

## 8 Deliverables

### 8.1 Field Reports

Reported horizontal positions shall be recorded in meters, with a precision of at least decimeters (refer to section 5 regarding requirements for vertical (depth) positions). This precision shall be maintained throughout the processing pipeline and be maintained in the digital data.

#### 8.1.1 Progress Sketch and Survey Outline

The hydrographer shall submit a Monthly Progress Sketch digitally via email, to the addresses specified in the Hydrographic Survey Project Instructions or Statement of Work no later than 5 calendar days from the end of the reported month. Progress sketches will typically be constructed using a desktop Geographic Information System. NOAA field units shall submit their progress sketches in MapInfo format and a separate statistics sheet in Excel, in accordance with section 2.2.2.10 and 5.2.3.2.1 of the OCS Field Procedures Manual. Contractors may refer to the separate statistics spreadsheet example (Figure L1 ) in Appendix 9.

The following provides clarification of the columns within the spreadsheet:

- The “LNM VBES” (vertical beam echo sounder), “LNM MB” (multibeam), and “LNM SSS” (side scan sonar) are for the purpose of reporting operations using only one sonar sensor.
- The “LNM Combo” is for reporting LNM if a combination of sensors is used, such as side scan and single beam or multibeam and side scan.
- The LNM above are to be subdivided between ship and launch platforms as appropriate.
- “Items Investigated” includes AWOIS items or newly discovered items that require extra survey time.
- “DAS” (day at sea)
- “Time Lost Days” are to be reported as days using decimals (i.e., 1.5) as determined from the Vessel Utilization Report by subtracting “Vessel Utilization” value (see c.5 below) from 1.0.

Contractors shall submit their progress sketches in MapInfo format or as an Adobe Acrobat .pdf file. The Progress Sketch is a page-size graphic that portrays survey accomplishments. All portions of the sketch must be neat and legible for reproduction. Every Progress Sketch shall be overlaid onto a large scale chart of the survey area that includes land area to give geographic context (do not include the raster chart file in email attachment, only reference chart used, if submitting in MapInfo format) and depict the following information, if applicable:

- Title block
- Statistics block
- Latitude and longitude tick marks
- Sheet limits
- Survey area limits

- Sheet letters and registry numbers

The title block consists of the title “Progress Sketch”, project number, locality, type of survey, inclusive dates of survey, and name of survey party (vessel or contractor name).

The statistics block contains monthly columns showing, in rows, the following items, if applicable:

- Lineal nautical miles of sounding lines (list side scan sonar, multibeam and/or single beam separately) with separate statistics for the ship vice launches; if multiple sensors are used (SSS/single beam or SSS/MB) the miles should be reported separately along with indication of the sensors used. NOTE: Lineal nautical miles of shoreline/nearshore buffer lines (with or without sonar) should be included with the statistics for single beam.
- Square nautical miles of each survey sheet completely surveyed (the sum of all the monthly progress sketches for the survey should approximately equal the final total area surveyed at the end of the project).
- Number of bottom samples collected
- Number of items investigated including those from the Automated Wreck and Obstruction Information System (AWOIS) and newly discovered items that require additional field work.
- Number of tide gauges installed/removed
- Number of days of down time due to weather
- Number of days of down time due to equipment
- Number of days of down time for other reasons
- Number of days field unit was on site working on project (for instance, the field unit may have departed on the 15th, meaning the monthly progress sketch only reflects 15 days of work)

Distinctive hatching or a percentage complete value should be used to differentiate the sheet areas surveyed each calendar month. Additional symbols may be used on the Progress Sketch as necessary, but should be explained in the legend.

### **Survey Outlines:**

After completion of all field work for a survey, the hydrographer shall provide a survey outline region in MapInfo compatible format, Latitude/Longitude coordinate system, NAD 83, that shows the extent of hydrography completed for the registered survey. Contractors shall forward the outline via email to the COTR. NOAA field units shall forward the outline directly to 'survey.outlines@noaa.gov (see OCS Field Procedures Manual, section 5.2.3.3.3). The outline should be submitted as soon as practical after completion of field work.

If the outline has not been submitted within 30 days of completion of field work, the hydrographer shall contact HSD Operations Branch or the COTR to explain the delay and provide an estimate for delivery. Any large differences ( $\pm 10\%$ ) between the total square miles reported via the progress sketches for the survey and the area defined by the survey outline should be explained in the cover e-mail.

### 8.1.2 Danger to Navigation

As soon as practicable after discovery, the hydrographer shall submit a Danger to Navigation Report. Timeliness is a critical issue in reporting dangers to navigation. The hydrographer should ensure that the discovery of a potential danger to navigation is reported immediately to the appropriate authority. Further, should additional dangers be discovered during the processing of the survey, a danger report shall be immediately forwarded.

A danger to navigation is considered to be any natural feature (e.g., shoal, boulder, reef, rock outcropping) as well as any cultural feature (e.g., wreck, obstruction, pile, wellhead) which, during the course of survey operations was found by the hydrographer to be inadequately charted as described below. Potential dangers shall be evaluated in the context of the largest scale nautical chart of the area. Unless specified otherwise in the Hydrographic Survey Project Instructions or Statement of Work, all submerged features with depths of 11 fathoms (66 feet) or less in navigable waters should be considered potential dangers to navigation and subject to reporting. During the course of reviewing survey data for potential dangers to navigation, the hydrographer should be aware of the types of vessels transiting the area along with usual and seasonal vessel routes throughout the survey area.

Danger to Navigation Reports are required for:

- Significant uncharted rocks, shoals, wrecks, and obstructions
- Depths from the present survey which are found to be significantly shoaler than charted depths or features, and are navigationally significant (typically depths of 11 fathoms (66 feet) or less)
- Uncharted or inadequately charted clearances for bridges and overhead cables or pipelines
- A fixed or floating aid to navigation found to be off station to an extent that the aid does not serve its purpose adequately
- A fixed or floating aid showing significantly different characteristics than those charted or described in the Light List
- Other submerged or visible features, or conditions considered dangerous to surface navigation

Once all dangers to navigation (DTON) are identified by using the criteria above, they must be reviewed in context with the largest scale chart covering the survey area. DTONs submitted should include the date that the feature data was acquired and should not cause undue clutter in relation to other soundings or features on the chart. When multiple distinct features are located within 3mm of each other, as depicted on the largest scale chart of the area, then the most significant DTON located within the 3mm radius shall be submitted as a single danger to navigation.

In cases where dangers are too complex to be adequately identified as discrete features, they should be appropriately depicted on a chartlet that accompanies the danger letter. For example, widespread shoaling would be represented as a series of depths with appropriate depth curves instead of listing individual soundings and geographic positions. Danger submission shall include a chartlet that portrays the raster chart and the Danger features. Include Multibeam and side scan imagery of the danger (see Appendix 6).

NOAA field units shall use Pydro and submit all Danger to Navigation Reports via e-mail directly to Marine Chart Division's (MCD) Nautical Data Branch at e-mail address [mcd.dton@noaa.gov](mailto:mcd.dton@noaa.gov), with courtesy copies to Chief, Operations Branch and to the chief of the appropriate Processing Branch, in accordance with section 4.4.4.6 of the OCS Field Procedures Manual.

Contractors shall submit all Danger to Navigation Reports via e-mail to the COTR and ACOTR at processing branch stated in the Statement of Work.

The contractor reports will be submitted as follows:

1. Letter in the format shown in Appendix 6 (Figure F.1 ) ,
2. An ascii text file of the format; ‘latitude, longitude, depth, feature, date, time’.

The ACOTR will review the DTON, import the ascii file into Pydro, and create the .xml file (ACOTR’s should see section 4.4.4.6 for more information). A letter and .xml file will then be forwarded to the Nautical Data Branch at mcd.dton@noaa.gov.

MCD will process the Danger to Navigation Reports and send the information to the USCG for inclusion in the Local Notice to Mariners. MCD will notify the submitting party of any changes made to the Dangers to Navigation Report by return e-mail. The Processing Branches will submit any dangers to navigation detected during office processing to MCD as stated above. If the Processing Branch is submitting a DTON that changes an earlier DTON submitted by a field unit, please explain the change in the cover letter.

