194		1.045		0.160			
		5.6720		0.948		5.7753		0.840		

Level-In, 2nd Level Line

THREE WIRE LEVELING					THREE WIRE LEVELING				
Project:	09CQ01	Location:	Tanapag Hbr, Saipan		Observer:	J. Burt	Recorder:	J. Burt	
Date:	5/27/2009 UTC, 5/28 L	Time:	2100 UTC, 0700 Local		Rodman:	C. Baptiste	Instr #:	486357	
From:	UH-4B	To:	Rod Stop		Weather:	Windy, Hot			
STATION	BACKSIGHT	MEAN	INTERVAL	SUM OF INT	FORESIGHT	MEAN	INTERVAL	SUM OF INT	REMARKS
TP	1.366		0.056		1.530		0.047		
TO	1.310	1.3100		0.112	1.483	1.4830		0.094	
UH-1	1.254		0.056		1.436		0.047		
		6.9820		1.060		7.2583		0.934	
UH-1	1.650		0.212		1.680		0.205		
TO	1.438	1.4377		0.425	1.475	1.4750		0.410	
UH-2C	1.225		0.213		1.270		0.205		
		8.4197		1.485		8.7333		1.344	
UH-2C	1.613		0.025		1.730		0.026		
TO	1.588	1.5880		0.050	1.704	1.7040		0.052	
Rod Stop	1.563		0.025		1.678		0.026		
		10.0077		1.535		10.4373		1.396	F.S. INTERVAL
								1.535	B.S. INTERVAL
B.S. MEAN	10.0077							2.931	100=TRANSIT LENGTH
-F.S. MEAN	10.4373					B DIST. (meters)		293.100	
Δ ELEVATION	-0.4297	= BDE				B DIST (Km)		0.2931	
FOR BACKWARDS RUN									

Level-Out, Level Line

THREE WIRE LEVELING					THREE WIRE LEVELING						
Project:	09CQ01		Location:	Tanapag Hbr, Saipan		Observer:	D. Brashear		Recorder:	K. Baden	
Date:	6/27/2009 UTC & L		Time:	0000 UTC, 1000 Local		Rodman:	J. Herron		Instr #:	486357	
From:	Rod Stop		To:	UH-4B		Weather:	Partly Cloudy, Light Wind, Hot and Humid				
STATION	BACKSIGHT	MEAN	INTERVAL	SUM OF INT	FORESIGHT	MEAN	INTERVAL	SUM OF INT	REMARKS		
Rod Stop	1.701		0.024		1.583		0.023				
TO	1.677	1.6770		0.048	1.560	1.5600		0.046			
UH-2C	1.653		0.024		1.537		0.023				
		1.6770		0.048		1.5600		0.046			
UH-2C	1.722		0.203		1.694		0.215				
TO	1.519	1.5183		0.408	1.479	1.4790		0.430			
UH-1	1.314		0.205		1.264		0.215				
		3.1953		0.456		3.0390		0.476			
UH-1	1.524		0.048		1.383		0.049				
TO	1.476	1.4763		0.095	1.334	1.3343		0.097			
TP	1.429		0.047		1.286		0.048				
		4.6717		0.551		4.3733		0.573			
TP	1.440		0.186		1.701		0.198				
TO	1.254	1.2533		0.374	1.503	1.5023		0.398			
UH-3B	1.066		0.188		1.303		0.200				
		5.9250		0.925		5.876		0.971			

Level-Out, Level Line

THREE WIRE LEVELING					THREE WIRE LEVELING				
Project:	09CQ01	Location:	Tanapag Hbr, Saipan		Observer:	D. Brashear	Recorder:	K. Baden	
Date:	6/27/2009 UTC & L	Time:	0000 UTC, 1000 Local		Rodman:	J. Herron	Instr #:	486357	
From:	Rod Stop	To:	UH-4B		Weather:	Partly Cloudy, Light Wind, Hot and Humid			
STATION	BACKSIGHT	MEAN	INTERVAL	SUM OF INT	FORESIGHT	MEAN	INTERVAL	SUM OF INT	REMARKS
UH-3B	1.526		0.063		1.487		0.074		
TO	1.463	1.4623		0.128	1.413	1.4123		0.150	
FST-TPG	1.398		0.065		1.337		0.076		
		7.3873		1.053		7.2880		1.121	
FST-TPG	1.378		0.050		1.621		0.080		
TO	1.328	1.3277		0.101	1.541	1.5410		0.160	
UH-5B	1.277		0.051		1.461		0.080		
		8.7150		1.154		8.8290		1.281	
UH-5B	1.846		0.143		1.286		0.125		
TO	1.703	1.7027		0.287	1.161	1.1603		0.252	
UH-4B	1.559		0.144		1.034		0.127		
		10.4177		1.441		9.9893		1.533	F.S. INTERVAL
								1.441	B.S. INTERVAL
B.S. MEAN	10.4177							2.974	100=TRANSIT LENGTH
-F.S. MEAN	9.9893					F DIST. (meters)		297.400	
Δ ELEVATION	0.4283	= FDE				F DIST (Km)		0.2974	
FOR FORWARD RUN		FDE =	0.4283						
		BDE =	-0.4260		A.E.	0.006543	PASS		
		EC =	0.0023						

Level-Out, Level Line

THREE WIRE LEVELING					THREE WIRE LEVELING				
Project:	09CQ01	Location:	Tanapag Hbr, Saipan		Observer:	D. Brashear	Recorder:	K. Baden	
Date:	6/27/2009 UTC & L	Time:	0000 UTC, 1000 Local		Rodman:	J. Herron	Instr #:	486357	
From:	Rod Stop	To:	UH-4B		Weather:	Partly Cloudy, Light Wind, Hot and Humid			
STATION	BACKSIGHT	MEAN	INTERVAL	SUM OF INT	FORESIGHT	MEAN	INTERVAL	SUM OF INT	REMARKS
UH-4B	1.316		0.120		1.886		0.150		
TO	1.196	1.1960		0.240	1.736	1.7360		0.300	
UH-5B	1.076		0.120		1.586		0.150		
		1.1960		0.240		1.7360		0.300	
UH-5B	1.576		0.062		1.375		0.075		
TO	1.514	1.5133		0.126	1.300	1.3000		0.150	
FST-TPG	1.450		0.064		1.225		0.075		
		2.7093		0.366		3.0360		0.450	
FST-TPG	1.476		0.070		1.526		0.070		
TO	1.406	1.4060		0.140	1.456	1.4560		0.140	
UH-3B	1.336		0.070		1.386		0.070		
		4.1153		0.506		4.4920		0.590	
UH-3B	1.687		0.191		1.440		0.194		
TO	1.496	1.4957		0.383	1.246	1.2467		0.386	
TP	1.304		0.192		1.054		0.192		
		5.6110		0.889		5.7387		0.976	

Level-Out, Level Line

THREE WIRE LEVELING					THREE WIRE LEVELING				
Project:	09CQ01	Location:	Tanapag Hbr, Saipan		Observer:	D. Brashear	Recorder:	K. Baden	
Date:	6/27/2009UTC & L	Time:	0000 UTC, 1000 Local		Rodman:	J. Herron	Instr #:	486357	
From:	Rod Stop	To:	UH-4B		Weather:	Partly Cloudy, Light Wind, Hot and Humid			
STATION	BACKSIGHT	MEAN	INTERVAL	SUM OF INT	FORESIGHT	MEAN	INTERVAL	SUM OF INT	REMARKS
TP	1.358		0.048		1.503		0.050		
TO	1.310	1.3103		0.095	1.453	1.4530		0.100	
UH-1	1.263		0.047		1.403		0.050		
		6.9213		0.984		7.1917		1.076	
UH-1	1.681		0.215		1.708		0.203		
TO	1.466	1.4660		0.430	1.505	1.5050		0.406	
UH-2C	1.251		0.215		1.302		0.203		
		8.3873		1.414		8.6967		1.482	
UH-2C	1.553		0.019		1.671		0.020		
TO	1.534	1.5343		0.037	1.651	1.6510		0.040	
Rod Stop	1.516		0.018		1.631		0.020		
		9.9217		1.451		10.3477		1.522	F.S. INTERVAL
								1.451	B.S. INTERVAL
B.S. MEAN	9.9217							2.973	100=TRANSIT LENGTH
-F.S. MEAN	10.3477							B DIST. (meters)	297.300
Δ ELEVATION	-0.4260	= BDE						B DIST (Km)	0.2973
FOR BACKWARDS RUN									

Level-Out, Level Line

ABSTRACT OF LEVELING			LEVELS					
<p>Date: 6/27/09 UTC and Local</p> <p>The symbol B.M. (a) is used here to designate the Staff Stops Elevation above the Orifice, or the graduation of the Staff corresponding to the point at which the level rod was held.</p> <p>Copy the Direct Elevation for each Bench Mark as given by the Forward and Backward runs of the levels into the form below. List the Bench Marks in Order of their Connection to the Staff on the Forward run.</p> <p>(Source: Naval Oceanographic Tide Gauge Installation Manual)</p>			DIFFERENCE OF ELEVATION					
			DESIGNATION OF SECTION	FORWARD RUN	BACKWARD RUN	MEAN		
			Meters	Meters	Meters			
			Elevation of Rod Stop above Orifice/Staff Zero (a) =			3.0000		
Rod Stop → UH-2C			0.1170	0.1167	0.1168			
UH-2C → UH-1			0.0393	0.0390	0.0392			
UH-1 → TP			0.1420	0.1427	0.1423			
TP → UH-3B			-0.2490	-0.2490	-0.2490			
UH-3B → FST-TPG			0.0500	0.0500	0.0500			
FST-TPG → UH-5B			-0.2133	-0.2133	-0.2133			
UH-5B → UH-4B			0.5423	0.5400	0.5412			
B.M. NUMBERS	FORWARD RUN	BACKWARD RUN	<p>Indicate sections as "Staff to 1," etc., with the Sign of the Forward run for the Mean.</p> <p>The Algebraic Sum of the successive Mean Differences gives the Elevations above Zero of the Tide Staff.</p> <p>(Source: Naval Oceanographic Tide Gauge Installation Manual)</p> <p>ELEVATIONS ABOVE ZERO OF THE TIDE STAFF</p>					
	Meters	Meters						
Rod Stop	3.0000	3.0000	UH-2C	3.1168	Meters	UH-3B	3.0493	Meters
UH-2C	3.1170	3.1167	UH-1	3.1560	Meters	FST-TPG	3.0993	Meters
UH-1	3.1563	3.1557	TP	3.2983	Meters	UH-5B	2.8860	Meters
TP	3.2983	3.2983			Meters	UH-4B	3.4272	Meters
UH-3B	3.0493	3.0493						
FST-TPG	3.0993	3.0993						
UH-5B	2.8860	2.8860						
UH-4B	3.4283	3.4260						

SIMULTANEOUS TIDE OBSERVATIONS						
Tide Gauge: Saipan - Tanapag Harbor 09CQ01 25 May 09 - 26 May 09 UTC						
FST Gauge vs Univ of Hawaii Gauge				FST Tide Staff vs FST Gauge		
Average Difference:		0.431 M		Average Difference:		-0.014 M
Standard Deviation:		0.011 M		Standard Deviation:		0.01 M
Note: Measured and Observed Tide units are in Meters						
<u>Tabulated Data</u>						
UTC Time	FST Tide Staff Observed By	FST Tide Staff Observed	Univ of Hawaii Gauge	FST Gauge	Univ of Hawaii Minus FST Gauge	FST Tide Staff Minus FST Gauge
23:00	JB	1.834	2.289	1.875	0.414	-0.041
23:06	JB	1.827	2.302	1.865	0.437	-0.038
23:12	JB	1.824	2.275	1.843	0.432	-0.019
23:18	JB	1.815	2.277	1.854	0.423	-0.039
23:24	JB	1.802	2.228	1.823	0.405	-0.021
23:30	JB	1.785	2.227	1.809	0.418	-0.024
23:36	JB	1.774	2.236	1.785	0.451	-0.011
23:42	JB	1.762	2.188	1.790	0.398	-0.028
23:48	JB	1.748	2.191	1.764	0.427	-0.016
23:54	JB	1.734	2.173	1.739	0.434	-0.005
00:00	JB	1.715	2.157	1.715	0.442	0.000
00:06	CAB	1.705	2.139	1.713	0.426	-0.008
00:12	CAB	1.665	2.098	1.691	0.407	-0.026
00:18	CAB	1.648	2.086	1.673	0.413	-0.025
00:24	CAB	1.627	2.091	1.660	0.431	-0.033
00:30	CAB	1.619	2.059	1.637	0.422	-0.018
00:36	CAB	1.595	2.034	1.616	0.418	-0.021
00:42	CAB	1.587	2.010	1.589	0.421	-0.002
00:48	CAB	1.548	1.985	1.569	0.416	-0.021
00:54	CAB	1.540	1.978	1.562	0.416	-0.022
01:00	CAB	1.513	1.964	1.539	0.425	-0.026
01:06	CAB	1.489	1.932	1.525	0.407	-0.036
01:12	CAB	1.467	1.922	1.493	0.429	-0.026
01:18	CAB	1.462	1.913	1.465	0.448	-0.003
01:24	CAB	1.437	1.883	1.450	0.433	-0.013
01:30	CAB	1.415	1.852	1.428	0.424	-0.013
01:36	CAB	1.401	1.845	1.408	0.437	-0.007
01:42	CAB	1.378	1.814	1.383	0.431	-0.005
01:48	CAB	1.353	1.805	1.369	0.436	-0.016
01:54	CAB	1.327	1.774	1.349	0.425	-0.022
02:00	CAB	1.311	1.762	1.327	0.435	-0.016
02:06	JB	1.305	1.742	1.310	0.432	-0.005
02:12	JB	1.285	1.721	1.291	0.430	-0.006
02:18	JB	1.273	1.716	1.280	0.436	-0.007
02:24	JB	1.258	1.695	1.256	0.439	0.002
02:30	JB	1.230	1.666	1.243	0.423	-0.013
02:36	JB	1.215	1.653	1.230	0.423	-0.015

Continued from previous page

SIMULTANEOUS TIDE OBSERVATIONS						
Tide Gauge: Saipan - Tanapag Harbor 09CQ01 25 May 09 - 26 May 09 UTC						
FST Gauge vs Univ of Hawaii Gauge			FST Tide Staff vs FST Gauge			
Average Difference:		0.438 M	Average Difference:		-0.007 M	
Standard Deviation:		0.004 M	Standard Deviation:		0.005 M	
Note: Measured and Observed Tide units are in Meters						
Tabulated Data						
UTC Time	FST Tide Staff Observed By	FST Tide Staff Observed	Univ of Hawaii Gauge	FST Gauge	Univ of Hawaii Minus FST Gauge	FST Tide Staff Minus FST Gauge
02:42	JB	1.198	1.644	1.206	0.438	-0.008
02:48	JB	1.179	1.625	1.191	0.434	-0.012
02:54	JB	1.168	1.617	1.182	0.435	-0.014
03:00	JB	1.155	1.604	1.164	0.44	-0.009
03:06	JB	1.14	1.589	1.153	0.436	-0.013
03:12	CAB	1.124	1.568	1.138	0.43	-0.014
03:18	CAB	1.117	1.564	1.127	0.437	-0.010
03:24	CAB	1.102	1.551	1.110	0.441	-0.008
03:30	CAB	1.097	1.543	1.102	0.441	-0.005
03:36	CAB	1.081	1.529	1.088	0.441	-0.007
03:42	CAB	1.073	1.520	1.082	0.438	-0.009
03:48	CAB	1.059	1.505	1.067	0.438	-0.008
03:54	CAB	1.054	1.501	1.059	0.442	-0.005
04:00	CAB	1.040	1.485	1.055	0.430	-0.015
04:06	CAB	1.037	1.480	1.043	0.437	-0.006
04:12	CAB	1.028	1.467	1.035	0.432	-0.007
04:18	CAB	1.015	1.458	1.023	0.435	-0.008
04:24	CAB	1.002	1.450	1.020	0.430	-0.018
04:30	CAB	1.003	1.445	1.004	0.441	-0.001
04:36	CAB	0.992	1.437	0.992	0.445	0.000
04:42	CAB	0.987	1.435	0.996	0.439	-0.009
04:48	CAB	0.979	1.423	0.982	0.441	-0.003
04:54	CAB	0.972	1.418	0.977	0.441	-0.005
05:00	CAB	0.971	1.418	0.977	0.441	-0.006

See Figure F-1 on Page F-39 for the Comparison Graph of this data.

SIMULTANEOUS TIDE OBSERVATIONS						
Tide Gauge: Saipan - Tanapag Harbor 09CQ01 10 Jun 09 - 11 Jun 09 UTC						
FST Gauge vs Univ of Hawaii Gauge				FST Tide Staff vs FST Gauge		
Average Difference:		0.445 M		Average Difference:		0.001 M
Standard Deviation:		0.005 M		Standard Deviation:		0.007 M
Note: Measured and Observed Tide units are in Meters						
<u>Tabulated Data</u>						
UTC Time	FST Tide Staff Observed By	FST Tide Staff Observed	Univ of Hawaii Gauge	FST Gauge	Univ of Hawaii Minus FST Gauge	FST Tide Staff Minus FST Gauge
22:42	BS	1.820	2.259	1.818	0.441	0.002
22:48	BS	1.810	2.255	1.812	0.443	-0.002
22:54	BS	1.810	2.257	1.817	0.440	-0.007
23:00	BS	1.810	2.244	1.807	0.437	0.003
23:06	BS	1.820	2.253	1.813	0.440	0.007
23:12	BS	1.820	2.260	1.809	0.451	0.011
23:18	BS	1.810	2.253	1.811	0.442	-0.001
23:24	BS	1.810	2.258	1.813	0.445	-0.003
23:30	BS	1.810	2.249	1.806	0.443	0.004
23:36	BS	1.800	2.244	1.800	0.444	0.000
23:42	BS	1.800	2.231	1.792	0.439	0.008
23:48	BS	1.800	2.244	1.792	0.452	0.008
23:54	BS	1.790	2.225	1.785	0.440	0.005
00:00	BS	1.770	2.230	1.785	0.445	-0.015
00:06	BS	1.770	2.216	1.767	0.449	0.003
00:12	BS	1.760	2.202	1.761	0.441	-0.001
00:18	BS	1.750	2.204	1.752	0.452	-0.002
00:24	BS	1.750	2.188	1.743	0.445	0.007
00:30	BS	1.750	2.202	1.748	0.454	0.002
00:36	BS	1.740	2.182	1.738	0.444	0.002
00:42	BS	1.720	2.161	1.720	0.441	0.000
00:48	BS	1.710	2.156	1.707	0.449	0.003
00:54	BS	1.700	2.146	1.697	0.449	0.003
01:00	BS	1.690	2.138	1.685	0.453	0.005
01:06	BS	1.680	2.123	1.676	0.447	0.004
01:12	BS	1.670	2.110	1.661	0.449	0.009
01:18	BS	1.650	2.105	1.662	0.443	-0.012
01:24	BS	1.640	2.086	1.643	0.443	-0.003
01:30	BS	1.620	2.067	1.638	0.429	-0.018
01:36	BS	1.610	2.057	1.607	0.450	0.003
01:42	BS	1.600	2.037	1.595	0.442	0.005

See Figure F-2 on Page F-39 for the Comparison Graph of this data.

SIMULTANEOUS TIDE OBSERVATIONS						
Tide Gauge: Saipan - Tanapag Harbor 09CQ01 16 Jun 09 - 17 Jun 09 UTC						
FST Gauge vs Univ of Hawaii Gauge			FST Tide Staff vs FST Gauge			
Average Difference:		0.474 M	Average Difference:		0.028 M	
Standard Deviation:		0.004 M	Standard Deviation:		0.005 M	
Note: Measured and Observed Tide units are in Meters						
<u>Tabulated Data</u>						
UTC Time	FST Tide Staff Observed By	FST Tide Staff Observed	Univ of Hawaii Gauge	FST Gauge	Univ of Hawaii Minus FST Gauge	FST Tide Staff Minus FST Gauge
22:48	BS	1.480	1.926	1.453	0.473	0.027
22:54	BS	1.480	1.930	1.451	0.479	0.029
23:00	BS	1.490	1.935	1.458	0.477	0.032
23:06	BS	1.490	1.931	1.457	0.474	0.033
23:12	BS	1.480	1.931	1.457	0.474	0.023
23:18	BS	1.480	1.922	1.456	0.466	0.024
23:24	BS	1.480	1.935	1.459	0.476	0.021
23:30	BS	1.490	1.933	1.459	0.474	0.031
23:36	BS	1.490	1.933	1.461	0.472	0.029
23:42	BS	1.500	1.941	1.471	0.470	0.029
23:48	BS	1.500	1.943	1.468	0.475	0.032
23:54	BS	1.500	1.951	1.477	0.474	0.023
00:00	BS	1.500	1.947	1.475	0.472	0.025
00:06	BS	1.500	1.954	1.480	0.474	0.020
00:12	BS	1.510	1.957	1.483	0.474	0.027
00:18	BS	1.520	1.960	1.487	0.473	0.033
00:24	BS	1.520	1.963	1.491	0.472	0.029
00:30	BS	1.520	1.972	1.497	0.475	0.023
00:36	BS	1.530	1.971	1.495	0.476	0.035
00:42	BS	1.530	1.972	1.505	0.467	0.025
00:48	BS	1.530	1.983	1.507	0.476	0.023
00:54	BS	1.540	1.981	1.509	0.472	0.031
01:00	BS	1.540	1.994	1.517	0.477	0.023
01:06	BS	1.550	1.997	1.522	0.475	0.028
01:12	BS	1.560	2.005	1.528	0.477	0.032
01:18	BS	1.560	2.023	1.545	0.478	0.015
01:24	BS	1.570	2.019	1.546	0.473	0.024
01:30	BS	1.580	2.034	1.558	0.476	0.022
01:36	BS	1.590	2.035	1.555	0.480	0.035
01:42	BS	1.600	2.048	1.564	0.484	0.036
01:48	BS	1.600	2.044	1.573	0.471	0.027
01:54	BS	1.620	2.058	1.586	0.472	0.034
02:00	BS	1.620	2.063	1.590	0.473	0.030

See Figure F-4 on Page F-40 for the Comparison Graph of this data.

SIMULTANEOUS TIDE OBSERVATIONS						
Tide Gauge: Saipan - Tanapag Harbor 09CQ01 24 Jun 09 - 25 Jun 09 UTC						
FST Gauge vs Univ of Hawaii Gauge				FST Tide Staff vs FST Gauge		
Average Difference:	0.499 M			Average Difference:	0.049 M	
Standard Deviation:	0.007 M			Standard Deviation:	0.009 M	
Note: Measured and Observed Tide units are in Meters						
<u>Tabulated Data</u>						
UTC Time	FST Tide Staff Observed By	FST Tide Staff Observed	Univ of Hawaii Gauge	FST Gauge	Univ of Hawaii Gauge Minus FST Gauge	FST Tide Staff Minus FST Gauge
21:54	BS	2.030	2.479	1.986	0.493	0.044
22:00	BS	2.030	2.482	1.992	0.490	0.038
22:06	BS	2.030	2.485	1.995	0.490	0.035
22:12	BS	2.040	2.486	1.999	0.487	0.041
22:18	BS	2.040	2.488	1.993	0.495	0.047
22:24	BS	2.030	2.488	1.995	0.493	0.035
22:30	BS	2.040	2.479	1.994	0.485	0.046
22:36	BS	2.030	2.482	1.985	0.497	0.045
22:42	BS	2.040	2.495	1.999	0.496	0.041
22:48	BS	2.030	2.493	1.997	0.496	0.033
22:54	BS	2.030	2.479	1.985	0.494	0.045
23:00	BS	2.040	2.477	1.977	0.500	0.063
23:06	BS	2.030	2.489	1.999	0.490	0.031
23:12	BS	2.030	2.472	1.978	0.494	0.052
23:18	BS	2.020	2.460	1.972	0.488	0.048
23:24	BS	2.010	2.457	1.963	0.494	0.047
23:30	BS	1.980	2.436	1.944	0.492	0.036
23:36	BS	1.990	2.444	1.947	0.497	0.043
23:42	BS	1.980	2.436	1.948	0.488	0.032
23:48	BS	1.970	2.421	1.930	0.491	0.040
23:54	BS	1.960	2.407	1.908	0.499	0.052
00:00	BS	1.950	2.397	1.905	0.492	0.045
00:06	BS	1.940	2.379	1.888	0.491	0.052
00:12	BS	1.930	2.370	1.875	0.495	0.055
00:18	BS	1.910	2.358	1.863	0.495	0.047
00:24	BS	1.890	2.339	1.843	0.496	0.047
00:30	BS	1.880	2.320	1.819	0.501	0.061
00:36	BS	1.850	2.313	1.814	0.499	0.036
00:42	BS	1.830	2.286	1.796	0.490	0.034
00:48	BS	1.820	2.271	1.773	0.498	0.047
00:54	BS	1.800	2.258	1.754	0.504	0.046
01:00	BS	1.780	2.229	1.738	0.491	0.042
01:06	BS	1.760	2.218	1.717	0.501	0.043
01:12	BS	1.750	2.202	1.706	0.496	0.044
01:18	BS	1.730	2.186	1.689	0.497	0.041
01:24	BS	1.710	2.171	1.670	0.501	0.040

Continued from previous page

SIMULTANEOUS TIDE OBSERVATIONS						
Tide Gauge: Saipan - Tanapag Harbor 09CQ01 24 Jun 09 - 25 Jun 09 UTC						
FST Gauge vs Univ of Hawaii Gauge				FST Tide Staff vs FST Gauge		
Average Difference:	0.509 M			Average Difference:	0.057 M	
Standard Deviation:	0.002 M			Standard Deviation:	0.006 M	
Note: Measured and Observed Tide units are in Meters						
Tabulated Data						
UTC Time	FST Tide Staff Observed By	FST Tide Staff Observed	Univ of Hawaii Gauge	FST Gauge	Univ of Hawaii Gauge Minus	FST Tide Staff Minus FST Gauge
01:30	BS	1.700	2.149	1.650	0.499	0.050
01:36	BS	1.670	2.126	1.625	0.501	0.045
01:42	BS	1.650	2.105	1.600	0.505	0.050
01:48	BS	1.640	2.085	1.585	0.500	0.055
01:54	BS	1.610	2.067	1.563	0.504	0.047
02:00	BS	1.590	2.040	1.540	0.500	0.050
02:06	BS	1.570	2.026	1.519	0.507	0.051
02:12	BS	1.550	2.000	1.501	0.499	0.049
02:18	BS	1.530	1.986	1.479	0.507	0.051
02:24	BS	1.510	1.964	1.455	0.509	0.055
02:30	BS	1.490	1.952	1.440	0.512	0.050
02:36	BS	1.480	1.936	1.428	0.508	0.052
02:42	BS	1.460	1.911	1.401	0.510	0.059
02:48	BS	1.440	1.894	1.382	0.512	0.058
02:54	BS	1.410	1.865	1.356	0.509	0.054
03:00	BS	1.400	1.841	1.333	0.508	0.067
03:06	BS	1.380	1.831	1.319	0.512	0.061
03:12	BS	1.360	1.806	1.300	0.506	0.060
03:18	BS	1.340	1.791	1.279	0.512	0.061
03:24	BS	1.320	1.773	1.268	0.505	0.052
03:30	BS	1.300	1.755	1.247	0.508	0.053
03:36	BS	1.290	1.731	1.225	0.506	0.065
03:42	BS	1.270	1.716	1.205	0.511	0.065
03:48	BS	1.240	1.703	1.193	0.510	0.047
03:54	BS	1.220	1.676	1.170	0.506	0.050
04:00	BS	1.220	1.671	1.159	0.512	0.061
04:06	BS	1.200	1.653	1.142	0.511	0.058
04:12	BS	1.190	1.635	1.124	0.511	0.066
04:18	BS	1.170	1.630	1.119	0.511	0.051

See Figure F-5 on Page F-41 for the Comparison Graph of this data.

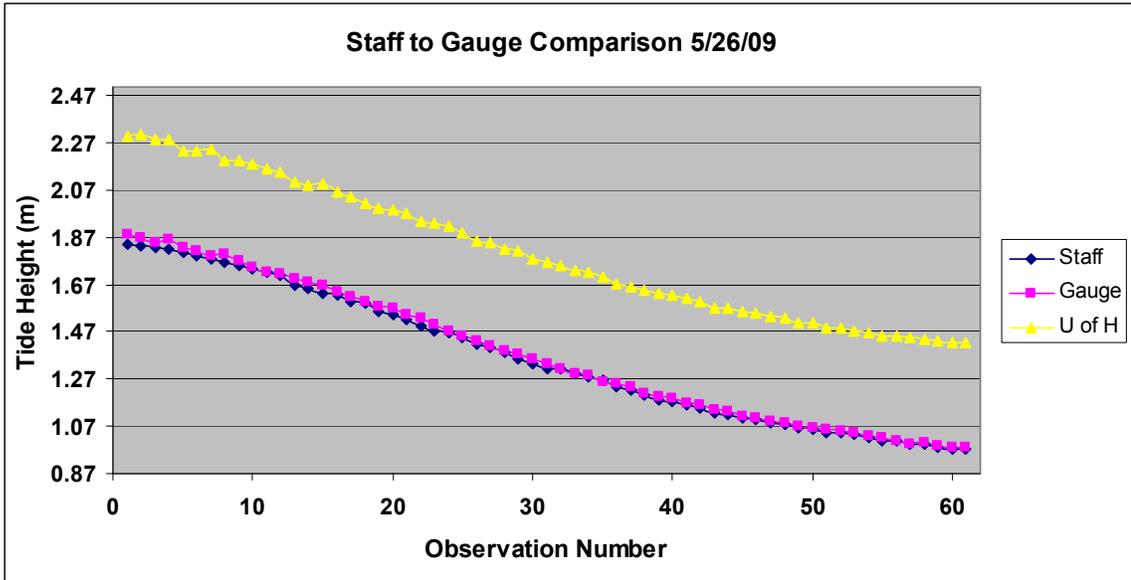


Figure F-1: Graphic representation of Simultaneous Tide Observations made on 5/26/09.

