

# Single beam in Hypack



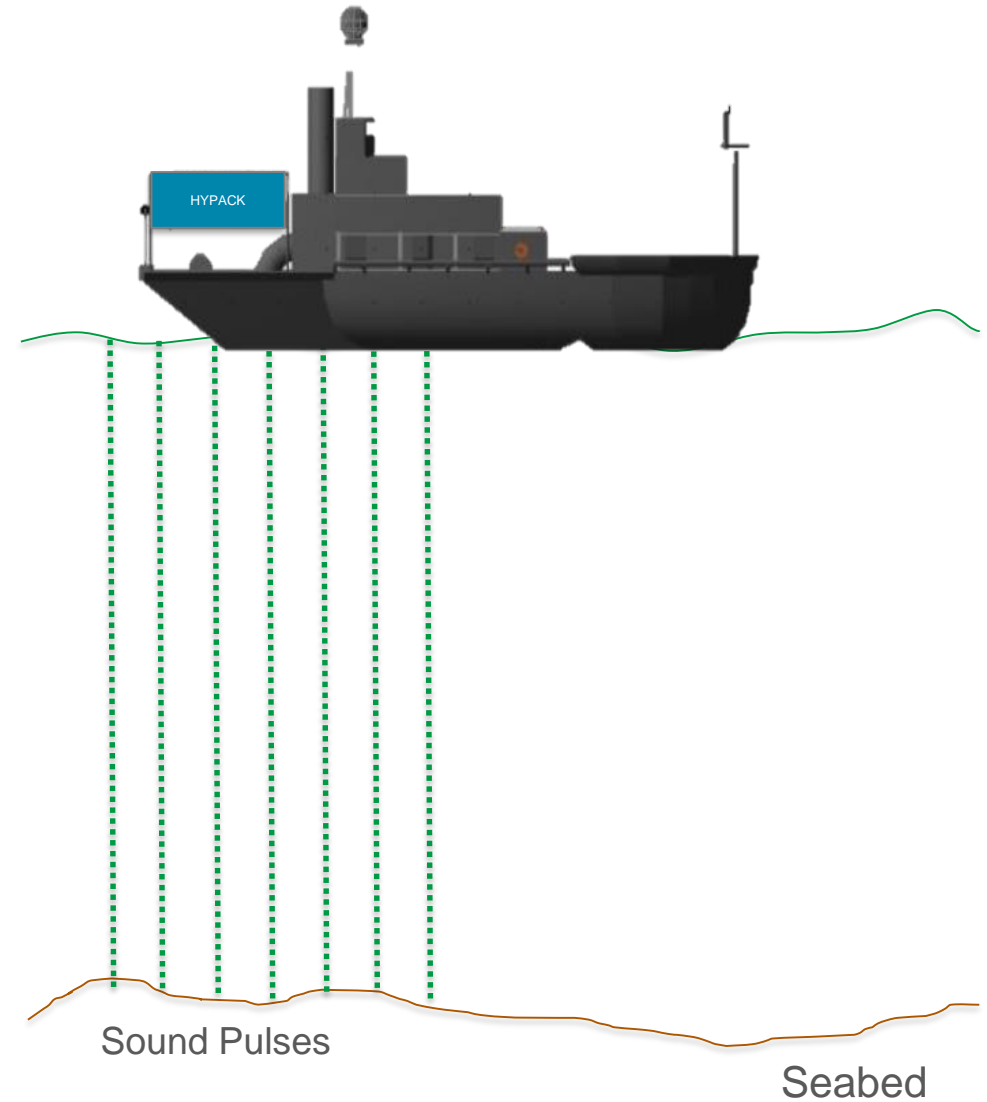
# Single Beam Echo Sounder

Measure travel time from the sonar to the reflected Seabed.

The SBES can only take one measurement at a time, hence the Single Beam.

The system typically “pings” several times per second.

Speed of Sound \* Time = Distance



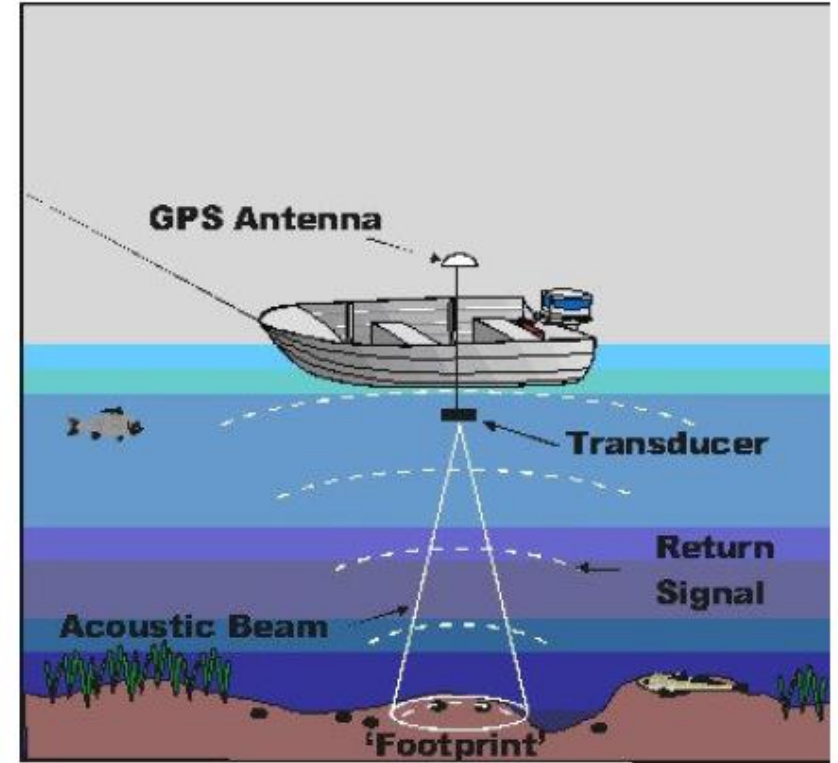
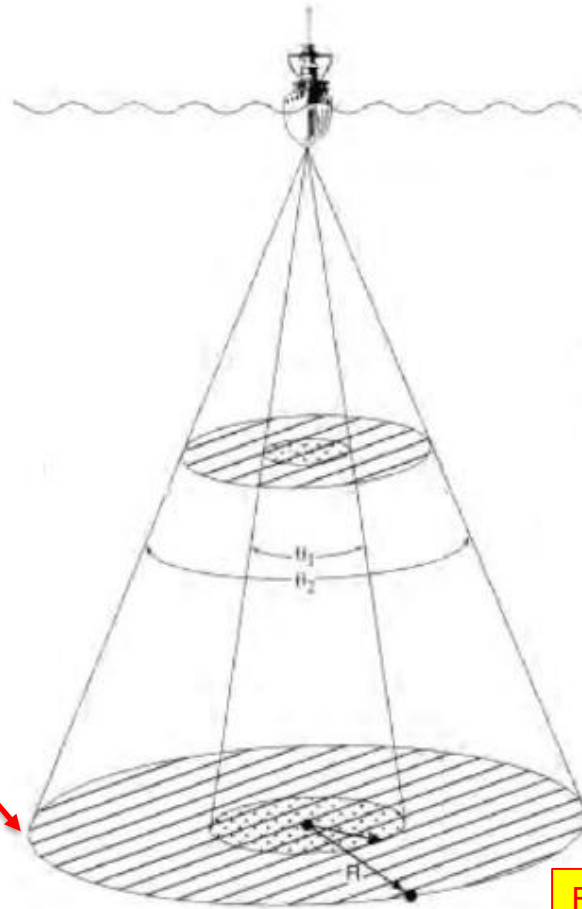
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# SBES – Beam Characteristics

