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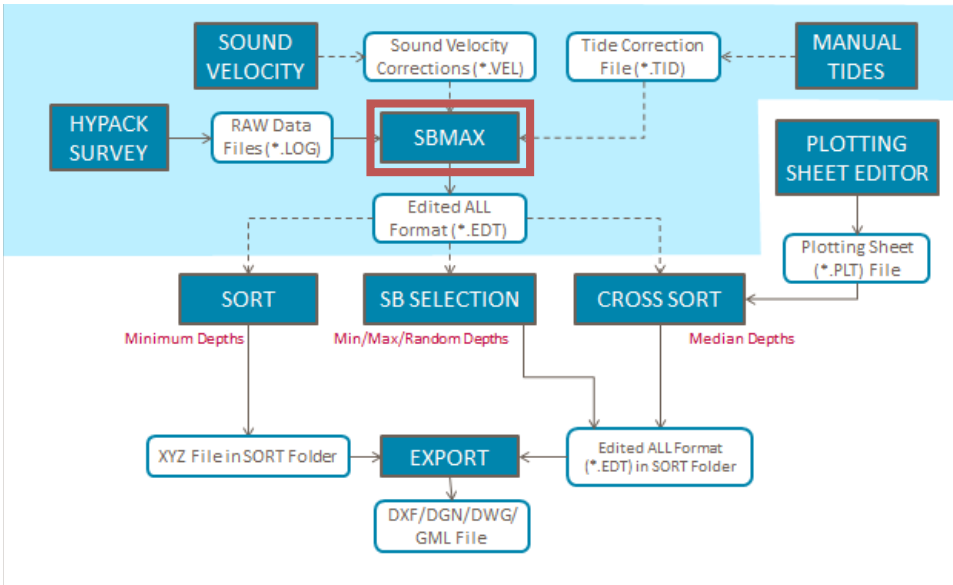
Sounding Better!

Flowcharts Hands On: SBMax64

by Judy Bragg

In November, we finished a series about processing single beam data from RAW survey data to CAD DXF format. When we covered the editing step, we used the 32-bit SINGLE BEAM EDITOR, but over the past two years, we've developed a new 64-bit SINGLE BEAM EDITOR that is quite different. Let's take a look at processing in the new editor.

FIGURE 1. *Sample Flowcharts*



The 64-bit SINGLE BEAM EDITOR reads RAW or edited single beam HS2X sounding files containing single beam, dual frequency or multiple transducer survey data. It applies corrections to the soundings to find corrected depth or elevation.

The 64-bit SINGLE BEAM EDITOR displays all measurements graphically and provides a number of editing methods. When editing is complete, the program saves the corrected and cleaned data for further work in the Sounding Selection and Final Product programs. The resulting output options include HS2X, XYZ, and All2 format files.

NOTE: To run the 64-bit modules, you must install HYPACK® on a computer with 64-bit capability.

32-BIT VS 64-BIT SINGLE BEAM EDITORS

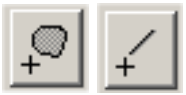
The 64-bit SBMax includes most of the features and functions of the 32-bit version. We kept features that worked well, made some improvements and added a new twist or two. There are some significant differences, even for a basic editing session:

PROCESSING DATA FROM MULTIPLE SURVEYS

You can edit data collected with different systems, at different times, or both in one editing session. You must take care to set the correct read parameters and corrections to each set, reviewing the parameters for each data set, one at a time, in the Corrections, Processing and Devices tabs. You must first select one or more files in the list, then set the correct options for the selected files.

EDITING TOOLS

Both editors include point and area editing tools, as well as search and filter options. In the 64-bit editor, we also see a **lasso** for freeform areas, and a **line select** tool for deleting all data above or below a line drawn across the display.



The **Fast Delete** mode data selected with the Lasso Select, Block Select or Line Select tools is automatically deleted according to your **Inside/Outside** and **Above/Below** selections. This option can speed things along when you are making multiple deletions using the same settings.

Draw Selected Files Only: Only the files selected in the file list appear in the Survey window and the Zoom Extents tool will include only those lines, not the full data set. The editing tools act on all data in the display so, by removing the unselected lines from the display, you protect them from inadvertent editing.

The **Tilt and Rotate tool** enables you to turn the data set forward and back, and left and right to view and edit it from whatever angle is most advantageous.

BINARY HS2X OUTPUT

The 64-bit SINGLE BEAM EDITOR can save to the XYZ and All2 formats also available in the 32-bit editor.

Additionally, and most importantly, the 64-bit editor saves to HS2X format, which saves the original data from all devices and all applied corrections.

IMPORTANT: *Always save the HS2X format.* It is the only format that retains all data enabling you to do further editing or corrections, *without re-editing your raw data*. In addition, you can save it again to your choice of other output formats.

Tip: When you save edited data to HS2X format, the file save options enable you to append a suffix to the file names. This enables you to save separate sets of edited files from the same set of raw data.

Each save operation can output all of your data or only the files selected in the Files list.

NOTE: The All2 format should be used for backward compatibility only.

SAMPLE EDITING SESSION

Hands On!

Download the Single Beam Processing project (http://bit.ly/2wl7X7C) and follow along. In this example, we'll load the raw data, apply a tide corrections file, clean the data and save the edited data to HS2X format files in the project \Edit folder.

You need to do the same preparation before you open the editor:

- **Set your geodetic parameters** in the GEODETIC PARAMETERS program. Typically they should match those of the survey.
- If you have not applied tide corrections during SURVEY, or want to apply new tide corrections, **create a Tide Corrections file** using the MANUAL TIDES or HARMONIC TIDES program. This project contains tide data imported from the NOAA website: NOAA Imp 070912_071212.TDX, which generates NOAA Imp 070912_071212.TID in the MANUAL TIDES program.
- **If necessary, create a Sound Velocity file** with your sound velocity cast data in the SOUND VELOCITY program. You can skip this step if you have set your echosounder to account for sound velocity before the survey. You can experiment with the SVProfile.VEL file included in the project folder.

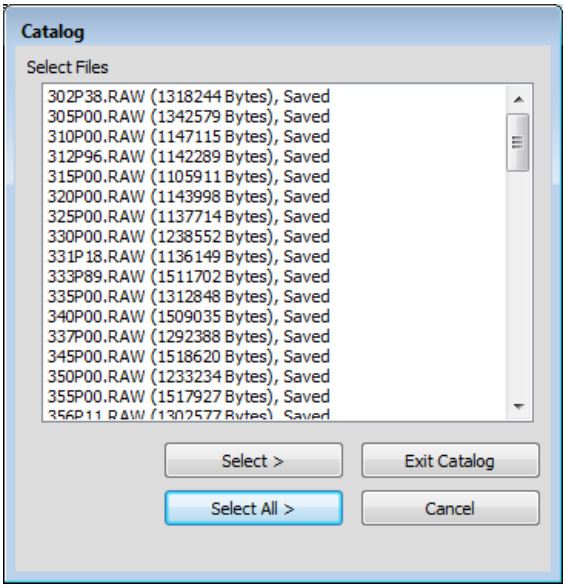
LOADING YOUR DATA

1. **Open the 64-bit SINGLE BEAM EDITOR.** Select PROCESSING-SINGLE BEAM EDITOR (64-bit) or click the icon.

2. **Select your Soundings data.** For our purposes in this article, load raw soundings. You can select a Catalog file (*.LOG), which is a list of several data files, or a single data file.

   If you select a LOG file, a Catalog dialog appears where you can select one or more files from the catalog.

FIGURE 2. Selecting Catalog Data



3. **Set your Read Parameters.** The Read Parameters dialog provides options for how the program reads, corrects and displays the data. If you want to apply tide or sound velocity corrections files, enter them in the Corrections tab. Each tab displays the current settings from the first selected file. If changes are required, a button is provided for each section to access an additional dialog for this purpose.

NOTE: This is where you can load **data from multiple surveys.** If the read parameters differ between files, review each data set, one at a time in the Corrections, Processing and Devices tabs. You must select one or more files in the list, then set the correct options for the selected files.