A copy of the Danger to Navigation Report shall be included in Appendix I of the Descriptive Report.

**8.1.2.1 Charted Feature Removal Request** Charted features, particularly “Position Approximate” wrecks and obstructions that are located in major shipping corridors should be expeditiously removed from the chart if adequately disproved. The Charted Feature Removal Request is similar to a Danger to Navigation Report, except it is used to remove a charted feature that represents a hazard, which does not exist, rather than add a newly found hazard. This process should be used sparingly, usually by responding to a request from local pilots or other authorities that a charted feature is a hindrance to operations. If removal of a feature is not time critical, utilize the descriptive report to recommend removal from the chart rather than the Charted Feature Removal Request.

The Operations Branch, within the Hydrographic Surveys Division, is responsible for defining the search criteria for all AWOIS items. If local authorities request the hydrographer to investigate a feature that has not been assigned, contact Operations Branch for a determination of the search criteria. Once the hydrographer meets the search criteria and determines the feature does not exist, they should expeditiously prepare the Charted Feature Removal Request and forward it to the appropriate Processing Branch for verification. The format for the request is the same as a Danger to Navigation Report. The Processing Branch will review the request and, if the verifier concurs with the hydrographer’s recommendation, will forward the request to the Marine Chart Division. See Figure F.1 in Appendix 6 for an example of a Charted Feature Removal Request.

### **8.1.3 Descriptive Report (DR)**

A Descriptive Report is required for each hydrographic survey completed, unless specified otherwise in the Project Instructions or Statement of Work.

The primary purposes of a Descriptive Report are to: 1) help cartographers process and evaluate the survey; 2) assist the compilers producing or revising charts; 3) document various specifications and attributes related to the survey and its by-products; and 4) provide a legal description of the

survey standards, methods, and results. The cartographers will have no knowledge of the particulars of a survey, other than what is documented in the Hydrographic Survey Project Instructions or Statement of Work, digital survey data, Descriptive Report, and supplemental reports referenced in the Descriptive Report. The Descriptive Report is archived as a historical and legal record for the survey.

The Descriptive Report supplements the survey data with information that cannot be depicted or described in the digital data. The Descriptive Report describes the conditions under which the survey was performed, discusses important factors affecting the survey's adequacy and accuracy, and focuses upon the results of the survey. It contains required information on certain standard subjects in concise form, and serves to index all other applicable records and reports.

General statements and detailed tabulations of graphically evident data, such as inshore rocks, shoals, or coral heads already shown in the S-57 feature file or compiled in Pydro, should normally not be included in the Descriptive Report. Hydrographic characteristics of the survey area such as nearshore features, shoreline, currents, water levels, and changes to the chart that are otherwise not clearly defined by the digital products should be completely described in the Descriptive Report.

The following information is required in each Descriptive Report in the order listed below:

**COVER SHEET** (NOAA Form 76-35A, see (Figure B) in Appendix 2)

Appropriate entries are made to identify the survey. For each survey, the Registry Number, Sublocality, General Locality, and State will be provided in the Hydrographic Survey Project Instructions or Statement of Work.

**TITLE SHEET** (NOAA Form 77-28, see Figure C.1 in Appendix 3)

The "Hydrographic Title Sheet" is often referred to for information pertaining to the survey. The "State", "General locality", and "Locality" entries are to be identical to those on the Cover Sheet. The "Date of survey" entries are the inclusive dates of the fieldwork.

For "Vessel", enter the name and hull number of the surveying vessel. The name(s) listed after "Surveyed by" are the personnel who supervised sounding operations and/or data processing.

The "Remarks" section should contain any additional information, including the purpose of the survey and survey area information that will identify the project or clarify the entries above. Other Descriptive Reports or special reports containing information or data pertinent to the survey that are not listed in Section E of the Descriptive Report text should be referenced here. Note the time zone used during data acquisition (e.g., All times are recorded in UTC). If applicable, list the name and address of the contractor and any major subcontractors. If applicable, include the UTM zone number.

**DESCRIPTIVE REPORT TEXT**

A hard copy of the Descriptive Report (DR) need not be submitted. Two digital copies of the DR shall be provided: in Microsoft Word format and Adobe PDF. The Microsoft Word format shall be converted to an Adobe PDF file when the DR has been finalized and shall have an approval sheet with a digital signature in accordance with section E.

The main body of the DR (sections A through E) shall be contained in a single file. Text shall be Times New Roman, with a font size of 12. Include all information required for complete understanding of the field records. When referring to a hydrographic feature in the S-57 feature file, give the

latitude and longitude of the feature. Discussions and explanations should be written in a clear and concise manner. Avoid using geographic names in the text of the Descriptive Report that do not appear on the nautical chart. Avoid verbosity.

On each page of the DR body, include registry number and field unit as a header. Pages shall be numbered consecutively from the first page of text, continuing through the page preceding the Approval Sheet (page numbers as a footer, centered on page). Include a Table of Contents with page numbers.

## **A. AREA SURVEYED**

Include a coverage graphic inclusive of the survey area. The information related to the present survey should be clearly shown and highlighted in some way to draw attention to its location within the project area. A second small scale graphic should be included if necessary to provide additional geographic context of where the survey is located.

List for each vessel (ship and/or launch number(s)) and the combined total of all vessels, the following information:

- Lineal nautical miles of single beam only sounding lines (mainscheme only)
- Lineal nautical miles of multibeam only sounding lines (mainscheme only)
- Lineal nautical miles of lidar sounding lines (mainscheme only)
- Lineal nautical miles of side scan sonar only lines (mainscheme only)
- Lineal nautical miles of any combination of the above techniques (specify methods)
- Lineal nautical miles of crosslines from single beam and multibeam combined
- Lineal nautical miles of lidar crosslines
- Lineal nautical miles of developments other than mainscheme lines
- Lineal nautical miles of shoreline/nearshore investigation (total length of the inshore buffer line)

NOTE: Any lineal nautical miles that are deleted for any reason should not be included in the above statistics.

List for the total survey the following information:

- Number of bottom samples collected
- Number of items investigated that required additional time/effort in the field beyond the above survey operations (these can be either from dive operations or obtaining a detached position but should not include items developed by sonar only or items deconflicted by “observations” only)
- Total number of square nautical miles
- Specific dates of data acquisition (e.g. June 5-9,16-19,22,24, 2005)

## **B. DATA ACQUISITION AND PROCESSING**

### **B1. Equipment**

In this section of the Descriptive Report list by manufacturer and model number only the major systems used to acquire survey data or control survey operations (e.g., single beam sonar, multibeam sonar, side scan sonar, lidar system, vessel attitude system, positioning system, sound speed system). Include a brief description of the vessel (e.g., length overall and draft). A detailed description of the systems used to acquire survey data or control operations shall be included in the project-wide Data Acquisition and Processing Report. See Section 8.1.4.1 for additional information.

Include in a narrative description, with figures when useful, of any deviations from the vessel or equipment configurations described in the Data Acquisition and Processing Report.

### **B2. Quality Control**

Discuss the internal consistency and integrity of the survey data. State the percentage of crossline miles as compared to main scheme miles. Evaluate their general agreement. If the magnitude of the discrepancy varies widely over the sheet, make a quantitative evaluation of the disagreements by area. Explain the methods used to reconcile significant differences at crossings, and give possible reasons for crossline discrepancies that could not be reconciled. See section 5.1.4.3 and 5.2.4.3 for additional information.

Discuss the uncertainty values of the submitted CARIS BASE surface(s) and/or BAG(s). Explain and/or justify any areas that have an uncertainty greater than the IHO levels allowed as described in section 5.1.2 and 5.2.2.

Evaluate survey junctions in this section. Junctions are made between adjoining contemporary surveys to ensure completeness and relative agreement of depths. List, by registry number, scale, date, and relative location, each survey with which junctions were made. Include a summary of each junction analysis. Explain methods used to reconcile significant differences at junctions, and give possible reasons for junction discrepancies that could not be reconciled. Include recommendations for adjustments to soundings, features, and depth curves, if applicable.

Discuss sonar system quality control checks.

Discuss any unusual conditions encountered during the present survey which would downgrade or otherwise affect the equipment operational effectiveness. Discuss any deficiencies that would affect the accuracy or quality of sounding data. Document these conditions; including how and when they were resolved.