As beam width increases the footprint on the seabed increases as well.  
The sounding is the strongest return within that area

	20'	40'
3 degree	1.0	2.1
5 degree	1.7	3.5
8 degree	2.8	5.6
45 degree	14.1	28.3

Footprint Radius



Fish Finders use a wide angle to “see” any fish nearby.

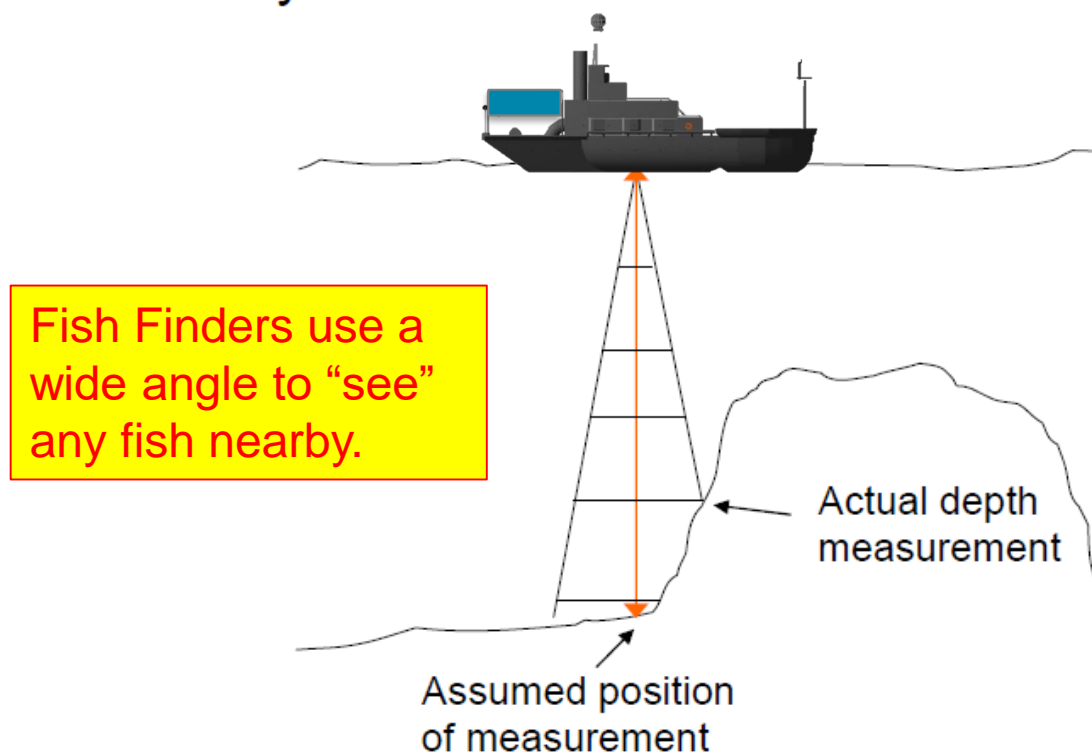


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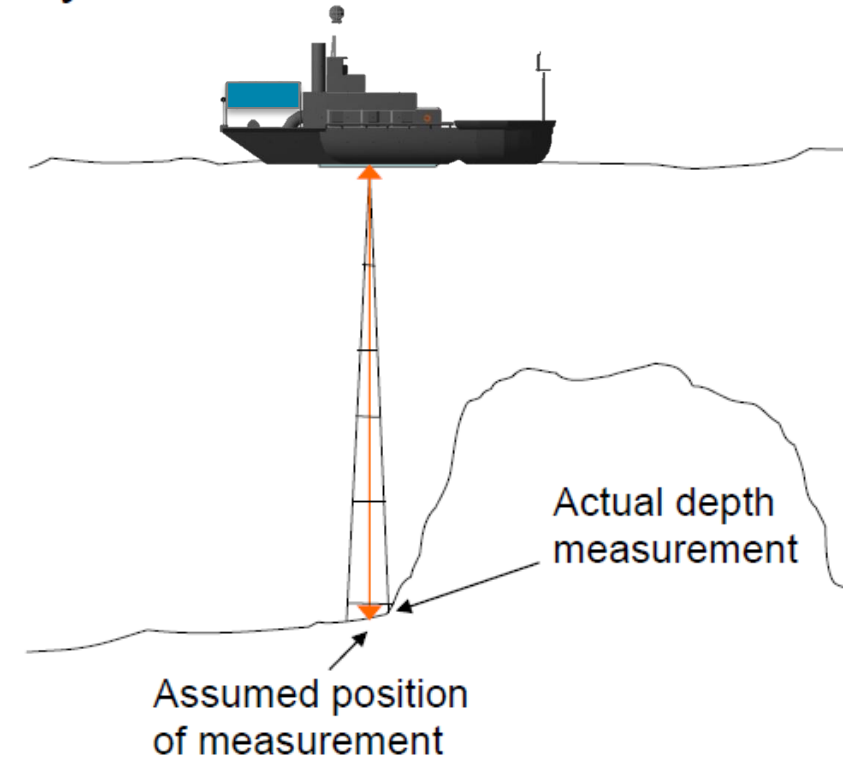
# SBES – Beam Characteristics

The width of the beam in a SBES can severely affect the accuracy of a reported sounding.