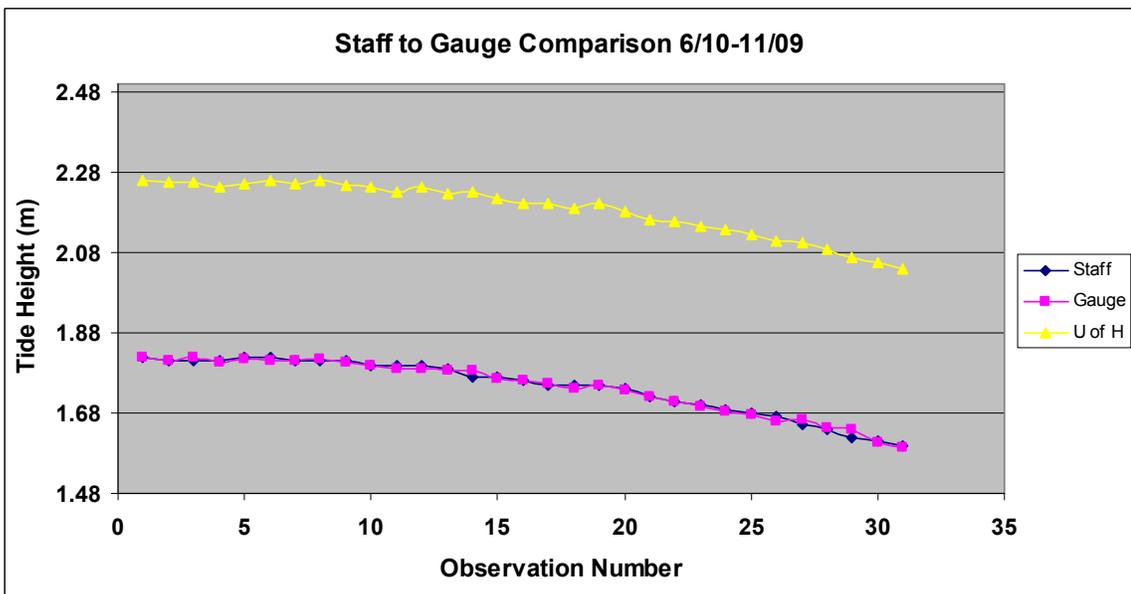


Figure F-2: Graphic representation of Simultaneous Tide Observations made on 6/10/09 and 6/11/09.

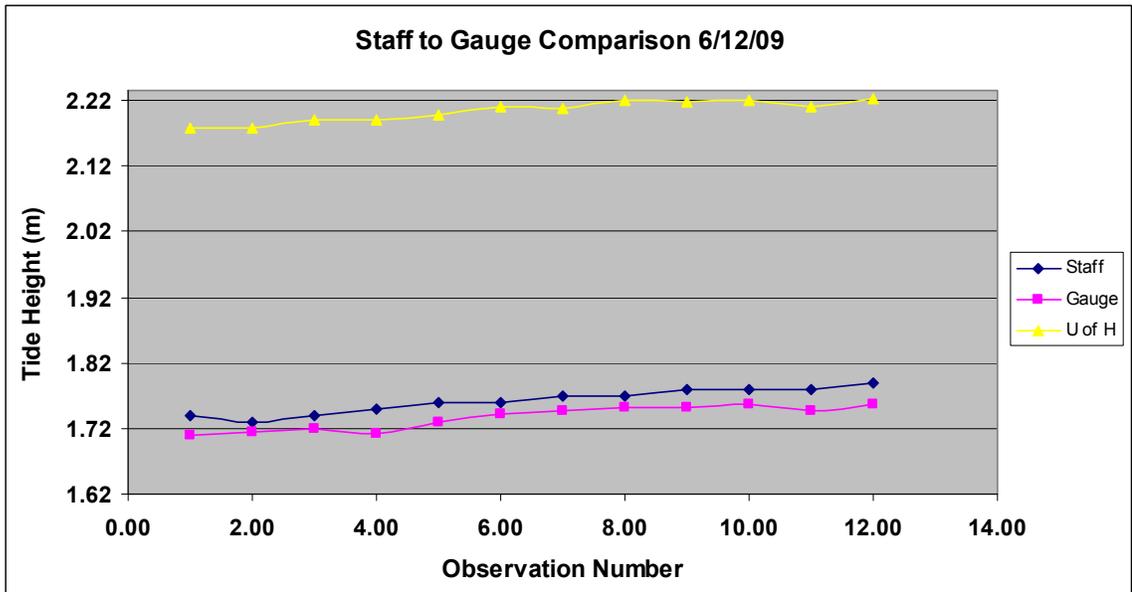


Figure F-3: Graphic representation of Simultaneous Tide Observations made on 6/12/09.

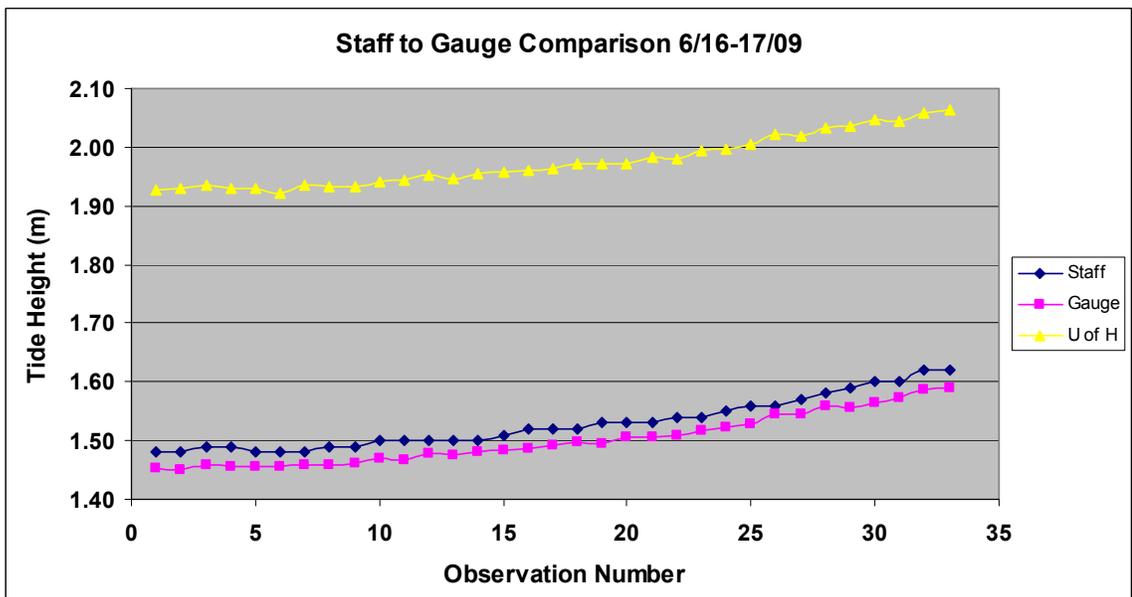


Figure F-4: Graphic representation of Simultaneous Tide Observations made on 6/16/09 and 6/17/09.

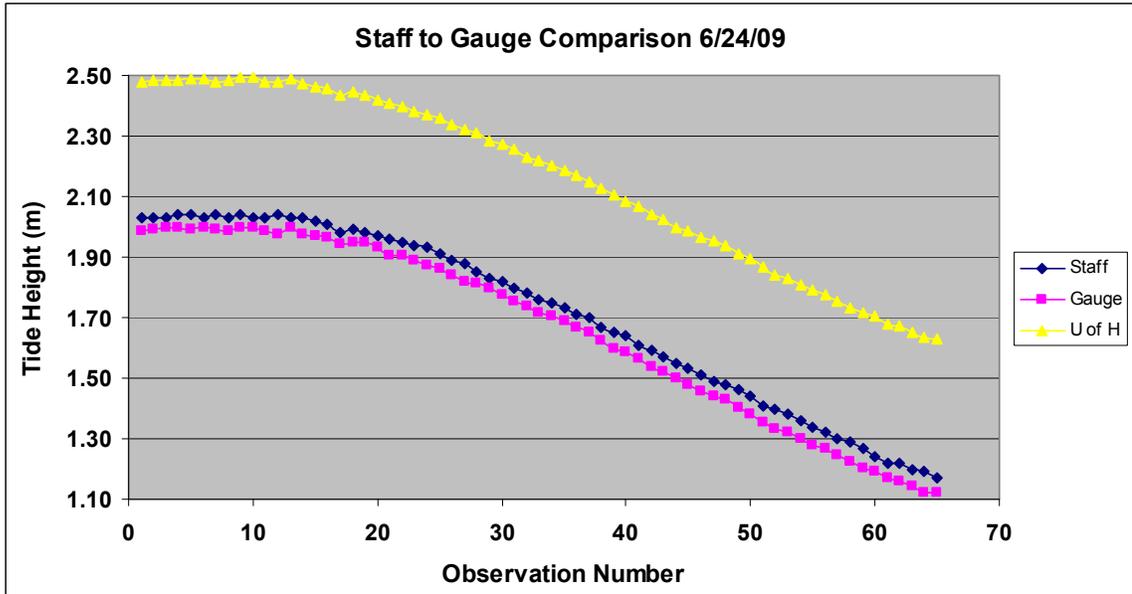


Figure F-5: Graphic representation of Simultaneous Tide Observations made on 6/24/09 and 6/25/09.

RECOVERY OF MEAN LOWER LOW WATER AT TANAPAG HARBOR, SAIPAN, CNMI

1. Introduction. This report describes how Mean Lower Low Water (MLLW) was recovered for reduction of sounding data at Tanapag Harbor, Saipan, CNMI. In recent years, NAVO has recovered and utilized this datum for sonar testing aboard the USNS BOWDITCH, USNS SUMNER, and USNS PATHFINDER, as well as the FST harbor survey in May – June 2009. MLLW was established at Tanapag Harbor by NOAA surveyors and tide analysts in 2001. POC for this report is Billy Mehaffey, commercial phone number (228) 688-4113, e-mail address billy.mehaffey@navy.mil.

2. Existing Information. Historical information on MLLW at Saipan (NOAA Station Number 1633227) was obtained from the NOAA Tides and Currents website,

<http://tidesandcurrents.noaa.gov/benchmarks/1633227.html>

The website provides a record of the origin of the datum:

Tidal datums at TANAPAG HARBOR, SAIPAN, N MARIANAS IS based on:

LENGTH OF SERIES: 5 Months
TIME PERIOD: October 2000 - February 2001
TIDAL EPOCH: 1983-2001
CONTROL TIDE STATION: 1630000 GUAM, APRA HARBOR

The website also lists the heights of seven different tidal bench marks above MLLW at Tanapag Harbor:

Bench Mark Elevation Information	In METERS above:	
	MLLW	MHW
Stamping or Designation		
163 3227 UH-2C	2.049	1.420
163 3227 CPA-1	2.347	1.718
163 3227 CPA-2	2.595	1.966
163 3227 UH-1	2.096	1.467
163 3227 UH-3B	1.984	1.355
163 3227 UH-4B	2.365	1.736
163 3227 UH-5B	1.828	1.199

Descriptions of each of these tidal bench marks for use in their recovery are also provided:

PRIMARY BENCH MARK STAMPING:
DESIGNATION: 163 3227 **UH-2C**

MONUMENTATION: Bolt VM#: 16316
AGENCY: University of Hawaii (UH) PID:
SETTING CLASSIFICATION: Concrete deck

The primary bench mark is a 9/16" SS hex head bolt set in the concrete deck

where the east face of Delta Dock (Delta -3) meets the east face of the parking lot (CPA-2) fronting the port building, located at the Commonwealth Port Authority (CPA) facility in Saipan Harbor (aka Tanapag Harbor), 2.83 m (9.3 ft) SSE of the SE corner of a diesel containment wall, 2.56 m (8.4 ft) NNE of utility pole #7, and 1.13 m (3.7 ft) west of the east pier face (CPA-2).

BENCH MARK STAMPING:

DESIGNATION: 163 3227 **CPA-1**

MONUMENTATION: Bench Mark disk VM#: 16317
AGENCY: US Geological Survey (USGS) PID:
SETTING CLASSIFICATION: Concrete deck

The bench mark is a disk set flush in the concrete deck in the extreme NW corner of the port, located at the Commonwealth Port Authority (CPA) facility in Saipan Harbor (aka Tanapag Harbor), 70.01 m (229.7 ft) north of the south end of Able Dock, 0.58 m (1.9 ft) south from the north edge of Baker Dock, and 0.55 m (1.8 ft) east of the west edge of Able Dock.

BENCH MARK STAMPING:

DESIGNATION: 163 3227 **CPA-2**

MONUMENTATION: Bench Mark disk VM#: 16318
AGENCY: US Geological Survey (USGS) PID:
SETTING CLASSIFICATION: Concrete bull rail

The bench mark is a disk set flush in the concrete bull rail in the extreme WSW corner of the port, located at the Commonwealth Port Authority (CPA) facility in Saipan Harbor (aka Tanapag Harbor), 70.01 m (229.7 ft) south of the north edge of Baker Dock, 1.60 m (5.2 ft) east of the west end of bull rail, 0.19 m (0.6 ft) north of the south end of bull rail, and 0.33 m (1.1 ft) above the pier deck.

BENCH MARK STAMPING:

DESIGNATION: 163 3227 **UH-1**

MONUMENTATION: Bolt VM#: 16319
AGENCY: University of Hawaii (UH) PID:
SETTING CLASSIFICATION: Concrete deck

The bench mark is a bolt embedded in the NE corner of Delta Dock, located at the Commonwealth Port Authority (CPA) facility in Saipan Harbor (aka Tanapag Harbor), 18.71 m (61.4 ft) east of the NW corner Delta Dock, 0.47 m (1.5 ft) west of the east pier face (Delta-3) of Delta Dock, and 0.42 m (1.4 ft) south of the north pier face (Delta-2) of Delta Dock.

BENCH MARK STAMPING:

DESIGNATION: 163 3227 **UH-3B**

MONUMENTATION: Bolt VM#: 16320
AGENCY: University of Hawaii (UH) PID:
SETTING CLASSIFICATION: Concrete deck

The bench mark is a 1/4" SS square headed pin marker set in the concrete deck, located at the Commonwealth Port Authority (CPA) facility in Saipan

Harbor (aka Tanapag Harbor), below the Mobile Gas sign, near the SW corner of Delta Deck, where the west face of Delta Dock (Delta-1) meets the north face of the parking lot (CPA-1) fronting the port building.

BENCH MARK STAMPING:

DESIGNATION: 163 3227 UH-4B

MONUMENTATION: Bolt VM#: 16321
 AGENCY: University of Hawaii (UH) PID:
 SETTING CLASSIFICATION: Concrete foundation for flagpole

The bench mark is a 9/16" SS hex head bolt set in the flag pole base north of the port building, located at the Commonwealth Port Authority (CPA) facility in Saipan Harbor (aka Tanapag Harbor), 46.53 m (152.7 ft) west of the east pier face (CPA-2), 42.21 m (138.5 ft) south of the north pier face (CPA-1), and 0.67 m (2.2 ft) north of the center flag pole.

BENCH MARK STAMPING:

DESIGNATION: 163 3227 UH-5B

MONUMENTATION: Bolt VM#: 16322
 AGENCY: University of Hawaii (UH) PID:
 SETTING CLASSIFICATION: Concrete deck

The bench mark is a 1-1/4" SS square headed pin marker set in the concrete deck near the SE corner of Charlie Dock where the east face of Charlie Dock (Charlie-2) meets the north face of the parking lot (CPA-1) fronting the port building, located at the Commonwealth Port Authority (CPA) facility in Saipan Harbor (aka Tanapag Harbor), 20.56 m (67.5 ft) south of the SE most large bollard on Charlie dock, 5.35 m (17.6 ft) north of Charlie-2 and CPA-1 corner, and 0.19 m (0.6 ft) west of the east face (Charlie-2) of Charlie Dock.

3. Tide Staff Installation. A tide staff was installed to support NAVO surveys in January 2009 by NAVO personnel stationed aboard USNS SUMNER. The tide staff was located adjacent to the University of Hawaii tide staff, and was less than a meter away from primary bench mark UH-2C. A rod stop was installed on the staff at a point 3.000 meters above the level of staff zero. On 19 January 2009, a differential level line meeting FGCC Third Order Specifications was run by NAVO Code NP432 personnel from the rod stop to tidal bench marks UH-2C, UH-3B, UH-4B, and UH-5B. The published heights of the bench marks above MLLW were subtracted from the leveled heights above staff zero to compute the height of MLLW above staff zero. The results of this level line were as follows:

Tidal Bench Mark	Height Above Staff Zero (m)	Height Above MLLW (m)	Height of MLLW Above Staff Zero (m)
UH-2C	3.117	2.049	1.068
UH-3B	3.051	1.984	1.067
UH-4B	3.431	2.365	1.066
UH-5B	2.888	1.828	1.060

A mean height of MLLW above staff zero was computed from the values computed relative to tidal bench marks UH-2C, UH-3B, and UH-4B. The value for MLLW computed from TBM UH-5B did not appear to be consistent with the other values, and so was excluded from the mean. This discrepancy should be investigated further. The resultant height of MLLW above the level of staff zero was computed to be 1.067 meters. The tide staff was secured to the pier with ½” anchor bolts epoxied in place, with removable nuts allowing the staff to be reused as needed. The hefty anchor bolts ensured the vertical stability of the staff, as was shown in subsequent level runs.

4. FST Tide Gauge Installation. On 23 May 2009, FST surveyors installed their tide gauge on the existing staff. They ran a differential level line to TBMs UH-1, UH-3B, UH-4B, and UH-5B. The results of this level line were as follows:

Tidal Bench Mark	Height Above Staff Zero (m)	Height Above MLLW (m)	Height of MLLW Above Staff Zero (m)
UH-1	3.156	2.096	1.060
UH-3B	3.050	1.984	1.066
UH-4B	3.431	2.365	1.066
UH-5B	2.888	1.828	1.060

The FST surveyors ran a second differential level line on 27-28 May 2009. The results of this level line were as follows:

Tidal Bench Mark	Height Above Staff Zero (m)	Height Above MLLW (m)	Height of MLLW Above Staff Zero (m)
UH-1	3.154	2.096	1.058
UH-2C	3.116	2.049	1.067
UH-3B	3.048	1.984	1.064
UH-4B	3.429	2.365	1.064
UH-5B	2.888	1.828	1.060

These results were similar to the January results. Note the consistent value for MLLW obtained from TBM UH-5B, which is matched by the MLLW value obtained from TBM UH-1.

5. USNS PATHFINDER Tide Gauge Installation. NAVO Code NP432 personnel assigned to USNS SUMNER attached a tide gauge to the existing staff on 17 July 2009 in support of multibeam sonar testing. On 28 July a differential level line was run from the rod stop to TBMs UH-2C, UH-3B, and UH-4B. The results of this level line were as follows:

Tidal Bench Mark	Height Above Staff Zero (m)	Height Above MLLW (m)	Height of MLLW Above Staff Zero (m)
UH-2C	3.117	2.049	1.068
UH-3B	3.051	1.984	1.067
UH-4B	3.431	2.365	1.066
UH-5B	Not Observed		

The results were identical to the January results. A mean height of MLLW above staff zero equal to 1.067 meters was computed.

6. Tidal Data Reduction. Upon completion of their survey, the FST surveyors submitted their observed tide data to NAVO Code NP432 for reduction to the level of chart datum, MLLW. Based upon the consistency of the level line results achieved by Code NP432 personnel, the height of MLLW above staff zero equal to 1.067 meters was applied to the observed tide data by the following:

$$\textit{Observed tide reading} - 1.067 \textit{ m} = \textit{Height of observed tide above MLLW}$$

It should be noted that the Code NP432 personnel employed a Topcon DL-101C digital level (SN UG0402) with a bar code level rod during each of their level runs.

7. FST Tide Gauge Drift. Code NP432 was not provided with visual staff readings with the observed tide data. As such, we are unable to offer any insight into any tide gauge drift compensation that may have been applied to the data by FST personnel.

09CQ01

Tanapag Harbor, Saipan

Appendix G:

Vessel Setup and Calibration

UNCLASSIFIED

DISTRIBUTION STATEMENT A:

**APPROVED FOR PUBLIC RELEASE
DISTRIBUTION UNLIMITED**

VESSEL OFFSETS			
Field Unit: FST Vessel, Swamp Fox (fst001)			
Offset Reference Point (0,0,0):		IMU	
Offset Calculation Method:		Manual with Tape Measure	
<u>Tabulated Data</u>			
Position	Offset		
	X	Y	Z
POSMV Configuration	+ forward	+ starboard	+ down
Ref. to IMU Lever Arm	0.000	0.000	0.000
Ref. to Primary (Port) GPS Lever Arm	-0.153	-1.069	-2.681
Ref. to Aux. 1 GPS Lever Arm	-0.153	-0.063	-2.689
Vessel Configuration - Caris	+ starboard	+ forward	+ down
Transducer Acoustic Center	-1.722	-0.615	1.095
Note: All distance units are in meters (m).			
<u>Graphic</u>			

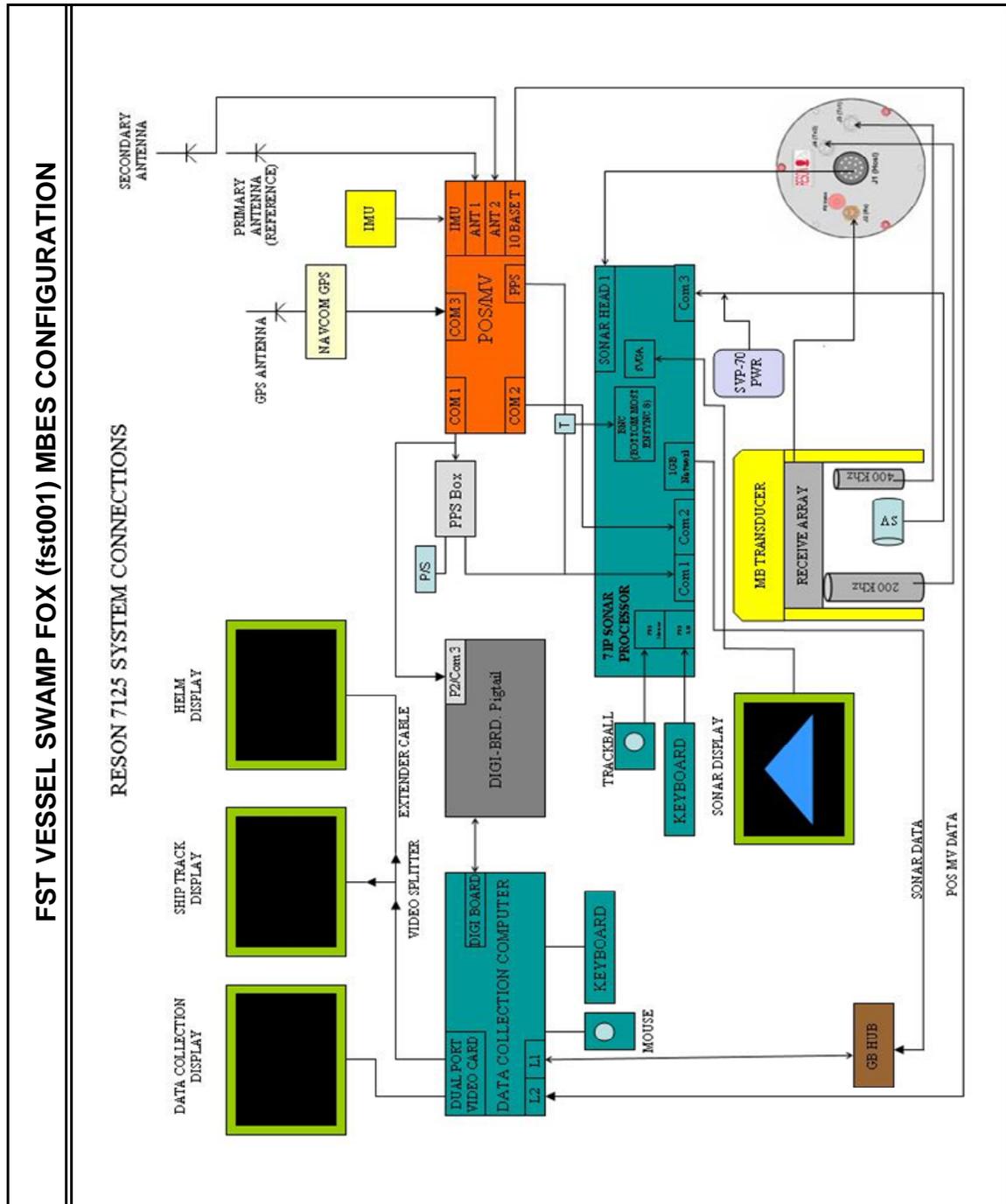
PATCH TEST ANALYSIS #1, 13 JUNE 2009							
Field Unit:		FST Vessel, Swamp Fox					
Software Used:		Caris HIPS & SIPS version 6.1					
Patch Test Conducted By:				Jessica Burt, HIC/UI			
Patch Test Reviewed By:				Charles A. Baptiste, HIC			
<u>Latency</u>							
Line		Speed	Heading	Calibration Offsets		Average	Standard
Set	File	(KTS)	(Deg)	(Seconds)			Deviation
1-1	000_A0210	3.0	105	-0.15	---	-0.2	0.07
1-2	000_0251	7.0	105				
2-1	000_0240	3.0	285	-0.25	---		
2-2	000_0306	7.0	285				
<u>Pitch</u>							
Line		Speed	Heading	Calibration Offsets		Average	Standard
Set	File	(KTS)	(Deg)	(Degrees)			Deviation
1-1	000_0220	3.0	285	1.4	1.0	1.10	0.20
1-2	000_0230	3.0	105				
2-1	000_A0210	3.0	105	1.0	1.0		
2-2	000_0220	3.0	285				
<u>Roll</u>							
Line		Speed	Heading	Calibration Offsets		Average	Standard
Set	File	(KTS)	(Deg)	(Degrees)			Deviation
1-1	000_0255	7.0	285	-1.35	-1.33	-1.34	0.01
1-2	000_0301	7.0	105				
2-1	000_0230	3.0	105	-1.33	-1.33		
2-2	000_0240	3.0	285				
<u>Yaw</u>							
Line		Speed	Heading	Calibration Offsets		Average	Standard
Set	File	(KTS)	(Deg)	(Degrees)			Deviation
1-1	yaw6	5.0	45	-0.5	---	-0.50	---
1-2	yaw9	5.5	225				

Note: Average values calculated on this worksheet do not exactly match values entered into the vessel configuration file. Values entered into the vessel configuration file are based on more samples (not all of which were recorded) and a weighted mean.

PATCH TEST #2, 16 JUNE 2009							
Field Unit:		FST Vessel, Swamp Fox					
Software Used:		Caris HIPS & SIPS version 6.1					
Patch Test Conducted By:		Jessica Burt, HIC/UI					
Patch Test Reviewed By:		Charles A. Baptiste, HIC					
<u>Latency</u>							
Line		Speed	Heading	Calibration Offsets		Average	Standard
Set	File	(KTS)	(Deg)	(Seconds)			Deviation
1-1	Pit_Roll	7.0	306	0	-0.1	-0.05	0.06
1-2	Pit_RollC	3.5	306				
2-1	Pit_RollB	6.5	126	0	-0.1		
2-2	Pit_RollD	3.1	126				
3-1	Pit_RollA	6.5	126	---	---		
3-2	Pit_RollID	3.1	126				
<u>Pitch</u>							
Line		Speed	Heading	Calibration Offsets		Average	Standard
Set	File	(KTS)	(Deg)	(Degrees)			Deviation
1-1	Pit_RollC	3.5	306	0	---	0.00	0.00
1-2	Pit_RollD	3.1	126				
2-1	Pit_Roll	7	306	0	---		
2-2	Pit_RollA	6.5	126				
<u>Roll</u>							
Line		Speed	Heading	Calibration Offsets		Average	Standard
Set	File	(KTS)	(Deg)	(Degrees)			Deviation
1-1	yaw1B	5.5	225	-1.36	-1.34	-1.35	0.01
1-2	yaw1D	5.5	45				
<u>Yaw</u>							
Line		Speed	Heading	Calibration Offsets		Average	Standard
Set	File	(KTS)	(Deg)	(Degrees)			Deviation
1-1	Yaw1	5.9	225	0.5	---	0.50	0.00
1-2	Yaw3	5.8	45				
2-1	Yaw1a	5.8	225	0.5	---		
2-2	Yaw3a	5.6	45				

Note: A second patch test was conducted after settings were changed to reduce the latency issue. Results from Patch Test #1 were taken into consideration when deciding what values to use in the vessel configuration file for the pitch, roll, and yaw offsets.

DYNAMIC DRAFT DATA							
Field Unit:		FST Vessel, Swamp Fox					
Tabulated Data							
Vessel Speed		Level	Tide	Corrected	Difference of Levels	Avg. Vessel Speed	
kts	m/s	Reading	Reading	Level		m/s	Level
0.0	0.000	3.30	0.57	3.300	---	0.0	3.300
4.0	2.058	3.32	0.56	3.310	0.000	2.058	3.310
4.0	2.058	3.32	0.56	3.310			
6.0	3.087	3.33	0.56	3.320	0.010	3.087	3.330
6.0	3.087	3.34	0.56	3.330			
8.0	4.116	3.39	0.54	3.360	0.020	4.116	3.370
8.0	4.116	3.42	0.53	3.380			
0.0	0.000	3.35	0.53	3.310	---	0.0	3.310
Note: All Level measurements are in Meters.							