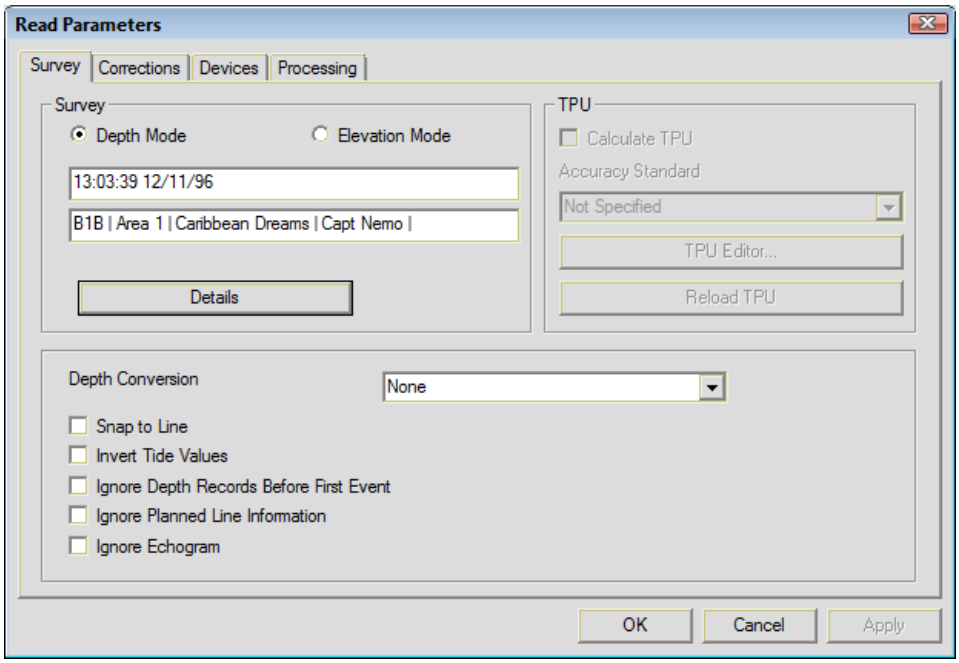
Hands On!

The Single Beam Processing project, you can experiment with this feature by applying different options to select files. To see that you follow the process correctly, you could apply a tide or draft correction to select files, then confirm the expected results in the Heave Tide Draft window.

The Read Parameters dialog is a 4-tabbed dialog:

- The **Survey tab** governs the data. You will review the vertical basis, Survey Information, and set depth conversion options. Click [Details] to access and modify the project information entered in HYPACK® SURVEY.

FIGURE 3. Survey Tab



- The **Corrections and Processing tabs** have to do with applying corrections to the raw data. Enter correction values or files and choose your options for processing RTK tide and MRU data.

  Click **[Default Values]** to set the options in this dialog that are usually safe in any situation.

FIGURE 4. Corrections Tab

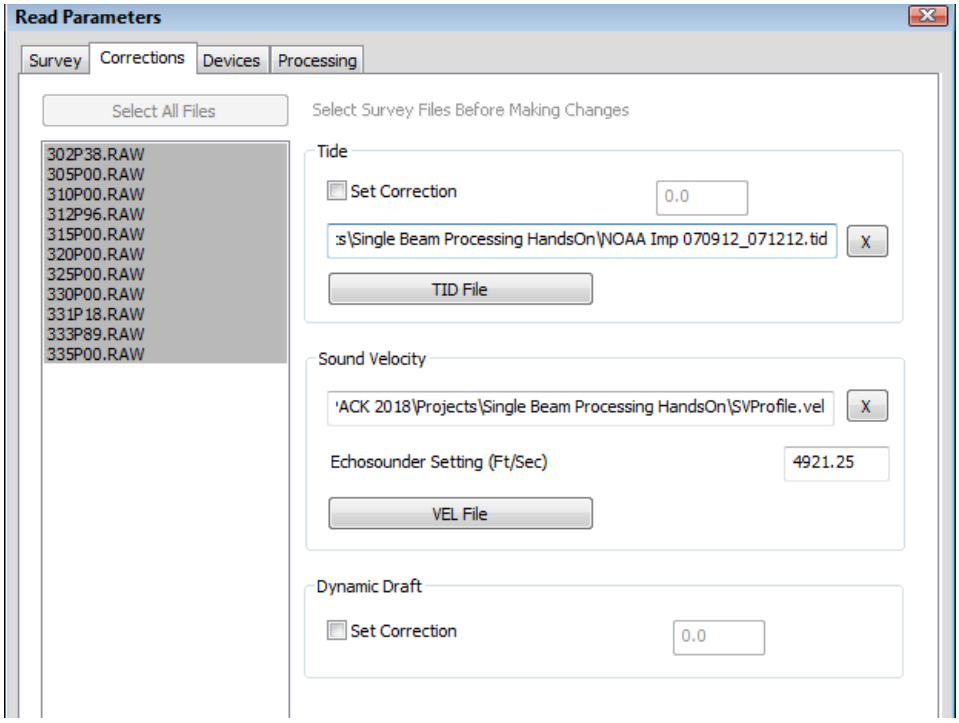
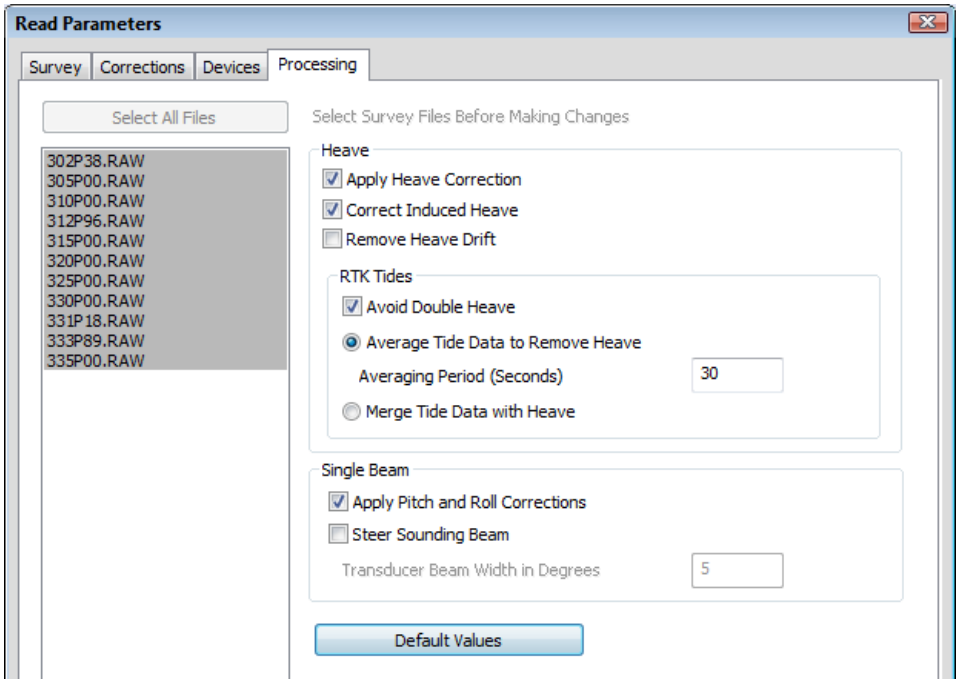


FIGURE 5. Processing Tab



- The **Devices tab** concerns your devices and their offsets during the survey. If you recorded the same type of data from multiple devices, you will choose the device from which you want to load data. You will then verify the correct offsets and make any corrections necessary.