Describe any other factors that affected corrections to soundings, such as sea state effects, the effect of sea grass or kelp, and unusual turbidity, salinity, or thermal layering in the water column. Provide a brief discussion on how the sound speed instruments (CTD, Moving Vessel profiler, Thermosalinograph etc.) were used and the frequency of the SVP casts. If appropriate, describe how the survey area was zoned to account for sound speed variations from differing water masses.

Discuss the specific equipment and survey methods used to meet the requirements for object detection and coverage for different areas of the survey. Any deviations from the specifications must be clearly explained in the Descriptive Report.

### **B3. Corrections to Echo Soundings**

Discuss any deviations from those described in the Correction to Echo Soundings section of the Data Acquisition and Processing Report.

Discuss the results of any sounding system calibration (e.g. patch test) conducted after the initial system calibration that affect the survey data and were not included in the Data Acquisition and Processing Report. Comment on the reason a new calibration was conducted.

#### B4. Data Processing

Discuss details of the submitted CARIS BASE surface(s) and/or BAG(s). For instance, how many grids cover the survey area, what grid resolutions were used, why were the different grid resolutions selected, how do the resolutions change over the depth range of the survey, etc.

### C. VERTICAL AND HORIZONTAL CONTROL

Include in this section of the Descriptive Report a summary of the methods used to determine, evaluate, and apply tide or water level corrections to echo soundings on this survey.

Describe how the preliminary zoning was determined to be accurate and/or describe any changes made to the preliminary zoning scheme.

State the horizontal datum and projection used for this survey. Briefly discuss the control stations used during this specific survey. If USCG DGPS stations are used, only list the station name in this section. Explain in detail any difficulties that may have degraded the expected position accuracy.

See Section 8.1.4 for additional information to be provided in the project Horizontal and Vertical Control Report. NOAA field units should also refer to section 5.2.3.2.3 in the OCS Field Procedures Manual.

### D. RESULTS AND RECOMMENDATIONS

#### D.1 Chart Comparison

Compare the survey with all corresponding bathymetric products available (e.g. Electronic Nautical Charts (ENCs) and Raster Nautical Charts (RNCs)) to prove or disprove any exceptional bathy features attained by the survey coverage. Identify the chart by number, scale, edition number, and edition date. In addition, Notices to Mariners affecting the survey area which were issued subsequent to the date of the Hydrographic Survey Project Instructions or Statement of Work and before the end of the survey must be specifically addressed. Identify the last Weekly and Local Notices to Mariners compared to during the survey by notice number and date. Any Notice that prompts a chart comparison item must be identified by its Notice to Mariners number and date.

There are two aspects of chart comparison: (1) general comparison between survey depths and charted soundings and (2) detailed comparison between survey data and charted shoals and potentially dangerous features. One method for accomplishing the first is a comparison between the digital surfaces generated from the survey data and the ENC using appropriate GIS software. Comment on the degree of general agreement with charted soundings and discuss general trends, such as shoaling or deepening occurring in the survey area. List significant charted depths that have been disproved but do not do a detailed evaluation of every charted sounding.

Greater effort is needed when conducting the detailed comparison between the survey data and all charted shoals and potentially hazardous features. Describe the methods of investigation and include least depths for significant changes. Contractors shall list charted features not found during



the present survey. NOAA units should reference section 5.2.3.3.2 Pydro Reports regarding features protocol.

Discuss the methods used for both aspects of chart comparison in sufficient detail to demonstrate that the chart comparison was accomplished adequately.

List and discuss comparisons of survey depths with controlling depths, tabulated depths, and reported depths of all maintained channels. Also discuss soundings in designated anchorages, precautionary areas, safety fairways, traffic separation schemes, pilot boarding areas and along channel lines and range lines.

Briefly describe assigned Automated Wreck and Obstruction Information System (AWOIS) items investigated by single beam or multibeam echosounder, side scan sonar, divers, and/or other methods in this section. Include an analysis of any differences between past and present survey findings and make a specific charting recommendation. Also, include any official salvage documentation that would expunge the feature from the chart without having to further investigate with a survey platform.

Any charted features that contain the label PA, ED, PD, or Rep (see Chart No. 1 for definitions.), not specifically assigned as an AWOIS item and investigated in this survey, should be documented and discussed in this section. The source of the charted feature should be listed if known. Also, discuss features such as wrecks and obstructions from miscellaneous sources. Describe the condition and distinguishing characteristics of all items mentioned. NOAA units should reference the Pydro generated "For Descriptive Report" feature report as necessary for this requirement (see section 5.2.3.3.2 of the OCS Field Procedures Manual).

Refer to any Danger to Navigation Reports submitted for this survey. A negative statement is required if no Danger to Navigation Reports were submitted.

## D.2 Additional Results

If specified in the Hydrographic Survey Project Instructions or Statement of Work, describe and discuss the shoreline investigation results.

If applicable, briefly discuss prior survey comparisons conducted by the hydrographer. In general, prior survey comparisons are not required by field personnel, but may be used at the discretion of the hydrographer for quality control purposes. Prior survey comparisons can be very helpful to the hydrographer both in the field and during final data processing. Prior surveys may be obtained by contacting the appropriate Processing Branch or by contacting the COTR (if not already provided on the project CD).

Discuss aids to navigation which do not serve their intended purpose, are damaged, or whose characteristics do not match the chart or Light List (see Section 7.2). A statement shall be made in this section of the Descriptive Report if all aids serve their intended purpose. NOAA units should refer to section 3.5.3.3 of the OCS Field Procedures Manual and Hydrographic Survey Project Instructions for specific guidance on positioning aids to navigation.

List all bridges, overhead cables, and overhead pipelines. State the status or condition of each feature. Provide applicable clearances determined by the survey party or by an authoritative source (e.g., the U.S. Coast Guard or U.S. Army Corps of Engineers). Include the geographic coordinates directly below the minimum clearance point. All such charted overhead features that no longer exist must also be listed. Include written documentation, if available, and photographs with the survey records. Invalid or uncharted overhead clearance information, or ongoing construction of bridges or overhead cables and pipelines, constituting a potential danger to navigation, should be reported to

the U.S. Coast Guard and the U.S. Army Corps of Engineers. Mention any submarine cables and pipelines and any associated crossing signs on the shoreline. Include coordinates for signage or the water entry point of the feature. Note ferry routes and list position of each ferry terminal, if not shown on the chart or contemporary NOS remote sensing maps.

For each drilling structure, production platform, and well head within the survey area (excluding temporary jack up rigs), make a comparison between the new survey position and the largest scale chart on which the feature is shown and discuss any differences.

Provide information of significant scientific or practical value resulting from the survey. Unusual submarine features such as abnormally large sand waves, shifting or migrating shoals, mounds, valleys, and escarpments should be described. Discuss anomalous tidal conditions encountered, such as the presence of swift currents not previously reported. Discuss any environmental conditions encountered, which have a direct bearing on the quality and accuracy of the hydrographic data. If special reports have been submitted on such subjects, refer to them by title, author, and date of preparation or publication.

Mention present or planned construction or dredging in the survey area that may affect the survey results or nautical charts. Recommend new surveys for any adjacent areas that need them. As appropriate, include recommendations for further investigations of unusual features or sea conditions of interest that go beyond routine charting requirements. Recommend insets to be shown on the published chart of the area, if requested by chart users or needed for clarity.

## **E. APPROVAL SHEET**

The approval sheet with a digital signature shall be part of the digital DR file. It is important to note that there is a distinct difference between a true digital signature and a digitized signature. The latter is simply an image or other capture of a person's pen-and ink signature. By using a document scanner or an electronic pen capture device, a person's signature may be digitized. However, simply attaching this type of signature to an electronic document is not the same as attaching a digital signature.

A digital signature, by contrast, appends a cryptographic "key" to the document that can be used to verify the identity of the signer (authentication), ensure that no changes have been made to the document since signing (integrity), and ensuring that the signer cannot deny having signed the document (non-repudiation). Until such time as an organization-wide digital signature solution is implemented, the nature of self-signed digital signatures will limit authentication and non-repudiation capabilities of the system. The mechanism of applying the digital signature may include a digitized version of a person's signature, or it may not.