## Wide beam system



## Narrow beam system



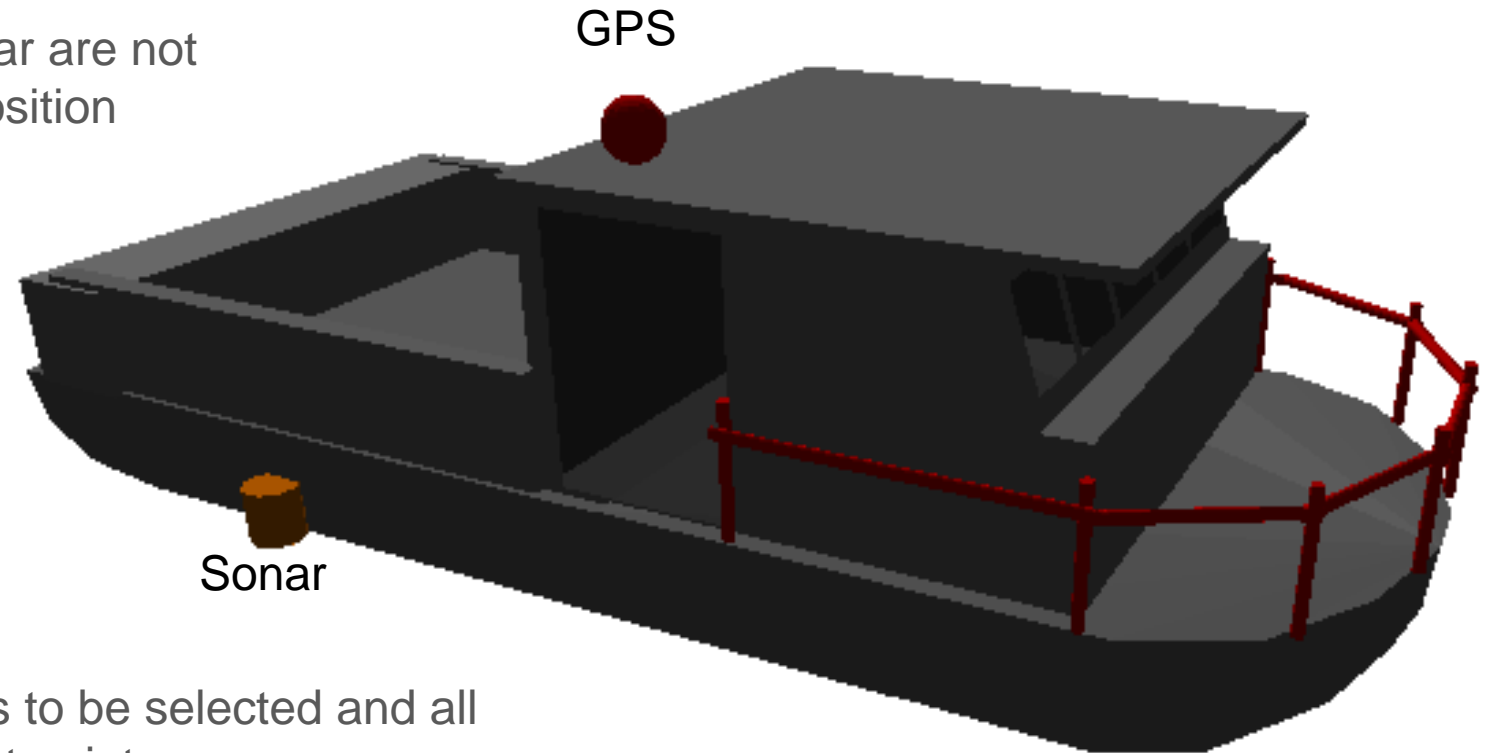
# HYPACK HARDWARE



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# Physical Offsets

Frequently the GPS and the Sonar are not located at the same horizontal position

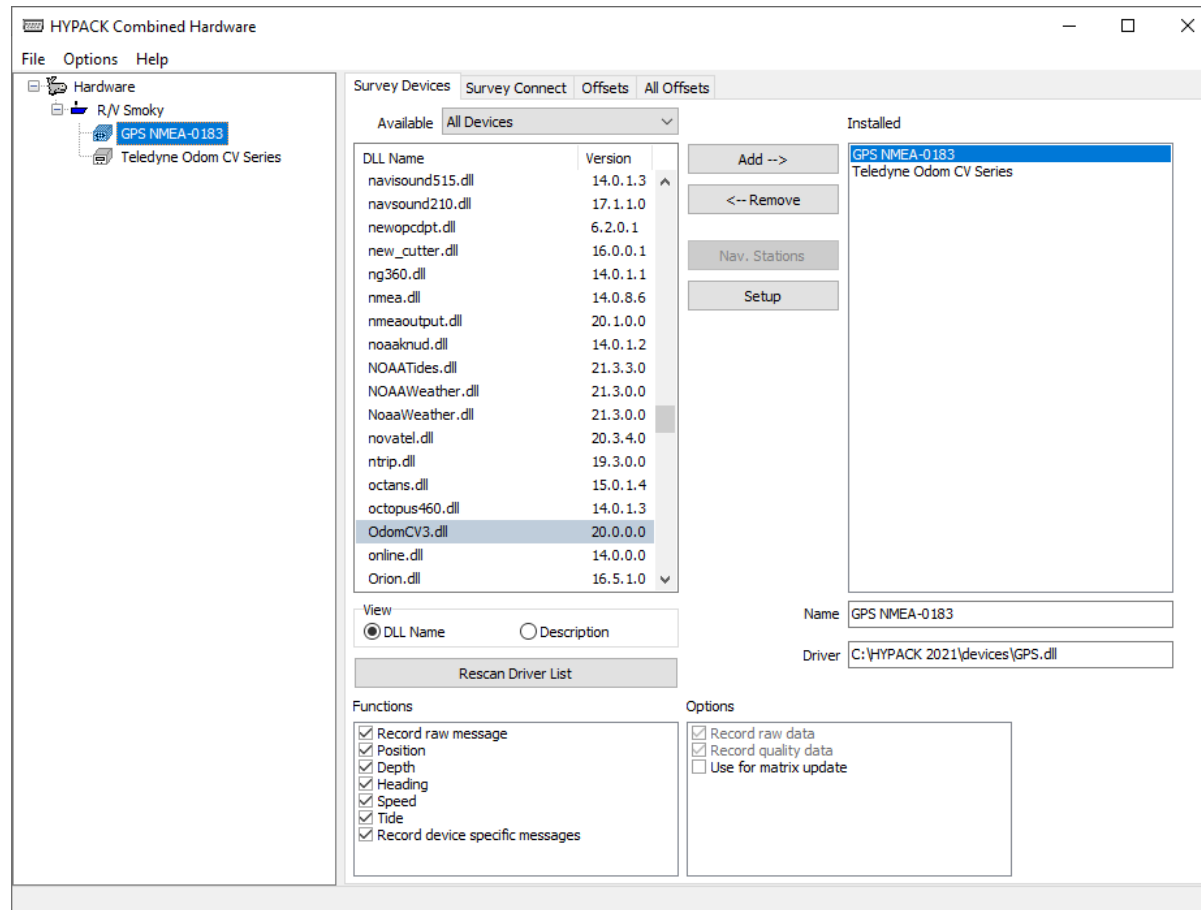


A reference point needs to be selected and all offsets measured to that point.