Vessel Name: Swamp_Fox_7125_MB.hvf
Vessel created: August 05, 2009

Depth Sensor:

Sensor Class: Swath
Time Stamp: 2009-161 00:00

Transducer #1:

Pitch Offset: 2.600
Roll Offset: -1.330
Azimuth Offset: 0.000

DeltaX: -1.722
DeltaY: -0.615
DeltaZ: 1.095

Manufacturer:
Model: sb7125d
Serial Number:

Depth Sensor:

Sensor Class: Swath
Time Stamp: 2009-165 00:00

Transducer #1:

Pitch Offset: 0.000
Roll Offset: -1.340
Azimuth Offset: 0.500

DeltaX: -1.722
DeltaY: -0.615
DeltaZ: 1.095

Manufacturer:
Model: sb7125d
Serial Number:

Navigation Sensor:**Time Stamp: 2009-161 00:00****Comments (null)****Latency -0.350****DeltaX: 0.000****DeltaY: 0.000****DeltaZ: 0.000****Manufacturer: (null)****Model: (null)****Serial Number: (null)****Time Stamp: 2009-165 00:00****Comments****Latency -0.050****DeltaX: 0.000****DeltaY: 0.000****DeltaZ: 0.000****Manufacturer:****Model:****Serial Number:**

Gyro Sensor:**Time Stamp: 2009-161 00:00****Comments****Latency 0.000**

Heave Sensor:**Time Stamp: 2009-161 00:00****Comments****Apply Yes****Latency 0.000****DeltaX: 0.000****DeltaY: 0.000**

DeltaZ: 0.000
Offset:0.000

Manufacturer: (null)
Model: (null)
Serial Number: (null)

Time Stamp: 2009-173 04:08

Comments

Apply Yes

Latency 0.000

DeltaX: 0.000

DeltaY: 0.000

DeltaZ: 0.000

Offset:-0.300

Manufacturer:
Model:
Serial Number:

Time Stamp: 2009-173 04:11

Comments

Apply Yes

Latency 0.000

DeltaX: 0.000

DeltaY: 0.000

DeltaZ: 0.000

Offset:0.300

Manufacturer:
Model:
Serial Number:

Time Stamp: 2009-173 04:13

Comments

Apply Yes

Latency 0.000

DeltaX: 0.000

DeltaY: 0.000

DeltaZ: 0.000

Offset:-0.300

Manufacturer:

Model:

Serial Number:

Time Stamp: 2009-173 04:16

Comments

Apply Yes

Latency 0.000

DeltaX: 0.000

DeltaY: 0.000

DeltaZ: 0.000

Offset:0.300

Manufacturer:

Model:

Serial Number:

Time Stamp: 2009-173 05:00

Comments

Apply Yes

Latency 0.000

DeltaX: 0.000

DeltaY: 0.000

DeltaZ: 0.000

Offset:0.000

Manufacturer:

Model:

Serial Number:

Pitch Sensor:

Time Stamp: 2009-161 00:00

Comments

Apply Yes

Latency 0.000

Pitch offset: 0.000

Manufacturer: (null)
Model: (null)
Serial Number: (null)

Roll Sensor:

Time Stamp: 2009-161 00:00

Comments

Apply Yes

Latency 0.000

Roll offset: 0.000

Manufacturer: (null)
Model: (null)
Serial Number: (null)

Draft Sensor:

Time Stamp: 2009-161 00:00

Apply Yes

Comments (null)

Entry 1) Draft: 3.300Speed: 0.000

Entry 2) Draft: 3.310Speed: 4.000

Entry 3) Draft: 3.320Speed: 6.000

Entry 4) Draft: 3.370Speed: 8.000

TPE

Time Stamp: 2009-161 00:00

Comments

Offsets

Motion sensing unit to the transducer 1

X Head 1 -1.722

Y Head 1 -0.615

Z Head 1 1.095

Motion sensing unit to the transducer 2

X Head 2 0.000

Y Head 2 0.000

Z Head 2 0.000

Navigation antenna to the transducer 1

X Head 1 -1.659
Y Head 1 -0.462
Z Head 1 3.784
Navigation antenna to the transducer 2
X Head 2 0.000
Y Head 2 0.000
Z Head 2 0.000

Roll offset of transducer number 1 0.000
Roll offset of transducer number 2 0.000

Heave Error: 0.020 or 5.000'' of heave amplitude.
Measurement errors: 0.010
Motion sensing unit alignment errors
Gyro:0.100 Pitch:0.100 Roll:0.100
Gyro measurement error: 0.020
Roll measurement error: 0.100
Pitch measurement error: 0.100
Navigation measurement error: 0.100
Transducer timing error: 0.010
Navigation timing error: 0.020
Gyro timing error: 0.020
Heave timing error: 0.020
PitchTimingStdDev: 0.020
Roll timing error: 0.020
Sound Velocity speed measurement error: 0.000
Surface sound speed measurement error: 0.000
Tide measurement error: 0.000
Tide zoning error: 0.000
Speed over ground measurement error: 0.514
Dynamic loading measurement error: 0.050
Static draft measurement error: 0.050
Delta draft measurement error: 0.050
StDev Comment: 0>,,J ↑ †J@3†Jp4†J 1†J0 ...J .†J0^,,J }€J°← †Ja

Svp Sensor:

Time Stamp: 2009-161 00:00

Comments (null)

Svp #1:

Pitch Offset: 0.000
Roll Offset: 0.000
Azimuth Offset: 0.000

DeltaX: -1.722
DeltaY: -0.615
DeltaZ: 1.095

SVP #2:

Pitch Offset: 0.000
Roll Offset: 0.000
Azimuth Offset: 0.000

DeltaX: 0.000
DeltaY: 0.000
DeltaZ: 0.000

Time Stamp: 2009-165 00:00

Comments

Svp #1:

Pitch Offset: 0.000
Roll Offset: 0.000
Azimuth Offset: 0.000

DeltaX: -1.722
DeltaY: -0.615
DeltaZ: 1.095

SVP #2:

Pitch Offset: 0.000
Roll Offset: 0.000
Azimuth Offset: 0.000

DeltaX: 0.000
DeltaY: 0.000
DeltaZ: 0.000

WaterLine:

Time Stamp: 2009-162 02:00

Comments (null)

Apply Yes

WaterLine 0.045

Time Stamp: 2009-162 23:20

Comments

Apply Yes

WaterLine 0.045

Time Stamp: 2009-163 06:50

Comments

Apply Yes

WaterLine 0.045

Time Stamp: 2009-165 22:50

Comments

Apply Yes

WaterLine 0.045

Time Stamp: 2009-166 06:40

Comments

Apply Yes

WaterLine 0.045

Time Stamp: 2009-166 23:30

Comments

Apply Yes

WaterLine 0.045

Time Stamp: 2009-167 05:15

Comments

Apply Yes

WaterLine 0.045

Time Stamp: 2009-172 22:40

Comments

Apply Yes

WaterLine 0.045

Time Stamp: 2009-173 02:10

Comments

Apply Yes
WaterLine 0.035

Time Stamp: 2009-173 05:20

Comments
Apply Yes
WaterLine 0.035

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Tanapag Harbor, Saipan

Appendix H:

List of Equipment

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DISTRIBUTION STATEMENT A:

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LIST OF EQUIPMENT		
Equipment Name	DPAS or Serial No.	Remarks
9m Safeboat "Swamp Fox" Survey Platform	---	1
Digibar Pro	70616	1
TPU, Klein	74096	1
Echotrac CV	77410	1
Computer, processing	66397	1
Processor, multibeam	70588	1
Reson Multibeam 7125	78589	1
Towfish, Klein 3000	70531	1
Navcom 2050M	77104	1
CTD, SBE 19	3144	1
Monitor, 20" VG2030	QCC082182473, 76, 81	3
Monitor, VG800	FST#0133	1
Processor, 4125	78900	1
Towfish, Edgetech 4125	78901	1
Computer, Laptop	78899	1
Computer, processing	79488 & 79500	2
Navcom 2040G	79091	1
Applanix POS MV 320 Version 4 Position and Orientation System	78589	1
TOPCON Level	486357	1
In-Situ Tide Gauge	18849	1
Ponar Bottom Grab	N/A	1

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Tanapag Harbor, Saipan

Appendix I:

List of Software

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DISTRIBUTION STATEMENT A:

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LIST OF SOFTWARE	
Software and Version	Remarks
HYPACK© Version 2008	
Hysweep 2008	
CARIS HIPS and SIPS Version 6.1 SP2	
CARIS HIPS and SIPS Hotfix 1 through 8	
CARIS GIS Version 4.4a SP 5	
CARIS GIS Hotfix 1 through 38	
CARIS DOM Version 3.2	
Fledermaus Version 6.7	
SBE SeaTerm Version 1.59	
Sea-Bird SBE Data Processing Version 5.37e	
Sea-Bird Seasave Version 5.39c	
CTD HTML Processing Script	~ii_c_sea-bird_ctd_sbe-19_script-processing.html
Sound Velocity Profile Generator Version 4.100	
Sonar Pro 11.2	
Sonar Wiz Map 4 Version 4.04.0015	
SA Watch Version 3.80.269	
Star Utilities Version 100.2.1	
In-Situ Win-Situ 4 Version 4.57.0.0	
NAVOTAS Version 2.3.5	
POS MV Controller Software Version 3 2.1	
Adobe Acrobat Professional 8.0	
Microsoft Office 2003	

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Appendix J:

Geodetic Station Descriptive Report, Calculations and Results

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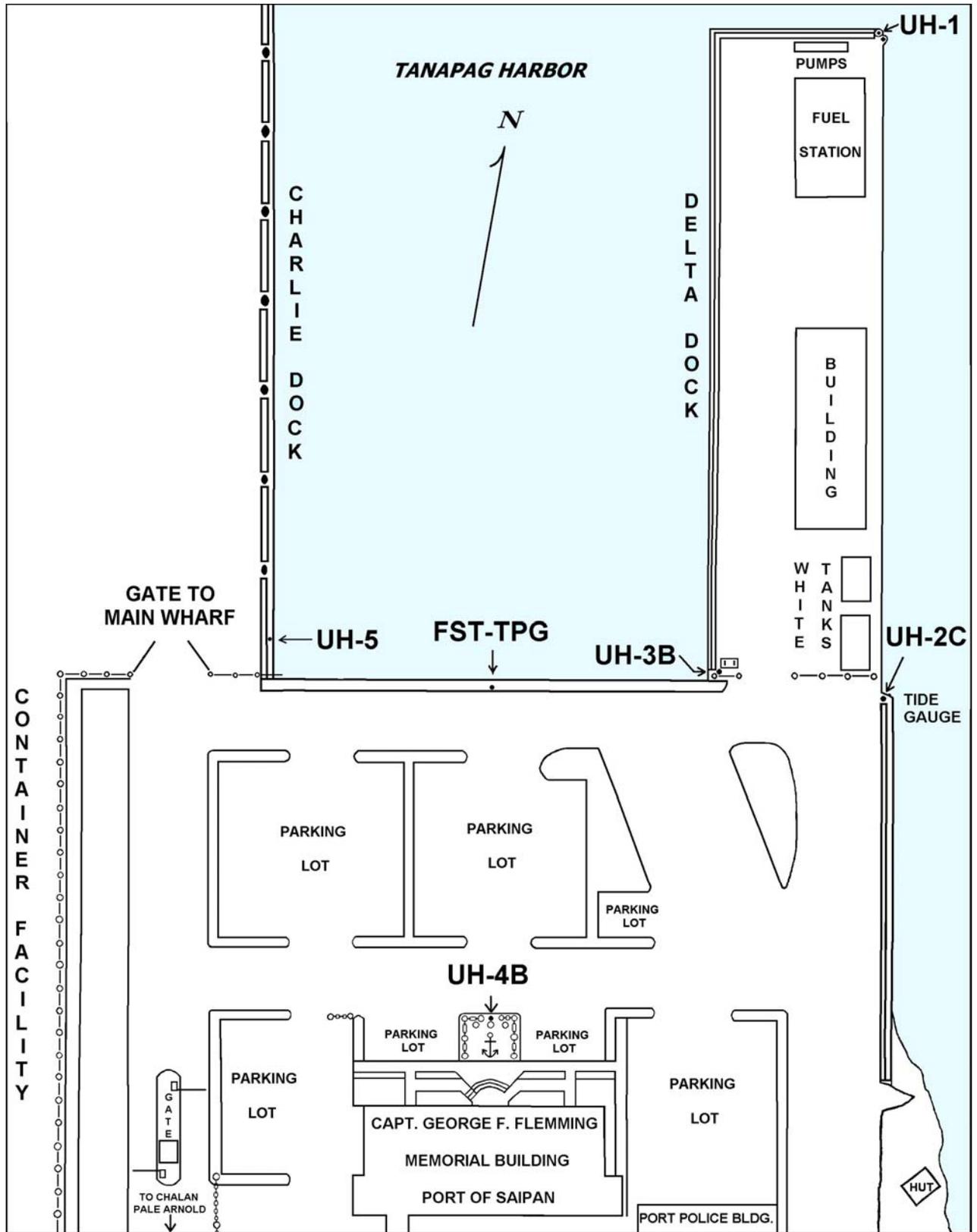


Figure J-1: Sketch of Geodetic Point FST-TPG Location.

FILE: SAIPAN.DAT 000049298

NGS OPUS SOLUTION REPORT

All computed coordinate accuracies are listed as peak-to-peak values.
 For additional information: www.ngs.noaa.gov/OPUS/Using_OPUS.html#accuracy

USER: charles.baptiste@navy.mil DATE: May 27, 2009
 RINEX FILE: saip145w.09o TIME: 09:37:26 UTC

SOFTWARE: page5 0810.20 master29.pl 081023 START: 2009/05/25 22:29:00
 EPHEMERIS: igr15331.eph [rapid] STOP: 2009/05/25 23:59:00
 NAV FILE: brdc1450.09n OBS USED: 2816 / 3117 : 90%
 ANT NAME: NAVSF2040G NONE # FIXED AMB: 27 / 32 : 84%
 ARP HEIGHT: 1.749 OVERALL RMS: 0.017(m)

REF FRAME: NAD_83 (MARP00) (EPOCH: 2002.0000) ITRF00 (EPOCH:2009.3972)

X: -5087463.836(m) 0.236(m) -5087464.729(m) 0.236(m)
 Y: 3465624.048(m) 0.291(m) 3465625.716(m) 0.291(m)
 Z: 1664283.239(m) 0.140(m) 1664284.571(m) 0.140(m)

LAT: 15 13 34.49316 0.126(m) 15 13 34.52065 0.126(m)
 E LON: 145 44 13.10255 0.365(m) 145 44 13.07320 0.365(m)
 W LON: 214 15 46.89745 0.365(m) 214 15 46.92680 0.365(m)
 EL HGT: 55.862(m) 0.073(m) 57.830(m) 0.073(m)

ORTHO HGT: [No NGS Geoid Model Available (FAQ 21).]

UTM COORDINATES	STATE PLANE COORDINATES
UTM (Zone 55)	*** NOTE ***
Northing (Y) [meters] 1683743.003	Please manually select
Easting (X) [meters] 364349.447	SPC zone.
Convergence [degrees] -0.33176134	
Point Scale 0.99982758	
Combined Factor 0.00000000	

US NATIONAL GRID DESIGNATOR: 55PCS6434983743(NAD 83)

BASE STATIONS USED				
PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
DF7984	GUUG U OF GUAM CORS ARP	N132559.520	E1444809.793	222509.8
AF9627	GUAM USGS GUAM OBSERV			
	CORS ARP	N133521.556	E1445206.127	203897.3
MCIL				1320731.1

NEAREST NGS PUBLISHED CONTROL POINT				
ID	NAME	N	W	Distance
DG3986	163 3227 TIDAL UH 3B	N151334.	W2141546.	30.8

This position and the above vector components were computed without any knowledge by the National Geodetic Survey regarding the equipment or field operating procedures used.

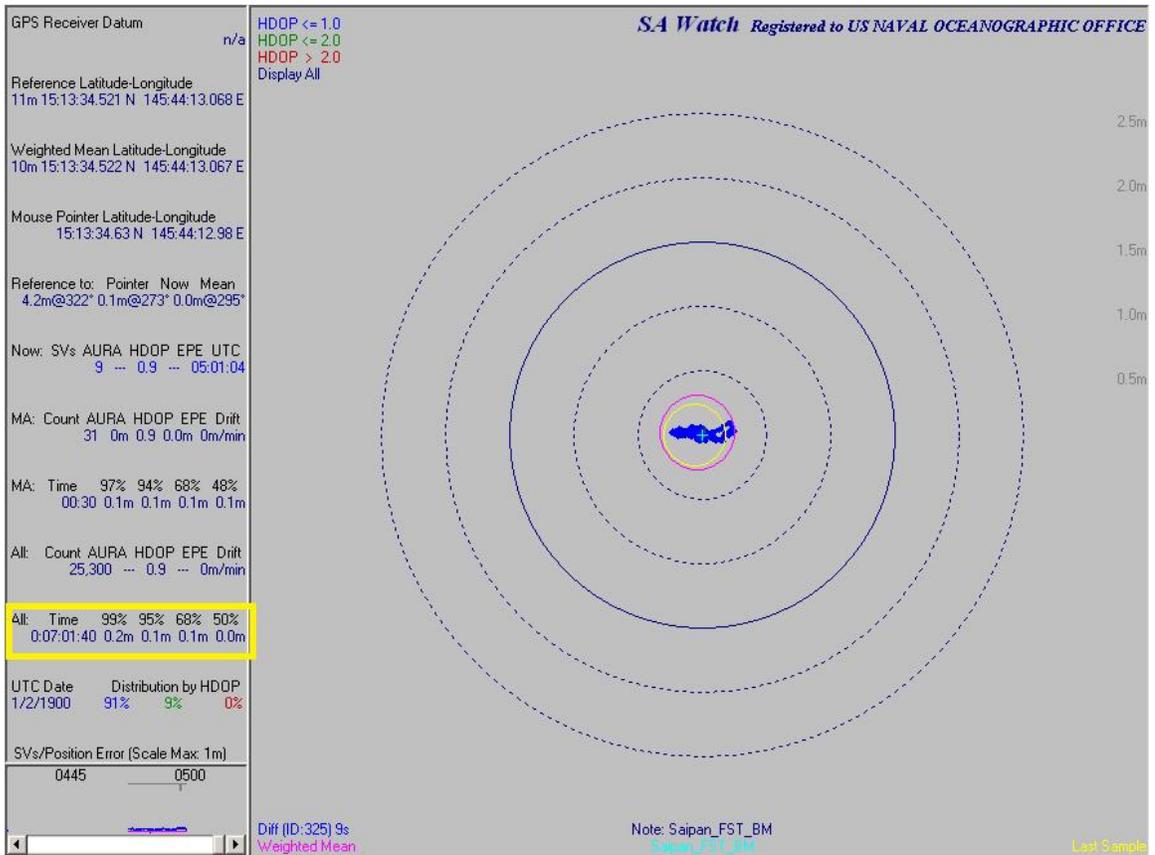


Figure J-2: Static Test: 0.1m @ 95% Confidence Level

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Tanapag Harbor, Saipan

Appendix K:

CTD Locations, Station Sheets and Plot

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DISTRIBUTION STATEMENT A:

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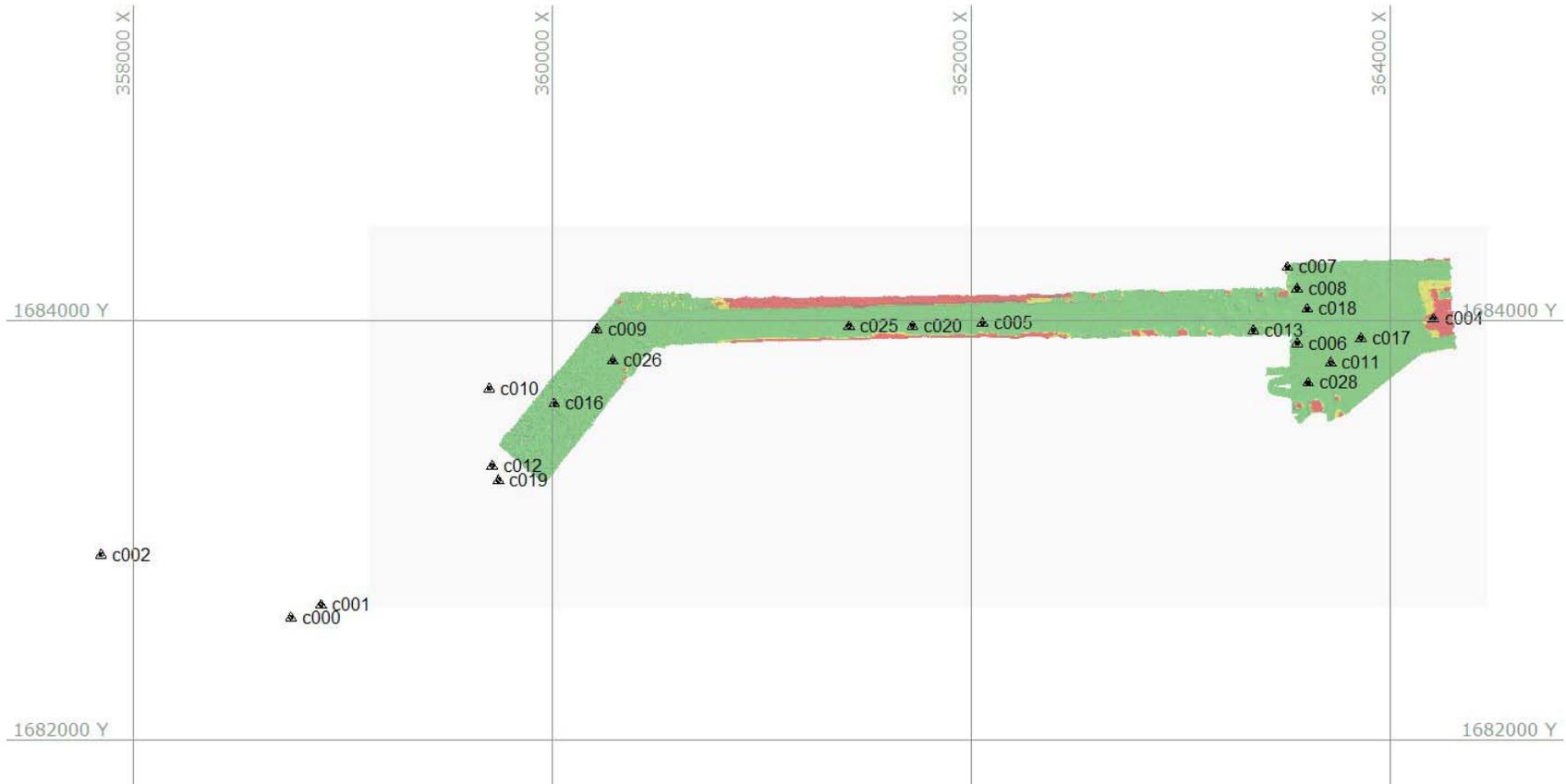


Figure K-1: CTD Site Locations.

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CTD STATION SUMMARY SHEET										RETURN TO: NAVAL OCEANOGRAPHIC OFFICE 1002 BALCH BLVD STENNIS SPACE CENTER, MS 39522-5001				
DISTRIBUTION STATEMENT A: Approved for Public Release Distribution Unlimited										Page 1 of 2				
SHIP: Swamp Fox			ARCHIVE: 09CQ01				AREA: Tanapag Harbor, Saipan				HIC: C. Baptiste / J. Burt			
CTD	JD	START	END	START LAT/LONG		START LAT/LONG		CTD	UP	MIN SV	MAX SV	MSG	BTL	COMMENTS
CAST #	(GMT)	TIME (GMT) HHMM	TIME (GMT) HHMMSS	DD MM SS	N/S E/W	DDD MM.mmmm	N/S E/W	SERIAL ####	DOWN COMPOSITE	MMMM	MMMM			BOTTOM DEPTH (METERS)
000	162	0102		15 12 55	N	15 12.9167	N	3144		1544.18	1544.34			24.30
				145 41 05	E	145 41.0833	E							
001	162	0145		15 12 57	N	15 12.9500	N	3144		1544.26	1544.40			23.31
				145 41 10	E	145 41.1667	E							
002	162	0314		15 13 05	N	15 13.0833	N	3144		1542.90	1544.29			220.00
				145 40 35	E	145 40.5833	E							
003														BAD
004	162	2256		15 13 43	N	15 13.7193	N	3144		1544.94	1545.24			9.43
				145 44 08	E	145 44.1384	E							
005	163	0006		15 13 42	N	15 13.7018	N	3144		1545.25	1545.47			12.63
				145 42 56	E	145 42.9356	E							
006	163	0255		15 13 39	N	15 13.6538	N	3144		1545.11	1545.81			13.26
				145 43 47	E	145 43.7759	E							
007	163	0651		15 13 51	N	15 13.8509	N	3144		1545.18	1545.65			11.23
				145 43 44	E	145 43.7481	E							
008	163	2250		15 13 48	N	15 13.7950	N	3144		1544.57	1545.34			15.09
				145 43 46	E	145 43.7742	E							
009	164	0129		15 13 41	N	15 13.6793	N	3144		1544.76	1545.16			11.92
				145 41 54	E	145 41.9069	E							
010	164	0522		15 13 31	N	15 13.5247	N	3144		1544.74	1545.21			6.00
				145 41 37	E	145 41.6206	E							
011	165	2231		15 13 36	N	15 13.6039	N	3144		1544.93	1545.06			13.80
				145 43 52	E	145 43.8652	E							
012	166	0041		15 13 19	N	15 13.2243	N	3144		1544.40	1544.54			14.76
				145 41 37	E	145 41.6295	E							
013	166	0331		15 13 41	N	15 13.6868	N	3144		1545.03	1545.57			13.01
				145 43 39	E	145 43.6584	E							
014														BAD

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CTD STATION SUMMARY SHEET								RETURN TO: NAVAL OCEANOGRAPHIC OFFICE 1002 BALCH BLVD STENNIS SPACE CENTER, MS 39522-5001						
DISTRIBUTION STATEMENT A: Approved for Public Release Distribution Unlimited								Page 2 of 2						
SHIP: Swamp Fox			ARCHIVE: 09CQ01			AREA: Tanapag Harbor, Saipan			HIC: C. Baptiste / J. Burt					
CTD	JD	START	END	START LAT/LONG		START LAT/LONG		CTD	UP	MIN SV	MAX SV	MSG	BTL	COMMENTS
CAST #	(GMT)	TIME (GMT) HHMM	TIME (GMT) HHMMSS	DD MM SS	N/S E/W	DDD MM.mmmm	N/S E/W	SERIAL ####	DOWN COMPOSITE	MMMM	MMMM			BOTTOM DEPTH (METERS)
015														BAD
016	166	0549		15 13 29	N	15 13.4861	N	3144		1544.53	1545.42			13.94
				145 41 47	E	145 41.7941	E							
017	166	2218		15 13 40	N	15 13.6681	N	3144		1544.98	1545.18			12.00
				145 43 57	E	145 43.9455	E							
018	167	0219		15 13 44	N	15 13.7428	N	3144		1544.22	1544.92			14.15
				145 43 48	E	145 43.8016	E							
019	167	0446		15 13 17	N	15 13.2867	N	3144		1544.07	1544.37			14.33
				145 41 38	E	145 41.6463	E							
020	167	0527		15 13 41	N	15 13.6931	N	3144		1544.36	1544.64			12.42
				145 42 44	E	145 42.7488	E							
021														BAD
022	169	0219		14 57 50	N	14 57.8442	N	3144		1544.64	1545.01			8.73
				145 37 13	E	145 37.2149	E							
023	169	0458		14 57 41	N	14 57.6833	N	3144		1544.88	1545.08			9.05
				145 37 25	E	145 37.4167	E							
024	169	0625		14 57 17	N	14 57.2847	N	3144		1544.69	1544.78			17.00
				145 37 15	E	145 37.2605	E							
025	172	2213		15 13 41	N	15 13.6915	N	3144		1544.65	1544.93			12.50
				145 42 35	E	145 42.5795	E							
026	173	0136		15 13 36	N	15 13.5983	N	3144		1544.78	1545.20			12.75
				145 41 57	E	145 41.9496	E							
027														BAD
028	173	0453		15 13 33	N	15 13.5517	N	3144		1545.23	1545.75			13.81
				145 43 48	E	145 43.8051	E							

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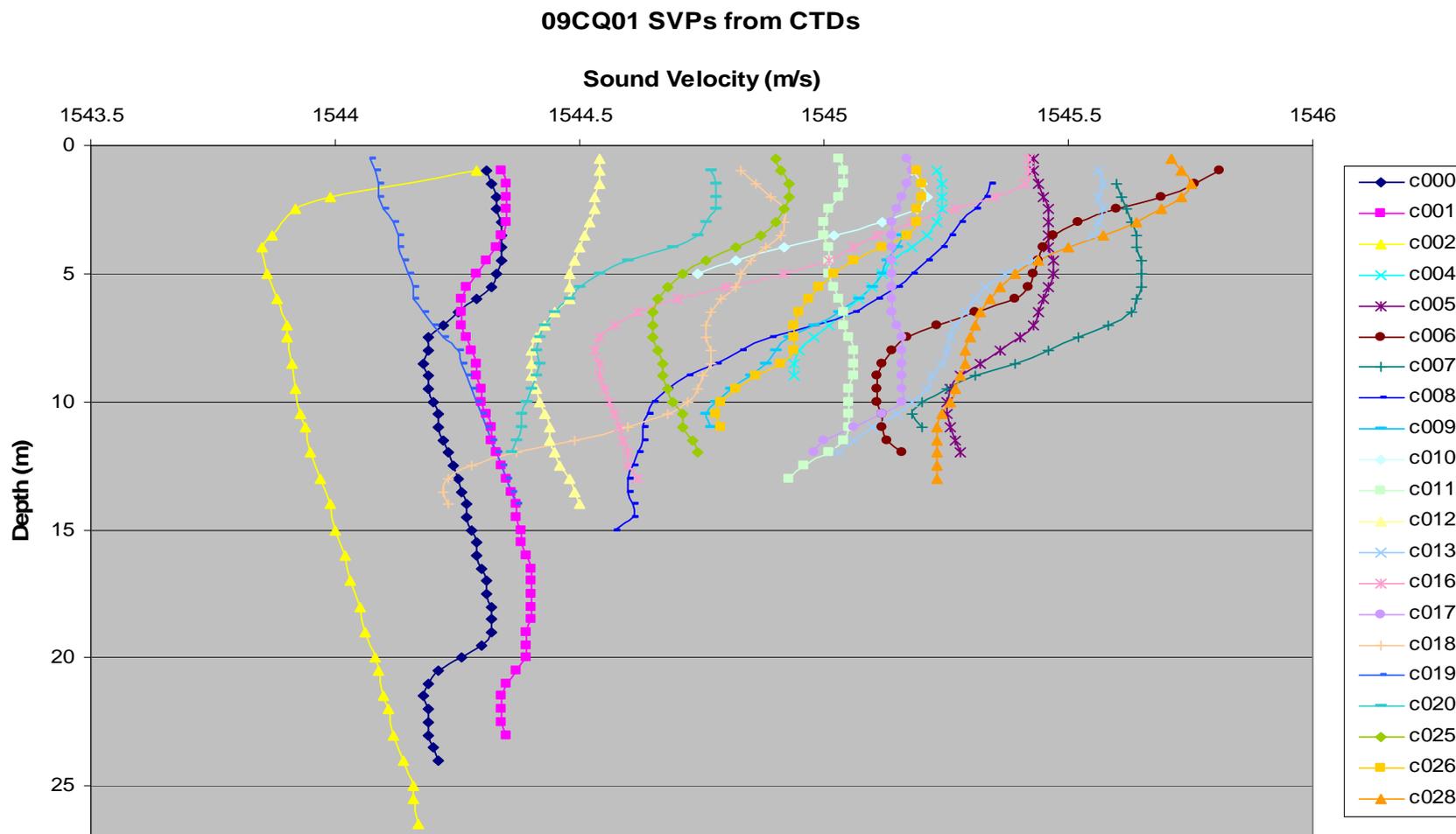


Figure K-2: Plot of Sound Velocity Profiles generated from CTD casts.