Use of the Adobe PDF format provides a standard vehicle for delivery of descriptive reports. PDF supports digital signatures, and has been identified as an archive format by the National Archives and Records Administration. The use of PDF combined with digital signatures provides reasonable protection and assurance against inadvertent document modification, as well as a means for tracking intentional document modification.

The approval sheet shall contain the following:

- Approval of the deliverable files, Descriptive Report, digital data, and all accompanying records. This approval constitutes the assumption of responsibility for the stated accuracy and completeness of the hydrographic survey.

- A statement as to whether the survey is complete and adequate for its intended purpose or if additional work is required.
- The amount and degree of personal supervision of the work.
- Additional information or references helpful for verifying and evaluating the survey.

List all reports and data not included with the survey records or Descriptive Report that have been submitted to the processing office or to another office (e.g., Data Acquisition and Processing Report, Vertical and Horizontal Report, Tides and Water Levels Package, Coast Pilot Report). Include date of the report or date of submission.

If appropriate, other personnel responsible for overseeing or directing operations on this survey sheet may also sign the Approval Sheet.

## **DESCRIPTIVE REPORT APPENDICES**

The Appendices shall be submitted as a separate Adobe Acrobat file from the DR and in a digital format only. NOAA units should refer to section 5.1.2.2 of the OCS Field Procedures Manual for additional guidance on the content of DR Appendices.

### **I. DANGER TO NAVIGATION REPORTS**

Include copies of Danger to Navigation Reports and correspondence. List each document by some type of unique identifier, such as date for a letter or e-mail.

### **II. SURVEY FEATURE REPORT**

Include a copy of all AWOIS item investigation reports and associated graphic correlation output. Include any official salvage documentation that supports an AWOIS charting recommendation. NOAA units shall meet this requirement by submitting the “For Descriptive Report” feature report generated in Pydro as Appendix II.

### **III. FINAL PROGRESS SKETCH AND SURVEY OUTLINE**

Include a copy of the final Progress Sketch and final survey outline that were submitted as per the requirements in Section 8.1.1.

### **IV. TIDES AND WATER LEVELS**

Include the following (if applicable):

- Field Tide Note (see section 4.2.2)
- Final Tide Note (see section 4.5.3)
- Abstract of Times of Hydrography (lists every day during which hydrography was conducted and the start and end times hydrography was conducted each day)
- A copy of the “Request for Approved Tides/Water Levels” letter
- Any other correspondence directly relating to tides and/or water levels

## V. SUPPLEMENTAL SURVEY RECORDS AND CORRESPONDENCE

Include any additional survey records not previously addressed in the Descriptive Report, Appendices or Separates (e.g., MapInfo tables) and a summary table of bottom samples obtained (if applicable). Any letter or email correspondence relating to the present survey should also be included. Contractors shall submit supplementary correspondence in a format that can be an easily read (e.g \*.txt) such that it is not proprietary to an email program.

## SEPARATES TO BE INCLUDED WITH THE SURVEY DATA

The following “SEPARATES TO BE INCLUDED WITH THE SURVEY DATA” supplementing the Descriptive Report shall be submitted with each survey. The Separates shall be submitted as a separate Adobe Acrobat file from the DR and in a digital format only. NOAA units should refer to section 5.1.2.2 of the OCS Field Procedures Manual for additional guidance on the content of DR Separates.

### I. ACQUISITION AND PROCESSING LOGS

Include all acquisition and processing logs in digital format from the present survey. Include positioning confidence checks and sounding system comparison checks.

### II. SOUND SPEED DATA

In previous versions of this manual, a table was required which identified the specific sound speed profiles used during the present survey. Now the requirement is to submit a list that can be imported into a GIS for office verifiers to analyze the distribution and frequency of the SVP casts. This deliverable should identify the positions and dates of all casts used; the maximum cast depth; and the dates/times for which the profiles were applied. CARIS users can fulfill this requirement with the submission of the SVP data that is within the CARIS project. Contractors and NOAA field units should refer to the location where the digital sound speed files are located, and include a directory listing of the files.

A vessel with a Moving Vessel Profiler (MVP) may use thousands of profiles for a single survey. In such cases, a table of each individual cast is not required. Instead, replace the table with a brief discussion on how the MVP was used (frequency, which areas of the survey, vessels and/or lines it was used, etc.) If individual casts were conducted as well, those casts should be included in a table.

Include confidence check results. Include copies of sound speed profiler calibration report(s), if calibration occurred after submission of the Data Acquisitions and Processing Report (DAPR).

### III. HYDROGRAPHIC SURVEY PROJECT INSTRUCTIONS/STATEMENT OF WORK

Include copies of the Hydrographic Survey Project Instructions or Statement of Work. Include all changes/modifications which apply to the survey being submitted.

### IV. CROSSLINE COMPARISONS

Include the summary plot analysis as a function of beam number if conducted for the main-scheme/crossline intersections as required in Section 5.1.4.35.1.4.3 and 5.2.4.35.2.4.3, if applicable. Include any other crossline quality reports required by the Hydrographic Survey Project Instructions or Statement of Work.

### V. SIDE SCAN CONTACT LISTING AND IMAGES OF SIGNIFICANT CONTACTS

Include the side scan contact listing, along with images of all significant contacts. Side scan contacts are included as part of a normal Pydro data submission, which fulfils this requirement. Non-Pydro users must submit significant contact images in a manner which allows the Processing Branch to easily review and correlate specific contacts with other supporting data sets.

#### **8.1.4 Descriptive Report Supplemental Reports**

**8.1.4.1 Data Acquisition and Processing Report** The Data Acquisition and Processing Report (DAPR) is a project-wide report that shall be submitted before, or not later than, the submission of the first survey of the project. For contract surveys, the DAPR shall be sent to the COTR and appropriate Processing Branch specified in the Statement of Work with each survey. For NOAA field units, the DAPR shall be sent to the Chief, Hydrographic Systems and Technology Program (HSTP) and the appropriate Processing Branch specified in the Hydrographic Survey Project Instructions. This report is separated into three sections: Equipment, Quality Control, and Corrections to Echo Soundings. These sections shall contain a detailed discussion on the project specific information addressed below.

A digital copy of the main text of the DAPR shall be provided in Adobe Acrobat format.

Include a cover sheet and title sheet which contain the following general information:

Cover Sheet. Include the type of survey(s), state, general locality and year (see Figure G.1 in Appendix 7).

Title Sheet. This contains additional descriptive information relative to the project. Include project number, date of Hydrographic Survey Project Instructions/Statement of Work, vessel(s), field unit/contractor, sub-contractors, and Chief of Party/Lead Hydrographer.

##### **A. Equipment**

Describe the major operational systems used to acquire survey data or control survey operations. Include the manufacturer, firmware version and model number, operational settings and how the equipment was used. Include a description of the vessel(s) used.

Specifically discuss single beam, multibeam, lidar and side scan sonar systems and operations in this section. Include range scales, number of beams, resolution, alongtrack coverage, and quality assurance tools used during data acquisition. Include discussion of other depth determination systems, such as, diver depth gauges, lead line, sounding poles, etc. If applicable, explain the calibration or determination of correctors, the dates of most recent calibrations, state whether or not checks were made on their accuracy and describe any nonstandard procedures used.

Discuss the computer hardware and software used for all data acquisition and processing. Describe acquisition and processing methods, procedures, and parameters used. Provide a complete list of all software versions and dates.

Include a description of equipment used to conduct shoreline verification. Briefly describe the method of conducting shoreline verification, including the processing of detached positions and depiction of shoreline features in the S-57 feature file.

##### **B. Quality Control**

Provide a description of the data processing routines for converting raw sounding data to the final Navigation Surface grids. Include a description of the methodology used to maintain data integrity,

from raw sounding data to final soundings. Processing flow diagrams are helpful. Any methods used to derive final depths such as cleaning filters, sounding suppression/data decimation parameters, gridding parameters, and surface computation algorithms shall be fully documented and described in this section.

Discuss the methods used to minimize the errors associated with depth determination and provide details of how the error models and TPU for each sounding is computed (see Section 5.1.3.5(multi-beam) or 5.2.1.2 (lidar)). Any deviation from this requirement shall be explained here.