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# HYPACK® Hardware

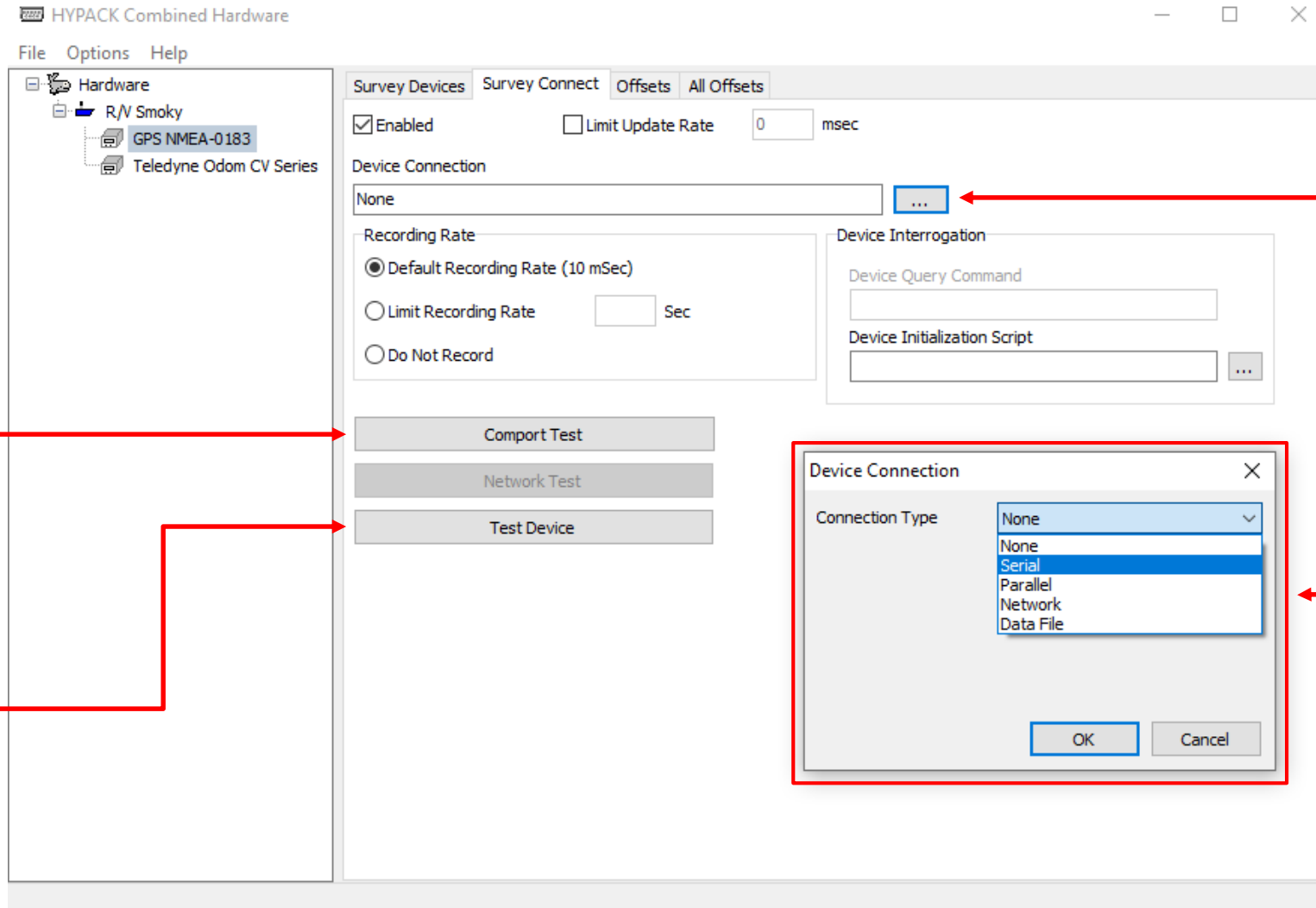


HYPACK HARDWARE, HYSWEEP HARDWARE & SIDE SCAN HARDWARE are all configured from this program.



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# Devices: Connect Tab



You can examine the serial port stream from here.

You can test the device from here.

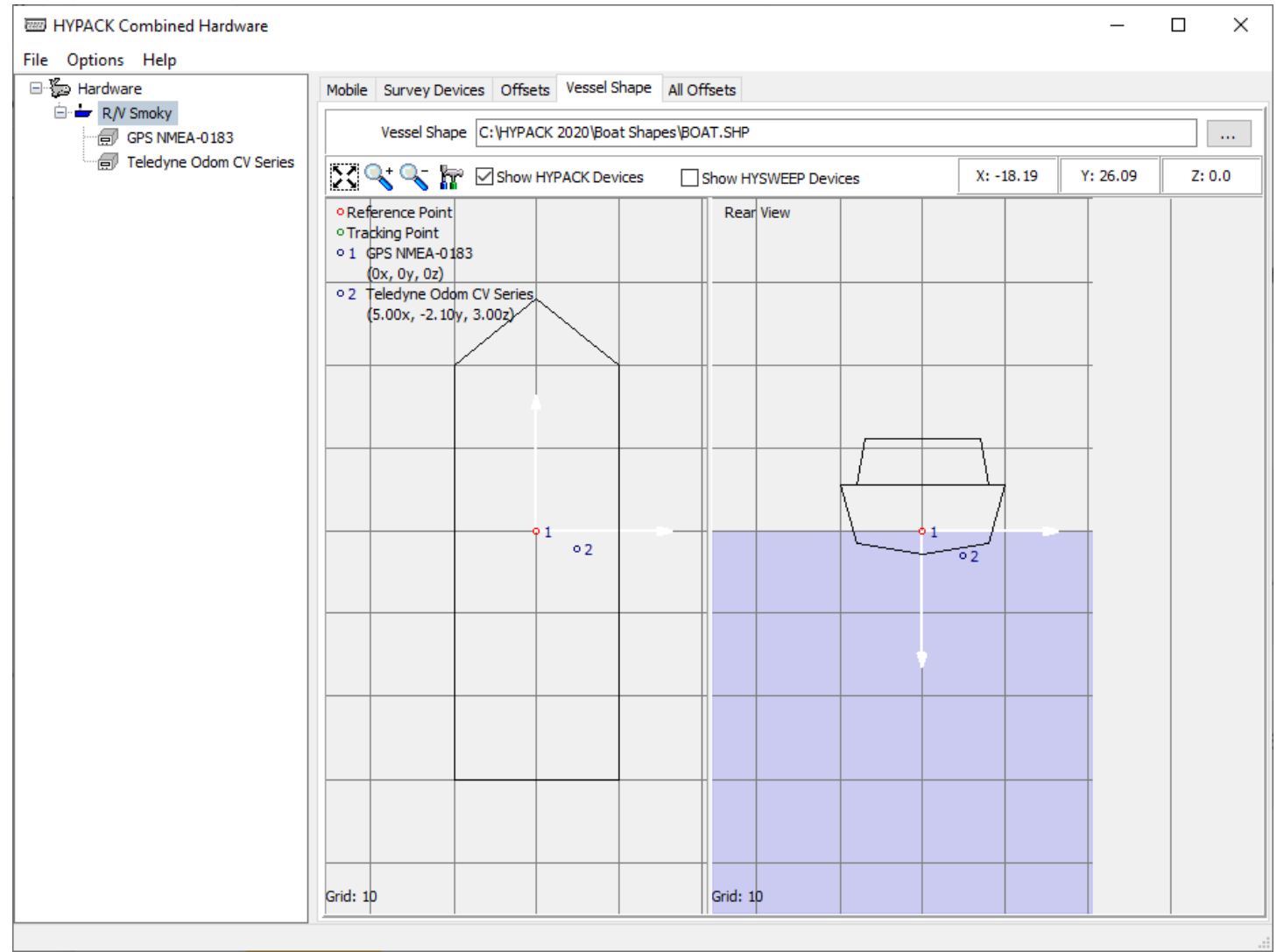
Click to get the Device Connection window.