09CQ01

Tanapag Harbor, Saipan

Appendix L:

Cross Check Analysis and Previous Survey Comparisons

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Cross Check Analysis

Soundings from cross check lines were compared to a base surface generated from development lines. The resolution of the base surface is 50 centimeters. The QC Report process analyzed the data by beam number assigning a percentage of passable counts per beam. The results generated from the CARIS QC Report process found that all beams, 1-512, meet IHO Order 1a and beams 1-501 meet IHO Special Order. The results of the CARIS QC Report process for cross check analysis is graphed below.

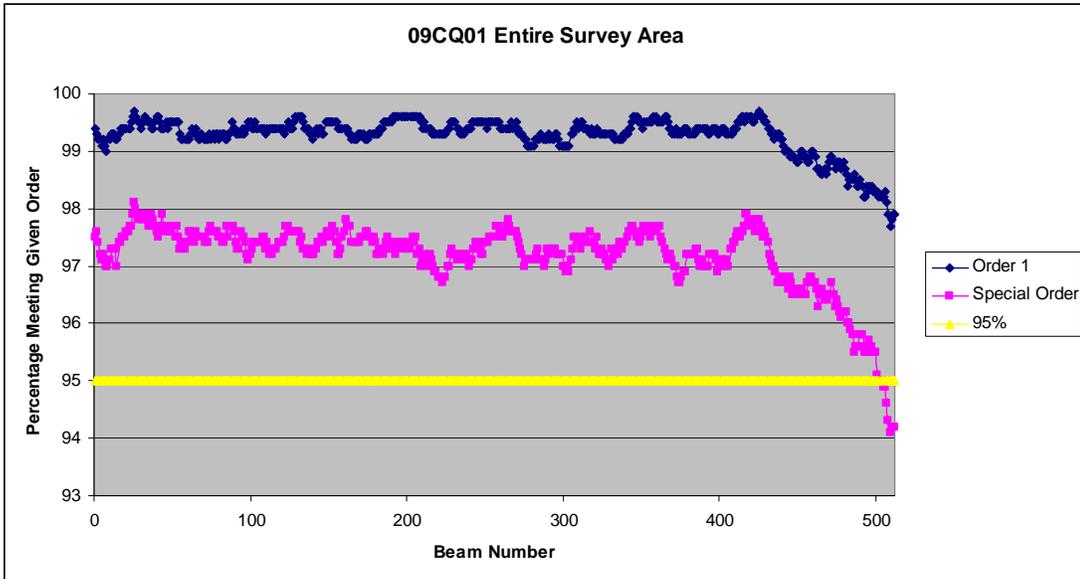


Figure L-1: CARIS HIPS 6.1 QC Report results for Cross Check Analysis of the entire Survey Area.

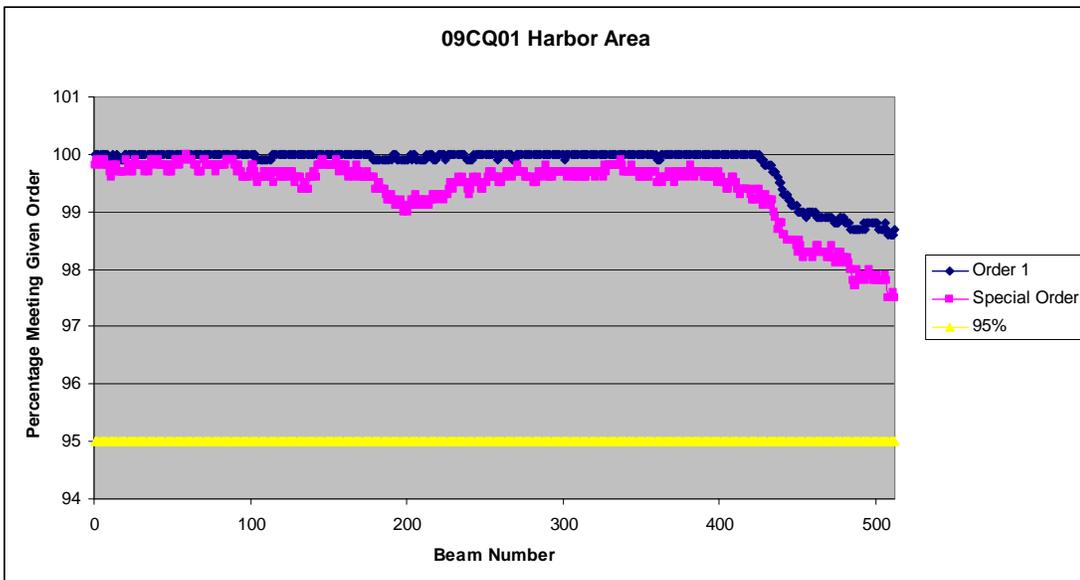


Figure L-2: CARIS HIPS 6.1 QC Report results for Cross Check Analysis of the Harbor Area.

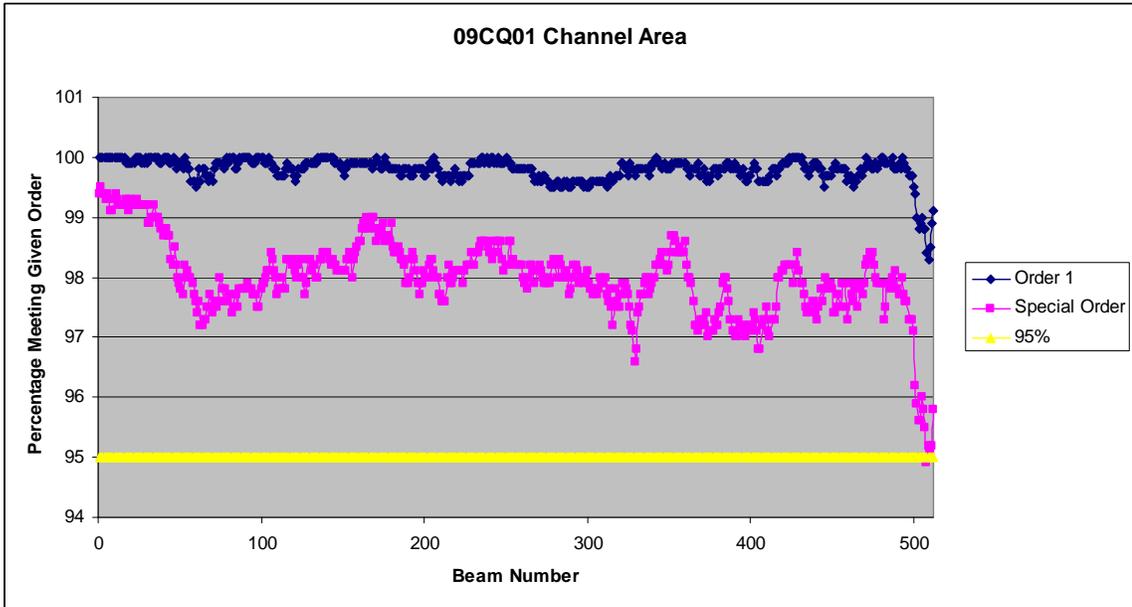


Figure L-3: CARIS HIPS 6.1 QC Report results for Cross Check Analysis of the Channel Area.

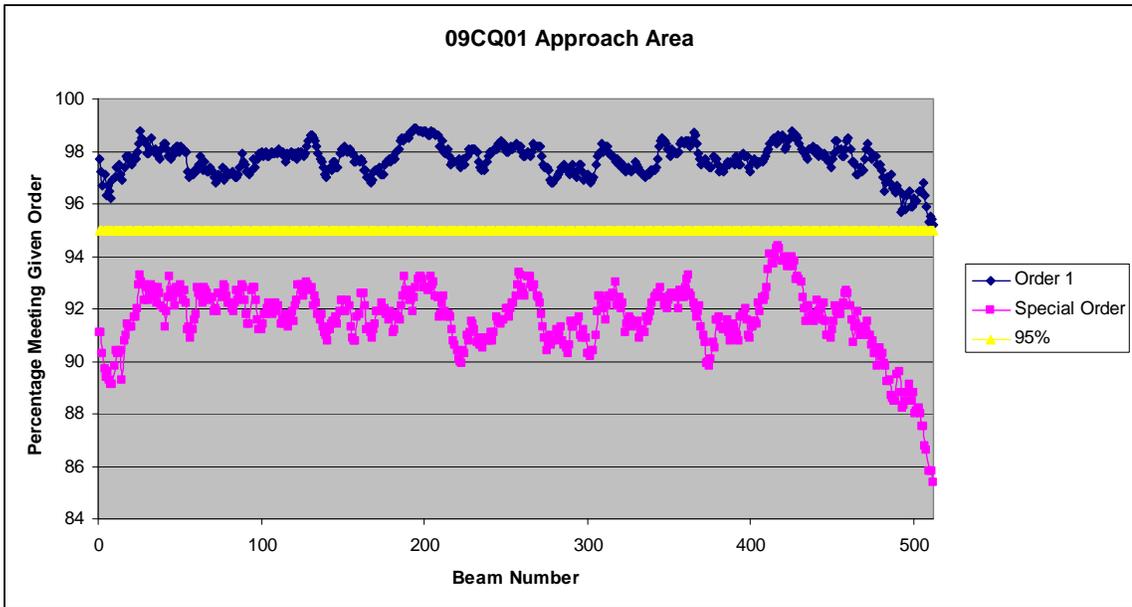


Figure L-4: CARIS HIPS 6.1 QC Report results for Cross Check Analysis of the Approach Area.

Previous Survey Comparisons

Base surfaces from a 2007 NOAA survey and a 2009 NAVO survey were independently compared to the base surface generated from FST 2009 survey. CARIS Base Editor program was used to compare the surfaces. Base surface differences were assigned a color based on differences of more than 0.5 meter (red), between 0.2 meter and 0.5 meter (yellow) and less than 0.2 meter (green). The survey area was divided into three sections: harbor, channel and approach. The results of average difference and standard deviations were computed for each section.

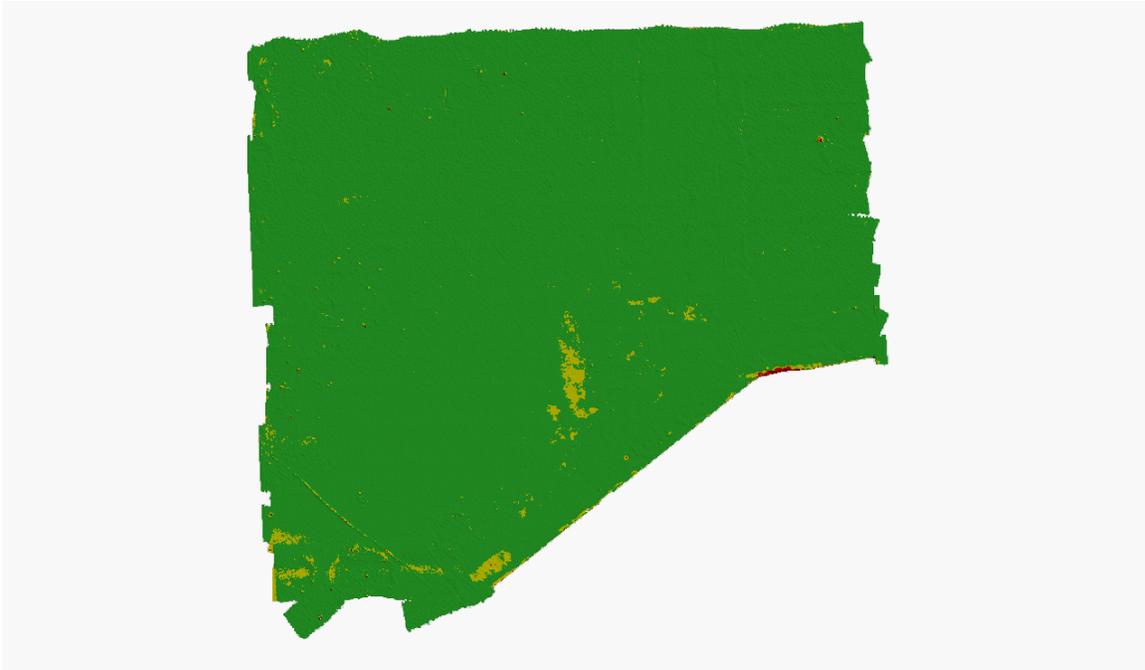


Figure L-5: 2007 NOAA - 2009 FST Base Surfaces comparison of Harbor data

Average Difference: 0.153m = 0.502ft = 6.0in

Standard Deviation: 0.197m

A positive difference value indicates FST's data is deeper, generally.



Figure L-6: 2007 NOAA - 2009 FST Base Surfaces comparison of Channel data

Average Difference: 0.140m = 0.459ft = 5.5in

Standard Deviation: 0.110m

A positive difference value indicates FST's data is deeper, generally.

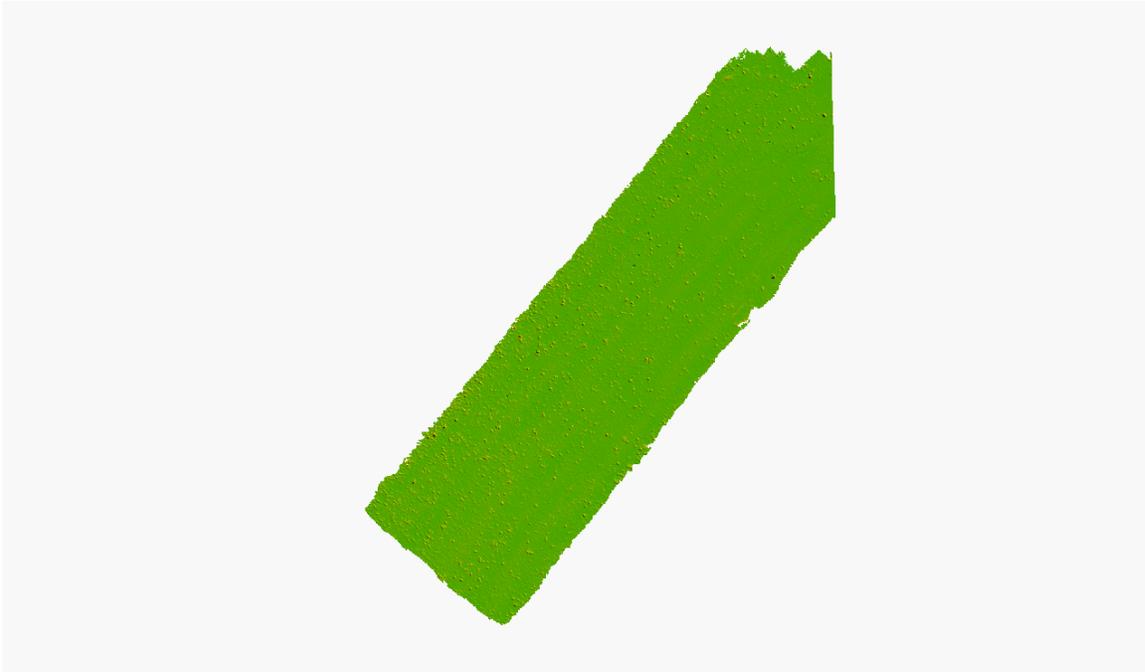


Figure L-7: 2007 NOAA - 2009 FST Base Surfaces comparison of Approach data

Average Difference: 0.130m = 0.426ft = 5.1in

Standard Deviation: 0.234m

A positive difference value indicates FST's data is deeper, generally.



Figure L-8: 2009 NAVO - 2009 FST Base Surfaces comparison of Harbor data

Average Difference: $-0.110\text{m} = -0.361\text{ft} = -4.3\text{in}$

Standard Deviation: 0.168m

A negative difference value indicates FST's data is shallower, generally.

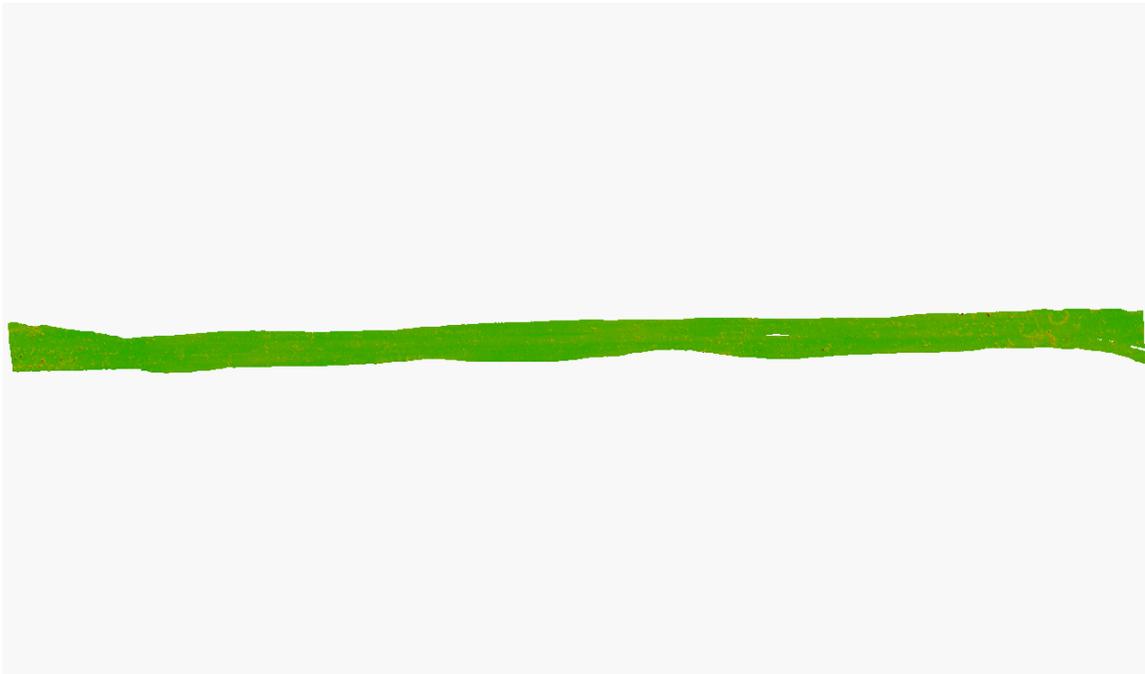


Figure L-9: 2009 NAVO - 2009 FST Base Surfaces comparison of Channel data

Average Difference: $-0.120\text{m} = 0.394\text{ft} = -4.7\text{in}$

Standard Deviation: 0.135m

A negative difference value indicates FST's data is shallower, generally.

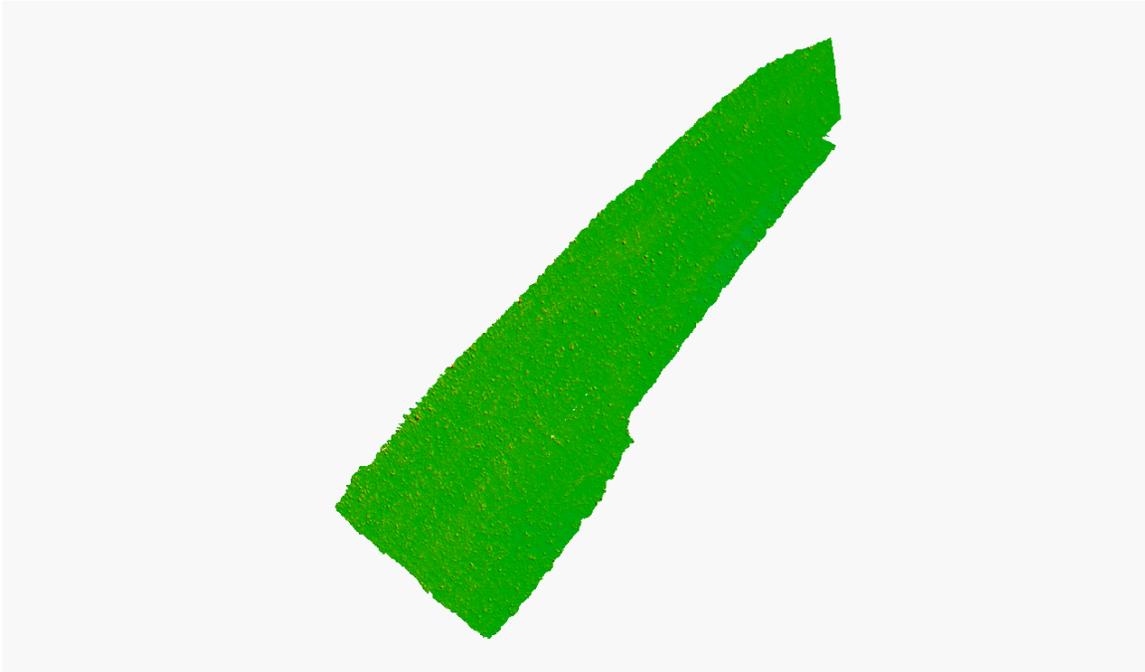


Figure L-10: 2009 NAVO - 2009 FST Base Surfaces comparison of Approach data

Average Difference: $-0.100\text{m} = -0.394\text{ft} = -3.9\text{in}$

Standard Deviation: 0.321m

A negative difference value indicates FST's data is shallower, generally.

09CQ01

Tanapag Harbor, Saipan

Appendix M:

General Shoreline Photography

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DISTRIBUTION STATEMENT A:

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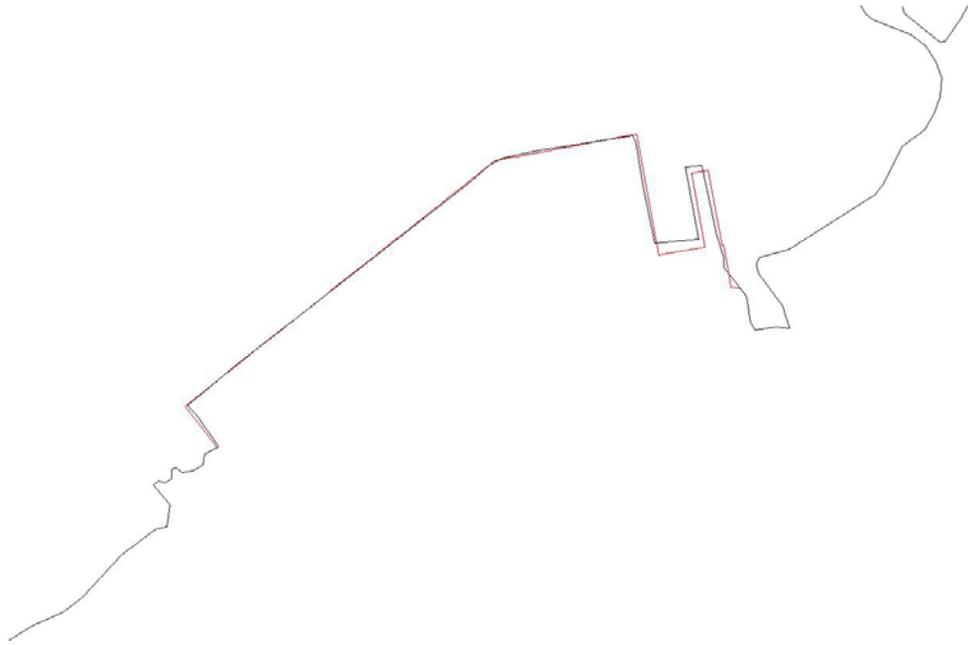


Figure M-1: The red line indicates shoreline surveyed with NAVCOM 2040G GPS receiver; the black line indicates shoreline extracted from the DNC.

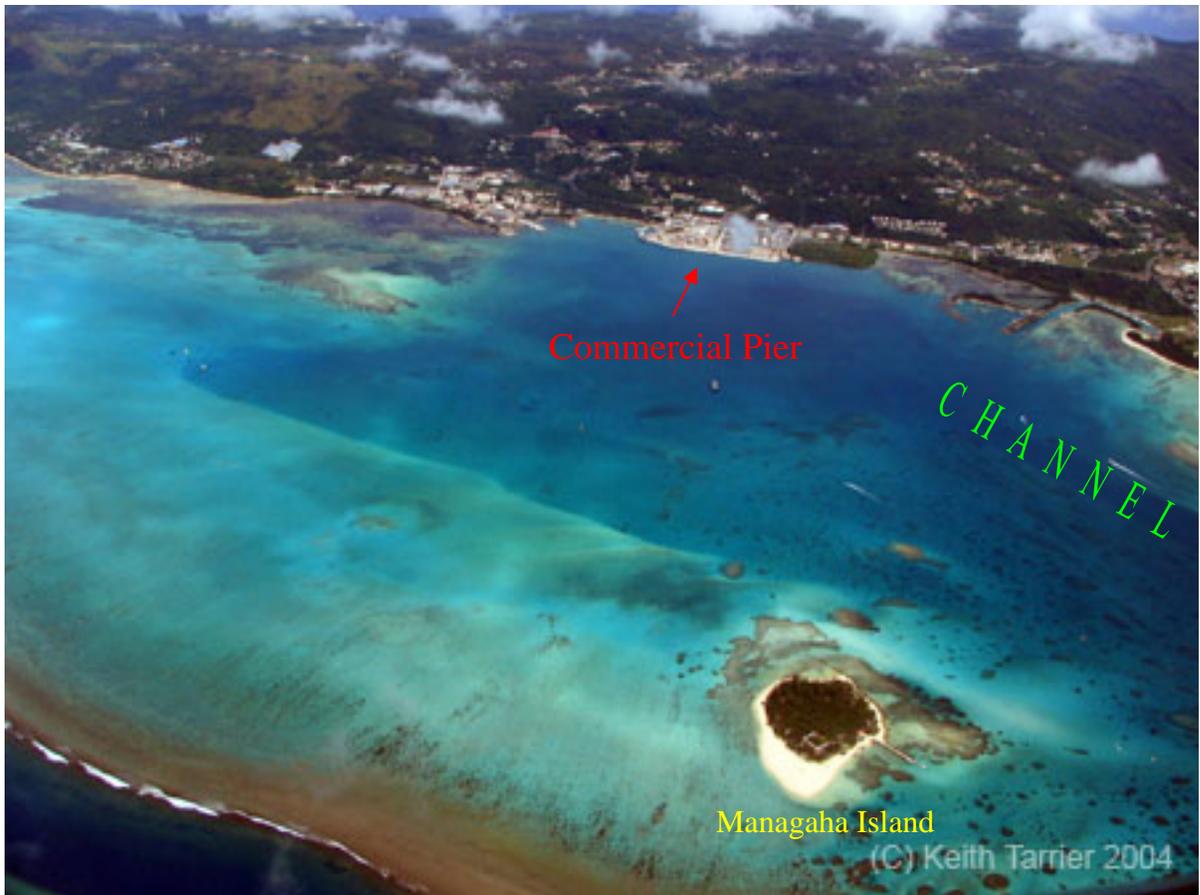


Photo M-1: Aerial photo of Tanapag Harbor, looking southeast. Used with permission from Keith Tarrier obtained via email 13 August 2009. Higher resolution image available upon request; email ktarrier@yahoo.com for more information.



Photo M-2: Buoy 1, South of Channel Entrance, looking East toward Garapan.



Photo M-3: Buoy 7, Mid-Channel, looking South toward Puntan Muchot.



Photo M-4: Buoy 10, East of Turning Basin, looking Southeast.



Photo M-5: North of Turning Basin, looking ESE toward Puntan Flores and the Range Lights.



Photo M-6: North of Turning Basin, looking South toward Commercial Pier.



Photo M-7: North of Turning Basin, looking Southwest toward Public Pier.



Photo M-8: North of Turning Basin, looking Northwest toward Managaha Island.



Photo M-9: Southwest of Turning Basin, looking East toward Commercial Pier.

09CQ01

Tanapag Harbor, Saipan

Appendix N:

Weekly Narrative and Operational Timeline

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DISTRIBUTION STATEMENT A:

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17-23 May 2009

- Shipment of tide gauge installation and leveling equipment and NAVCOM 2040 GPS receiver arrives at Port Manager's office in Saipan ahead of personnel.
- Team attends a site specific force protection briefing pre-deployment.
- On 22 MAY 09 Charles Baptiste and Jessica Burt arrive in Saipan and meet with Port Manager to receive equipment and obtain access to processing office.
- Team installs and levels in tide gauge and tide gauge begins recording tide data.

24-30 May 2009

- Collected shoreline GPS data with rover.
- Installed geodetic benchmark point FST-TPG.
- Collected 7 hours of static GPS observations over newly installed geodetic mark.
- Collected 6 hours of simultaneous observations between tide staff and tide gauge.
- Ran a level line incorporating FST-TPG.
- Positioned and photographed 3 land based ATONs.
- Positioned and photographed 12 buoy ATONs.
- Built a tide staff for use in Tinian Harbor.