FIGURE 6. Devices Tab

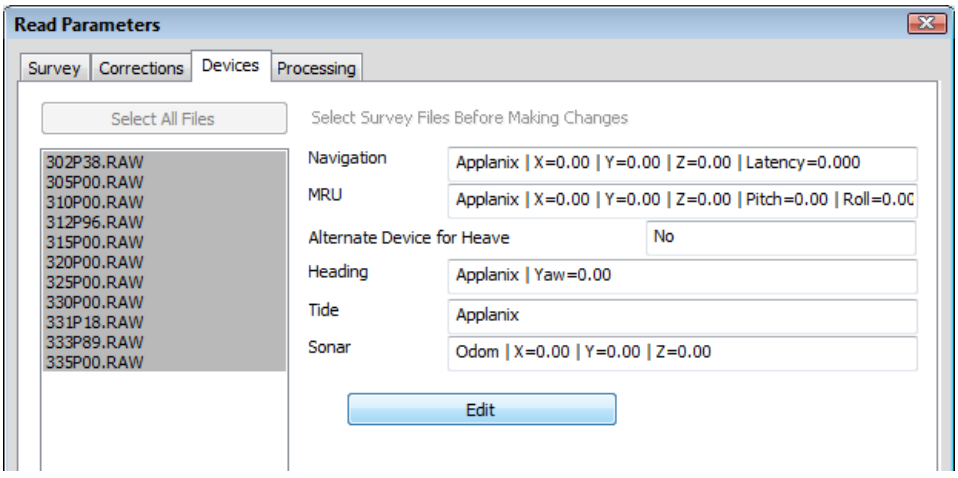
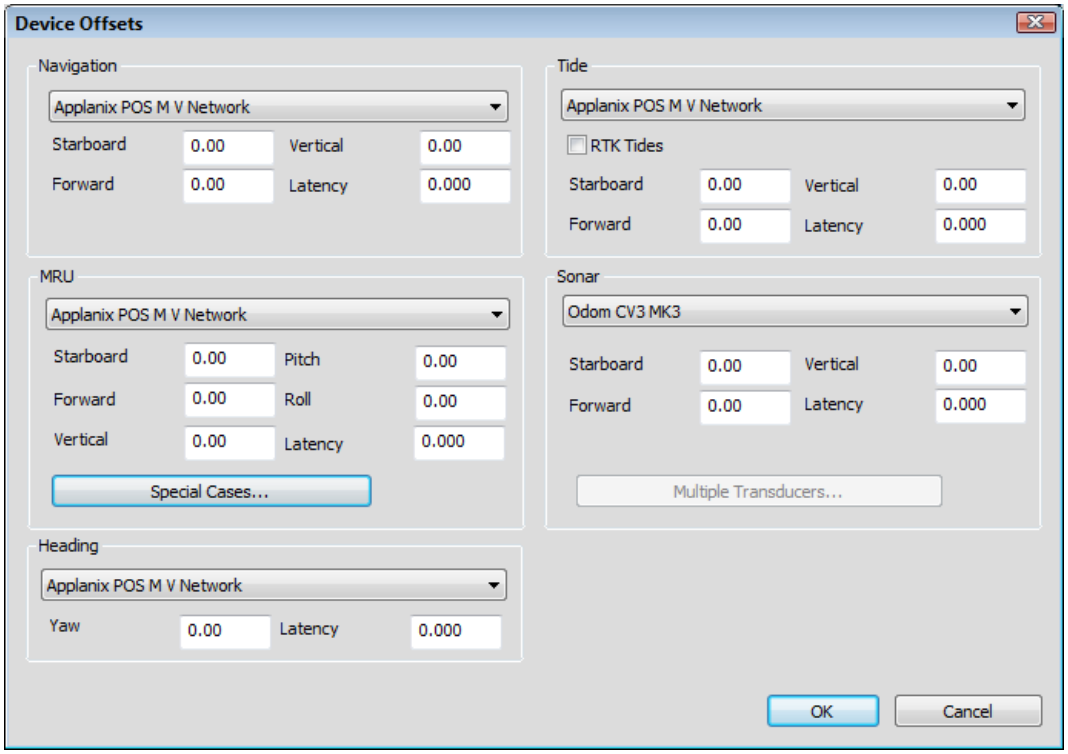


FIGURE 7. *Editing Offsets*



Separate options for Navigation and RTK Tides enable you to use separate systems for position and tide.

If it is an RTK survey, check the RTK Tides option in the Devices tab, and set the processing options in the Processing tab. The editor calculates vertical position—tide and heave together—using RTK GPS elevation; the program ignores heave data from the MRU.

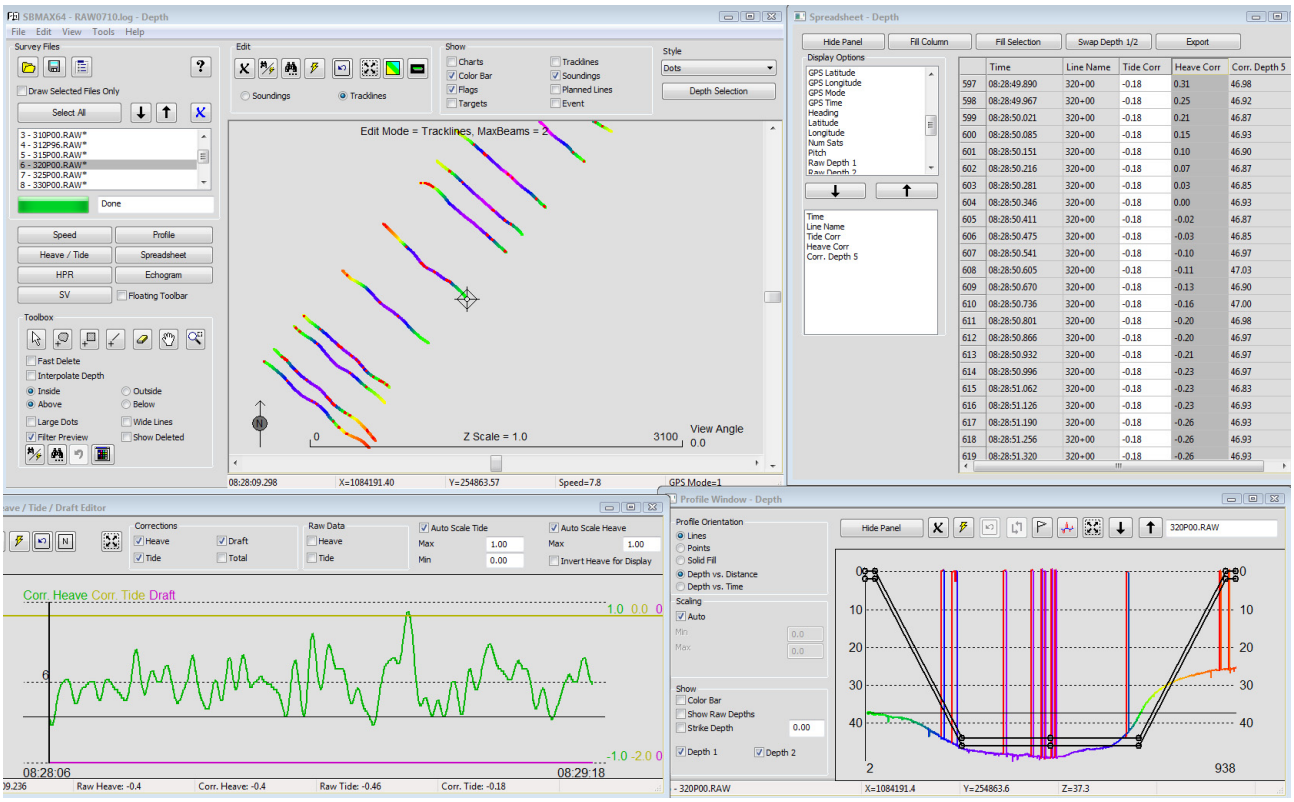
With today's technology, averaging tide data to remove heave is the preferred method to avoid double heave corrections.

NOTE: Offsets and corrections affect *only the edited data saved from this session*.

Set your options in each tab, then click [OK] to continue. The editor reads and displays the data in the Survey window according to your instructions. Access additional windows, as needed, using the buttons on the left.

Tip: Use options in the View menu to configure the windows displayed. VIEW-TILE WINDOWS relocates all open windows at the upper-left corner of your screen. You can always position and resize each window manually.

FIGURE 8. *Sample SBMAX64 Displays*



EDITING

IMPORTANT: *Editing affects all visible data*. Before you perform any edits, *select only the data you intend to edit for display* in the toolbar.

To edit select values where windows graph multiple values (e.g. the Heave/Tide, and Heave, Pitch and Roll windows), s*elect only the values you intend to edit for display* in the toolbar.

To block edit select lines in the map display, select only the lines you intend to edit, and select **Draw Selected Files Only** in the Survey Files area of the SBMax64 shell.

In an effort to focus on the processes, detailed descriptions of the tools may be found in the Reference Information section at the end of this article if you need them.

POSITIONING AND CORRECTIONS

You can perform any of the editing processes at any time; however, it makes the most sense to do all processes involving positioning and corrections to make your soundings as accurate as possible, *before* you begin evaluating and cleaning sounding data.

The Survey window displays your track lines where you can remove bad positioning.

Additional windows graph your correction values, one or more lines at a time, according to what is selected in the file list and in the window toolbar. This enables you to view the selected corrections one line at a time or compare multiple lines.

If, at any time, you delete position, heave, tide or draft data, the program interpolates the data.