# Vessel Page: Vessel Shape Tab

You can visually inspect the location of your sensors and pick your default 2-D boat shape for HYPACK SURVEY.



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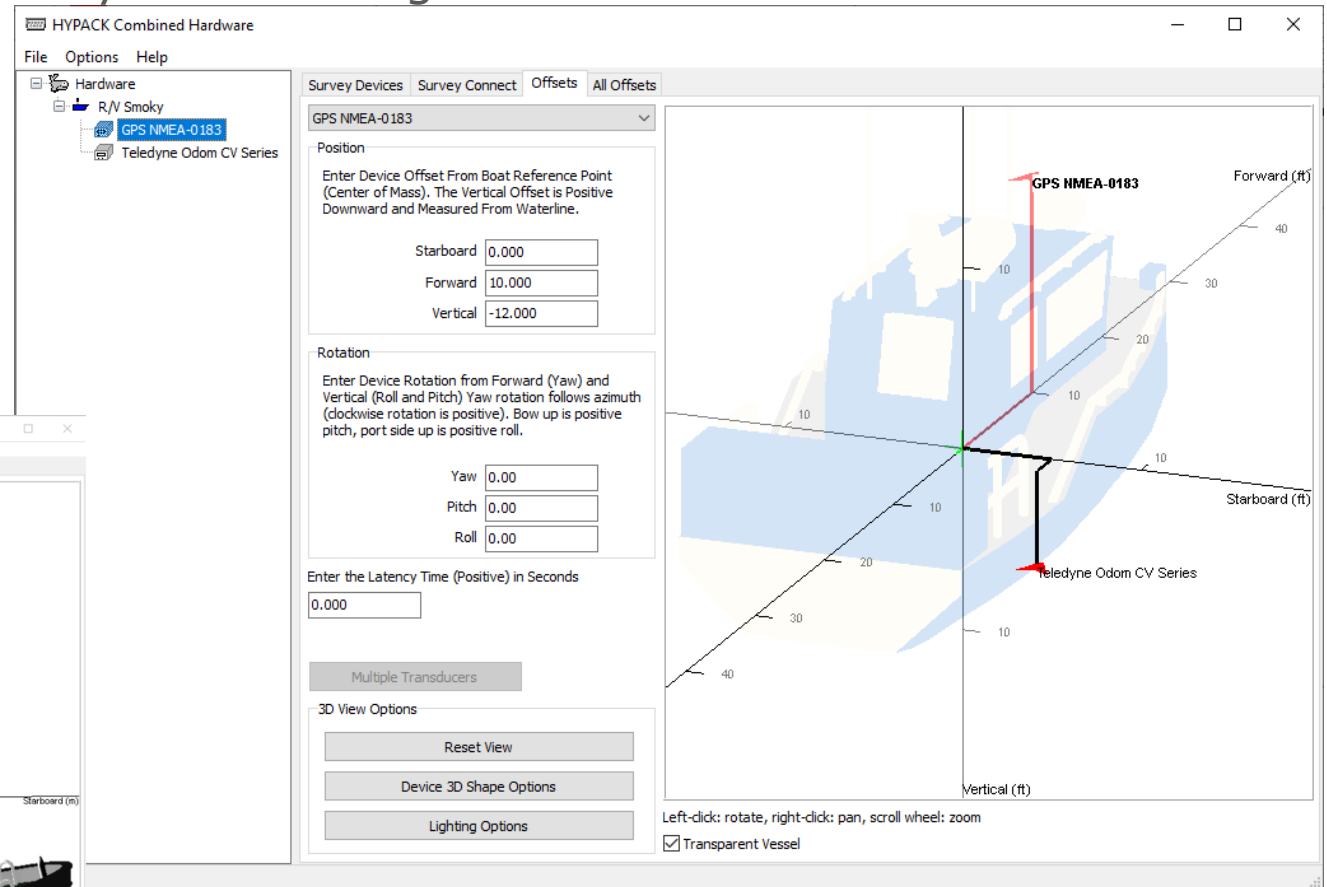
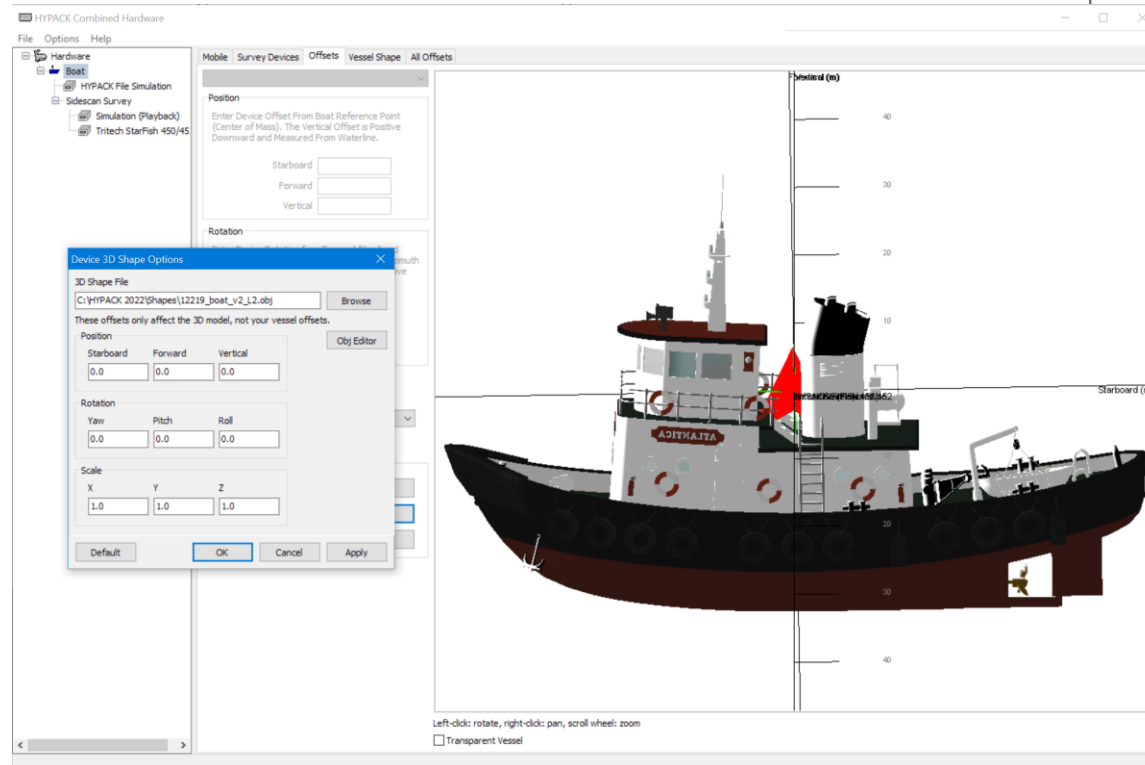
# Devices: Device Offsets Tab