31 May - 06 June 2009

- Created CARIS map for Tanapag Harbor smooth sheet and added all data collected thus far.
- Created CARIS map for Tinian smooth sheet.
- Collected a second dataset of static GPS over the geodetic benchmark that was installed last week.
- Installed and leveled in a tide gauge in Tinian Harbor.
- Made optimized HYPACK line files for all survey areas.
- Collected lead line depths along the wharf in Tanapag Harbor.

07-13 June 2009

- Transported boat and equipment from airport to Tanapag Harbor.
- Assembled transducer and prepared boat for deployment.
- Measured offsets for vessel configuration file.
- Fueled and launched the boat.
- Calibrated the POS/MV to obtain GAMS solution.
- Conducted a squat-settlement test.
- Set up HYPACK project (hardware configuration and line plans) on boat.
- Ran lines for multibeam patch test calibration.
- Ran lines for side-scan sonar layback calibration.
- Ran Tanapag Harbor cross check lines.
- Collected 27.3 linear nautical miles of multibeam development lines in Tanapag Harbor.

- Collected 3 hours of tide staff observations for comparison to University of Hawaii tide gauge.
- Began processing multibeam data.

14-20 June 2009

- Finished collection of multibeam and side scan data on all development lines in Tanapag Harbor.
- Performed lead line check of multibeam system.
- Performed bar check calibration of single beam system.
- Continued field processing of multibeam data.
- Began field processing of side scan data.
- Surveyed Tinian Harbor (collected data for patch test calibration; multibeam and side scan data collection complete; collected shoreline GPS; positioned buoys; leveled out and removed tide gauge).
- Observed light characteristics.
- Collected bottom samples in Tanapag Harbor.
- Made secchi disk observations in Tanapag Harbor.
- Installed new tide gauge for NAVO.

21-27 June 2009

- Collected extra multibeam data in sections of Priority 1 area where increased data density was needed for easier processing.
- Collected multibeam data over area requested by NAVO for comparison with their new systems. Collected the same dataset several times with the various settings available on the Reson 7125 for further analysis at a later date.
- Re-ran side scan lines over entire Tanapag Harbor survey area; collected new data with Edgetech 4125 towfish. The Reson 7125 multibeam high frequency signal was suspected of interfering with the high frequency channel of the side scan sonar data collected by the Klein 3000 towfish.
- Continued processing multibeam, single beam and side scan data previously collected.
- Recovered boat and pressure-washed fuzzy green marine growth off hull.
- Leveled in new NAVO tide gauge. Leveled out FST tide gauge.

09CQ01

Tanapag Harbor, Saipan

Appendix O:

Water Clarity Observations via Secchi Disk

UNCLASSIFIED

DISTRIBUTION STATEMENT A:

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DISTRIBUTION UNLIMITED**

SECCHI DISK AND WATER COLOR LOG

SHIP: Swamp Fox OBSERVER: D. Brashear

DATE (month, day, year): June 18, 2009 TIME (GMT): 0014 (LCL): 1014

LATITUDE (deg, min, sec, hemisphere) : 15-13-34N

LONGITUDE (deg, min, sec, hemisphere): 145-43-54E

LOCATION: Tanapag Harbor, Saipan SUN ANGLE ABOVE HORIZON (°) 55

CLOUD TYPE: Cumulus/Cirrus CLOUD AMOUNT (%): 75

CURRENT WEATHER: Mostly Cloudy

BOTTOM DEPTH (meters): 12.80 WAVE HEIGHT (feet): 0

TIDAL CURRENT (check one): SLACK () EBB () FLOOD () NOT APPLICABLE ()**SECCHI DISK READINGS (Taken on sunny side of ship)****WHITE SIDE****WIRE ANGLE (° off of vertical)**

READING DOWN (meters): 5.5 DOWN (°): 0

READING UP (meters): 5.5 UP (°): 0

AVERAGE READING (meters): 5.5 CALCULATED DEPTH (meters): 5.5

NOTE: CALCULATED DEPTH = AVERAGE READING * COS(WIRE ANGLE)

WATER COLOR**(Observation when Secchi disc is at ½ of average depth reading;
Forel-Ule number is preferred but if not available fill in at least one other)**

FOREL-ULE NO.: 3 pretty

MUNSEL PAINT SCALE: N/A

DESCRIPTION OF WATER COLOR TO UNAIDED EYE: clear blue

CHECK ANY SEA SURFACE CONDITIONS WHICH MAY AFFECT READINGSWAVES () RIPPLES () FOAM () PRECIPITATION () OIL () DEBRIS ()

GLITTER () GLARE () PLANKTERS () OVERBOARD DISCHARGE () OTHER ()

POLAROID GLASSES OR OTHER AIDS: None**REMARKS:**

SECCHI DISK AND WATER COLOR LOG

SHIP: Swamp Fox OBSERVER: J. Herron

DATE (month, day, year): June 18, 2009 TIME (GMT): 0030 (LCL): 1030

LATITUDE (deg, min, sec, hemisphere) : 15-13-48N

LONGITUDE (deg, min, sec, hemisphere): 145-43-54E

LOCATION: Tanapag Harbor, Saipan SUN ANGLE ABOVE HORIZON (°) 60

CLOUD TYPE: Cumulus/Cirrus CLOUD AMOUNT (%): 75

CURRENT WEATHER: Mostly Cloudy

BOTTOM DEPTH (meters): 12.26 WAVE HEIGHT (feet): 0

TIDAL CURRENT (check one): SLACK () EBB () FLOOD () NOT APPLICABLE ()**SECCHI DISK READINGS (Taken on sunny side of ship)****WHITE SIDE****WIRE ANGLE (° off of vertical)**

READING DOWN (meters): 5.5 DOWN (°): 0

READING UP (meters): 5.5 UP (°): 0

AVERAGE READING (meters): 5.5 CALCULATED DEPTH (meters): 5.5

NOTE: CALCULATED DEPTH = AVERAGE READING * COS(WIRE ANGLE)

WATER COLOR**(Observation when Secchi disc is at ½ of average depth reading;
Forel-Ule number is preferred but if not available fill in at least one other)**

FOREL-ULE NO.: 3 pretty

MUNSEL PAINT SCALE: N/A

DESCRIPTION OF WATER COLOR TO UNAIDED EYE: Aqua

CHECK ANY SEA SURFACE CONDITIONS WHICH MAY AFFECT READINGSWAVES () RIPPLES () FOAM () PRECIPITATION () OIL () DEBRIS ()GLITTER () GLARE () PLANKTERS () OVERBOARD DISCHARGE () OTHER ()**POLAROID GLASSES OR OTHER AIDS: None****REMARKS:**

SECCHI DISK AND WATER COLOR LOG

SHIP: Swamp Fox OBSERVER: J. Herron

DATE (month, day, year): June 18, 2009 TIME (GMT): 0046 (LCL): 1046

LATITUDE (deg, min, sec, hemisphere) : 15-13-44N

LONGITUDE (deg, min, sec, hemisphere): 145-43-42E

LOCATION: Tanapag Harbor, Saipan SUN ANGLE ABOVE HORIZON (°) 65

CLOUD TYPE: Cumulus/Cirrus CLOUD AMOUNT (%): 75

CURRENT WEATHER: Mostly Cloudy

BOTTOM DEPTH (meters): 14.64 WAVE HEIGHT (feet): 0

TIDAL CURRENT (check one): SLACK () EBB () FLOOD () NOT APPLICABLE ()**SECCHI DISK READINGS (Taken on sunny side of ship)****WHITE SIDE****WIRE ANGLE (° off of vertical)**

READING DOWN (meters): 7.0 DOWN (°): 0

READING UP (meters): 7.0 UP (°): 0

AVERAGE READING (meters): 7.0 CALCULATED DEPTH (meters): 7.0

NOTE: CALCULATED DEPTH = AVERAGE READING * COS(WIRE ANGLE)

WATER COLOR**(Observation when Secchi disc is at ½ of average depth reading;
Forel-Ule number is preferred but if not available fill in at least one other)**

FOREL-ULE NO.: 3 pretty

MUNSEL PAINT SCALE: N/A

DESCRIPTION OF WATER COLOR TO UNAIDED EYE: Teal/Turquoise

CHECK ANY SEA SURFACE CONDITIONS WHICH MAY AFFECT READINGSWAVES () RIPPLES () FOAM () PRECIPITATION () OIL () DEBRIS ()GLITTER () GLARE () PLANKTERS () OVERBOARD DISCHARGE () OTHER ()**POLAROID GLASSES OR OTHER AIDS: None****REMARKS:**

SECCHI DISK AND WATER COLOR LOG

SHIP: Swamp Fox OBSERVER: J. Herron

DATE (month, day, year): June 18, 2009 TIME (GMT): 0059 (LCL): 1059

LATITUDE (deg, min, sec, hemisphere) : 15-13-43N

LONGITUDE (deg, min, sec, hemisphere): 145-43-09E

LOCATION: Tanapag Channel, Saipan SUN ANGLE ABOVE HORIZON (°) 70

CLOUD TYPE: Cumulus/Cirrus CLOUD AMOUNT (%): 75

CURRENT WEATHER: Mostly Cloudy

BOTTOM DEPTH (meters): 12.30 WAVE HEIGHT (feet): 0

TIDAL CURRENT (check one): SLACK () EBB () FLOOD () NOT APPLICABLE ()**SECCHI DISK READINGS (Taken on sunny side of ship)****WHITE SIDE****WIRE ANGLE (° off of vertical)**

READING DOWN (meters): 7.5 DOWN (°): 0

READING UP (meters): 7.5 UP (°): 0

AVERAGE READING (meters): 7.5 CALCULATED DEPTH (meters): 7.5

NOTE: CALCULATED DEPTH = AVERAGE READING * COS(WIRE ANGLE)

WATER COLOR**(Observation when Secchi disc is at ½ of average depth reading;
Forel-Ule number is preferred but if not available fill in at least one other)**

FOREL-ULE NO.: 3 pretty

MUNSEL PAINT SCALE: N/A

DESCRIPTION OF WATER COLOR TO UNAIDED EYE: Teal/Turquoise

CHECK ANY SEA SURFACE CONDITIONS WHICH MAY AFFECT READINGSWAVES () RIPPLES () FOAM () PRECIPITATION () OIL () DEBRIS ()GLITTER () GLARE () PLANKTERS () OVERBOARD DISCHARGE () OTHER ()**POLAROID GLASSES OR OTHER AIDS: None****REMARKS:**

SECCHI DISK AND WATER COLOR LOG

SHIP: Swamp Fox OBSERVER: J. Herron

DATE (month, day, year): June 18, 2009 TIME (GMT): 0114 (LCL): 1014

LATITUDE (deg, min, sec, hemisphere) : 15-13-41N

LONGITUDE (deg, min, sec, hemisphere): 145-42-35E

LOCATION: Tanapag Channel, Saipan SUN ANGLE ABOVE HORIZON (°) 75

CLOUD TYPE: Cumulus/Cirrus CLOUD AMOUNT (%): 75

CURRENT WEATHER: Mostly Cloudy

BOTTOM DEPTH (meters): 10.50 WAVE HEIGHT (feet): 1

TIDAL CURRENT (check one): SLACK () EBB () FLOOD () NOT APPLICABLE ()**SECCHI DISK READINGS (Taken on sunny side of ship)****WHITE SIDE****WIRE ANGLE (° off of vertical)**

READING DOWN (meters): 5.0 DOWN (°): 0

READING UP (meters): 5.0 UP (°): 0

AVERAGE READING (meters): 5.0 CALCULATED DEPTH (meters): 5.0

NOTE: CALCULATED DEPTH = AVERAGE READING * COS(WIRE ANGLE)

WATER COLOR**(Observation when Secchi disc is at ½ of average depth reading;
Forel-Ule number is preferred but if not available fill in at least one other)**

FOREL-ULE NO.: 3 pretty

MUNSEL PAINT SCALE: N/A

DESCRIPTION OF WATER COLOR TO UNAIDED EYE: Teal/Turquoise

CHECK ANY SEA SURFACE CONDITIONS WHICH MAY AFFECT READINGSWAVES () RIPPLES () FOAM () PRECIPITATION () OIL () DEBRIS ()

GLITTER () GLARE () PLANKTERS () OVERBOARD DISCHARGE () OTHER ()

POLAROID GLASSES OR OTHER AIDS: None**REMARKS:**

SECCHI DISK AND WATER COLOR LOG

SHIP: Swamp Fox OBSERVER: J. Herron

DATE (month, day, year): June 18, 2009 TIME (GMT): 0129 (LCL): 1129

LATITUDE (deg, min, sec, hemisphere) : 15-13-41N

LONGITUDE (deg, min, sec, hemisphere): 145-42-04E

LOCATION: Tanapag Channel, Saipan SUN ANGLE ABOVE HORIZON (°) 80

CLOUD TYPE: Cumulus/Cirrus CLOUD AMOUNT (%): 75

CURRENT WEATHER: Mostly Cloudy

BOTTOM DEPTH (meters): 12.60 WAVE HEIGHT (feet): 2

TIDAL CURRENT (check one): SLACK () EBB () FLOOD () NOT APPLICABLE ()**SECCHI DISK READINGS (Taken on sunny side of ship)****WHITE SIDE****WIRE ANGLE (° off of vertical)**

READING DOWN (meters): 5.0 DOWN (°): 0

READING UP (meters): 5.0 UP (°): 0

AVERAGE READING (meters): 5.0 CALCULATED DEPTH (meters): 5.0

NOTE: CALCULATED DEPTH = AVERAGE READING * COS(WIRE ANGLE)

WATER COLOR**(Observation when Secchi disc is at ½ of average depth reading;
Forel-Ule number is preferred but if not available fill in at least one other)**

FOREL-ULE NO.: 2 pretty

MUNSEL PAINT SCALE: N/A

DESCRIPTION OF WATER COLOR TO UNAIDED EYE: Light Blue/Aqua

CHECK ANY SEA SURFACE CONDITIONS WHICH MAY AFFECT READINGSWAVES () RIPPLES () FOAM () PRECIPITATION () OIL () DEBRIS ()GLITTER () GLARE () PLANKTERS () OVERBOARD DISCHARGE () OTHER ()**POLAROID GLASSES OR OTHER AIDS: None****REMARKS:**

SECCHI DISK AND WATER COLOR LOG

SHIP: Swamp Fox OBSERVER: J. Herron

DATE (month, day, year): June 18, 2009 TIME (GMT): 0144 (LCL): 1144

LATITUDE (deg, min, sec, hemisphere) : 15-13-25N

LONGITUDE (deg, min, sec, hemisphere): 145-41-46E

LOCATION: Tanapag Channel, Saipan SUN ANGLE ABOVE HORIZON (°) 85

CLOUD TYPE: Cumulus/Cirrus CLOUD AMOUNT (%): 75

CURRENT WEATHER: Mostly Cloudy

BOTTOM DEPTH (meters): 12.60 WAVE HEIGHT (feet): 2

TIDAL CURRENT (check one): SLACK () EBB () FLOOD () NOT APPLICABLE ()**SECCHI DISK READINGS (Taken on sunny side of ship)****WHITE SIDE****WIRE ANGLE (° off of vertical)**

READING DOWN (meters): 4.0 DOWN (°): 0

READING UP (meters): 4.0 UP (°): 0

AVERAGE READING (meters): 4.0 CALCULATED DEPTH (meters): 4.0

NOTE: CALCULATED DEPTH = AVERAGE READING * COS(WIRE ANGLE)

WATER COLOR**(Observation when Secchi disc is at ½ of average depth reading;
Forel-Ule number is preferred but if not available fill in at least one other)**

FOREL-ULE NO.: 2 pretty

MUNSEL PAINT SCALE: N/A

DESCRIPTION OF WATER COLOR TO UNAIDED EYE: Light Blue/Aqua

CHECK ANY SEA SURFACE CONDITIONS WHICH MAY AFFECT READINGSWAVES () RIPPLES () FOAM () PRECIPITATION () OIL () DEBRIS ()

GLITTER () GLARE () PLANKTERS () OVERBOARD DISCHARGE () OTHER ()

POLAROID GLASSES OR OTHER AIDS: None**REMARKS:**

W00208 HCell Report
Kurt Brown, Physical Scientist
Pacific Hydrographic Branch

1. Specifications, Standards and Guidance Used in HCell Compilation

HCell compilation of survey W00208 used:

Office of Coast Survey HCell Specifications: Draft, Version : 4.0, 17 March, 2010.
HCell Reference Guide: Version 2.0, 22 February, 2010.

Note that an area of W00208 was superseded by survey W00211 after several dangers were identified and removed in the approach to the channel. As the surveys were compiled concurrently, the portion of W00208 that is superseded by W00211 was not compiled. The HCell for W00211 should be used in this area.

1. Compilation Scale

Depths and features for HCell W00208 were compiled to the following raster charts shown in the table, below:

Chart	Scale	Edition	Edition Date	NTM Date
81076	1:12,000	12th	008/01/2007	05/15/2010

The following ENC's were also used during compilation:

Chart	Scale
US5SP07M	1:12,000

2. Soundings

A survey-scale sounding (SOUNDG) feature object layer was built in CARIS BASE Editor from the shoal layer of the 0.5-meter combined surface, W00208_Combined_50cm. A shoal-biased selection was made at 1:2,500 survey scale using a Radius Table file with values shown in the table, below.

Shoal Limit (m)	Deep Limit (m)	Radius (mm)
-4.7	10	3
10	20	4
20	50	4.5
50	200	5

In CARIS BASE Editor soundings were manually selected from the high density sounding layers (SS) and imported into a new layer (CS) created to accommodate chart density depths. Manual selection was used to accomplish a density and distribution that closely represents the seafloor morphology.

3. Depth Contours

Depth contours at the intervals on the largest scale chart are included in the *_SS HCell for MCD raster charting division to use for guidance in creating chart contours. The metric and fathom equivalent contour values are shown in the table below.

Chart Contour Intervals in Feet from Chart 16708	Metric Equivalent to Chart Feet, Arithmetically Rounded	Metric Equivalent of Chart Feet, with NOAA Rounding Applied	Feet with NOAA Rounding Applied	Feet with NOAA Rounding Removed for Display on W00208_SS.000
0	0	0.000	0.000	0
6	1.8288	2.0574	6.75	6
18	5.4864	5.715	18.75	18
36	10.9728	11.2014	36.75	36

With the exception of the zero contours included in the *_CS file, contours have not been deconflicted against shoreline features, soundings and hydrography, as all other features in the *_CS file and soundings in the *_SS have been. This may result in conflicts between the *_SS file contours and HCell features at or near the survey limits. Conflicts with M_QUAL, COALNE and SBDARE objects, and with DEPCNT objects representing MLLW, should be expected. HCell features should be honored over *_SS.000 file contours in all cases where conflicts are found.

4. Meta Areas

The following Meta object areas are included in HCell W00208:

M_QUAL

The Meta area objects were constructed on the basis of the limits of the hydrography.

5. Features

Features addressed by the field units are delivered to PHB where they are deconflicted against the hydrography and the largest scale chart. These features, as well as features digitized from the Base Surface are included in the HCell. Features to be retained from the chart were bluenoted in the HCell. See the HCell Reference Guide for guidance used in compiling features to the chart scale HCell.

6. S-57 Objects and Attributes

The *_CS HCell contains the following Objects:

\$CSYMB	Blue Notes-Notes to the MCD chart Compiler
M_QUAL	Data quality Meta object
SBDARE	Bottom Samples
SOUNDG	Soundings at the chart scale density
COALNE	Charted coastline connected to revised wharf

SLCONS	Revised wharf
LIGHTS	Private ATON
\$LINES	Used for delineation of pipeline visible in SWMB data

The *_SS HCell contains the following Objects:

DEPCNT	Generalized contours at chart scale intervals
SOUNDG	Soundings at the survey scale density

7. Spatial Framework

7.1 Coordinate System

All spatial map and base cell file deliverables are in an LLDG geographic coordinate system, with WGS84 horizontal, MHW vertical, and MLLW (1983-2001 NTDE) sounding datums.

7.2 Horizontal and Vertical Units

DUNI, HUNI and PUNI are used to define units for depth, height and horizontal position in the chart units HCell, as shown below.

Chart Unit Base Cell Units:

Depth Units (DUNI):	Feet
Height Units (HUNI):	Feet
Positional Units (PUNI):	Meters

During creation of the HCell in CARIS BASE Editor and CARIS S-57 Composer, all soundings and features are maintained in metric units with as high precision as possible. Depth units for soundings measured with sonar maintain millimeter precision. Depths on rocks above MLLW and heights on islets above MHW are typically measured with range finder, so precision is less. Units and precision are shown below.

BASE Editor and S-57 Composer Units:

Sounding Units:	Meters rounded to the nearest millimeter
Spot Height Units:	Meters rounded to the nearest decimeter

See the HCell Reference Guide for specific metric to charting units conversion routines and formulas for application of NOAA rounding.

9. Data Processing Notes

There were no significant deviations from the standards and protocols given in the HCell Specification and HCell Reference Guide.

10. QA/QC and ENC Validation Checks

W00208 was subjected to QA checks in S-57 Composer prior to exporting to the metric HCell base cell (000) file. The millimeter precision metric S-57 HCell was converted to chart units and NOAA rounding applied. dKart Inspector was then used to further check the data set for

conformity with the S-58 ver. 2 standard (formerly Appendix B.1 Annex C of the S-57 standard). All tests were run and warnings and errors investigated and corrected unless they are MCD approved as inherent to and acceptable for HCells.

11. Products

11.1 HSD, MCD and CGTP Deliverables

W00208_CS.000	Base Cell File, Chart Units, Soundings and features compiled to 1:40,000
W00208_SS.000	Base Cell File, Chart Units, Soundings and Contours compiled to 1:10,000
W00208_DR.pdf	Descriptive Report including end notes compiled during office processing and certification, the HCell Report, and supplemental items
W00208_outline.gml	Survey outline
W00208_outline.xsd	Survey outline

11.3 Software

CARIS HIPS Ver. 6.1	Inspection of Combined BASE Surfaces
CARIS BASE Editor Ver. 2.3	Creation of soundings and bathy-derived features, creation of the depth area, meta area objects, and Blue Notes; Survey evaluation and verification; Initial HCell assembly.
CARIS S-57 Composer Ver. 2.1	Final compilation of the HCell, correct geometry and build topology, apply final attributes, export the HCell, and QA.
CARIS GIS 4.4a	Setting the sounding rounding variable for conversion of the metric HCell to NOAA charting units with NOAA rounding.
CARIS HOM Ver. 3.3	Perform conversion of the metric HCell to NOAA charting units with NOAA rounding.
HydroService AS, dKart Inspector Ver. 5.1, SP 1	Validation of the base cell file.
Northport Systems, Inc., Fugawi View ENC Ver.1.0.0.3	Independent inspection of final HCells using a COTS viewer.

12. Contacts

Inquiries regarding this HCell content or construction should be directed to:

Kurt Brown
 Physical Scientist
 Pacific Hydrographic Branch
 Seattle, WA
 206-526-6839
 kurt.brown@noaa.gov

ABBREVIATED REPORT OF SURVEY

**TANAPAG HARBOR APPROACH,
SAIPAN ISLAND**

COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

ARCHIVE # 10CQ01

NOVEMBER 2009 THROUGH JANUARY 2010

Jessica Burt
Hydrographer in Charge

UNCLASSIFIED

DISTRIBUTION STATEMENT A:

**APPROVED FOR PUBLIC RELEASE
DISTRIBUTION UNLIMITED**

FLEET SURVEY TEAM
STENNIS SPACE CENTER, MISSISSIPPI

REPORT OF SURVEY
ARCHIVE # 10CQ01

Country: Commonwealth of the Northern Mariana Islands (CNMI), USA

Area: Tanapag Harbor, Saipan Island

Dates of Survey: 23 November 2009 – 09 December and 05 – 25 January 2010

Archive #: 10CQ01

Chart: NOAA 81076, 12th Ed., Aug./07

Sailing Directions: NGA PUB 126, Pacific Islands

World Port Index: Port of Saipan 56520

U.S. Coast Guard
Light List: Volume VI, Pacific Coast and Pacific Islands, 2009

NGA
List of Lights: PUB. 111, 2008

Horizontal Datum: World Geodetic System 1984 (WGS 84)

Projection: Transverse Mercator

Grid: Universal Transverse Mercator (UTM)
Central Meridian = 147° E
UTM Zone 55N

Sounding Datum: Mean Lower Low Water (MLLW)

Vertical Datum: Mean Sea Level (MSL)

Survey Team

Name	Qualification	Dates (2009-2010)	Position
Jessica Burt	Hydrographer M1	23 Nov – 25 Jan	Hydrographer in Charge
Lt Michael Redmayne, RN	Hydrographer M1	23 Nov – 19 Jan	Hydro Lead
Henry Stout	Electronic Technician	23 Nov – 25 Jan	Electronic Technician

STATISTICS

PRIMARY DATA COLLECTION	MILEAGE	REMARKS
Multibeam	8.95 nm	
Singlebeam	0.00 nm	
Side Scan	0.00 nm	

DATA TYPE	GOOD	BAD	TOTAL	REMARKS
XBT Drops	0	0	0	
Bottom Samples	0	0	0	
DigiBar SV Casts	3	0	3	
CTD Casts	0	0	0	
Optics	0	0	0	
Water Samples	0	0	0	
ADCP Points	0	0	0	
Tide Stations	1	0	50 Days	

DATA DELIVERED	NUMBER	SCALE	REMARKS
Fully edited and validated multibeam dataset and abbreviated report of survey	1	N/A	Delivered to NAVO for update of field chart and NOAA for update of official chart

Action	NUMBER	REMARKS
Bathymetric Data Collection Days	1	On water days collecting data
Ancillary Data Collection Days	2	Tide gauge level in/out
Boat setup/tear down	4	
Processing days	2	
Days Lost to Shipping Issues	12	
Days Lost to Bad Weather	8	
Total Days On Site	37	

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1. General

1.1. Requirements: A detachment of the Fleet Survey Team (FST) conducted a hydrographic survey of the Tanapag Harbor Approach in conjunction with USNS SAFEGUARD/Mobile Dive Salvage Unit (MDSU) Danger to Navigation (DTON) removal operations. A DTON in this area is defined by the Navy to be any object with a depth less than 36 ft.

1.2. Survey Area and Objectives: The area surveyed is within the territorial waters of the Commonwealth of the Northern Mariana Islands (CNMI). The survey's main objective was to collect high-resolution, high-density multibeam data to verify successful clearance of DTONs identified during survey 09CQ01.

1.3. Elements Affecting Survey Operations:

1.3.1. Weather: Weather conditions had a substantial impact on survey operations. Winds in excess of 20kts lasted for several days and caused survey work to be postponed twice.

1.3.2. Local Elements: The Port of Tanapag has low to moderate shipping activity, resulting in minimal survey disruption. Pleasure craft and commercial operators infrequently crossed in front of the survey platform causing the survey team to deviate from the survey line.

2. Datums and Geodetic Control

2.1. Datums:

2.1.1. Horizontal Datum: World Geodetic System 1984 (WGS84).

2.1.2. Projection Grid: Universal Transverse Mercator (UTM) Zone 55 – North.

2.1.3. Vertical Datum: Mean Sea Level (MSL).

2.1.4. Sounding Datum: Mean Lower Low Water (MLLW).

2.2. Geodetic Control: This survey utilized a WADGPS system that received differential corrections via satellite; thus, the survey party was not required to establish an accurate horizontal control point. However, the survey party did make use of the rudimentary control point, FST-TPG, established during survey 09CQ01 for the purpose of checking the horizontal accuracy of the survey platform's principle positioning system, a NAVCOM SF-2050M GPS receiver. The control point, FST-TPG, is marked by a bolt glued to the cement sidewalk located between docks Charlie and Delta. One hour of GPS data was collected and then processed using SA Watch. See *Appendix G* for the results.

2.3. Station Description: FST-TPG is located between Charlie and Delta Docks along the sidewalk between the two docks and is approximately 15 meters west of the southwest corner of Delta Dock or 13 meters east of the southeast corner of Charlie Dock. See *Appendix G* for a detailed description.

2.4. Shoreline: No shoreline data was collected during this survey.

3. Digital Surveying System

3.1. Data Collection and Processing Systems: No significant hardware problems were encountered. *Appendix B* lists equipment utilized for this project.

3.2. Data Collection and Processing Software: No significant software problems were encountered. *Appendix C* lists software utilized for this project.

3.3. Performance: Quality of the data obtained depended heavily on the sea-state in which it was collected. The final post DTON removal survey was conducted during favorable conditions.

4. Side Scan Sonar

4.1. Equipment: No side scan was collected.

5. Calibrations

5.1. Horizontal Positioning: The horizontal positioning system utilized on the vessel was a NAVCOM SF-2050M GPS system. To test static accuracy, the system was set up over geodetic point FST-TPG for one hour. Results indicate an accuracy of 0.5m at 95% confidence. See *Appendix G* for additional information.

5.2. Motion Sensor: This survey employed a DMS 25 motion sensor system that is bolted on to the multibeam echosounder.

5.3. Multibeam Echosounder: This survey employed an Odom ES3-M multibeam echosounder. Prior to sounding data collection, the team performed multibeam echosounder calibrations, which involved patch tests to determine position latency, roll bias, pitch bias and yaw bias values. Patch test results indicate no position latency. The bias values for roll, pitch, and yaw were determined to be 0° for the purposes of the vessel configuration within Caris HIPS. This is due to the motion sensor being attached to the sounder, and therefore any of these bias figures are taken into account real time. In order to ensure that the internal “zeroes” of the motion sensor were reading correctly with

reference to the actual plane of x, y and z a patch test was conducted and found to be correct. Refer to *Appendix F* for patch test results.

5.4. Survey Platform: Survey operations were performed onboard a Naval 7-meter RHIB equipped with an inboard motor capable of propelling the RHIB in excess of 20kts; however, vessel speed was limited between 3kts and 5kts for data collection operations. The vessel configuration file used in data processing is provided in *Appendix F*.