Discuss how under the navigation surface concept individual sounds are propagated or combined into a node that is consistent with any specific object detection requirements for the project.

Methods and standards used to examine side scan sonar records should be noted and a brief description of processing procedures should be provided. Include the methods for establishing proof of swath coverage and the criteria for selecting contacts. Additionally, include a brief description of how your review of digital side scan data meets the object detection and accuracy requirements per section 6.2. The number of pixels used to display digital side scan data on a computer is constrained by the width of the display window and the screen resolution. Any compression method used in the review of the side scan display must be discussed (e.g., whether an average or maximum pixel intensity within a regularly-spaced across-track interval X meters is used).

### C. Corrections to Echo Soundings

This section addresses the methods used for the determination of all corrections to echo soundings that apply to the entire project. Describe the methods used to determine, evaluate, and apply the following corrections to echo soundings, including the uncertainties for each item:

- Instrument corrections
- All vessel configuration parameters, offsets, layback, etc include diagrams, pictures, or figures of the equipment as installed onboard
- Static and dynamic draft measurements
- Heave, roll, pitch biases, and navigation timing errors. State the manufacturer, model, accuracy, and resolution of heave, roll, and pitch sensor(s). Discuss accuracy and alignment test procedures and results. Include copies of system alignment, accuracy, and calibration reports.
- Discuss the source of tide or water level correctors used for data processing and final sounding reduction

### D. Approval Sheet

The Chief of Party or Lead Hydrographer shall furnish a digitally signed statement of approval for all information contained within the Data Acquisition and Processing Report using the procedures prescribed in section E under the Descriptive Report Approval Sheet.

If appropriate, other personnel responsible for overseeing or directing operations on this project report may also sign the Approval Sheet.

**8.1.4.2 Horizontal and Vertical Control Report** The Horizontal and Vertical Control Report is a project-wide report which shall be submitted before, or not later than, the submission of the last survey in project area. NOAA field units should also refer to section 5.2.3.2.3 in the OCS Field Procedures Manual.

A digital copy of the main text of the Horizontal and Vertical Control Report shall be provided in Adobe Acrobat format.

Include a cover sheet and title sheet which contain the following general information:

- Cover Sheet - Include the type of survey(s), state, general locality and year.
- Title Sheet - This contains additional descriptive information relative to the project. Include project number, survey registry numbers to which this report applies (with associated dates of survey and locality), date of Hydrographic Survey Project Instructions/Statement of Work, vessel(s), field unit/contractor, sub-contractors, and Chief of Party/Lead Hydrographer.

#### A. Vertical Control

The Vertical Control section of the project Horizontal and Vertical Control Report shall document all Tide and Water Level activities that took place as part of this project. Specific information pertaining to an individual survey sheet and the Request for Approved Tides letter shall be documented in the Descriptive Report for the individual survey. This section shall contain a discussion of:

- All stations established by the field unit (include gauge model/type). Give station number, latitude/longitude, and the dates/times of operation.
- The method by which correctors for the field data were obtained and applied.
- The time meridian used to annotate the tide records.
- A list of any unusual tidal, water level, or current conditions.
- The height and time corrections, and zoning if different from that specified in the Hydrographic Survey Project Instructions or Statement of Work.
- Ellipsoidal benchmark positioning techniques and procedures

#### B. Horizontal Control

The Horizontal Control section of the project Horizontal and Vertical Control Report shall document Hydrographic Position Control activities that took place as part of this project. Specific information pertaining to an individual survey sheet shall be documented in the Descriptive Report for the individual survey.

For horizontal control stations established by the field unit, describe the survey methods used to establish the station, and state the standards of accuracy used. Include position accuracy plots (see Section 3.2.2). For all horizontal control stations established by the field unit, list:

- The latitude to at least the nearest 1/100th of a second.
- The longitude to at least the nearest 1/100th of a second.
- The station elevation (ellipsoidal height).

- The geodetic station name and year it was established.
- Briefly, describe the methods and adequacy of positioning system confidence checks.

### C. Approval Sheet

The Chief of Party or Lead Hydrographer shall furnish a digitally signed statement of approval for all information contained within the Horizontal and Vertical Control Report using the procedures prescribed in section E under the Descriptive Report Approval Sheet.

If appropriate, other personnel responsible for overseeing or directing operations on this project report may also sign the Approval Sheet.

## 8.2 S-57 Feature File

The International Hydrographic Organization (IHO) Special Publication 57 (IHO S-57) is the IHO Transfer Standard for Digital Hydrographic Data (current version is edition 3.1). The IHO intends for the standard to be used for the exchange of digital hydrographic data between hydrographic offices, and for the distribution of hydrographic data to manufacturers, mariners and other data users. It was developed so that the transfer of all forms of hydrographic data would take place in a consistent and uniform manner. IHO Special Publication 57 may be downloaded free of charge at [www.iho.shom.fr](http://www.iho.shom.fr)

Smooth sheets will no longer be required of Contractors or NOAA field units. The Processing Branches will use the S-57 feature file in conjunction with the BAG and other survey deliverables to compile the survey data into navigational products.

The deliverables for a survey shall be:

1. Features contained in a single S-57 (.000) base cell file.
2. A collection of Bathymetric Attributed Grids (BAG).
3. Metadata contained in the DR and associated reports.

NOAA field units may meet the features requirement using Pydro or Notebook deliverables (see section 4.4.9 and 4.10 of the OCS Field Procedures Manual)

The hydrographer shall submit BAGs or BASE surfaces at the highest appropriate resolution for the bathymetry and feature detection requirements set in the Project Instructions. The BAG should be in the NAD83 datum. The BAG should be UTM projected. The metadata for the BAG shall include the NAD83 datum and UTM projection with the proper zone and resolution of the grid. The S-57 feature file shall be in the WGS84 datum and unprojected.

The S-57 feature file contains all the attributed information on specific objects that cannot be portrayed in a simple depth grid. Features to include in the S-57 feature file include; wrecks, obstructions, shoreline, rocks, islets, oil platforms, nature of seabed (bottom samples) and all other objects that may need to be compiled to a navigational product and require additional information that cannot be included in the BAG.

U.S. Coast Guard maintained aids to navigation shall NOT be included in the S-57 feature file. The hydrographer shall investigate all aids to navigation and report results as required in section 7.2 and



8.1.4.1 Privately maintained aids and/or mooring buoys should be included in the S-57 feature file, unless they are transitory.

The S-57 feature file shall include shoreline data only if the hydrographer conducted shoreline verification. New features and changes to the source shoreline shall be portrayed in the S-57 feature file and be fully attributed.

General soundings, contours and depth areas will NOT be included in the S-57 feature file since these objects will be derived from the final BAGs during chart compilation. In rare cases, an isolated sounding may be part of the S-57 feature file if it needs a danger circle and/or additional attributions.

### 8.2.1 S-57 Attribution

These Specifications and Deliverables will not attempt to include all possible objects and attributions that may be required for a hydrographic survey. For a full reference the hydrographer should refer to the resources described in section 8.2.

A list of the more common objects and attributions that may be used during a typical hydrographic survey is given below. If the hydrographer has any questions on the appropriate attribution for an object, they should contact the COTR and/or the appropriate Processing Branch for clarification.

All S-57 mandatory attributes for an object shall be completed. The hydrographer shall attempt to provide as much additional information as possible on an object to facilitate the Branches in final chart compilation of the survey. Whenever possible, additional information should be associated with the object itself. The attributes, INFORM, TXTDSC and PICREP can be used to provide additional information. If it is not practical to communicate additional information using an attribute associated with the object, then the hydrographer can provide the information using the DR, Item Investigation Report, Detached Position log (with photo), or other means.

All objects in the S-57 feature file must be properly attributed. S-57 feature file attributions can be divided into three broad categories; depths, features, meta-objects. The most common items for each category and the related mandatory attributes are described below.

**ALL objects** (depths, features and meta-objects), unless otherwise noted, will have the attributes SORDAT and SORIND populated. For features that originate from an ENC or raster chart, use the SORDAT and SORIND from that source. For other features:

SORIND (Source indication)

Format: ‘Country code, Authority code, Source, ID Code’. Example, “US,US,surve,H11393”, if data came from a survey. Country (US), Authority (US for OCS), Source (survey), ID code (registry number). If feature is from RSD provided GC, the ID code becomes the GC number, if the feature is carried forward from a chart or ENC the ID code is the chart number (i.e. ‘chart 16707’).