Specify the position for each device, relative to your boat origin.

Remember, Z is positive downwards!

You can now visually inspect the location of your sensors in 3D.

Pan, tilt and zoom in/out. User can load 3od shape files.



# GPS Configuration



# GPS: Setup Window

## Synchronization:

- Are you using a 1PPS box?

## GPS Status Codes:

- Standard – NMEA 3.0 (Most GPS units made after 2005)
- Uncheck NMEA box to manually set the Code values.
- Option to Show Alarm if GPS Status is lost.

Setup

Use PPS box

**Synchronization**

NMEA Show alarm

Invalid	0	<input type="checkbox"/>
Stand-Alone	1	<input type="checkbox"/>
Differential	2	<input type="checkbox"/>
Float RTK	5	<input type="checkbox"/>
RTK	3	<input type="checkbox"/>
Fixed RTK	4	<input type="checkbox"/>

User Modified NMEA Messages: None

Show debug messages

Ignore Checksum

Use only for heading (OTFGYRO)

Report antenna elevation as depth

Use GPS time when not synchronizing (special configurations only !!!)

Advanced

Tide

Minimum Status for RTK Tide: Fixed RTK

Filter RTK tide

Time constant: Samples

**Alarms** Show alarm

Maximum HDOP value	0.0	<input type="checkbox"/>
Min number of satellites	0	<input type="checkbox"/>
Max synchronization error (ms)	500.0	<input type="checkbox"/>
Max baseline error	0.0	<input type="checkbox"/>
Max correction age interval (s)	0.0	<input type="checkbox"/>

**Used sentences**

<input checked="" type="checkbox"/> GGA	<input type="checkbox"/> GJK	<input checked="" type="checkbox"/> HDT	<input checked="" type="checkbox"/> GSA
<input type="checkbox"/> GLL	<input type="checkbox"/> RMC	<input checked="" type="checkbox"/> VTG	<input checked="" type="checkbox"/> GST
<input type="checkbox"/> GNS	<input type="checkbox"/> LLQ		<input checked="" type="checkbox"/> GSV
<input type="checkbox"/> PTNL, GJK			<input checked="" type="checkbox"/> PTNL, QA

OK Cancel



# GPS: Setup Window

## RTK Tide:

- Minimum status:
  - Compute for all and correct in post-processing.
- Filter RTK Tide:
  - Recommended on dredges.
  - Not recommended on survey vessels.

## Alarms:

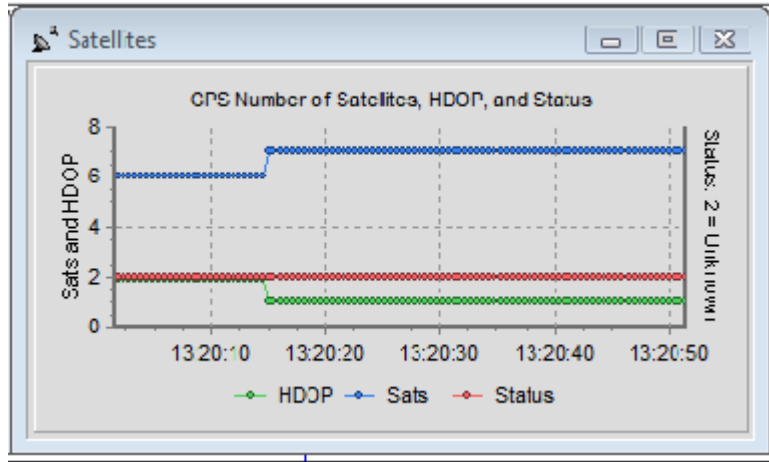
- Maximum HDOP Value: *recommended: 4.0*
- Minimum number of Satellites: *recommended: 5*
- Maximum synch error (ms): *recommended: 100*
- Maximum baseline error:
  - Used when computing bearing between two GPS.*
  - recommended: DGPS: 2m | RTK: 0.5m*
- Maximum correction age interval(s):
  - Time between corrections from the RTK base station*

The screenshot shows the 'Setup' dialog box with the following sections:

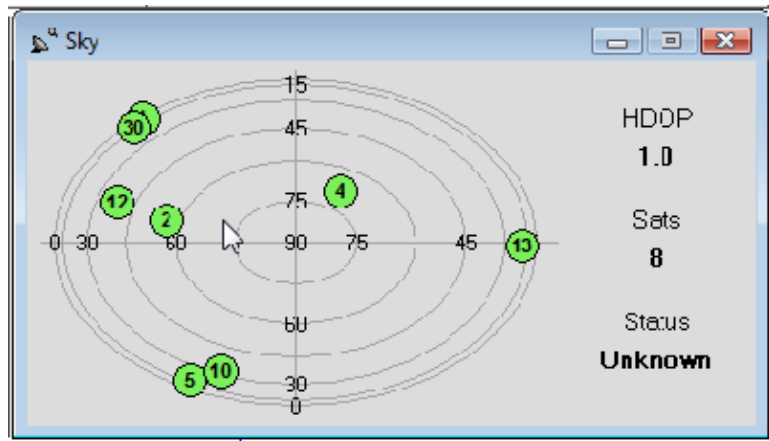
- Synchronization:**  Use PPS box
- GPS Status Codes:**  NMEA. Table: Invalid (0,  Show alarm), Stand-Alone (1,  Show alarm), Differential (2,  Show alarm), Float RTK (5,  Show alarm), RTK (3,  Show alarm), Fixed RTK (4,  Show alarm).
- User Modified NMEA Messages:** None (dropdown)
- Show debug messages
- Ignore Checksum
- Use only for heading (OTFGYRO)
- Report antenna elevation as depth
- Use GPS time when not synchronizing (special configurations only !!!)
- Advanced** button
- Tide (highlighted):** Minimum Status for RTK Tide (Fixed RTK selected),  Filter RTK tide, Time constant (input) Samples.
- Alarms:** Maximum HDOP value (0.0,  Show alarm), Min number of satellites (0,  Show alarm), Max synchronization error (ms) (500.0,  Show alarm), Max baseline error (0.0,  Show alarm), Max correction age interval (s) (0.0,  Show alarm).
- Used sentences:** Position (GGA, GLL, GNS, PTNL, GGK, RMC, LLQ), Heading (HDT, VTG), Misc (GSA, GST, GSV, PTNL, QA).
- OK and Cancel buttons.



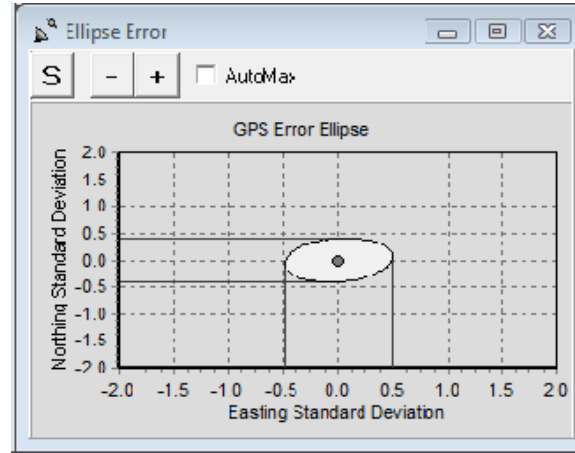
# GPS Windows in Survey



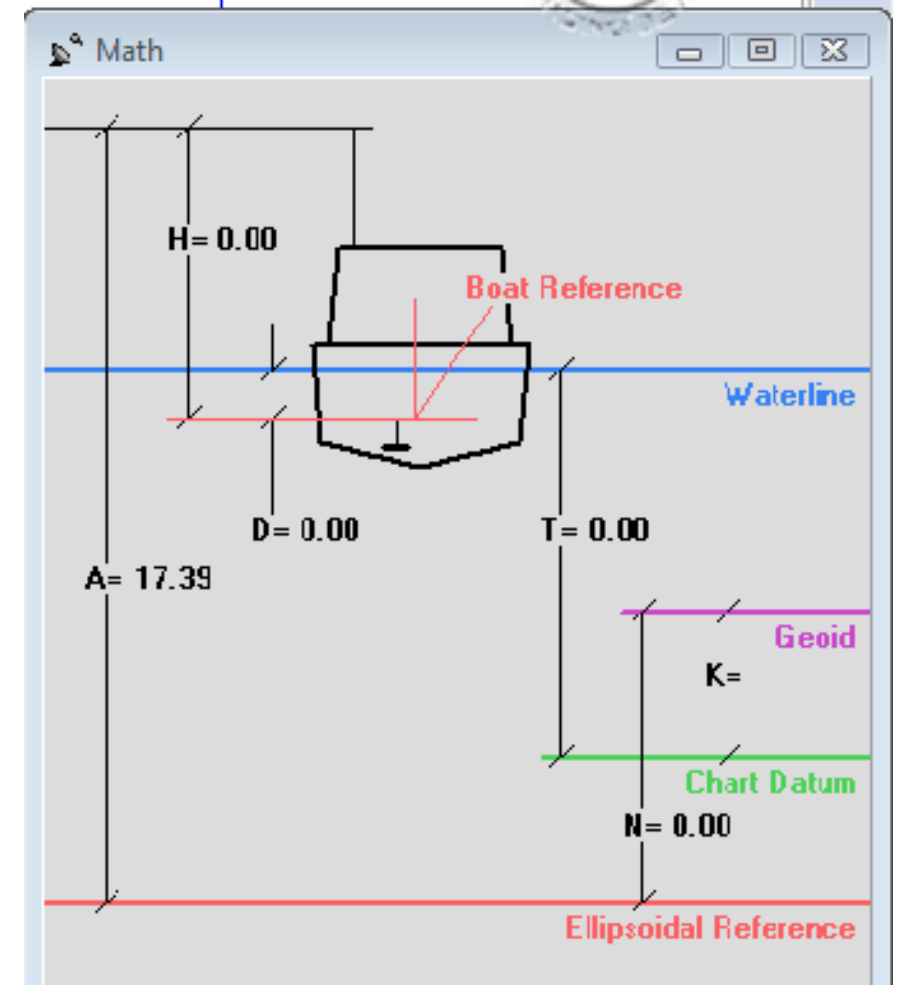
HDOP (Green), # of Sats (Blue), Status: (Red)



Sky Plot (Requires \$GPGSV sentence)



Error Ellipse  
(Requires \$GPGST sentence)



RTK Math Window



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# Sound Velocity and Single Beam Data