6. Bathymetry

6.1. Sounding Development: DTON removal operations caused USNS SAFEGUARD to anchor in the Approach; it was noticed that during one evolution the anchor dragged a rock into a new position and effectively created a new DTON which was later removed. To ensure that no other new DTONs were created by SAFEGUARD's anchors, FST surveyed the entire area in which they had worked/moored. Development lines were oriented parallel to the approach boundaries and spaced 10 meters apart. No new DTONs were found. See *Appendix A* for survey area graphics.

6.2. Sounding Selection: The shoalest point over each DTON position was determined by using the "find and designate" function in Caris HIPS version 6.1, SP2. Final post-DTON removal depths can be found in *Appendix A*.

6.3. Cross Check Lines: Surrounding Area: Four cross check lines were run across the middle of the surrounding area and compared against a 50cm-resolution base surface. Results indicate that the data passes IHO Order 1a standards for depth accuracy. See *Appendix D* for additional information.

6.4. Agreement with Existing Charts: NOAA Chart 81076 was referenced for data comparison. 10CQ01 data is in agreement with the chart¹.

6.5. Agreement with Prior Surveys: A 50cm resolution base surface of 10CQ01 data was compared to a 50cm resolution base surface of 09CQ01 data. The 09CQ01 data was collected with a Reson 7125 multibeam system. A difference surface was generated in Caris BASE Editor between the 10CQ01 dataset and the 09CQ01 dataset. Comparison results with the previous data indicate an average difference of 0.773 ft with a standard deviation of 0.460 ft.

The 10CQ01 data is deeper than the 09CQ01 data². See *Appendix D* for additional information.

6.6. Reports of Dangers/Hydrographic Notes: NOAA Chart 81076 shows that the approach and channel areas are clear to a depth of 34 ft except in the vicinity of buoy 2A. Our data supports this information; however, the depth of interest for

this entire survey area is 36 ft. FST survey 09CQ01 identified sixteen contacts with a least depth of less than 36 ft in the area that is encompassed by the delineation of the approach, channel and harbor as it appears on NOAA Chart 81076.³ This survey was to verify the removal of five of those sixteen DTONs by USNS SAFEGUARD/MDSU1 CO17. More information about the DTON removal results can be found in *Appendix A*.

7. Oceanography

7.1. CTD Stations: No CTD casts were taken. Sound velocity profiles were taken at regular intervals during survey operations with an Odom Digibar Pro.

7.2. Oceanographic Parameters: No additional oceanographic parameters were collected.

7.3. ADCP: No system was deployed.

8. Sailing Directions and Nomenclature

8.1. Sailing Direction Changes: No changes to the current information published in NGA Pub. 126 or NOAA Coast Pilot 7 were required.

8.2. Prominent Features: Prominent features descriptions in Coast Pilot 7 are accurate.

8.3. Warnings and Cautions: Warnings and cautions stated on NOAA Chart 81076 and in the Coast Pilot remain applicable.

8.4. Anchorage Area: The team did not confer with Saipan Port Authority officials concerning anchorage areas.

8.5. Photography: No photographs of the survey area were taken.

9. Tides, Tide Gauges and Sounding Datum

9.1. Tide Gauge Location: The tide gauge was installed on the pier wall where Delta Dock meets the parking lot of the Commonwealth Port Authority office building near Benchmark UH-2C. See *Appendix E* for locations and photographs.

9.2. Tide Gauge Comparison: Tide data was compared to observations of the tide staff for 6 hours on two occasions. The average difference between the two was used to determine the vertical offset between gauge zero, staff zero, and the

bench marks used for leveling. A diagram of the vertical offsets between all relevant points can be found in *Appendix E*. In addition a comparison of the FST gauge was made against the University of Hawaii gauge located approximately 1 meter from the FST gauge, and they were found to be in agreement.

9.3. Tide Gauge Type: In-Situ Mini Troll 700 Vented.

9.4. Tide Gauge Malfunctions: The tide gauge remained operational for the entire collection period. The gauge resorted to an incorrect time zone for a period of time during the survey, however this was corrected for and checked for accuracy.

9.5. Standard Port: Guam.

10. Tidal Streams and Currents

10.1. Tidal Streams and Currents: Tidal streams and currents were not measured.

11. Seabed Topography and Texture

11.1. Seabed Topography and Texture: No bottom samples were collected.

11.2. Sonar Trace Interpretation: Not applicable.

11.3. Dredging Activities: USNS SAFEGUARD did not dredge the Approach, but did eliminate DTONs either by moving them to deeper water or crushing them in place. No other dredging type activities were noted.

11.4. Previous Survey Comparison: Not applicable.

12. Charted and Uncharted Wrecks and Obstructions

12.1. Charted Wrecks and Obstructions: There are numerous wrecks and obstructions depicted on NOAA Chart 81076, but none were located within the Tanapag Harbor Approach survey area. The search was limited to the area in which the USNS SAFEGUARD conducted their DTON removal operations using the Odom ES3-M multibeam to confirm the clearance of previously identified DTONs and ensure that no new DTONs were created by the ship's anchors.

12.2. Uncharted Wrecks and Obstructions: No uncharted wrecks or obstructions were found.

12.3. Wrecks and Obstructions Least Depth: Least depth for all DTONs was determined from multibeam data. See *Appendix A* for more information.

13. Charted and Uncharted Lights, NAVAIDs, Buoys and Piers

13.1. Light Characteristics: Light and buoy characteristics were not observed during this survey.

14. Coastline, Topography, Conspicuous Objects

14.1. Coastline Positioning: Shoreline positions were not collected during this survey.

14.2. Conspicuous Objects: There were no objects to report.

15. Ancillary Observations

15.1. Water Clarity Observations: No water clarity observations were conducted.

15.2. Biological Observations: No biological observations were conducted.

16. Accuracy of Soundings

16.1 Total Vertical Uncertainty: Caris HIPS 6.1 SP2 was used to generate an uncertainty surface from the final 10CQ01 multibeam dataset. Total Propagated Error (TPE) values from the manufacturers' technical specifications for the various devices were entered into the vessel configuration file and the "Compute TPE" function was utilized. The minimum uncertainty was 0.636 ft and the maximum uncertainty was 0.850 ft with an average uncertainty of about 0.65 ft for the entire survey area. The allowable vertical uncertainty to meet IHO Order 1a in 32.8 ft of water is 1.693 ft. The majority of the 10CQ01 survey area is deeper than 32.8 ft and thus the allowable vertical uncertainty to meet IHO Order 1a is greater than 1.693 ft. See *Appendix D* for additional information.

17. Positional Accuracy

17.1. Vessel Reference Point and Offsets: All offsets are referenced to the DMS 25 Motion Reference Unit (MRU), which is bolted to the Odom ES3 multibeam echosounder. Offset measurements were calculated from the technical

specification diagrams and made using a steel tape. See *Appendix F* for additional information.

17.2. Positional Accuracy: A NAVCOM SF-2050M GPS system was utilized as the positioning system on the RHIB throughout this survey. A static test was performed to evaluate system accuracy. Results indicated an accuracy of 0.5 meter at the 95% confidence level.

18. Weekly Summary

18.1. Weekly Summary: See *Appendix H*.

19. Summary/Closing Remarks

The main purpose of SURVOP 10CQ01 was to collect high-resolution, high-density multibeam data to verify the DTON removal efforts of USNS SAFEGUARD. Results indicate that 5 DTONs were successfully removed from the Approach area.

It should be noted that the vertical accuracy of this survey is to IHO Order 1a, not IHO Special Order. In accordance with IHO Order 1a the uncertainty associated with the data gathered during this survey *may mean that the depths measured are shallower than 36' in the main channel*. Care should be taken when using the data to produce a product that suggests a fixed channel depth, and it is recommended that information regarding vertical uncertainty be passed to the mariner who may use any such product.

The survey team would like to thank the USNS SAFEGUARD and MDSU divers for their excellent support during this SURVOP. The mission essential support they provided enabled us to complete this project.

MEMORANDUM

From: Jessica Burt, Hydrographer in Charge 10CQ01

To: Commanding Officer, Fleet Survey Team

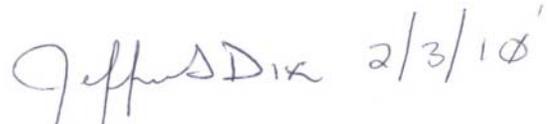
Via: Plans Department

SUBJ: INTERNATIONAL HYDROGRAPHIC ORGANIZATION SURVEY ORDER
RECOMMENDATION FOR SURVEY 10CQ01

1. Recommend that survey 10CQ01 be accepted as meeting International Hydrographic Organization (IHO) Order 1a survey standards in accordance with IHO Special Publication 44, 5th Edition, dated February 2008. All data as noted in the following report meets or exceeds the requirements for IHO Order 1a Survey.


Ms. Jessica Burt
Hydrographer in Charge, 10CQ01

2. After reviewing survey 10CQ01, Fleet Survey Team Plans Department Quality Review Team concurs with above recommendation.


2/3/10

LCDR Jeffrey Dixon
Plans Department Head

3. Concur with recommendation.


2/3/10
CDR R. R. Delgado
Commanding Officer
Fleet Survey Team

Revisions Compiled During Office Processing and Certification

¹ Concur with clarification. Although there is general agreement with the chart, depths have changed 1-2 feet in several areas.

² Concur

³ Several soundings less than 36 ft remain at the outside edge of the channel and are included in the HCell. The compiler recommends that soundings be charted as shown in the HCell and that the controlling depth of the channel be changed to 36 ft.

10CQ01

Tanapag Harbor Approach, Saipan

Appendix A:

Survey Area Graphic and DTON Removal Results

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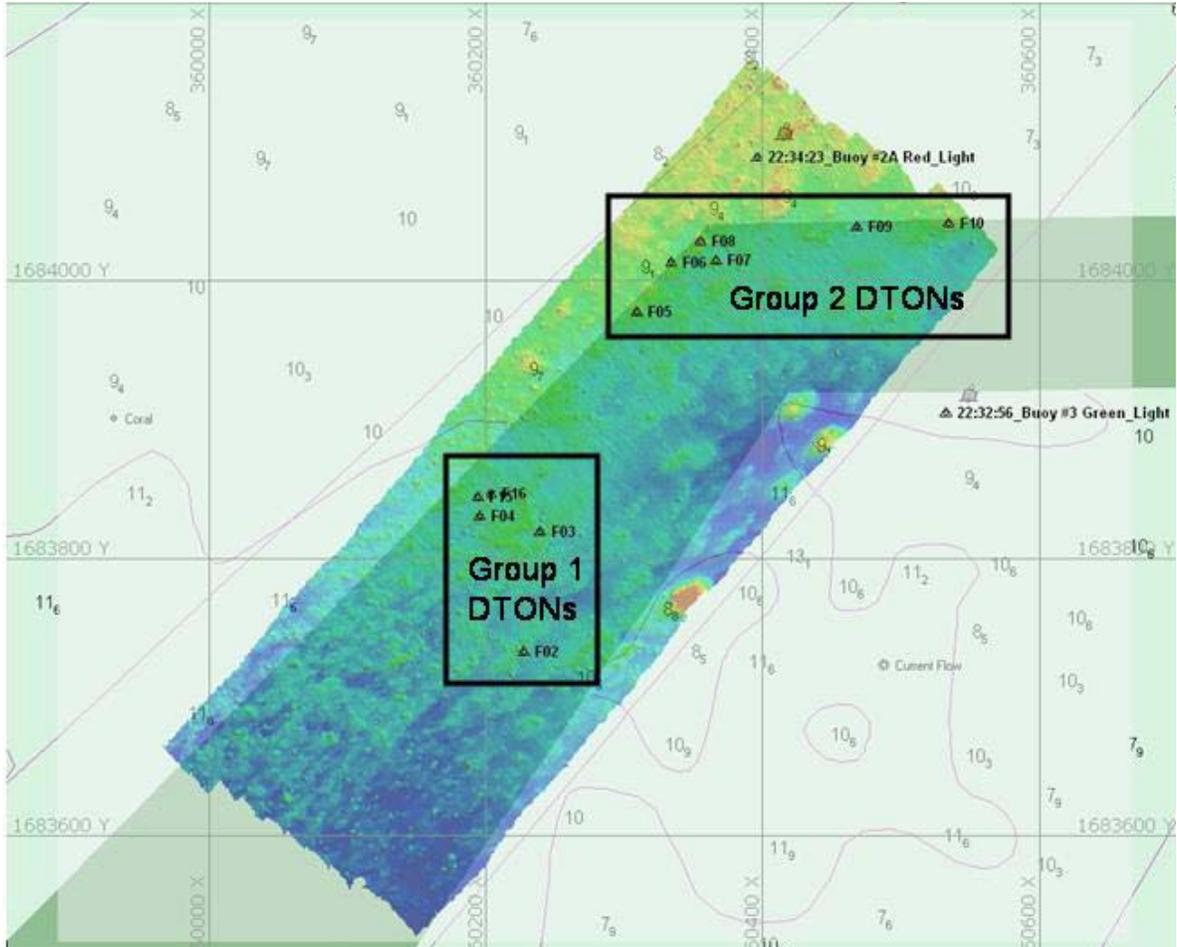


Figure A-1: Picture showing MBES coverage identifying the 2 groups of DTONs surveyed during 10CQ01.

Positions given in the following tables are from the 10CQ01 dataset and may vary slightly from previously reported positions; this is to be expected.

DTON	Latitude	Longitude	June 2009 Reson 7125 Depth	January 2010 Odom ES3-M Depth	June 2009 depth minus January 2010 depth
F02	15° 13' 33.34" N	145° 41' 54.96" E	35.751 ft	37.500 ft	-1.749 ft
F03	15° 13' 36.18" N	145° 41' 55.44" E	34.655 ft	37.917 ft	-3.262 ft
F04	15° 13' 36.54" N	145° 41' 53.87" E	34.751 ft	37.037 ft	-2.286 ft
F15	15° 13' 37.06" N	145° 41' 53.76" E	35.167 ft	38.786 ft	-3.619 ft
F16	15° 13' 37.11" N	145° 41' 54.25" E	35.407 ft	37.270 ft	-1.863 ft
Average Depth Difference:					-2.5558 ft

Table A-1: Group 1 DTONs – worked on by SAFEGUARD.

DTON	Latitude	Longitude	June 2009 Reson 7125 Depth	January 2010 Odom ES3-M Depth	June 2009 depth minus January 2010 depth
F05	15° 13' 41.37" N	145° 41' 57.67" E	35.873 ft	36.365 ft	-0.492 ft
F06	15° 13' 42.55" N	145° 41' 58.45" E	35.636 ft	35.686 ft	-0.050 ft
F07	15° 13' 42.56" N	145° 41' 59.56" E	35.193 ft	36.217 ft	-1.024 ft
F08	15° 13' 43.05" N	145° 41' 59.21" E	35.095 ft	35.466 ft	-0.371 ft
F09	15° 13' 43.37" N	145° 42' 02.99" E	34.029 ft	34.285 ft	-0.256 ft
F10	15° 13' 43.49" N	145° 42' 05.17" E	34.445 ft	35.282 ft	-0.837 ft
Average Depth Difference:					-0.505 ft

Table A-2: Group 2 DTONS – not worked on by SAFEGUARD.

10CQ01

Tanapag Harbor Approach, Saipan

Appendix B:

List of Equipment

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LIST OF EQUIPMENT		
Equipment Name	DPAS or Serial No.	Remarks
7m RHIB Survey Platform	---	1
Laptop, Hysweep Acquisition	DPAS 78322	1
Laptop, ES3 Control	DPAS 78314	1
Computer, processing	DPAS 79501	1
Odom ES3-M multibeam system which consists of an Odom ES3 echosounder with a TSS DMS 25 MRU bolted on to it	DPAS 79783	1
DigiBar V sound velocimeter (for sound speed at the transducer)	DPAS 79783	1
DigiBar Pro (for sound speed profile throughout the water column)	S/N 98705	1
NAVCOM SF-2050M GPS Receiver	DPAS 79351	1
Hemisphere Crescent VS-110 Heading Sensor	S/N 0803-5594-004	1
InSitu MiniTROLL 700 Vented Tide Gauge	S/N 134939	1
Leica Digital Level	S/N 723289	1

10CQ01

Tanapag Harbor Approach, Saipan

Appendix C:

List of Software

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LIST OF SOFTWARE	
Software and Version	Remarks
HYPACK© Version 2009a with updated gps.dll	
Hysweep 2009a	
Odom ES3 Control Program	
Caris HIPS and SIPS Version 6.1 SP2	
Caris HIPS and SIPS Hotfixes 1 through 8	
Caris GIS Version 4.4a SP 5	
Caris GIS Hotfixes 1 through 38	
Caris Bathy DataBASE Version 2.3	
Fledermaus Version 7.0.1	
Data Magic Version 7.0.1c	
SA Watch	
StarUtil	
In-Situ Win-Situ 5	
NAVOTAS	
Royal Admiralty Total Tide	
Adobe Acrobat Professional 8.0	
Microsoft Office 2003	

10CQ01

Tanapag Harbor Approach, Saipan

Appendix D:

Quality Control and Total Propagated Uncertainty (TPU)

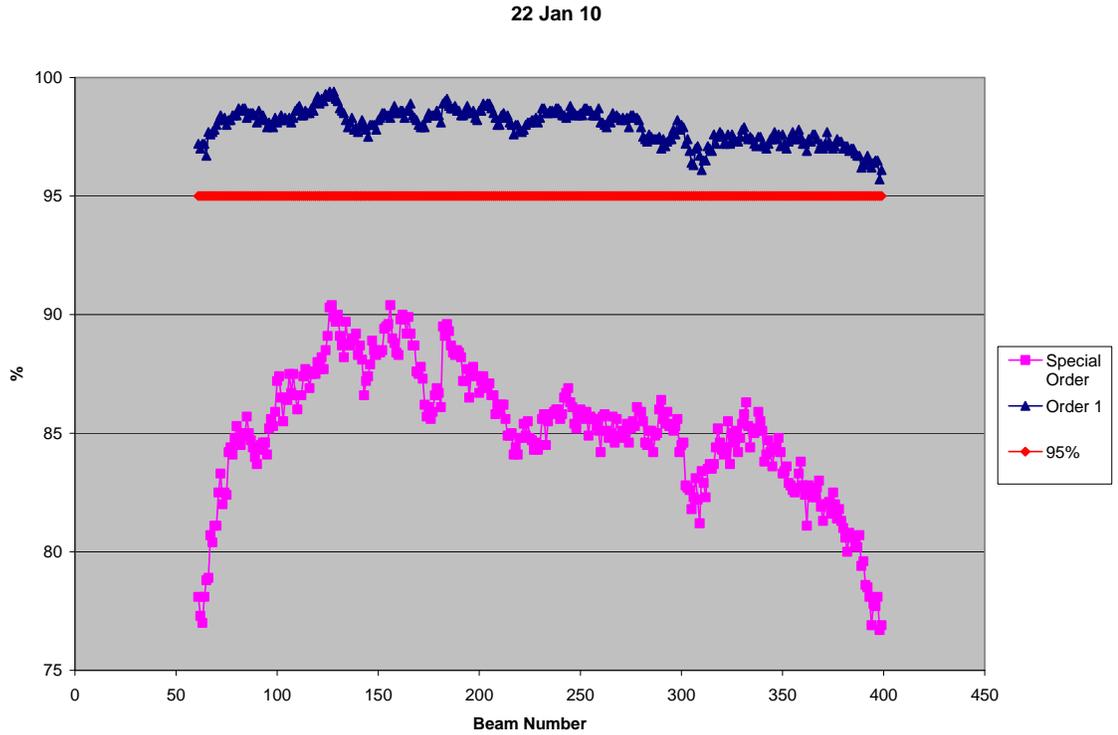
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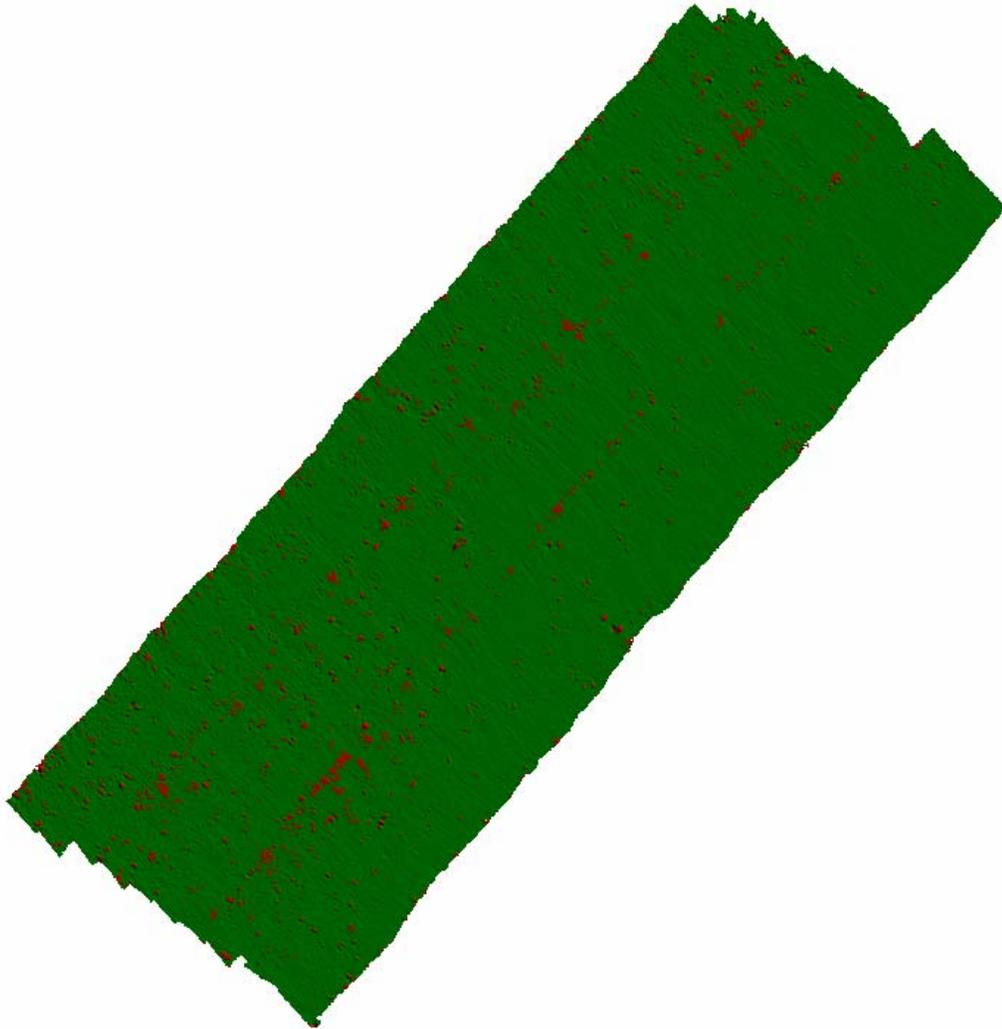
1. Cross Check Analysis

1.1 A filter was used to reject beams 1-60 and 400-480. Four cross check lines were compared to a 50cm resolution BASE surface. Results of the Caris HIPs and SIPs QC report are shown in the following graph:



2. Previous Survey Comparison

2.1 Caris BASE Editor was used to create a difference surface between 10CQ01 ES3-M data and 09CQ01 Reson 7125 data. The 10CQ01 data is, on average, 0.773 ft deeper than the 09CQ01 data. The standard deviation of the depth difference is 0.460 ft. The following graphic is a screen capture of the difference surface colored so that differences of less than 1.5 ft show up as green and differences of more than 1.5 ft show up as red.



3.0 TPE Values Entered into the Caris Vessel Configuration File

Heave Error: 0.030 or 5.000% of heave amplitude
 Measurement errors: 0.000
 Motion sensing unit alignment errors
 Gyro:0.000 Pitch:0.000 Roll:0.000
 Gyro measurement error: 0.150
 Roll measurement error: 0.250
 Pitch measurement error: 0.250
 Navigation measurement error: 0.100
 Transducer timing error: 0.000
 Navigation timing error: 0.000
 Gyro timing error: 0.000
 Heave timing error: 0.000
 PitchTimingStdDev: 0.000
 Roll timing error: 0.000
 Sound Velocity speed measurement error: 0.000
 Surface sound speed measurement error: 0.000
 Tide measurement error: 0.000
 Tide zoning error: 0.000
 Speed over ground measurement error: 0.257
 Dynamic loading measurement error: 0.030
 Static draft measurement error: 0.061
 Delta draft measurement error: 0.000

4. Caris HIPs BASE Surface QC Report

4.1 Results of the Caris HIPs BASE Surface QC Report, generated using the larger of standard deviation or uncertainty, are as follows:

Number of nodes processed: 591,997
 Number of nodes populated: 591,506 (99.9%)
 Number of holidays detected: 0

IHO S-44 Special Order:

Range: 0.0 to 20.0 (meters)
 Number of nodes considered: 591,506
 Number of nodes within: 368,222 (62.3%)
 Residual mean: 0.016269045337159

S-44 Order 1:

Range: 0.0 to 20.0 (meters)
 Number of nodes considered: 591,506
 Number of nodes within: 561,903 (95.0%)
 Residual mean: -0.243710658922387

5. Average Uncertainties versus Allowable Uncertainties

5.1 9,662 soundings, chosen from the areas where the BASE Surface showed the highest uncertainties, were queried in subset editor to generate the following:

Average Depth (ft)	Average Calculated Dp TPE (ft)	S44 Order 1a Allowable TVU (ft)	Average Calculated Hz TPE (ft)	S44 Order 1a Allowable THU (ft)
43.366	0.689	1.734	0.871	18.573

10CQ01

Tanapag Harbor Approach, Saipan

Appendix E:

Tides

UNCLASSIFIED

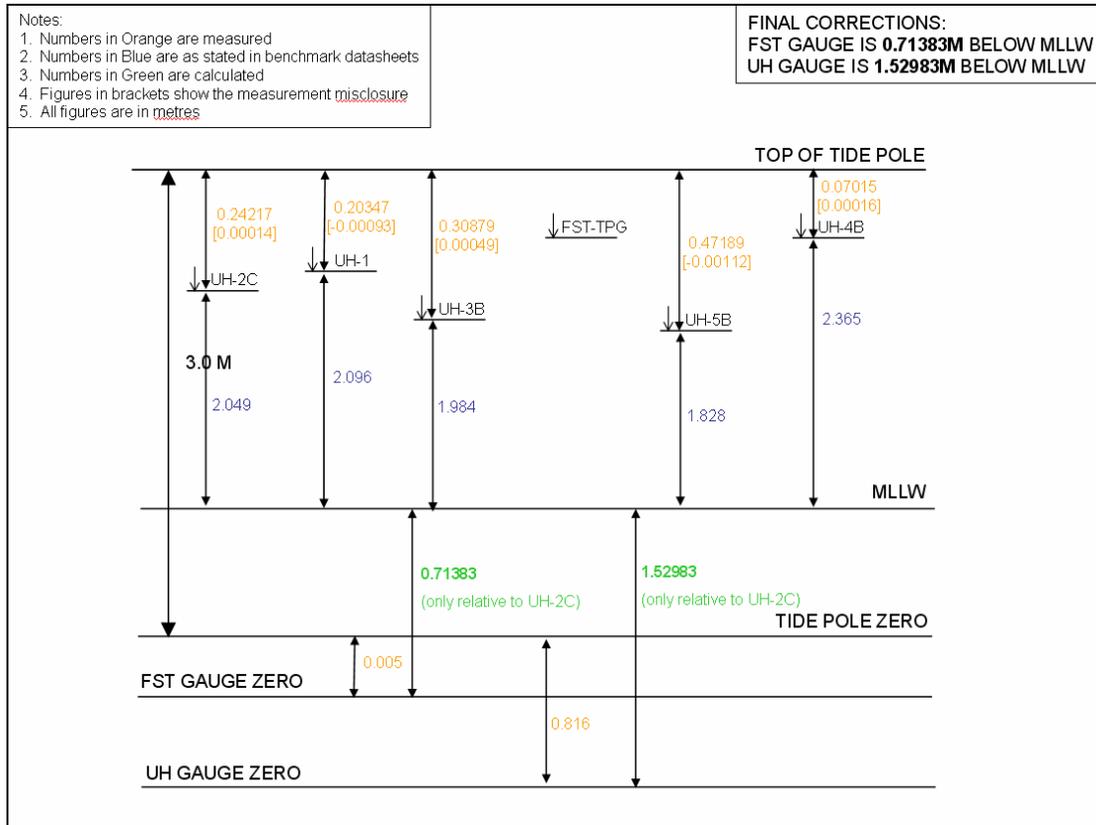
DISTRIBUTION STATEMENT A:

**APPROVED FOR PUBLIC RELEASE
DISTRIBUTION UNLIMITED**

1. Determination of Sounding Datum

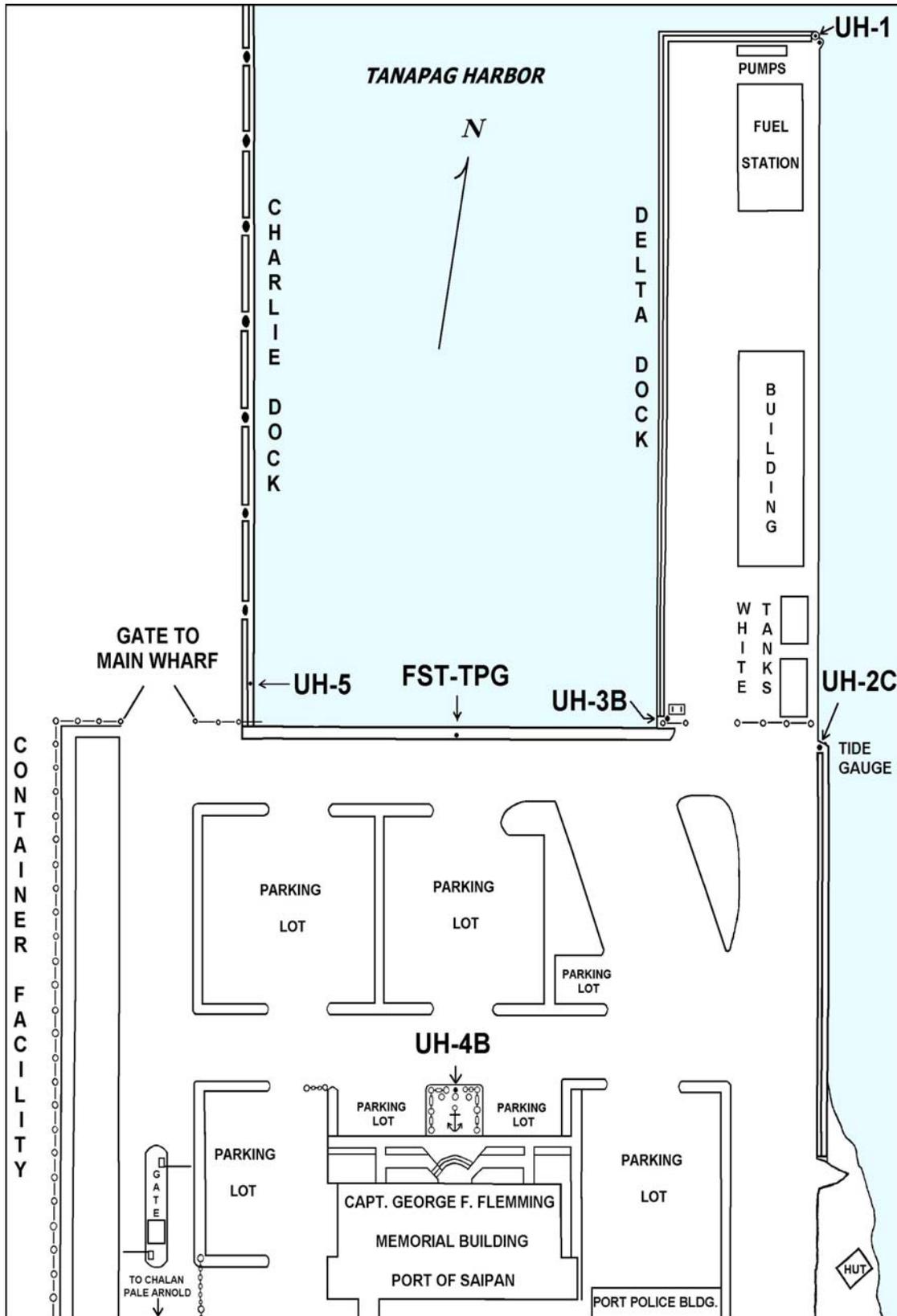
1.1 Sounding datum for this survey is defined as Mean Lower Low Water. It was determined by leveling runs from benchmarks on record with NOAA in the area, specifically bench mark designation 163 3227 (UH2C), VM# 16316. 4 other benchmarks were also leveled to ensure that UH2-C has not experienced any vertical shift.