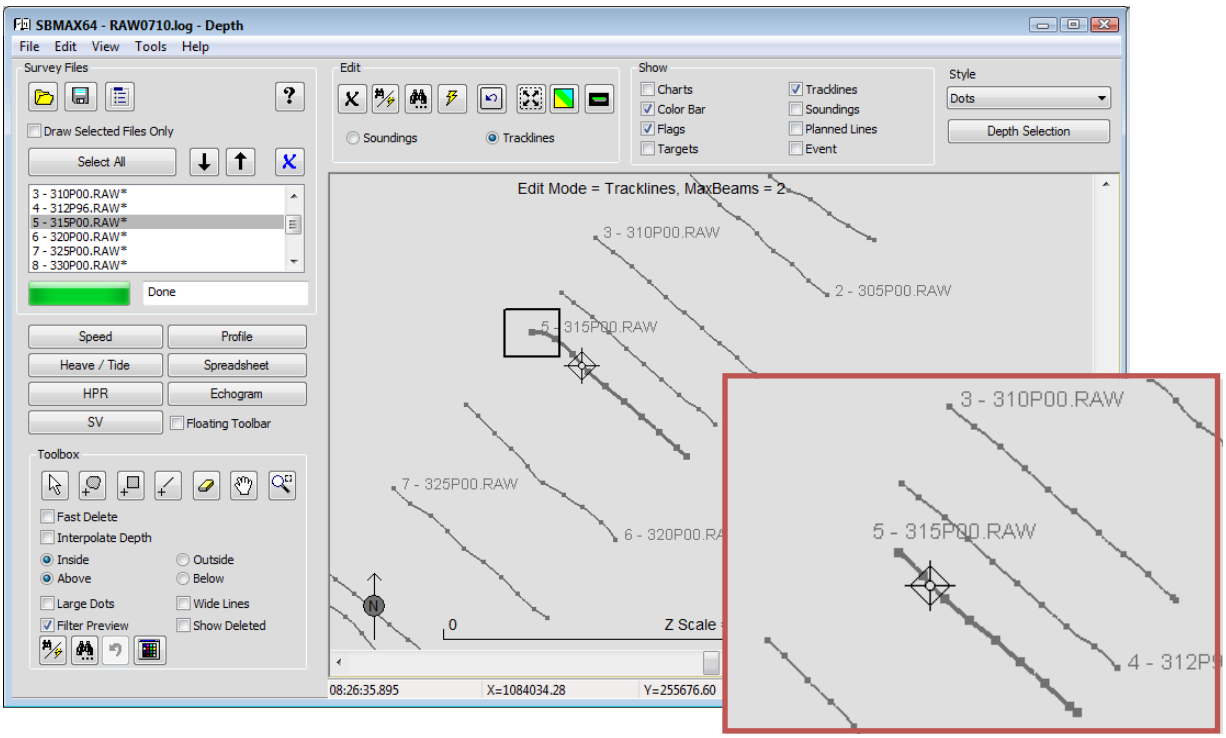
TRACK LINES

Examine and edit track lines. In the Survey window, use the editing tools to remove bad positioning.

In this example, the track lines generally look good. Line 315P00.RAW has a prominent curve on the end that may indicate a bad start to the survey line, which you may choose to remove. You can also remove position spikes that indicate a bad GPS reading.

- **When positions are deleted from interior of line**, new positions are interpolated and depths are not lost.
- **When positions are deleted from the ends of a line**, depth data is lost.

FIGURE 9. *Clipping a Track Line—Before (left) and After (right)*

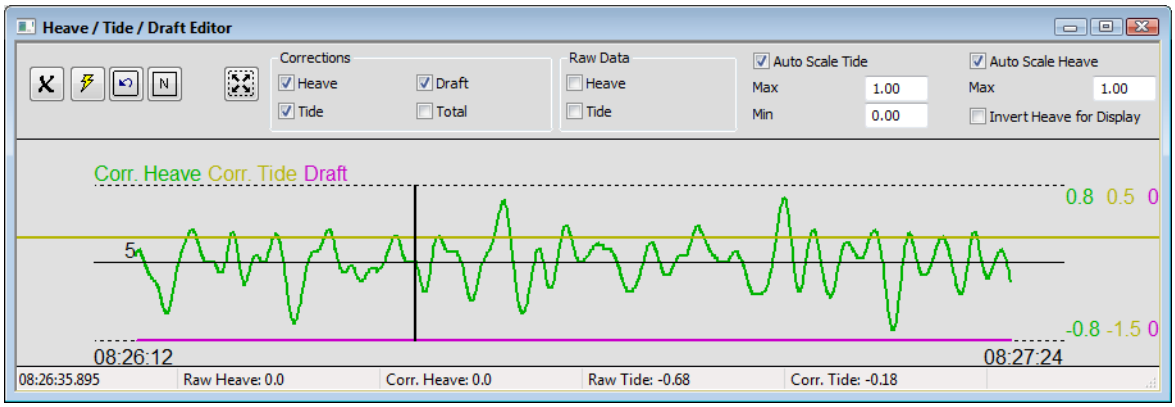


CORRECTIONS

Check your corrections. You can return to the Read Parameters dialog and load different corrections files, if necessary. You can also edit heave, tide and draft in the Heave/Tide window. (You can make these changes at any time, but *ideally* you want the most accurate sounding positioning before you edit your soundings.)

IMPORTANT: Where most windows graph multiple values, *editing affects all visible graphs*. Before you perform any edits, select only the values you intend to edit for display in the toolbar.

FIGURE 10. *Heave (green), Tide (gold) and Draft (pink) Corrections*



In the Heave/Tide window, instead of deleting erroneous data, you can replace it with user-defined values using the fill button. The fill value replaces the data that may have been recorded during data collection *in the edited data only*. If you have entered tide corrections in the Read Parameters, or if the value is not displayed in the graph, the fill values are disabled.

Hands On!

If you have corrections that differ between files, review each data set one at a time by selecting the files in the file list before making modifications. Remember, to avoid changing values other than Draft, clear the other values from the display. When you click the icon, the Fill Options dialog appears where you set new values for each of the values *currently displayed in the window.*

Experiment with changing the draft or tide corrections for all files versus for select files, and modifying or deleting ranges of corrections or soundings.

Tip: If you use a Fill Options dialog to edit tide or heave corrections, and the results are not what you intended, you can restore all of the filled corrections in the currently loaded data set to their original values through the Undelete and Reset dialog (EDIT-UNDELETE AND RESET).

SHIFTING DRAFT

The following shows one example: shifting the Draft from 0 to 1.