<b>SORIND Source Code</b>	<b>Features File Source</b>
survy	For surveyed features: Bottom samples; Features with heights or elevations (exposed rocks and wrecks, etc.) obtained using rangefinder or similar device; Navigation aids; Mooring buoys, Piles and dolphins; Shoreline construction or other features gathered using portable GPS device; Kelp or other observed features where no discrete position was taken; Features digitized from extents obtained by the field (ledges, reefs, piers and fish pens, shoreline construction, etc.); Meta area objects.
nsurf	For soundings, depth contours and depth areas from the BASE Surface; For submerged rocks, wrecks, obstructions and other features from the BASE Surface.
digit	For digital map sources, such as GC shoreline.
graph	Reserved for all features compiled to the Features file from raster charts or ENC's.
reprt	Reserved for MCD's use for letters, reports, NTM's or digital documents.

#### SORDAT (Source date)

Is the date associated with the SORIND above. For a hydrographic survey, it is the last day of field operations. For a GC shoreline, the date the survey was flown, from the metadata. From a raster chart, the chart date. From the ENC, it is the date that the ENC has for the SORIND.

#### **DEPTHS**

Depth information is stored in three different forms, points (SOUNDG), lines (DEPCNT) and Areas (DEPARE). The S-57 feature file will have all depth units in meters.

#### SOUNDG (Sounding)

A measured water depth or spot which has been reduced to a vertical datum (may be a drying height). Soundings are bundled together by survey and share most attributes. The number of soundings included is appropriate for the scale of the survey as defined in the Statement of Work.

Mandatory Attributes:

- QUASOU (Quality of Sounding Measurement) - Generally set to '1', for depth known.
- TECSOU (Technique of Sounding Measurement) – see table below

<b>Technique of Measurement for Height or Depth</b>	<b>S-57 Attribute ID</b>
Single beam echosounder (alone)	'1' if found by echo-sounder
Side Scan sonar (alone)	'2' if found by side scan sonar
Multibeam (alone)	'3' if found by multibeam
Diver depth	'4' if found by diver
Lidar (alone)	'7' if found by laser
Heights on rocks or islets using rangefinder	'12' if found by leveling
Navigation surface resulting from combinations of sounding techniques, such as multibeam mixed with single beam or side scan mixed with multibeam and/or single beam (skunk-striping), or single beam or multibeam mixed with lidar	'14' computer generated

## FEATURES

All features should be attributed as fully as possible, with a few exceptions. Several common features are listed below, followed by the mandatory attributes required for them. Mandatory attributes for all features (WRECKS, UWTRC and OBSTRN) are listed after the OBSTRN explanation. Do NOT attribute SCAMIN (Scale minimum) on any objects.

### WRECKS (Wreck)

The ruined remains of a stranded or sunken vessel which has been rendered useless. (IHO Dictionary, S-32, 5th Edition, 6027)

Mandatory Attributes:

- CATWRK (Category of Wreck) – For instance ‘1’ for non-dangerous wreck, ‘2’ for dangerous wreck, ‘3’ for distributed remains of wreck, etc. or VALSOU (Value of Sounding) - Least depth of the wreck.

### UWTRC (Underwater/awash rock)

A concreted mass of stony material or coral which dries, is awash or is below the water surface (See Rock Attribution Figure H.1 in Appendix 8)

### OBSTRN (Obstruction)

In marine navigation, anything that hinders or prevents movement, particularly anything that endangers or prevents passage of a vessel. The term is usually used to refer to an isolated danger to navigation... (IHO Dictionary, S-32, 5th Edition, 3503)

Mandatory Attributes for all features:

- TECSOU (Technique of sounding measurement) - Typically ‘1’ if found by echo-sounder, ‘3’ if found by multi-beam, ‘4’ if found by diver, ‘7’ if found by laser.
- QUASOU (Quality of Sounding Measurement) - Generally set to ‘1’, for depth known.
- VALSOU (Value of Sounding) – Least depth of the wreck.
- WATLEV (Water Level Effect) – For instance, ‘1’ for partly submerged at high water, ‘2’ for always dry, ‘3’ for always under water/submerged, ‘4’ for covers and uncovers, etc.

### SBDARE (Seabed area) Objects

The nature of bottom includes the material of which it is composed and its physical characteristics. Also called character (or characteristics) of the bottom, or quality of the bottom. (IHO Dictionary, S-32, 5th Edition, 515). The S-57 point object SBDARE is typically used to report characteristics from bottom samples taken.

Mandatory Attributes:

Bottom characteristic objects will have one or the other or both of the following attributes (usually NATSUR):

- NATSUR (Nature of surface) – Refer to S-57 library for codes, for instance, ‘1’ is mud, ‘2’ is clay, ‘3’ is silt, ‘4’ is sand, etc.
- NATQUA (Nature of surface - qualifying terms) – Refer to S-57 library for codes, for instance, ‘1’ is fine, ‘2’ is medium, ‘3’ is coarse, etc.

Where SBDARE is used to describe bottom characteristics obtained through bottom sampling, NATSUR must be attributed. NATQUA is optional. Multiple characteristics and qualifiers may be used. If a bottom sample was attempted but not achieved, use NATQUA (hard). Where SBDARE is used to describe a rocky seafloor, NATSUR (rock) is used.

SBDARE line or area objects may also be used to characterize areas of the seafloor that are rocky in nature (See Section 5.1.1.3 for additional details regarding these areas). In rocky nearshore areas, the least depths of many features in a relatively small area may fail to be preserved, even by very high resolution BASE surfaces. In these instances the hydrographer shall designate the least depths on the shoalest of features. The extents of the area should then be delineated and characterized as SBDARE (seabed area), and the attribute NATSUR (nature of surface) encoded as “rock”, as follows:

- NATSUR (Nature of surface) – ‘9’ rock
- NATQUA (Nature of surface - qualifying terms) – (none)

## **SHORELINE**

Shoreline information, if required by project, should be encoded in S-57 using the following feature objects and attributes.

### COALNE (Coastline)

MHW line determined from bathy/topo data or geo-referenced orthophotos. COALNE is attributed with CATCOA (Category of Coastline), if known. ELEVAT should not be attributed for this object.

### LNDARE (Land area)

A rock becomes an islet at 2 feet (0.6 meters) above MHW. LNDARE point, line or area objects may be used to characterize islets (see “S-57 Encoding Guidelines for Rocks and Islets for the Pacific Coast and Alaska”). LNDARE objects should be accompanied by LNDELV point or line object, denoting the highest point of the feature.

### LNDELV (Land elevation)

Elevation for islets is encoded using the object LNDELV, with attribute ELEVAT, which is given relative to the MHW datum (taken from “S-57 Encoding Guidelines for Rocks and Islets for the Pacific Coast and Alaska”).

## **META-OBJECTS**

Meta-Objects provide metadata and additional information for large areas of the survey, or to attribute the entire survey area. The required meta-objects with their mandatory attributes are listed below.

Areas of different coverage types should be separated and attributed using CATZOC (Category of zone of confidence in data) according to the following table:

S-57 Attribute ID	CATZOC Description
A1	Object detection multibeam
A2	100% multibeam coverage or 200% sidescan coverage with skunk-striping using multibeam
B	Single beam bathymetry or developments, or skunk-striping using VBES (single beam) or Lidar alone
C	Single beam lines for reconnaissance
U	For features with heights obtained with methods other than sonar, or where extents were collected for islets, reefs, ledges, shoreline construction, etc.

- POSACC (Positional Accuracy, in meters) – For USCG beacons or other modern Differential GPS systems, will typically be 10 meters.
- SURSTA (Start date of survey) - When compiling from a hydrographic survey, enter the start date of the field operations in format, CCYYMMDD.
- SUREND (End date of survey) - When compiling from a hydrographic survey, enter the end date of the field operations in format, CCYYMMDD.
- INFORM (Information) - Contains the Following String: Registry Number, Project Number, and Contractor Name (H10934, OPR-D904-00, World Surveys Inc.)