1.2 Level runs are documented in the Excel file “10CQ01_Levelbk.xls”. The resulting measurements are summarized in the following diagram:



1.3 Leveling Information

The following pages detail the station locations, station descriptions and leveling measurements from the above summary:



DESCRIPTION OF BENCH MARK - BM1	
1. B.M. No.:	163 3227 UH-2C
2. Established by:	University of Hawaii (UH)
Date:	Not Available
3. Recovered by:	Fleet Survey Team (FST)
4. Type of Mark:	14mm diameter (9/16") Center Punched Stainless Steel Hex Head Bolt set in the concrete wharf deck, the Bolt is raised approximately 5mm (13/64") above concrete surface
5. How Stamped:	Bolt Head is Not Stamped but is Center Punched, Not Marked, Stainless Steel Bolt only
6. Location and Detailed Description:	UH-2C is located where the East face of Delta Dock (Delta -3) meets the East face of the parking lot (CPA-2) fronting the port building, located at the Commonwealth Port Authority (CPA) facility in Tanapag Harbor (aka Saipan Harbor), 2.83m (9.3 ft) SSE of the SE corner of a diesel (white tanks) containment wall, 2.56 m (8.4 ft) NNE of utility pole # 7 and 1.13m (3.7 ft) West of the East pier face (CPA-2). See Graphic.
PHOTOS	
	

DESCRIPTION OF BENCH MARK - BM2	
1. B.M. No.:	163 3227 UH-1
2. Established by:	University of Hawaii (UH)
Date:	Not Available
3. Recovered by:	Fleet Survey Team (FST)
4. Type of Mark:	Circular Stainless Steel disk (Pin Marker) approximately 40mm (1 1/2") diameter and approximately 5mm (13/64") high at the raised center above the concrete deck
5. How Stamped:	Not Stamped or Marked, Stainless Steel Disk only
6. Location and Detailed Description:	UH-1 is embedded in the NE corner of Delta Dock, located at the Commonwealth Port Authority (CPA) facility in Tanapag Harbor (aka Saipan Harbor), 18.71m (61.4 ft) East of the NW corner of Delta Dock, 0.47m (1.5 ft) West of the East pier face (Delta '-3) of Delta Dock and 0.42 m (1.4 ft) South of the North pier face (Delta '-2) of Delta Dock. See Graphic.
PHOTOS	
<div style="display: flex; justify-content: space-around;">   </div>	

DESCRIPTION OF BENCH MARK - BM3	
1. B.M. No.:	163 3227 UH-3B
2. Established by:	University of Hawaii (UH)
Date:	Not Available
3. Recovered by:	Fleet Survey Team (FST)
4. Type of Mark:	32mm X 32mm (1 1/4" X 1 1/4") Stainless Steel Square Head Pin Marker with raised round center approximately 5mm (13/64") high set in concrete
5. How Stamped:	Not Stamped or Marked, Square Head Pin Marker only
6. Location and Detailed Description:	UH-3B is located at the Commonwealth Port Authority (CPA) facility in Tanapag Harbor (aka Saipan Harbor), below the Mobil Gas sign, near the SW corner of Delta Dock, where the West face of Delta Dock (Delta '-1) meets the North face of the parking lot (CPA '-1) fronting the Port of Saipan building. At time of Benchmark recovery the Mobil Gas sign was not attached to the sign base. See Graphic.
PHOTOS	
<div style="display: flex; justify-content: space-around;">   </div>	

DESCRIPTION OF BENCH MARK - BM4	
1. B.M. No.:	FST-TPG
2. Established by:	Fleet Survey Team (FST)
Date:	25 May 2009
3. Recovered by:	Not Applicable
4. Type of Mark:	Circular Stainless Steel Bolt, Center Punched, 15mm diameter (9/16"), epoxyed into the concrete wharf deck
5. How Stamped:	Not Stamped, Center Punched, No other Markings, Bolt only
6. Location and Detailed Description: Benchmark FST-TPG is located directly in the center of the Southside wharf halfway between Charlie and Delta Docks on the concrete deck. The bolt can be recovered by walking straight out of the Port of Saipan building past the flag poles and parking lot to the wharf. It will be about 0.8m from the edge of the wharf. See Graphic.	
PHOTOS	
<div style="display: flex; justify-content: space-around;">   </div>	

DESCRIPTION OF BENCH MARK - BM5	
1. B.M. No.:	163 3227 UH-5B
2. Established by:	University of Hawaii (UH)
Date:	Not Available
3. Recovered by:	Fleet Survey Team (FST)
4. Type of Mark:	32mm X 32mm (1 1/4" X 1 1/4") Stainless Steel Square Head Pin Marker set into the concrete wharf deck, marker has round raised 8mm (5/16") center above concrete deck
5. How Stamped:	Not Stamped or Marked, Square Head Pin Marker only
6. Location and Detailed Description:	UH-5B is located near the SE corner of Charlie Dock where the East face of Charlie Dock (Charlie-2) meets the North face of the parking lot (CPA-1) fronting the port building, located at the Commonwealth Port Authority (CPA) facility in Tanapag Harbor (aka Saipan Harbor), 20.56m (67.5 ft) South of the SE largest bollard on Charlie Dock, 5.35m (17.6 ft) North of Charlie-2 and CPA -1 corner and 0.19m (0.6 ft) West of the East face (Charlie-2) of Charlie Dock. See Graphic.
PHOTOS	
<div style="display: flex; justify-content: space-around;">   </div>	

DESCRIPTION OF BENCH MARK - BM6	
1. B.M. No.:	163 3227 UH-4B
2. Established by:	University of Hawaii (UH)
Date:	Not Available
3. Recovered by:	Fleet Survey Team (FST)
4. Type of Mark:	14mm (9/16") Stainless Steel Hex Head Bolt set in the concrete foundation for the center flagpole, the Bolt sits approximatly 5mm (13/64") above the concrete deck
5. How Stamped:	Not Stamped or Marked, Bolt only
6. Location and Detailed Description:	UH-4B is set in the concrete flag pole base North of the port building located at the Commonwealth Port Authority (CPA) facility at Tanapag Harbor (aka Saipan Harbor), 46.53m (152.7 ft) West of the East pier face (CPA-2), 42.21m (138.5 ft) South of the North pier face (CPA-1) and 0.67m (2.2 ft) North of the center flag pole. See Graphic.
PHOTOS	
<div style="display: flex; justify-content: space-around;">   </div>	

THREE WIRE LEVELING					THREE WIRE LEVELING				
Project:	10CQ01	Location:	Saipan		Observer:	M. Redmayne	Recorder:	J. Burt	
Date:	12/6/2009 L	Time:	1500L		Rodman:	W. Stout	Instr #:	Leica DNA03	
From:		To:			Weather:	overcast, hot			
STATION	BACKSIGHT	Distance	FORESIGHT	Distance	Vertical Offset	Misclosure	Average	REMARKS	
Rod Stop									
TO	1.46059	5.78	1.70283	5.03	0.24224				
UH-2C						0.00014	0.24217		
UH-2C									
TO	1.66239	4.92	1.42029	5.72	-0.24210				
Rod Stop									
RS									
TO	1.34902	32.79	1.55202	50.56	0.20300				
UH-1						-0.00093	0.20347		
UH-1									
TO	1.59345	45.14	1.38952	38.18	-0.20393				
RS									
RS									
TO	1.50449	10.63	1.81352	8.17	0.30903				
UH-3B						0.00049	0.30879		

THREE WIRE LEVELING					THREE WIRE LEVELING				
Project:	10CQ01	Location:	Saipan		Observer:	M. Redmayne	Recorder:	J. Burt	
Date:	12/6/2009 L	Time:	1500L		Rodman:	W. Stout	Instr #:	Leica DNA03	
From:		To:			Weather:	overcast, hot			
STATION	BACKSIGHT	Distance	FORESIGHT	Distance	Vertical Offset	Misclosure	Average	REMARKS	
UH-3B									
TO	1.84647	10.35	1.53793	8.44	-0.30854				
RS									
RS									
TO	1.27410	24.28	1.53162	22.02	0.25752				
FST-TPG						-0.00072	0.25788		
FST-TPG									
TO	1.43991	22.38	1.18167	26.74	-0.25824				
RS									
RS									
TO	1.38267	38.87	1.74575	34.62	0.36308				
TP									
TP									
TO	1.54083	13.83	1.64908	14.54	0.10825				
UH-5B					0.47133				

THREE WIRE LEVELING					THREE WIRE LEVELING				
Project:	10CQ01	Location:	Saipan		Observer:	M. Redmayne	Recorder:	J. Burt	
Date:	12/6/2009 L	Time:	1500L		Rodman:	W. Stout	Instr #:	Leica DNA03	
From:		To:			Weather:	overcast, hot			
STATION	BACKSIGHT	Distance	FORESIGHT	Distance	Vertical Offset	Misclosure	Average	REMARKS	
TP						-0.00112	0.47189		
TO	1.69267	31.93	1.32863	41.68	-0.36404				
RS									
UH-5B									
TO	1.68857	15.74	1.58016	13.19	-0.10841				
TP					-0.47245				
RS									
TO	1.60972	34.03	1.53957	33.63	-0.07015				
UH-4B						0.00016	0.07023		
UH-4B									
TO	1.53590	34.03	1.60621	34.03	0.07031				
RS									

THREE WIRE LEVELING					THREE WIRE LEVELING							
Project:	10CQ01		Location:		Saipan		Observer:	J. Burt		Recorder:	J. Burt	
Date:	01/23/10 L		Time:		0900L		Rodman:	W. Stout		Instr #:	Leica DNA03	
From:			To:				Weather:	overcast, hot				
STATION	BACKSIGHT	Distance	FORESIGHT	Distance	Vertical Offset	Misclosure	Average	REMARKS				
Rod Stop												
TO	1.38024	6.28	1.62215	5.56	0.24191							
UH-2C												
						-0.00028	0.24205					
UH-2C												
TO	1.63042	5.41	1.38823	6.11	-0.24219							
Rod Stop												
RS												
TO	1.26043	34.32	1.46273	49.05	0.20230							
UH-1												
						-0.00095	0.20278					
UH-1												
TO	1.47769	46.44	1.27444	36.97	-0.20325							
RS												
RS												
TO	1.42395	9.01	1.73318	9.81	0.30923							
UH-3B												
						-0.00012	0.30929					

THREE WIRE LEVELING					THREE WIRE LEVELING							
Project:	10CQ01		Location:		Saipan		Observer:	J. Burt		Recorder:	J. Burt	
Date:	01/23/10 L		Time:		0900L		Rodman:	W. Stout		Instr #:	Leica DNA03	
From:			To:				Weather:	overcast, hot				
STATION	BACKSIGHT	Distance	FORESIGHT	Distance	Vertical Offset	Misclosure	Average	REMARKS				
UH-3B												
TO	1.70066	10.80	1.39131	8.01	-0.30935							
RS												
RS												
TO	1.20072	21.44	1.45949	26.90	0.25877							
FST-TPG												
						0.00007	0.25874					
FST-TPG												
TO	1.46654	25.54	1.20784	23.31	-0.25870							
RS												
RS												
TO	1.16752	44.21	1.63976	33.04	0.47224							
UH-5B												
						0.00013	0.47218					
UH-5B												
TO	1.66304	33.22	1.19093	44.07	-0.47211							
RS												

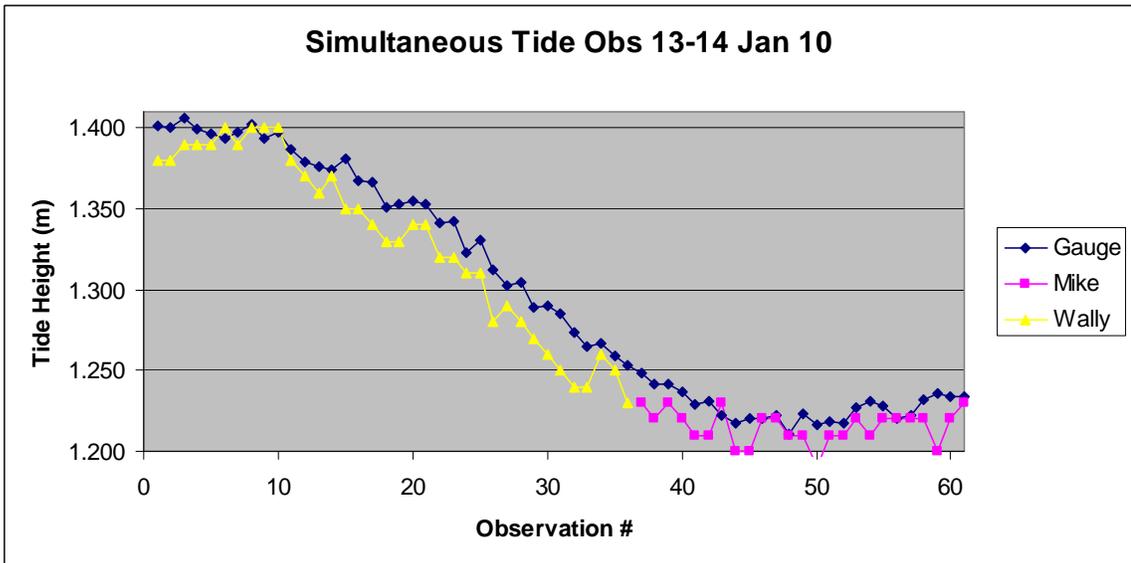
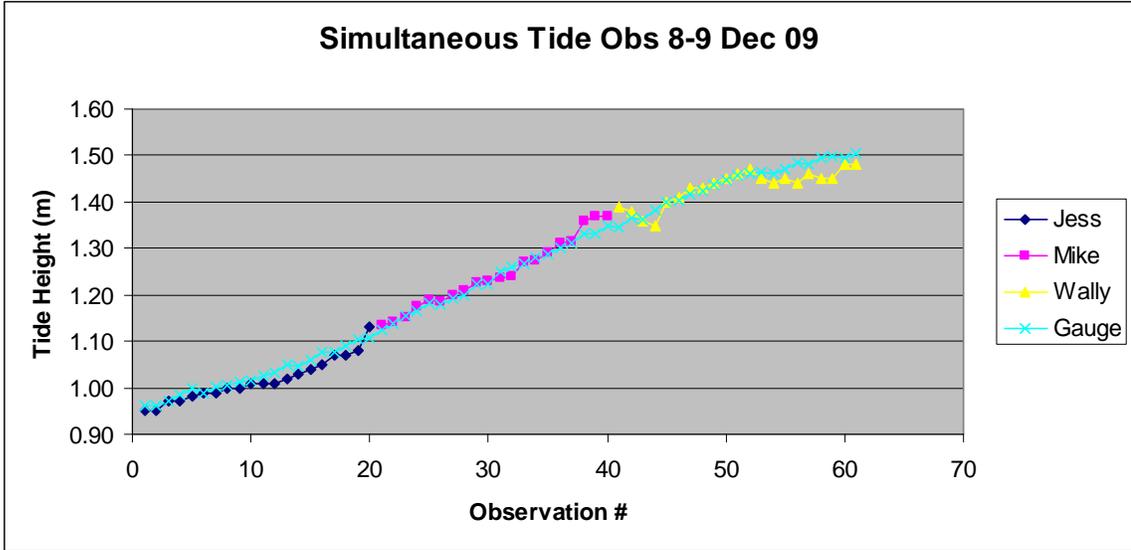
THREE WIRE LEVELING					THREE WIRE LEVELING							
Project:	10CQ01		Location:		Saipan		Observer:	J. Burt		Recorder:	J. Burt	
Date:	1/23/2010		Time:		0900L		Rodman:	W. Stout		Instr #:	Leica DNA03	
From:			To:				Weather:	overcast, hot				
STATION	BACKSIGHT	Distance	FORESIGHT	Distance	Vertical Offset	Misclosure	Average	REMARKS				
RS												
TO	1.48486	33.81	1.41513	31.25	-0.06973							
UH-4B												
						0.00036	0.06991					
UH-4B												
TO	1.44971	31.84	1.51980	34.05	0.07009							
RS												

2. Automatic Tide Gauge to Tide Pole Comparisons

2.1 The tide pole was compared to the automatic tide gauge on 8 Dec 09 and 14 Jan 10, each time for 6 hours at 6 minute intervals. The following table shows the observed data and resulting graph:

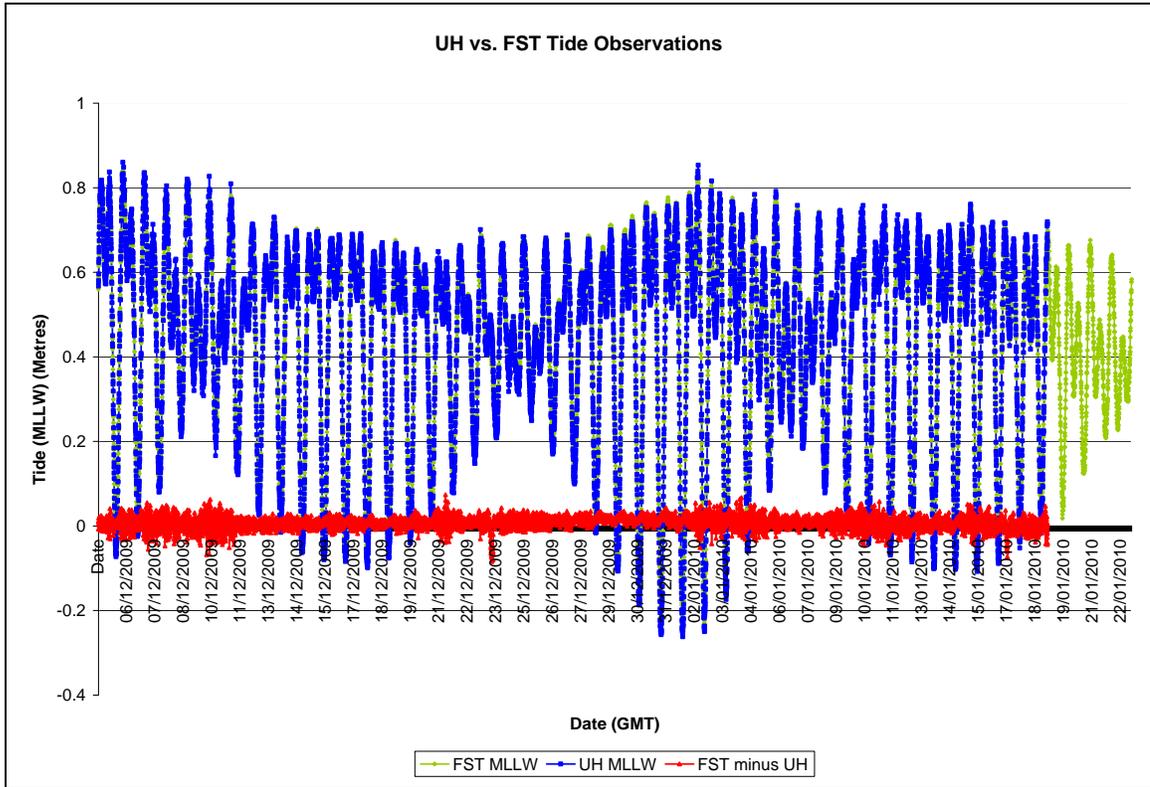
SIMULTANEOUS TIDE OBSERVATIONS, 8-9 December 2009 UTC						
Tide Gauge: Tanapag Harbor, Saipan 10CQ01						
Avg. Difference Vented:			-0.005	Avg. Difference UH:		-0.816 M
Standard Deviation Vented:			0.0186301	Standard Deviation UH:		0.026 M
Tabulated Data						
UTC Time	Observed By	Observed Tides	Measured Vented	UH Gauge	Observed - Vented	Observed - UH Gauge
21:00	JB	0.95	0.962071	1.783	-0.01	-0.833
21:06	JB	0.95	0.960635	1.761	-0.01	-0.811
21:12	JB	0.97	0.970062	1.783	0.00	-0.813
21:18	JB	0.97	0.985526	1.786	-0.02	-0.816
21:24	JB	0.98	0.9988	1.805	-0.02	-0.825
21:30	JB	0.99	0.987976	1.78	0.00	-0.79
21:36	JB	0.99	1.002223	1.823	-0.01	-0.833
21:42	JB	1.00	1.004507	1.802	0.00	-0.802
21:48	JB	1.00	1.011788	1.82	-0.01	-0.82
21:54	JB	1.01	1.016674	1.829	-0.01	-0.819
22:00	JB	1.01	1.026891	1.829	-0.02	-0.819
22:06	JB	1.01	1.032816	1.835	-0.02	-0.825
22:12	JB	1.02	1.050856	1.86	-0.03	-0.84
22:18	JB	1.03	1.045776	1.85	-0.02	-0.82
22:24	JB	1.04	1.060149	1.859	-0.02	-0.819
22:30	JB	1.05	1.075494	1.883	-0.03	-0.833
22:36	JB	1.07	1.076802	1.875	-0.01	-0.805
22:42	JB	1.07	1.090269	1.889	-0.02	-0.819
22:48	JB	1.08	1.103003	1.917	-0.02	-0.837
22:54	JB	1.13	1.108598	1.913	0.02	-0.783
23:00	MR	1.135	1.123378	1.927	0.01	-0.792
23:06	MR	1.14	1.138934	1.967	0.00	-0.827
23:12	MR	1.15	1.155299	1.98	-0.01	-0.83
23:18	MR	1.175	1.163388	1.977	0.01	-0.802
23:24	MR	1.19	1.182775	1.981	0.01	-0.791
23:30	MR	1.185	1.179928	1.966	0.01	-0.781
23:36	MR	1.20	1.192252	2.011	0.01	-0.811
23:42	MR	1.21	1.197395	2.009	0.01	-0.799
23:48	MR	1.225	1.222003	2.05	0.00	-0.825
23:54	MR	1.23	1.222166	2.027	0.01	-0.797
00:00	MR	1.235	1.248386	2.06	-0.01	-0.825
00:06	MR	1.24	1.25964	2.094	-0.02	-0.854
00:12	MR	1.27	1.266277	2.083	0.00	-0.813
00:18	MR	1.275	1.281539	2.091	-0.01	-0.816
00:24	MR	1.29	1.288399	2.086	0.00	-0.796
00:30	MR	1.31	1.300749	2.13	0.01	-0.82
00:36	MR	1.315	1.312425	2.109	0.00	-0.794
00:42	MR	1.36	1.330504	2.139	0.03	-0.779
00:48	MR	1.37	1.33166	2.131	0.04	-0.761
00:54	MR	1.37	1.349819	2.158	0.02	-0.788
01:00	HWS	1.39	1.345049	2.151	0.04	-0.761
01:06	HWS	1.38	1.363922	2.171	0.02	-0.791
01:12	HWS	1.36	1.360476	2.183	0.00	-0.823
01:18	HWS	1.35	1.382445	2.174	-0.03	-0.824
01:24	HWS	1.40	1.400838	2.217	0.00	-0.817
01:30	HWS	1.41	1.402531	2.222	0.01	-0.812
01:36	HWS	1.43	1.415753	2.228	0.01	-0.798
01:42	HWS	1.43	1.423207	2.246	0.01	-0.816
01:48	HWS	1.44	1.435845	2.225	0.00	-0.785
01:54	HWS	1.45	1.448268	2.271	0.00	-0.821
02:00	HWS	1.46	1.45807	2.241	0.00	-0.781
02:06	HWS	1.47	1.459522	2.278	0.01	-0.808
02:12	HWS	1.45	1.462794	2.282	-0.01	-0.832
02:18	HWS	1.44	1.461264	2.284	-0.02	-0.844
02:24	HWS	1.45	1.471173	2.286	-0.02	-0.836
02:30	HWS	1.44	1.484586	2.331	-0.04	-0.891
02:36	HWS	1.46	1.482479	2.336	-0.02	-0.876
02:42	HWS	1.45	1.495723	2.313	-0.05	-0.863
02:48	HWS	1.45	1.497653	2.307	-0.05	-0.857
02:54	HWS	1.48	1.493471	2.316	-0.01	-0.836
03:00	HWS	1.48	1.504617	2.35	-0.02	-0.87

SIMULTANEOUS TIDE OBSERVATIONS, 13-14 JAN 2010 UTC						
Tide Gauge: Tanapag Harbor, Saipan, 10CQ01						
Avg. Difference Vented:		-0.014 M	Avg. Difference UH:		-0.816 M	
Standard Deviation Vented		0.011 M	Standard Deviation UH:		0.013 M	
Tabulated Data						
UTC Time	Observed By	Observed Tides	Measured Vented	UH Gauge	Observed - Vented	Observed - UH
22:30	HWS	1.38	1.401	2.208	-0.021	-0.828
22:36	HWS	1.38	1.400	2.207	-0.020	-0.827
22:42	HWS	1.39	1.406	2.226	-0.016	-0.836
22:48	HWS	1.39	1.399	2.218	-0.009	-0.828
22:54	HWS	1.39	1.396	2.209	-0.006	-0.819
23:00	HWS	1.40	1.394	2.205	0.006	-0.805
23:06	HWS	1.39	1.397	2.21	-0.007	-0.820
23:12	HWS	1.40	1.402	2.208	-0.002	-0.808
23:18	HWS	1.40	1.394	2.207	0.006	-0.807
23:24	HWS	1.40	1.397	2.217	0.003	-0.817
23:30	HWS	1.38	1.387	2.2	-0.007	-0.820
23:36	HWS	1.37	1.379	2.211	-0.009	-0.841
23:42	HWS	1.36	1.376	2.186	-0.016	-0.826
23:48	HWS	1.37	1.374	2.19	-0.004	-0.820
23:54	HWS	1.35	1.381	2.188	-0.031	-0.838
00:00	HWS	1.35	1.367	2.171	-0.017	-0.821
00:06	HWS	1.34	1.366	2.188	-0.026	-0.848
00:12	HWS	1.33	1.351	2.148	-0.021	-0.818
00:18	HWS	1.33	1.353	2.173	-0.023	-0.843
00:24	HWS	1.34	1.355	2.161	-0.015	-0.821
00:30	HWS	1.34	1.353	2.156	-0.013	-0.816
00:36	HWS	1.32	1.341	2.16	-0.021	-0.840
00:42	HWS	1.32	1.342	2.14	-0.022	-0.820
00:48	HWS	1.31	1.323	2.137	-0.013	-0.827
00:54	HWS	1.31	1.331	2.139	-0.021	-0.829
01:00	HWS	1.28	1.312	2.126	-0.032	-0.846
01:06	HWS	1.29	1.303	2.109	-0.013	-0.819
01:12	HWS	1.28	1.305	2.107	-0.025	-0.827
01:18	HWS	1.27	1.289	2.089	-0.019	-0.819
01:24	HWS	1.26	1.290	2.102	-0.030	-0.842
01:30	HWS	1.25	1.285	2.095	-0.035	-0.845
01:36	HWS	1.24	1.274	2.09	-0.034	-0.850
01:42	HWS	1.24	1.265	2.071	-0.025	-0.831
01:48	HWS	1.26	1.267	2.077	-0.007	-0.817
01:54	HWS	1.25	1.259	2.074	-0.009	-0.824
02:00	HWS	1.23	1.253	2.061	-0.023	-0.831
02:06	MR	1.23	1.248	2.067	-0.018	-0.837
02:12	MR	1.22	1.242	2.058	-0.022	-0.838
02:18	MR	1.23	1.242	2.053	-0.012	-0.823
02:24	MR	1.22	1.237	2.045	-0.017	-0.825
02:30	MR	1.21	1.229	2.035	-0.019	-0.825
02:36	MR	1.21	1.231	2.034	-0.021	-0.824
02:42	MR	1.23	1.222	2.03	0.008	-0.800
02:48	MR	1.20	1.217	2.04	-0.017	-0.840
02:54	MR	1.20	1.220	2.02	-0.020	-0.820
03:00	MR	1.22	1.220	2.021	0.000	-0.801
03:06	MR	1.22	1.222	2.031	-0.002	-0.811
03:12	MR	1.21	1.211	2.026	-0.001	-0.816
03:18	MR	1.21	1.223	2.022	-0.013	-0.812
03:24	MR	1.19	1.216	2.031	-0.026	-0.841
03:30	MR	1.21	1.218	2.024	-0.008	-0.814
03:36	MR	1.21	1.217	2.015	-0.007	-0.805
03:42	MR	1.22	1.227	2.025	-0.007	-0.805
03:48	MR	1.21	1.231	2.036	-0.021	-0.826
03:54	MR	1.22	1.228	2.041	-0.008	-0.821
04:00	MR	1.22	1.220	2.034	0.000	-0.814
04:06	MR	1.22	1.222	2.03	-0.002	-0.810
04:12	MR	1.22	1.232	2.023	-0.012	-0.803
04:18	MR	1.20	1.236	2.059	-0.036	-0.859
04:24	MR	1.22	1.234	2.044	-0.014	-0.824
04:30	MR	1.23	1.234	2.037	-0.004	-0.807