FIGURE 11. Draft = 0

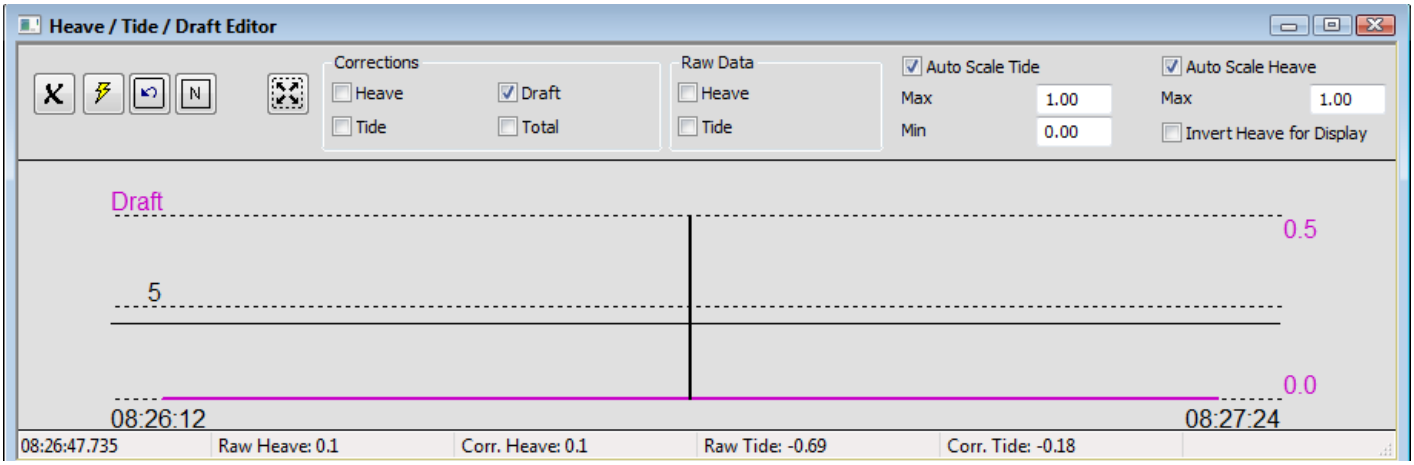
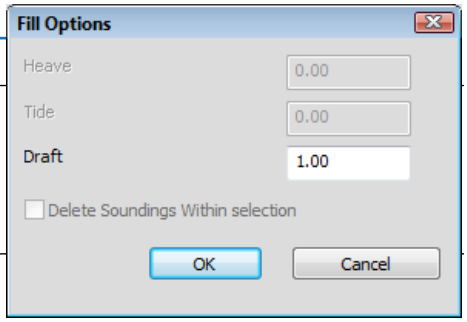
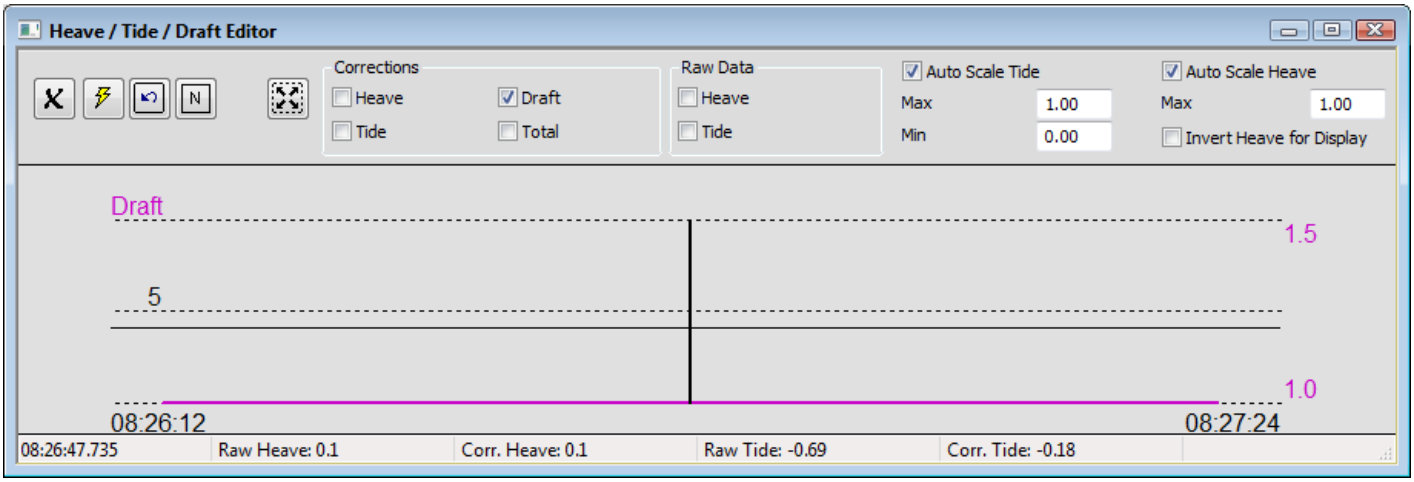


FIGURE 12. Fill Options Window—Changing Draft to 1.0



NOTE: The Heave and Tide are disabled because they are not displayed in the graph. Tide would also be disabled if you applied a Tide Corrections file in the Read Parameters (Figure 4 on page 5).

FIGURE 13. The Results—Draft = 1

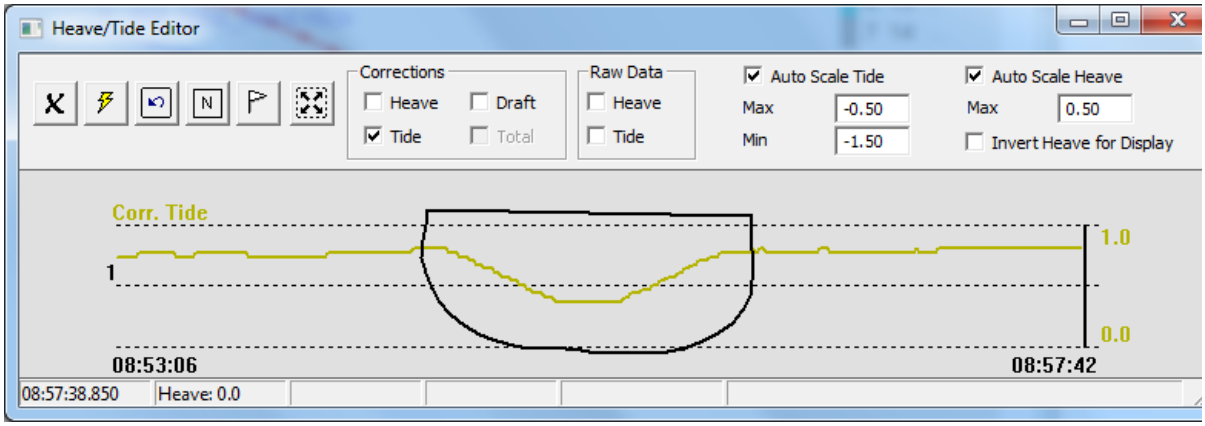


CORRECTING A RANGE

If you lose your RTK positioning for a short time, you may have a span of tide data that is too far out of range. You can use the Fill dialog to replace that section of tide data with a value that is closer to the truth. The same process could be used in this window to remove Heave Drift from the Heave display.

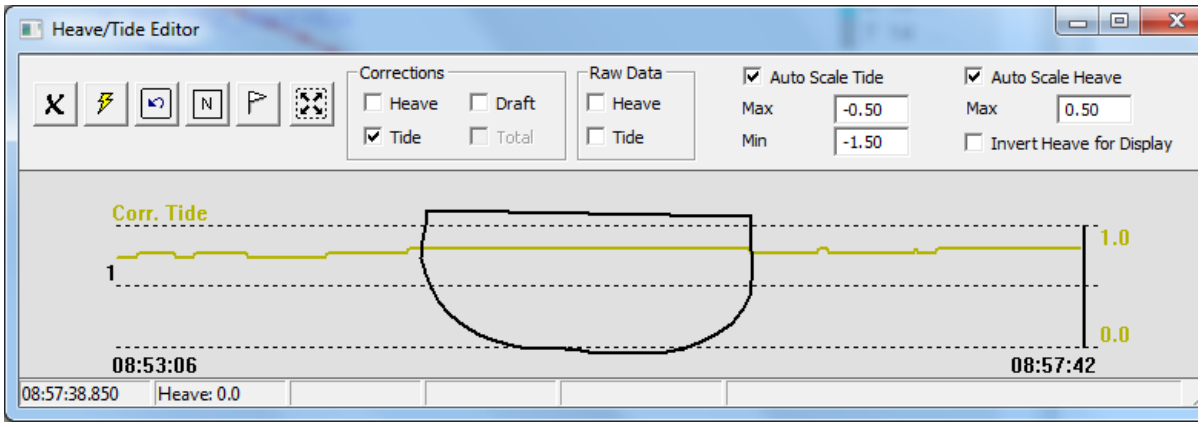
1. **In the Heave/Tide Window, check tide correction for the display**.
2. **Use the lasso or block edit tool to define the section of bad data**.

FIGURE 14. Replacing Bad RTK Tides—Before



3. **Click the Fill icon**.
4. **Enter the replacement tide correction (in this example 0.8) and click [OK]**.

FIGURE 15. Replacing Bad RTK Tides—After



SOUNDINGS

The 64-bit SINGLE BEAM EDITOR provides a selection of tools with which you will manually delete and correct your soundings. You can also choose from a wide selection of filters (eg. depth range; cross track, spike and pitch/roll limits; GPS quality and more) that can identify and, if desired, automatically remove data falling outside of your chosen specifications.

Tip: Consider setting filters to automatically delete points that are *clearly* bogus, then take more care. You could quickly scan each line, manually removing the more obvious outliers, then set tighter filters and step through the remaining points that the filters find.

Delete vs Interpolate:

If sounding data is deleted, the data will be interpolated or removed according to the status of the selection in the Settings dialog (EDIT-SETTINGS) which toggles between the two

choices. If you have elected to interpolate, soundings will only be removed if data is removed at either end of the survey line, rendering interpolation impossible.

Show Deleted: Each deleted sounding is marked with a red 'X'. When you restore a sounding, its red 'X' disappears.

Tip: If editing operations have produced unsatisfactory results, you can reverse them, in the reverse order in which they were performed, using the Undo icon on the toolbar.

MANUAL METHODS

Point and Area-based editing of soundings is primarily done in the Profile window while you scroll using the arrow keys. The data in the Survey window may also be edited in this manner.