#### M\_COVR (Coverage)

A geographical area that describes the coverage and extent of spatial objects. The area that comprises the compiled data or extents of survey.

Mandatory Attribute:

- CATCOV (Category of coverage) – ‘1’ for coverage available: continuous coverage of spatial objects is available within this area. ‘2’ for no coverage available: an area containing no spatial objects (i.e. an area within the survey limits, not addressed by the hydrographer.)

### 8.2.2 Cartographic Specifications and Conventions

**Generalization of Features** If the hydrographer determines an area unsafe, a foul area can may be shown, but all available survey data that exists for any and all feature objects will be included in the S-57 feature file (see the following sections regarding rocky areas: 5.1.1.3 and 5.1.2 for multibeam data, 5.2.1.2 for lidar data and 8.1.2).

**Determination of the MHW Elevation** A MHW value is required for compilation of all Feature files containing shoreline or intertidal areas. It is used for defining DRVAL1 (Depth Range Value) attribute field for intertidal DEPARE’s where DRVAL2 will always be 0.0. Example: -3.2 to 0.0 meters. If an ENC covering the survey area exists, use the MHW value of the ENC. (This is easily accomplished by querying any reef, ledge or other intertidal area on the ENC. Use the DRVAL1 or drying contour value, always indicated by a negative value.) If no ENC exists, use the smallest listed Mean High Water value in the paper chart TIDAL INFORMATION box. If no MHW category is shown, use the smallest listed Mean Higher High Water value. If none of the above is available, use the MHW from the tide note associated with the hydrographic survey. If there is no tide note, then the MHW value should be -999999999.0, this is equivalent to “UNKNOWN”.

**Rocky Areas** Rather than encoding numerous discrete submerged UWTROC objects in a relatively small area it is acceptable to delineate the extents of the rocky area, using the Navigation Surface as a reference, then encode as an area object: SBDARE, attribute: rock.

**Rocks and Islets** A rock will be depicted as an islet at 1 ft above MHW for Atlantic and Gulf coasts, and 2 feet above MHW for Pacific and Alaska coasts. Only four of the seven possible WATLEV categories will be used for equating VALSOU to WATLEV for rocks and islets. (See Rock Attribution Figure H.1 in Appendix 8, for use of S-57 attribution of rocks and islets for Feature files.)

If applicable, the S-57 feature file should have the following parameters set;

- Producing Agency = US Office of Coast Survey,
- Navigational Purpose = 1 thru 5 according to chart compilation scale,
- Individual Cell Code = H number of survey, H12345 becomes '12345',
- Horizontal Datum = WGS84 (datum of S-57 file),
- Vertical Datum (for heights) = MHW,
- Sounding Datum = MLLW,
- Units = metric
- Compilation Scale = survey scale,
- Coordinate Multiplication Factor = 10,000,000,
- Sounding Multiplication Factor = 1,000.

## 8.3 Side Scan Sonar

### 8.3.1 Side Scan Sonar Mosaic

A separate side scan mosaic for each 100 percent coverage shall be used as a graphic means for demonstrating bottom coverage. Pixel resolution of the side scan mosaics should be 1 m by 1 m. The hydrographer shall submit a digital file of each 100% coverage (see Section 8.4.4).

If possible, the mosaics should be generated in one complete image file. If the survey area is too large and/or creates a large image file that is unmanageable due to file size, then the hydrographer shall subdivide the area into smaller more manageable subsections. Contact the COTR and/or appropriate Processing Branch to discuss file size limitations for each survey. However, do not create mosaics for individual side scan line files.

### 8.3.2 Side Scan Sonar Contact List

#### Contact List

A Sonar Contact List of all contacts, both significant (Section 6.3.2) and insignificant, are required and must include the specific elements of information which are described below, along with a brief discussion of how each is to be derived. Specific entries may vary by hydrographer. The format should be reviewed by the COTR and/or Processing Branch before data collection is conducted.

A digital copy of the contact list, ideally in spreadsheet format, shall be submitted with the survey deliverables.

Column 1: Search Track Number—identifies the particular search track from which the contact was observed.

Column 2: Contact Number—uniquely identifies the contact. An example of a contact number is a number based on the date/time the contact was observed, followed by a letter indicating the port or starboard (P or S) channel. For example, if a port-side contact is observed on day 181 at 150125, the contact number will be 181/150125P. Using signed (+ or -) contact range in column 4 eliminates the need for the P or S indicator.

Column 3: Towfish Layback—the approximate distance in meters from the positioning system antenna to the towfish. Unless computed by an automated system, the towfish may be assumed to be directly astern of the towing vessel and on the search track.

Column 4: Contact Range—the horizontal distance from the towfish track to the contact, expressed in meters.

Column 5: Contact Position—the preliminary position as determined by reconstruction of the vessel position, towfish layback, towfish position, port or starboard channel, and contact range at the time the contact was observed. The Contact Position shall be stated as a latitude/longitude (decimal degree) or X/Y (easting, northing) values.

Column 6: Estimate of contact height computed from range and shadow length.

Column 7: Remarks—used to denote first impressions of the contact's identity (e.g., wreck, rock, etc.), or to make any comments deemed appropriate. If, after examining the records and correlating targets from overlapping coverage, the hydrographer determines that a contact does not warrant further investigation, it shall be noted as such. A brief statement of the reasons must be made. Any abbreviations should be defined on the list.

Column 8: Comparison with shallow water multibeam data—used to note the corresponding shallow water multibeam data (day/time, line number, etc.), the results of comparing the side scan sonar data with the multibeam data (e.g., contact did not appear in the multibeam data, swmb least depth = x.x—sss least depth = y.y).

Column 9: Contact is depicted in the S-57 feature file—answered in one of three ways: (1) yes, obstr, (2) yes, sounding only or (3) no.

Once added to the list, a contact should never be removed. If, after further processing, a contact is deemed not significant by the hydrographer, it shall be labeled as such in column 7. The contact list, and any subsequent field examination lists and records developed from the contact list, shall be included with the data submission in digital form.

The contact list should be created such that it can be imported into a GIS for office verifiers to analyze the distribution of contacts. However, if the hydrographer creates any image files showing the distribution of contacts and/or other products to assist with processing and analysis of the data, they may be included with the survey deliverables.

In some areas, significant contacts may be clustered (e.g., debris, boulder field). Such an area may lend itself to being depicted as a single feature within the S-57 feature file: a danger curve depicting the limit with accurately positioned least depth(s). If the hydrographer has any questions to how the feature should be portrayed and attributed within the S-57 feature file, they should contact the appropriate Processing Branch.

### **Contact Images**

For each significant contact in the contact list, the hydrographer shall provide an image of the contact. Digital images shall be in a standard image format (e.g., tif, gif, jpg). Copies of the images shall be included in the Separates, Section V. Digital file names shall coincide with the contact name as depicted on the contact list.

### **8.3.3 Data Acquisition and Processing Abstracts**

All sonargrams and data acquisition/processing comments shall be submitted digitally. Time references shall be made in Coordinated Universal Time (UTC).

The hydrographer shall have a system to clearly indicate the status of the side scan acquisition system. Historically, this was accomplished by annotating the paper sonargram as the data was being collected. Further annotations could be made during field and/or office review of the sonargrams. Modern survey systems acquire the data digitally, therefore, separate data acquisition/processing logs may be used to record the needed information.

The following comments (or annotations) shall be made in a manner that they can be correlated by time or other method back to the digital side scan sonar record.

### **System-Status Annotations**

System-status annotations are required to describe the recorder settings and the towing situation. System-status annotations shall include:

- Mode of tuning (manual or auto).
- Range-scale setting.
- Operator's name or initials.
- Length of tow-cable deployed (tow point to towfish).
- Depressor in use (yes or no).
- Weather and sea conditions.

System-status annotations shall be made:

- Prior to obtaining the first position of the day.
- While on-line, whenever the system set up or status changes.



### **First Position/Last Position Annotations**

The following annotations shall be made at the first position on each survey line:

- Line begins (LB) or line resumes (LR).
- Tow-vessel heading (degrees true or magnetic).
- Towing speed (engine rpm, and pitch if applicable).
- Index number and time (at event mark).