3. Comparison to Other Sources of Data

3.1 The University of Hawaii tide gauge that was located approximately 1m from the installed gauge was downloaded and compared to the dataset, and found to be in agreement. The comparison graph is as follows:



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Tanapag Harbor Approach, Saipan

Appendix F:

Vessel Setup and Calibration

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DISTRIBUTION STATEMENT A:

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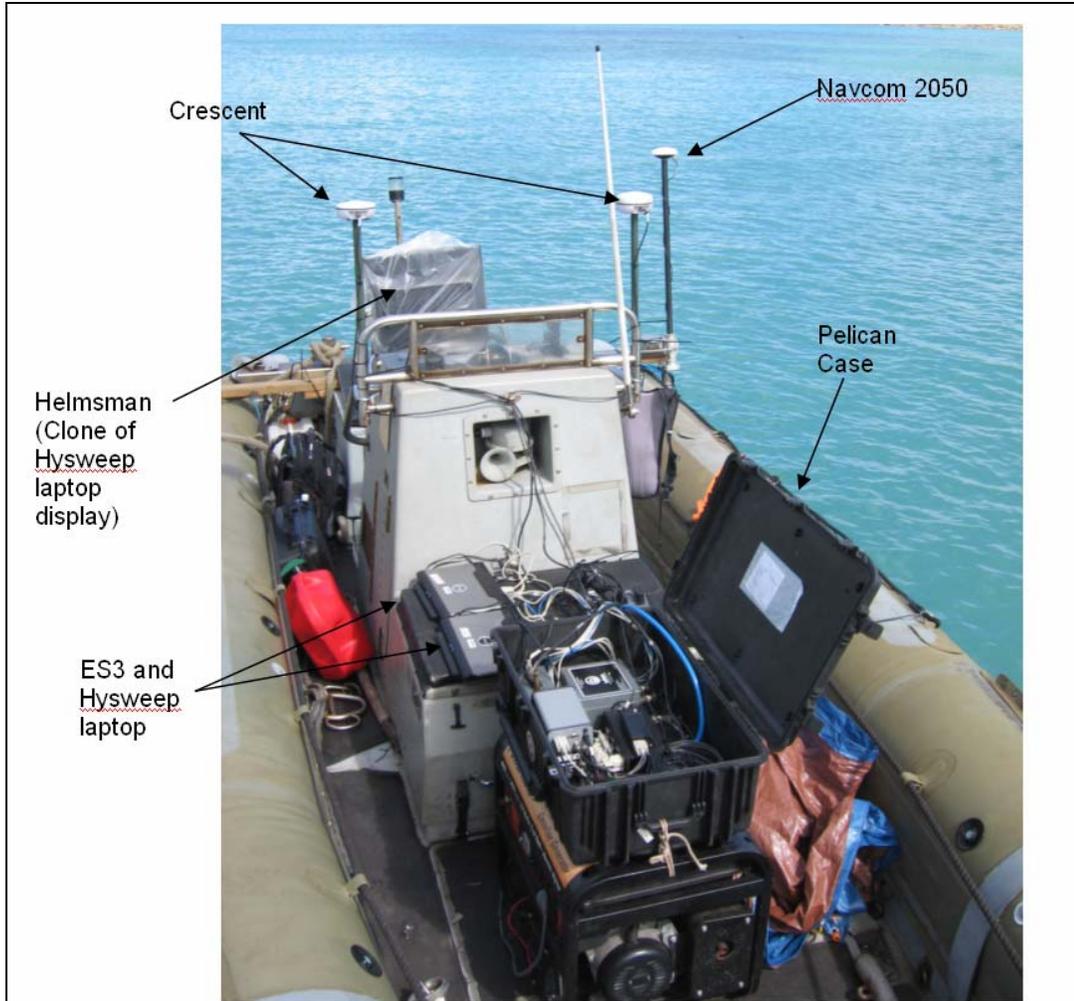


Figure F-2: Photograph showing the equipment set up on the vessel used to conduct the survey.

2. Offset Measurements and Vessel Configuration File

2.1 Offsets were measured using a standard tape measure and recorded for entry into the Caris HIPS vessel configuration file. The Caris vessel report follows:

Vessel Name: SG_RHIB_RPatMRU.hvf
 Vessel created: January 28, 2010

Depth Sensor:

```

Sensor Class:      Swath
Time Stamp:      2010-005 00:00

Transducer #1:
-----
Pitch Offset:      0.000
Roll Offset:       0.000
Azimuth Offset:    0.000
    
```

DeltaX: 0.000
DeltaY: 0.080
DeltaZ: 0.000

Manufacturer:
Model: dt260a
Serial Number:

Navigation Sensor:

Time Stamp: 2010-005 00:00

Comments (null)
Latency 0.000
DeltaX: 0.000
DeltaY: -0.010
DeltaZ: -1.370

Manufacturer: (null)
Model: (null)
Serial Number: (null)

Gyro Sensor:

Time Stamp: 2010-005 00:00

Comments (null)
Latency 0.000

Heave Sensor:

Time Stamp: 2010-005 00:00

Comments (null)
Apply Yes
Latency 0.000
DeltaX: 0.000
DeltaY: 0.000
DeltaZ: 0.000
Offset: 0.000

Manufacturer: (null)
Model: (null)
Serial Number: (null)

Pitch Sensor:

Time Stamp: 2010-005 00:00

Comments (null)
Apply Yes
Latency 0.000
Pitch offset: 0.000

Manufacturer: (null)
Model: (null)
Serial Number: (null)

Roll Sensor:

Time Stamp: 2010-005 00:00

Comments (null)
 Apply No
 Latency 0.000
 Roll offset: 0.000

Manufacturer: (null)
 Model: (null)
 Serial Number: (null)

TPE

Time Stamp: 2010-005 00:00

Comments
 Offsets

Motion sensing unit to the transducer 1

X Head 1 0.000
 Y Head 1 0.080
 Z Head 1 0.000

Motion sensing unit to the transducer 2

X Head 2 0.000
 Y Head 2 0.000
 Z Head 2 0.000

Navigation antenna to the transducer 1

X Head 1 0.000
 Y Head 1 -0.090
 Z Head 1 -1.370

Navigation antenna to the transducer 2

X Head 2 0.000
 Y Head 2 0.000
 Z Head 2 0.000

Roll offset of transducer number 1 0.000
 Roll offset of transducer number 2 0.000

Heave Error: 0.030 or 5.000% of heave amplitude.

Measurement errors: 0.000

Motion sensing unit alignment errors

Gyro:0.000 Pitch:0.000 Roll:0.000

Gyro measurement error: 0.150

Roll measurement error: 0.250

Pitch measurement error: 0.250

Navigation measurement error: 0.100

Transducer timing error: 0.000

Navigation timing error: 0.000

Gyro timing error: 0.000

Heave timing error: 0.000

PitchTimingStdDev: 0.000

Roll timing error: 0.000

Sound Velocity speed measurement error: 0.000

Surface sound speed measurement error: 0.000

Tide measurement error: 0.000

Tide zoning error: 0.000

Speed over ground measurement error: 0.257

Dynamic loading measurement error: 0.030

Static draft measurement error: 0.061

Delta draft measurement error: 0.000

StDev Comment: 0>„J •†J@3†Jp4†J 1†J0 …J .†J0^„J` }€J°•†Ja

Svp Sensor:

Time Stamp: 2010-005 00:00

Comments (null)

Svp #1:

 Pitch Offset: 0.000
 Roll Offset: 0.000
 Azimuth Offset: 0.000

DeltaX: 0.000
 DeltaY: 0.080
 DeltaZ: 0.000

SVP #2:

 Pitch Offset: 0.000
 Roll Offset: 0.000
 Azimuth Offset: 0.000

DeltaX: 0.000
 DeltaY: 0.000
 DeltaZ: 0.000

 WaterLine:

Time Stamp: 2010-005 00:00

Comments

Apply Yes

WaterLine -0.670

Time Stamp: 2010-021 00:00

Comments

Apply Yes

WaterLine -0.670

Time Stamp: 2010-022 00:00

Comments

Apply Yes

WaterLine -0.670

3. Patch Test / Calibration

3.1 A patch test was carried out on several occasions to determine the offsets for the sounder and MRU. This system is fairly unique in that the MRU is physically attached to the sounder, and therefore any heave, pitch and roll associated with installation is accounted for in real time. However, if an internal difference between the 'real' horizon and the 'calculated' horizon exists, the patch test will identify this. No such difference was found during patch tests conducted during this survey.

3.2 Latency tests were also carried out as part of the patch tests, and no navigation latency error was found to exist.

3.3 During normal survey operations cross check lines were run and QC analysis conducted to ensure that the system was performing correctly and obtaining data in accordance with the required specification. Results can be seen in *Appendix D*.

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Appendix G:

Geodetics

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DISTRIBUTION STATEMENT A:

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STATION DESCRIPTION				NOTE: Change heading to "STATION RECOVERY" when this form is so used.				ARCHIVE NO. 09CQ01	
NAME OF STATION FST-TPG		LOCALITY Saipan Island – Tanapag Harbor		ORGANIZATION Fleet Survey Team		DATE STATION ESTABLISHED 25 May 2009			
REFERENCE MARKS AND PROMINENT OBJECTS		DISTANCE (Meters)	DIRECTION	AZIMUTH	MARKED BY	DATE	25 May 2009		
IN MAIN SCHEME		-----	0° 00' 00"		FIELD BOOK NO.	Report of Survey (ROS)	PAGE	Appendix J	
See attached graphic for prominent reference points.					DESCRIBED BY	Barry Sysak	DATE	18 Aug 2009	
					FIELD BOOK NO.		PAGE		
					SURFACE-STATION MARK	Circular Head 15mm (9/16") diameter Stainless Steel Bolt, Center Punched, epoxy glued into top edge of concrete wharf			
					SUB-SURFACE MARK	Not Applicable			
DETAILED DESCRIPTION <i>(Covering general location and accessibility, reference and witness marks, local residents familiar with location of station, etc.)</i>					SKETCH				
Benchmark FST-TPG is located at the Port of Saipan's Tanapag Harbor (aka. Saipan Harbor). It is halfway between Charlie and Delta Docks on the Southside of the concrete wharf about 0.8m from the wharf edge. The Stainless Steel bolt is epoxy glued into the concrete and is easy to spot with all the excess epoxy glue surrounding the marker. See photo of marker.					SEE ATTACHED GRAPHIC				
From the Hyatt Hotel entrance drive East on Micro Beach Road for approximately 0.5 mi. to Chalan Pale Arnold (Middle Road). Make a left and drive approximately 1.2 mi. to the Blue Port of Saipan sign on the right or the cement factory on the left. The Blue Port of Saipan sign is small and located between palm trees and is hard to spot. Make a left on the road and drive straight for 0.15 mi. to the Port of Saipan parking lot gate. From the gate drive 60 meters and make a right and proceed 35 meters. The marker will be located on the left at the Southside concrete wharf. See attached graphic.									
The Benchmark is fairly secure since it is located inside a gated parking lot and the Port Police are located inside the Port of Saipan building.									
FINAL VALUES - WGS 84 ELLIPSOID (ITRF00)		ORIGIN OF COORDINATES							
ELEVATION	1.481m above Mean Water Level								
ELLIPSOIDAL HEIGHT	-57.830m (below Benchmark)	OBS. SPOT							
LATITUDE	15° 13' 34.52065" N	LATITUDE							
LONGITUDE	145° 44' 13.07320" E	LONGITUDE							

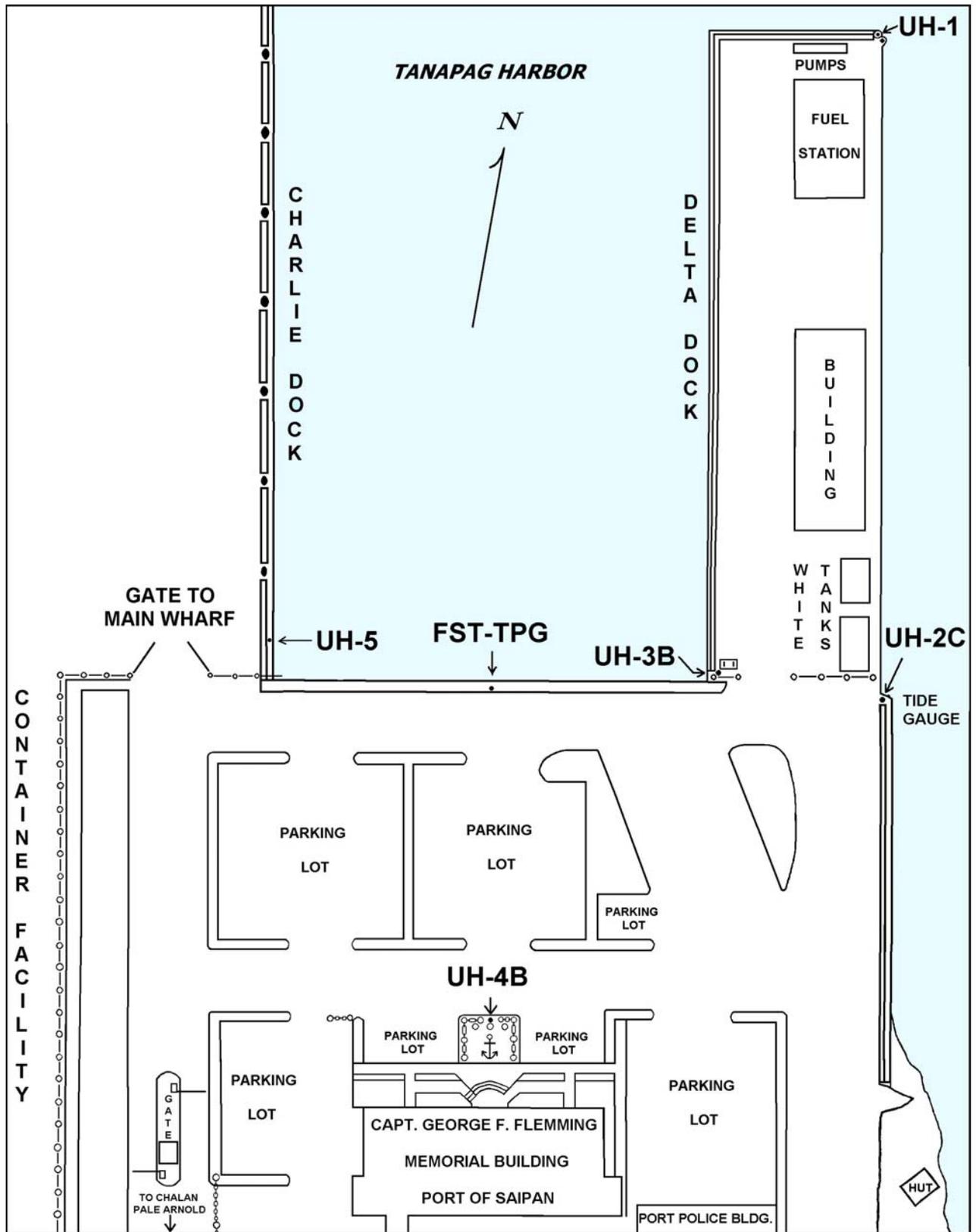


Figure G-1: Sketch of Geodetic Point FST-TPG Location.

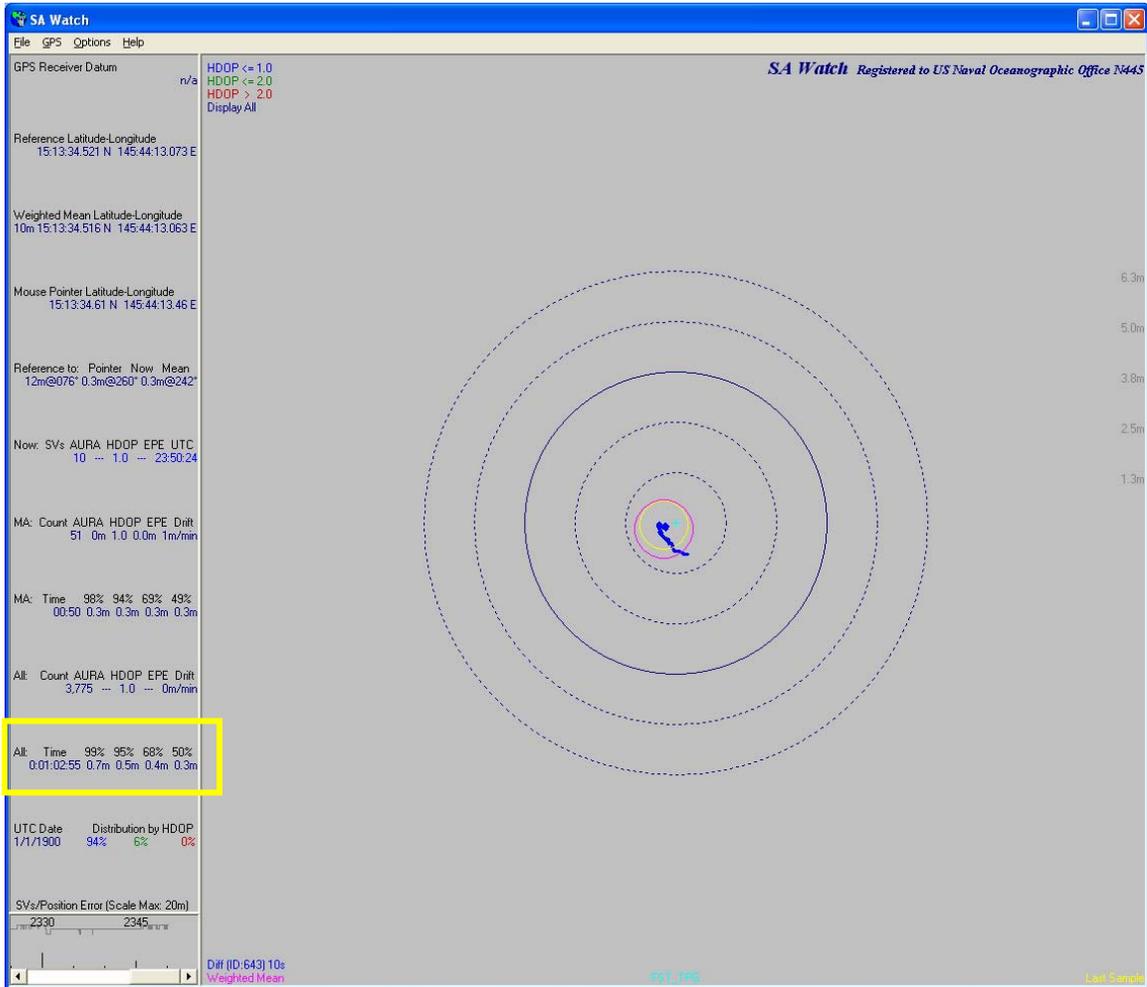


Figure G-2: Static Test: 0.5m @ 95% Confidence Level.

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Tanapag Harbor Approach, Saipan

Appendix H:

Weekly Summary

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DISTRIBUTION STATEMENT A:

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22 – 28 November 2009

- Generated top-down 2d images of group 1 DTONs at request of dive team OIC.
- Met with dive team OIC and MDV as well as USNS Safeguard Captain and Chief Mate to discuss the mission.
- Met with Dr. Joyner of NOAA Coastal Resource Management and secured permission to use their boat if the CPA boat becomes inoperable.
- Purchased lumber and hardware for multibeam mount.
- Created a large scale plot of the group 1 DTON locations for planning purposes at request of USNS Safeguard Captain.
- Queried UPS (repeatedly) as to where our gear was and when it was expected to arrive in Saipan.

29 November – 5 December 2009

- Continued querying UPS (repeatedly) as to where our gear was and when it was expected to arrive in Saipan.
- Installed tide gauge.
- Rigged SAFEGUARD's RHIB as ES3-M multibeam survey platform.
- Configured and thoroughly wet-tested survey system.
- Leveled-in tide gauge.

06 – 09 December 2009

- Collected and processed patch test data.
- Collected and processed ES3-M multibeam data over DTON groups 1, 2, 3, and 5.

10 December 2009 – 5 January 2010

- Survey team returned to Stennis for holiday stand-down. Processing of data and comparison to previous data continued through out.

06 – 09 January 2010

- Reinforced the multibeam mount.
- Measured and verified new offset values.
- Collected multibeam data over group 1 (which MDSU had worked on) and group 3 (which MDSU had not worked on).
- Resolved the following issues: mount flex, tidal solution, vessel configuration, and software setup.

10 – 16 January 2010

- Collected data over Group 3, DTON F01, with filters turned off.
- Collected data over Group 1 DTONs.
- Processed Group 1 DTON data and confirmed that all five DTONs are now deeper than 36 feet. DTON F04 was identified at 36.1', so it was decided that further clearance work was to be completed on this DTON to allow a greater safety margin.
- Conducted 6 hours of tide staff observations.
- Wrote a comprehensive SOP for using the Odom ES3-M multibeam system.

17 – 23 January 2010

- Collected and processed data over DTON F04.
- Collected and processed data over entire area in which SAFEGUARD worked.
- Confirmed no new DTONs were created by the ship's anchors.
- Conducted squat-settlement test.
- Conducted static accuracy test of NAVCOM 2050 GPS antenna.
- Revised Odom ES3-M SOP.
- Levelled out and removed tide gauge.
- Downloaded final observed tides file; sent it and other pertinent tide information to Lt Redmayne to forward to NAVO for processing.
- Began writing report of survey.
- Cleaned and packed gear in preparation for shipment.

W00211 HCell Report
Kurt Brown, Physical Scientist
Pacific Hydrographic Branch

1. Specifications, Standards and Guidance Used in HCell Compilation

HCell compilation of survey W00211 used:

Office of Coast Survey HCell Specifications: Draft, Version : 4.0, 17 March, 2010.
HCell Reference Guide: Version 2.0, 22 February, 2010.

Note that an area of W00208 was superseded by survey W00211 after several dangers were identified and removed in the approach to the channel. As the surveys were compiled concurrently, the portion of W00208 that is superseded by W00211 was not compiled. The HCell for W00211 should be used in this area.

1. Compilation Scale

Depths and features for HCell W00211 were compiled to the following raster charts shown in the table, below:

Chart	Scale	Edition	Edition Date	NTM Date
81076	1:12,000	12th	008/01/2007	05/15/2010

The following ENCs were also used during compilation:

Chart	Scale
US5SP07M	1:12,000

2. Soundings

A survey-scale sounding (SOUNDG) feature object layer was built in CARIS BASE Editor from the shoal layer of the 0.5-meter uncertainty surface, W00211_0p5_office_final. This surface was created during compilation as the recommended surface in the SAR was not accurately depicting the shoalest points on numerous coral heads. A shoal-biased selection was made at 1:2,500 survey scale using a Radius Table file with values shown in the table, below.

Shoal Limit (m)	Deep Limit (m)	Radius (mm)
-4.7	10	3
10	20	4
20	50	4.5
50	200	5

In CARIS BASE Editor soundings were manually selected from the high density sounding layers (SS) and imported into a new layer (CS) created to accommodate chart density depths. Manual selection was used to accomplish a density and distribution that closely represents the seafloor morphology.

3. Depth Contours

Depth contours at the intervals on the largest scale chart are included in the *_SS HCell for MCD raster charting division to use for guidance in creating chart contours. The metric and fathom equivalent contour values are shown in the table below.

Chart Contour Intervals in Feet from Chart 16708	Metric Equivalent to Chart Feet, Arithmetically Rounded	Metric Equivalent of Chart Feet, with NOAA Rounding Applied	Feet with NOAA Rounding Applied	Feet with NOAA Rounding Removed for Display on W00211_SS.000
0	0	0.000	0.000	0
6	1.8288	2.0574	6.75	6
18	5.4864	5.715	18.75	18
36	10.9728	11.2014	36.75	36

With the exception of the zero contours included in the *_CS file, contours have not been deconflicted against shoreline features, soundings and hydrography, as all other features in the *_CS file and soundings in the *_SS have been. This may result in conflicts between the *_SS file contours and HCell features at or near the survey limits. Conflicts with M_QUAL, COALNE and SBDARE objects, and with DEPCNT objects representing MLLW, should be expected. HCell features should be honored over *_SS.000 file contours in all cases where conflicts are found.

4. Meta Areas

The following Meta object area is included in HCell W00211:

M_QUAL

The Meta area object was constructed on the basis of the limits of the hydrography.

5. Features

Features were not included in the HCell.

6. S-57 Objects and Attributes

The *_CS HCell contains the following Objects:

\$CSYMB	Blue Notes-Notes to the MCD chart Compiler
M_QUAL	Data quality Meta object
SOUNDG	Soundings at the chart scale density

The *_SS HCell contains the following Objects:

DEPCNT	Generalized contours at chart scale intervals
--------	---

7. Spatial Framework

7.1 Coordinate System

All spatial map and base cell file deliverables are in an LLDG geographic coordinate system, with WGS84 horizontal, MHW vertical, and MLLW (1983-2001 NTDE) sounding datums.

7.2 Horizontal and Vertical Units

DUNI, HUNI and PUNI are used to define units for depth, height and horizontal position in the chart units HCell, as shown below.

Chart Unit Base Cell Units:

Depth Units (DUNI):	Feet
Height Units (HUNI):	Feet
Positional Units (PUNI):	Meters

During creation of the HCell in CARIS BASE Editor and CARIS S-57 Composer, all soundings and features are maintained in metric units with as high precision as possible. Depth units for soundings measured with sonar maintain millimeter precision. Depths on rocks above MLLW and heights on islets above MHW are typically measured with range finder, so precision is less. Units and precision are shown below.

BASE Editor and S-57 Composer Units:

Sounding Units:	Meters rounded to the nearest millimeter
Spot Height Units:	Meters rounded to the nearest decimeter

See the HCell Reference Guide for specific metric to charting units conversion routines and formulas for application of NOAA rounding.

9. Data Processing Notes

There were no significant deviations from the standards and protocols given in the HCell Specification and HCell Reference Guide.

10. QA/QC and ENC Validation Checks

W00211 was subjected to QA checks in S-57 Composer prior to exporting to the metric HCell base cell (000) file. The millimeter precision metric S-57 HCell was converted to chart units and NOAA rounding applied. dKart Inspector was then used to further check the data set for conformity with the S-58 ver. 2 standard (formerly Appendix B.1 Annex C of the S-57 standard). All tests were run and warnings and errors investigated and corrected unless they are MCD approved as inherent to and acceptable for HCells.

11. Products

11.1 HSD, MCD and CGTP Deliverables

W00211_CS.000	Base Cell File, Chart Units, Soundings and features compiled to 1:40,000
W00211_SS.000	Base Cell File, Chart Units, Soundings and Contours compiled to 1:10,000
W00211_DR.pdf	Descriptive Report including end notes compiled during office processing and certification, the HCell Report, and supplemental items
W00211_outline.gml	Survey outline
W00211_outline.xsd	Survey outline

11.3 Software

CARIS HIPS Ver. 6.1	Inspection of Combined BASE Surfaces
CARIS BASE Editor Ver. 2.3	Creation of soundings and bathy-derived features, creation of the depth area, meta area objects, and Blue Notes; Survey evaluation and verification; Initial HCell assembly.
CARIS S-57 Composer Ver. 2.1	Final compilation of the HCell, correct geometry and build topology, apply final attributes, export the HCell, and QA.
CARIS GIS 4.4a	Setting the sounding rounding variable for conversion of the metric HCell to NOAA charting units with NOAA rounding.
CARIS HOM Ver. 3.3	Perform conversion of the metric HCell to NOAA charting units with NOAA rounding.
HydroService AS, dKart Inspector Ver. 5.1, SP 1	Validation of the base cell file.
Northport Systems, Inc., Fugawi View ENC Ver.1.0.0.3	Independent inspection of final HCells using a COTS viewer.

12. Contacts

Inquiries regarding this HCell content or construction should be directed to:

Kurt Brown
Physical Scientist
Pacific Hydrographic Branch
Seattle, WA
206-526-6839
kurt.brown@noaa.gov

APPROVAL SHEET
W00208 and W00211

Initial Approvals:

The survey evaluation and verification has been conducted according to branch processing procedures and the HCell compiled per the latest OCS HCell Specifications.

The survey and associated records have been inspected with regard to survey coverage, delineation of the depth curves, development of critical depths, S-57 classification and attribution of soundings and features, cartographic characterization, and verification or disproof of charted data within the survey limits. The survey records and digital data comply with OCS requirements except where noted in the Descriptive Report and are adequate to supersede prior surveys and nautical charts in the common area.

I have reviewed the HCell, accompanying data, and reports. This survey and accompanying digital data meet or exceed OCS requirements and standards for products in support of nautical charting except where noted in the Descriptive Report.