Point Editing:

Each editing stage offers point editing where you delete one point at a time.

1. **Select the point with the cursor**.
2. **Click the Delete Point or Selection icon** (or the Delete key).

The eraser tool removes a small number of points at a time:

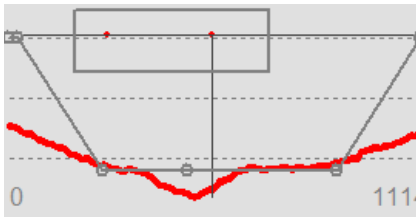
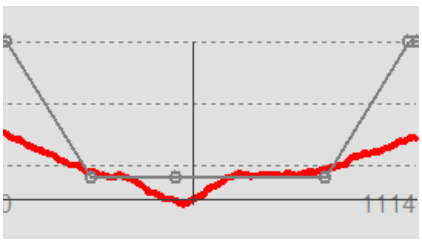
1. **Select the eraser tool in the toolbox**. The cursor changes to a small square.
2. **Position the square cursor over one or more points and click**.

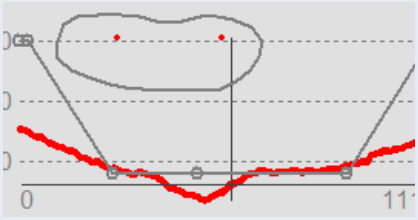
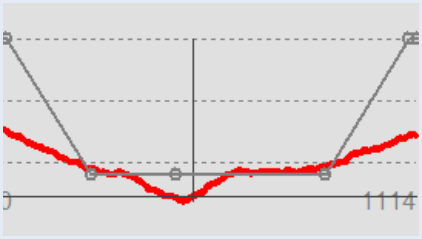
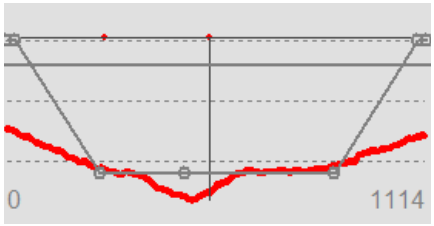
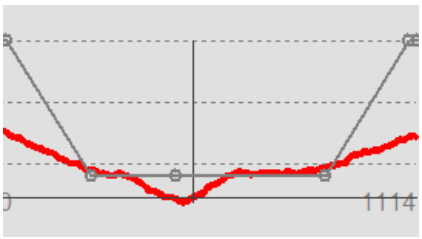
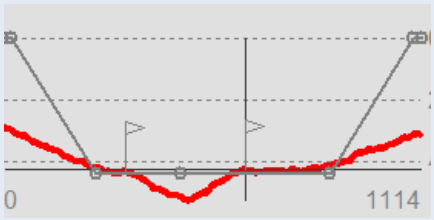
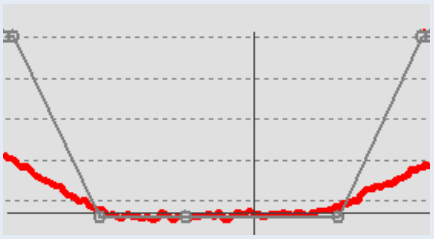
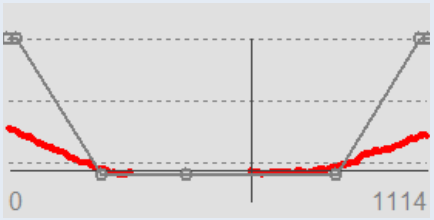
Area-Based Editing:

Area-based Editing enables you delete all points inside or outside an area defined by the Block Select or Lasso Select tool, or all points above or below a line drawn by the Line Select tool.

In the following table, the Block Select, Lasso and Line tools were used to remove a few stray soundings near the waterline, all with the same results. The example with the flags more clearly shows the effect of the Interpolate Depth option.

TABLE 1. *Area Deletion Examples*

Deletion Tool	Before	After
Block Select (Inside Option)		

Deletion Tool	Before	After
Lasso Select (Inside Option)		
Line Select (Above Option)		
Flag Select Flags mark start and end of range: Set cursor at start location and click the flag icon. Repeat for end of range, then click Delete.		*Interpolated Depths (top) and Removed Depths (bottom)*  

FILTERS

In the Search and Filters dialog, use the filter settings to mark soundings for your evaluation during editing. *Filtering does not replace careful, intelligent human evaluation of your data.* You can use automatic filtering to remove soundings that are clearly bogus or to get a quick estimate of your survey area; however, *for more accurate results* you must look more closely at the filtered soundings in the context of the surrounding data and remove only what is clearly erroneous.

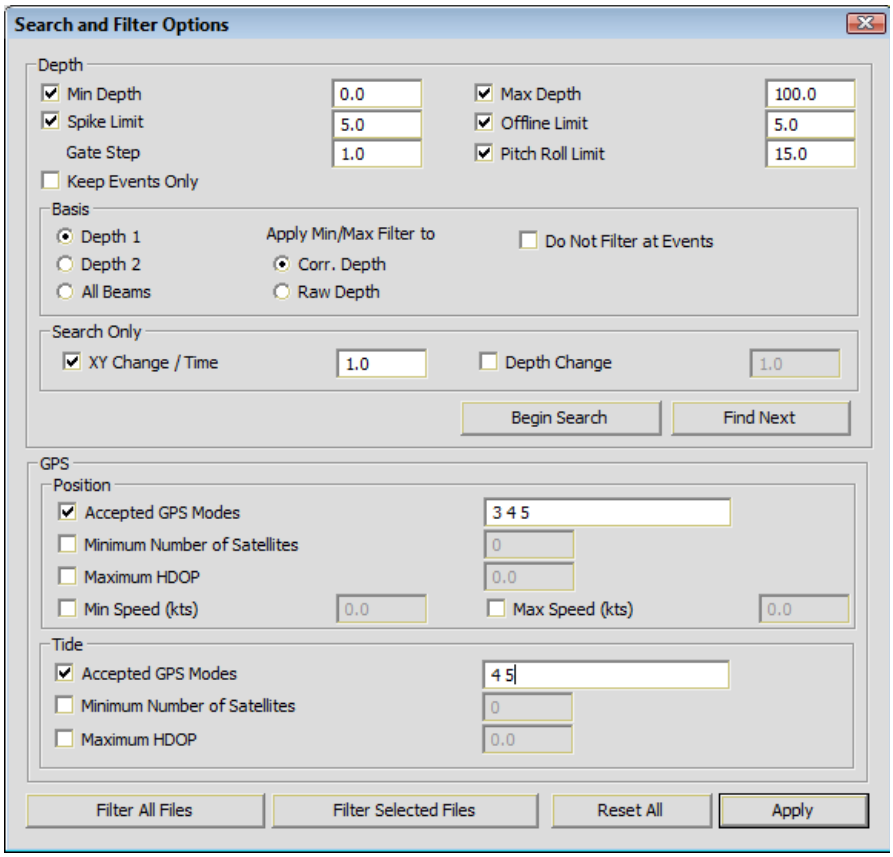
Hands On!

Experiment with different filters. Check the **Filter Preview** option to a yellow 'X' on each sounding that falls outside the filter parameters, then change your filter settings and see how the display changes. You can save a dataset for each set of filters, appending a different tag for each in the Save Options, then compare the results in the final product modules.

Search and Filter Options

To open the Search and Filter Options dialog, select EDIT-SEARCH AND FILTER OPTIONS (Ctrl+F) or with the Search and Filter icon in the toolbox.