The following annotations shall be made at the last position on each survey line:

- Line turns (LTRA, LTLA), line breaks (LBKS), or line ends (LE) index number and time (at event mark).

### **Special Annotations**

The occurrence of any of the following events shall also be annotated:

- Change in operator (new name or initials).
- Change in range-scale setting.
- Confidence checks.
- Individual changes to recorder channel settings.
- Change in tow-cable length (tow point to towfish).
- Change in towing speed (engine rpm and pitch) or vessel heading.
- Change in tow point.
- Significant contact observed.
- Surface phenomenon observed (wakes, passing vessels, etc.).
- Passes by buoys or other known features within sonar range (identify object).
- Interference (state source if known).
- Time corresponding to the index marker.

The hydrographer shall make any other annotations necessary to note any occurrence which may later serve to reconstruct the operation. Too much information is always better than not enough.

**Annotation Methods** Header and system-status annotations may be made using any of the following methods:

- By use of an automatic annotator, if available.
- Typed entries in the data acquisition system.
- Typed entries in a separate annotation file.

The method is left to the hydrographer's discretion, but should be used consistently throughout the operation.

## 8.4 Digital Data Files

The survey data will be supplied in a digital format. Hard copy plots and hard copy printouts of reports are no longer required.

This section is provided as a summary for the major digital deliverables that may be required for a typical hydrographic survey. Not all sections will apply to all surveys. For both single beam and multibeam data, Contractors should separate digital deliverables into two data types: raw and processed. Raw should be uncorrected or with exception of online corrections. Processed data should include the Caris HDCS format or GSF.

NOAA units should refer to Chapter 5 of the OCS Field Procedures Manual for specific format and other guidance pertaining to survey deliverables.

### 8.4.1 Media

Digital data shall be submitted on USB hard drives. Each registered survey shall be submitted on a separate USB drive unless prior agreement is obtained from the COTR or Processing Branch. The hydrographer shall include a directory listing of each drive, or other method to enable the Processing Branch to determine where specific data sets are located. Other formats may be allowed if agreed upon in advance with the appropriate Processing Branch. The hydrographer shall work with NOAA to ensure no compatibility problems exist after data submission.

Network Attached Storage Units, specifically MaxAttach or equivalent may also be used to submit data. The hydrographer should contact the appropriate Processing Branch ahead of time to determine proper shipping methods, directory structure and reach agreement on when (or if) the Processing Branch will return the device.

### 8.4.2 Single-beam Data

The single-beam data format will be specified in the Hydrographic Survey Project Instructions or Statement of Work. Typically, the data will be submitted in a CARIS HIPS compatible format.

### **8.4.3 Shallow-Water Multibeam and Lidar Data**

The hydrographer's multibeam data format shall provide complete traceability for all positions, soundings, and correctors including sensor offsets, biases, dynamic attitude, sound speed, position, sensor position, date and time, vertical datum reducers, and sounding data from acquisition through postprocessing. Data quality and edit flags must be traceable.

#### **Full Resolution Multibeam Data**

The hydrographer shall submit full resolution multibeam data in a format readable by CARIS HIPS (Version 6.1, by CARIS). Full resolution multibeam data shall be delivered fully corrected for tides, sound speed, vessel offsets, draft and dynamic draft. These corrections may be made within CARIS, with data submitted as a complete CARIS project (including HDCS files, sound speed files, Vessel Configuration, CARIS tide files, etc.). Contractors that process with Caris, shall submit the fieldsheet directory so that re-computation could occur if necessary.

Or the data may be submitted fully corrected, such that it will be read in CARIS HIPS using a 'zeroed' Vessel Configuration file (.vcf or .hvf) and a 'zero' tide file (.tid), etc. Full resolution data are defined as all data acquired and logged during normal survey operations. Information and specifications on CARIS HIPS and data formats may be obtained from CARIS at 506-458-8533.

#### **Full Resolution Lidar Data**

The contractor shall submit the full resolution lidar data in CARIS compatible format (Version 6.1, by CARIS). The submission will include the appropriate CARIS converter, lidar data before conversion, and all necessary CARIS files so that NOAA can reconvert all files, if desired. Contractors that process with Caris, shall submit the fieldsheet directory so that re-computation could occur if necessary.

#### **CARIS BASE Surface and/or BAG**

The final depth information from the survey will be composed of a collection of grids. This collection of grids must reflect the state of the seafloor at the time of the survey. The finalized uncertainty of the grids shall be the greater of the standard deviation and a priori uncertainty. The hydrographer must take steps to ensure that all data has been correctly processed and that appropriate designated soundings have been selected (see section 5.1.1.3, 5.1.2 and 5.2.1.2). The collection of grids representing the final reviewed results of the hydrographic survey shall be submitted as CARIS BASE or BAG surfaces. NOAA field units typically process hydrographic data using CARIS HIPS software. CARIS' format for the Navigation Surface is a Bathymetry Associated with Statistical Error (BASE) surfaces, either an Uncertainty or CUBE Surface. Non-CARIS users may submit their Navigation Surfaces as a Bathymetric Attributed Grid (BAG).

The grids shall have a sequential naming convention, such as H12345\_1\_of\_5.BAG, H12345\_2\_of\_5.BAG, H12345\_3\_of\_5.BAG, etc.

#### **Specific Multibeam Data**

The hydrographer shall submit data used for determining navigation time latency, pitch, roll, and yaw biases in a separate directory on the submitted drive. The data format shall be such that CARIS HIPS can convert the data, thus making it compatible as described earlier in this Section.

#### **8.4.4 Side Scan Sonar Data**

The hydrographer shall submit digital side scan data in a format readable by CARIS SIPS (version 6.1, by CARIS, phone: (506) 458-8533). Digital side scan sonar shall be geocoded using the towfish position (towfish position corrected). Information and specifications on CARIS SIPS and data formats may be obtained from CARIS.

#### **Side Scan Contact Images**

The hydrographer shall submit digital images of all significant side scan contacts within the contact list (see Section 8.3.2). Digital images shall be in a standard image format (e.g., .tif, .gif, .jpg). The file name shall coincide with the contact name as depicted on the contact list.

#### **Side Scan Mosaics**

The hydrographer shall submit a digital image file for each 100 percent coverage. The digital image file shall be in a standard geo-referenced image format (section 8.3.1). Contractors that process with Caris, shall submit the fieldsheet directory so that re-computation could occur if necessary and include the referenced image file.

#### **8.4.5 Other Data**

#### **Tide and Sound Speed Data**

The hydrographer shall submit tide data and sound speed data applied to all multibeam depths on the project data drives. The hydrographer shall identify the data format and all data element descriptions (e.g., ASCII text file or Excel spreadsheet file; date/time referenced to UTC, tide relative to MLLW datum to the nearest centimeter). All tide data required by 4, shall be sent directly to the appropriate CO-OPS office.

#### **Vessel Configuration File**

The hydrographer shall submit a CARIS HIPS compatible HIPS Vessel File (HVF) for each vessel used during survey operations. CARIS-compatible HVF shall contain those static and dynamic correctors, offsets and uncertainties which are to be applied to the "Full Resolution Multibeam Data" set submitted as referenced in Section 8.4.3 If the data is submitted fully corrected with uncertainties already associated with each sounding, then the CARIS HVF may be "all zeros". In such a case, the hydrographer must provide details on what values were derived for all the static and dynamic correctors, offset and uncertainties and other information that is usually contained within a HVF in the DR and/or DAPR. Information and specifications on the HVF format may be obtained from CARIS.

## **Metadata**

The following reports shall be included on the submitted data drive in a clearly labeled directory;

- The main body of the Descriptive Report in Microsoft Word format.
- The Appendices and Separates to the DR in Adobe Acrobat .PDF format.
- The Data Acquisition and Processing Report in Adobe Acrobat .PDF format.
- The Horizontal and Vertical Control Report in Adobe Acrobat .PDF format.

## **S-57 Feature File**

The S-57 feature file shall be included on the submitted drive in a clearly labeled directory.

## **Supporting Data**

- Any associated text or image files to support S-57 feature file objects.
- Other interim data products that may help the Processing Branch verify the survey and understand the pipeline from acquisition to final product.