FIGURE 16. *Search and Filter Options*

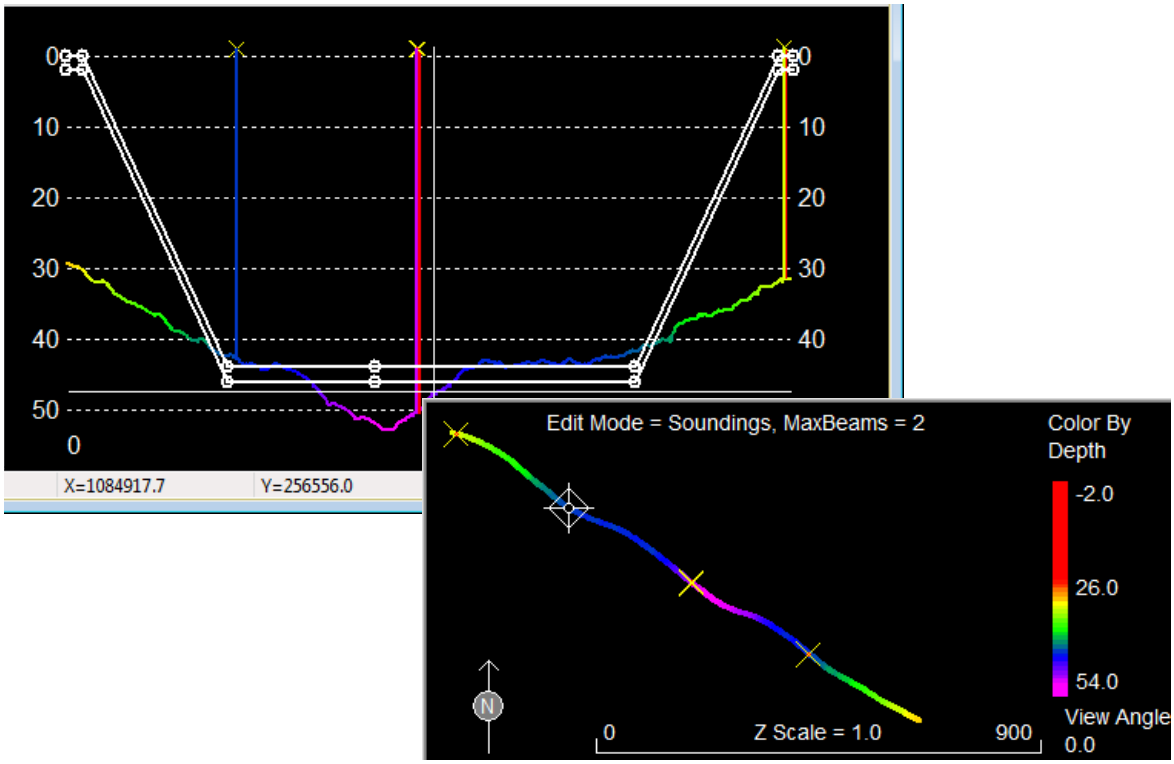


Most options are intuitive. Detailed descriptions have been placed in the reference Information section at the end of this article.

When the **Filter Preview** option is selected in the Toolbox, the soundings that fall outside of the current filters are marked with a yellow ‘X’ in the Profile window before you run the filter.

To preview the same soundings in the Survey window, check the Sounding option in the Show area of the toolbar.

FIGURE 17. Show Filter—Profile (top) and Map View (bottom)



To see where points are deleted, check Show Deleted in the toolbox.

PIC OF DELETED

AUTOMATIC FILTERING

There are several ways to apply filters to your data. Regardless of which method you choose, you always begin the same way:

1. **Load your full data set to the editor.**
2. **Set filter criteria in the Search and Filters dialog.**
3. **Apply the filters.** The following table describes how to apply your filters according to your goals.

BEWARE! With the click of a button, automatic filtering marks soundings that fall outside of your filter parameters for deletion. These methods are purely statistical based on your filter settings. Once you click button to filter the data, *you have no further control in the filtering*.

TABLE 2. Filter Applications

Apply Filters to...	Process
All loaded data	Click [Filter All Files].
All Soundings on Select Lines	A. **In the file list, select the lines you want to edit.** Hold the Ctrl key and select the lines either in the file list or in the Survey window display. (Verify the selections in the file list and Survey window are synchronized.) B. **Click [Filter Selected Files]**.
Applying Filters to Soundings on the Current Line	**In the Profile window, select the line you want to filter and click the Filter icon**. 
Deleting All Filtered Data in a Select Area	In the Heave/Tide and Speed windows: A. **Use one of the area-based editing tools to define the area**. B. **Click the Filter Window or Selection icon in the same window.** 

NOTE: If you're not happy with the deletion results, reverse the operation with the Undo icon in the tool box. 

4. **Save your data**.

Manual Processing With Filters

Manual processing gives you full control in cleaning your data. You can examine data marked for filtering and use the editing tools to manipulate, view and intelligently clean your data.

To search for filtered soundings:

1. **Load your full data set to the editor.**
2. **Open the Search and Filters dialog and set your filters.**
3. **Set your cursor at the beginning of your data set**. (Click [Begin Search].) This is optional but, if you want to check all of your data methodically, it's best start at the beginning.
4. **Click [Find Next] or the Find Next icon (F3).** Since the window displays are synchronized, you can view the same point in all windows to make your editing decision. 
5. **Use the editing tools to remove bad data**. The displays automatically update to remain synchronized.
6. **Repeat steps 4 and 5 until you reach the end of your data**.
7. **Save your data**.

Tip: It's a good idea to save your data periodically through the editing process to preserve your work.

SAVING YOUR EDITED DATA

FILE-SAVE SURVEY displays the File Save dialog where you can choose the file format for the saved data and, in some cases, some additional save options.

The edited HSX2 and All2 format data is saved, by default, to the project Edit folder, and the XYZ output files are saved to the project Sort folder; however, you can set an alternate location.

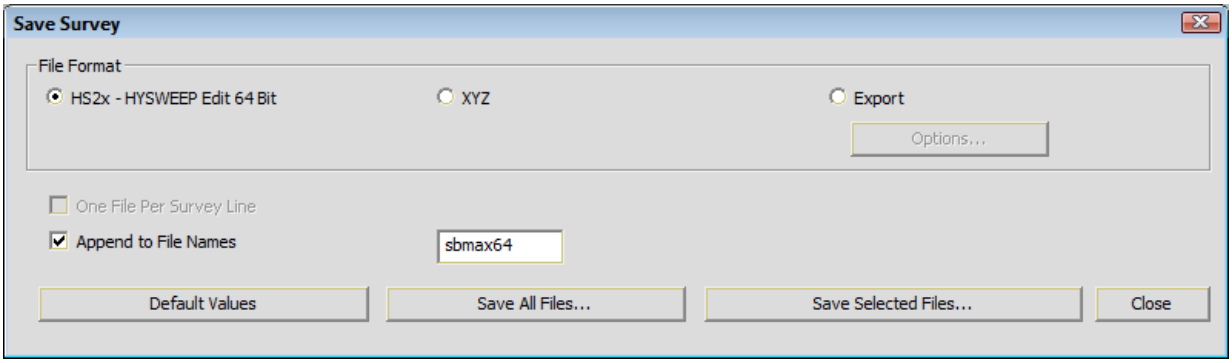
After each save operation, the editor returns to the File Save dialog in case you want to perform additional saves using different options.

When you are finished, click [Close] to return to the editor interface.

IMPORTANT: It can not be said too many times—*Always save to HS2X format* to preserve your editing and correction information. Output to the other formats if you need them for something, but always keep the HS2X.

Tip: When you save edited data to HS2X format, the file save options enable you to append a suffix to the file names. This enables you to save separate sets of edited files from the same set of raw data.

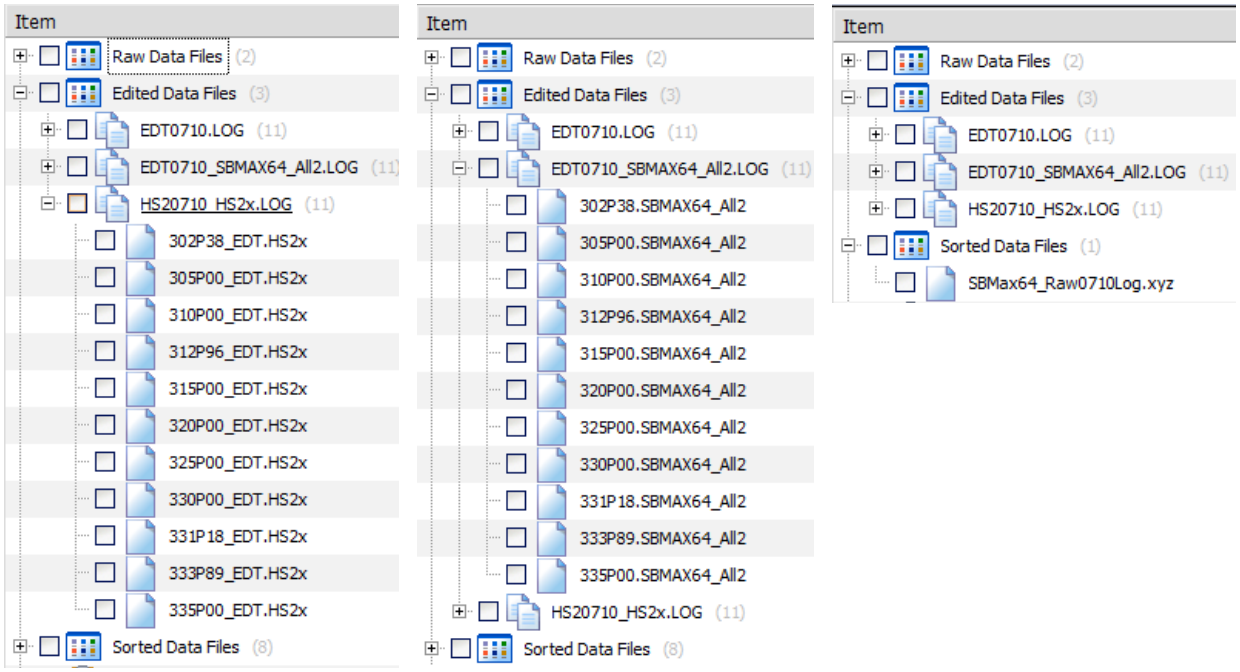
FIGURE 18. *Save Dialog*



Experiment with different outputs. In this project, I have saved three times:

- **HSX2:** The HS2X lines are filed together in the HS20710_HS2x.LOG.
- **XYZ**: You can save all lines to one XYZ file with a user-defined name, or save each line to a separate XYZ file, each named with the raw root file name.
- **All2**: Use the default EDT extension or define another extension, which is used as the file extension and is appended to the root of the catalog file name.

FIGURE 19. Saved Output Files



REFERENCE INFORMATION

EDITING TOOLS

The Toolbox

Toolbox The toolbox in the main interface provides the tools for editing your data *in any window*. It also provides quick access to a few of the view options most commonly turned on and off during the editing process.

Tip: Check the **Floating Toolbar** option to display a Toolbox window that will always be visible on top of your other windows.

TABLE 3. The Toolbox Tools

Tool	Function
	**Measure Tool:** Click and drag this tool between two points in any window display and the status bar displays measurements relevant to the window and the position, distance and direction of your measurement.
	**Lasso Select:** Defines a free-form area for use with delete and filter operations. Select the Inside or Outside option and click and drag the tool to draw a free-form area in your data display. When you release the mouse button, the program closes the area.

Tool	Function
	**Block Select:** Defines a rectangular area for use with delete and filter operations. Select the Inside or Outside option and drag from one corner to the diagonally opposite corner.
	**Line Select:** Defines a straight line across your data for use with delete and filter operations. Select the Above or Below option then drag a line between the good and bad data.
	**Flag Select:** In the Profile window, place flags at each end of a range between which you want to remove all soundings.
	**Eraser Tool:** Deletes small, square areas of data at a time. The cursor changes to a small square. Any soundings visible in the square when you click are deleted.
	**Tilt and Rotate:** This tool enables you to see the data in each window from any angle. It works in the Survey display only. • **To begin data rotation** in the opposite direction of your cursor, click and drag in the data display. • **To stop data rotation**, release the mouse button.
	**Zoom Window:** Select this option and drag a rectangle in the window to define the extent of your desired view. The program will redraw the screen to display the defined area optimally.
	**Arrow Buttons:** Scroll through the survey lines making any necessary corrections for each profile.
Mouse Wheel	**Zoom** display in and out.
Right Mouse	**To pan your display**, press and hold the right mouse button over the graphical display, drag the display in the window and release the button.
	Launches the Color Settings dialog.
Search and Filter Icons: Minimal tools required to manually clean your data based on your search and filter options. 	
	The **Undo** icon reverses editing operations in the reverse order in which they were performed.

Window-Specific Tools

Each window has a toolbar whose tools affect *only the contents of that window*. Some of these are common to all windows.

TABLE 4. Window-specific Tools

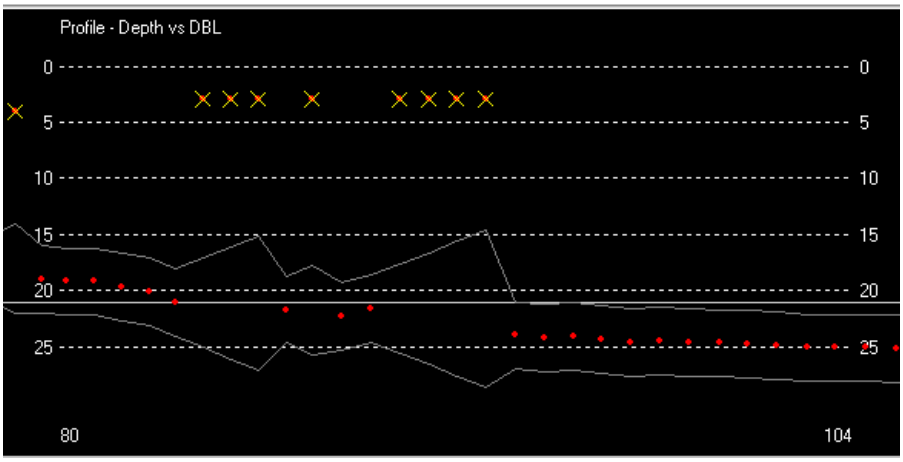
Tool	Function
	**Delete Point or Selection**
	**Filter Window or Selection**
	**Undelete Selection**
	**Zoom Extents:** Draws the screen at a zoom scale that displays all enabled data.
	Golden Sounding (Profile window only)
	**Fill Value (Heave/Tide/Draft window only)**: Replaces erroneous data with user-defined values *in the edited data only*.

NOTE: *The Undelete Selection icon in each window is very different from the Undo icon in the tool box.* The **Undelete Selection** icon reinstates all data within a user-defined area. The **Undo** icon reverses editing operations in the reverse order in which they were performed.

FILTER SETTINGS

- **Minimum Corrected Depth** and **Maximum Corrected Depth** reject any depths which are outside user-specified Minimum and Maximum Allowable Depths
- **Off-line Limit** rejects any points that are more than a specified distance away from the planned survey line.
- **Spike Limit** defines a gate above and below an accepted depth. If the depth is outside the gate, it is rejected and the gate is expanded by adding the Gate Step to the Spike Limit. When a depth is accepted, the gate collapses to that depth level plus and minus the Spike Limit.
  In the following figure, the Spike Limit is 3 and the Gate Step is 1. Each time a sounding is more than 3 units deeper or shoaler than the previous one, it is filtered out (yellow 'X') and the spike limit increases to 4. The process is repeated with the next sounding and wider spike limit until we get a sounding that falls within the spike limit. In this segment, several in a row all fell within the 6 unit range. The next three soundings were filtered because they were outside of the (expanding) spike limit. The next sounding fell within the limits so the gate again narrowed to 3 units either side of that depth and the procedure continued on to the next point.

FIGURE 20. Spike Limits and Gate Steps in the Profile Window of the SINGLE BEAM EDITOR



- **Roll, Pitch Limit** removes soundings where pitch or roll are greater than a user-specified number of degrees.
- **Keep Events Only** removes all soundings except those that occur on the event.
- **Search Basis** determines what data is included in the search and filter operations.
  - Search based on Depth 1, Depth 2 or both.
  - Apply the filters for Minimum Depth and Maximum Depth based on the corrected or raw depth value.
  - Elect to filter all of the data or only points that are not event marks. Some users wish to read the event marks to maintain the integrity of the track line. If a point with an event mark is removed, the event mark will be moved to the next point when you plot track lines.

Search Only Options:

- **XY Change/Time** and **Depth Change** are used with the Search feature to seek bad data points based on the predicted position for the Position (XY) and Depth. If the actual value is too far from the predicted value, it is assumed the data point is bad and the cursor is moved directly to that point. You must decide what, if anything, to do about it.

GPS filter options omit position and RTK tide data based on user-defined GPS quality criteria.

- **Accepted GPS Modes**: List GPS modes for which you want to read data. If the GPS mode does not match any of the specified values, the POS or TID record will be omitted from being read into the editor. Values may be separated by commas or spaces.
- **Minimum Number of Satellites**: If the number of satellites recorded in the quality information is less than the user-specified number, the POS or TID record will be filtered.
- **Maximum HDOP**: If the HDOP recorded in the quality information is more than the user-specified number, the POS or TID record will be filtered.
- **Minimum** and **Maximum Speed (speed over ground in Kts)**: If the speed calculated ((pos2-pos1)/time) is outside the user-specified speed range, the POS record will be filtered.