# Sound Velocity Corrections

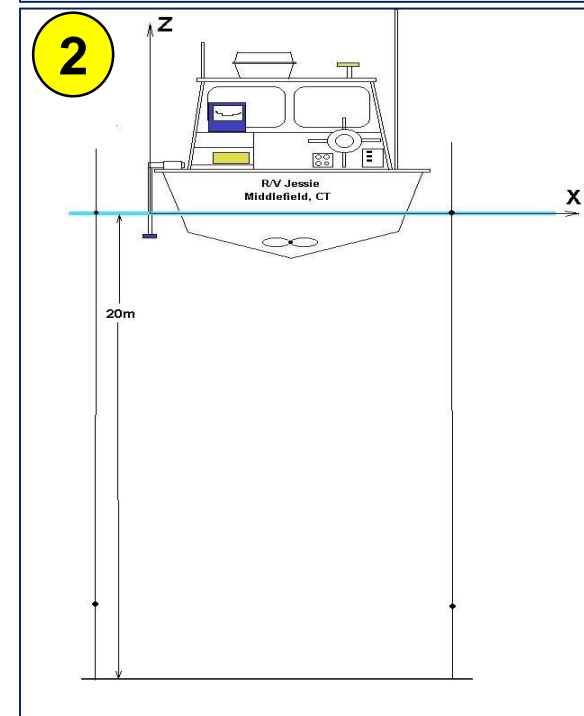
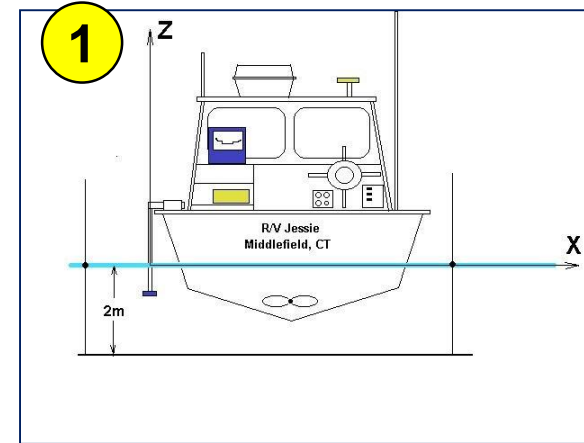
Method	Usage	Program
Calibrating your echosounder with a bar check.	Single Beam	None.
Correcting with a Sound Velocity Speed profile.	Multibeam and Single Beam	<b>SOUND VELOCITY</b>
Correcting for sound velocity based on measured errors at each depth.	Single Beam	<b>SOUNDING ADJUSTMENT</b> Separate program or built into SBMAX





# The Bar Check

- Lower a bar or plate 5' or 2m beneath the surface.
  - Adjust the 'zero' or 'draft' or 'tide' on your echo sounder until you read that value.
- Lower the bar to your deepest Project depth to be measured.
  - Adjust the sound velocity speed until you read that value.
- Repeat steps 1 and 2 until you don't have to make any adjustments.
  - Your echo sounder will now output soundings that have sound velocity speed corrections factored into the output depth.



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# Problems with Bar Checks

- Wave action: (Nothing like trying to calibrate your sounder to a tenth of a foot while standing in a 2' sea.)
- Currents: The bar moves from beneath the transducer when you lower it, limiting your ability to see it.
- Performing the bar check outside your survey area: It's more convenient to do the bar check in the harbor.
- Surveying with a single bar check in an area where the sound velocity profile changes (fresh versus salt water boundaries).

Set aside time for your crews to practice and perform bar checks!



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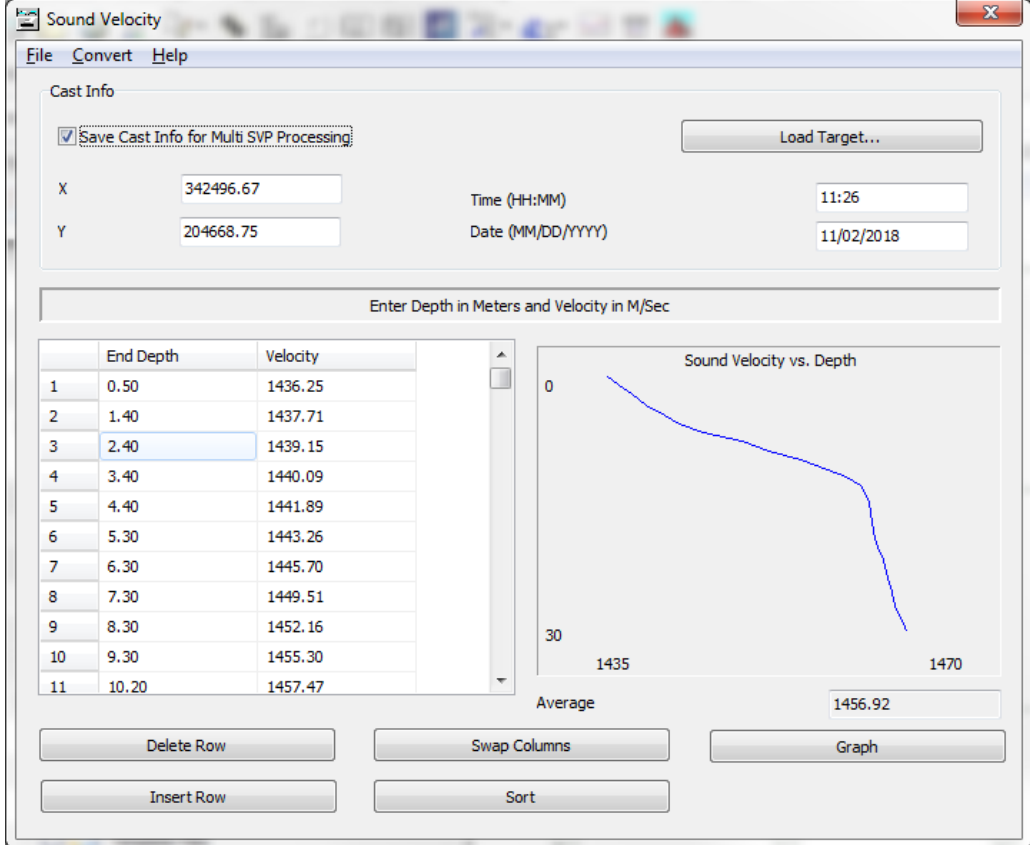
# Using Data from a Velocity Probe

Use the SOUND VELOCITY program to enter the velocity information.

Direct import from:

- SonTek CastAway
- Valeport SWiFT
- AML Base X2

Load the resulting \*.VEL file into the SINGLE BEAM EDITOR.



The screenshot displays the 'Sound Velocity' software interface. At the top, there is a menu bar with 'File', 'Convert', and 'Help'. Below the menu bar is the 'Cast Info' section, which includes a checked checkbox for 'Save Cast Info for Multi SVP Processing', a 'Load Target...' button, and input fields for X (342496.67), Y (204668.75), Time (11:26), and Date (11/02/2018). The main area is titled 'Enter Depth in Meters and Velocity in M/Sec' and contains a table with 11 rows of data. To the right of the table is a graph titled 'Sound Velocity vs. Depth' showing a blue line representing the velocity profile. Below the graph is an 'Average' field showing 1456.92. At the bottom, there are buttons for 'Delete Row', 'Insert Row', 'Swap Columns', 'Sort', and 'Graph'.

	End Depth	Velocity
1	0.50	1436.25
2	1.40	1437.71
3	2.40	1439.15
4	3.40	1440.09
5	4.40	1441.89
6	5.30	1443.26
7	6.30	1445.70
8	7.30	1449.51
9	8.30	1452.16
10	9.30	1455.30
11	10.20	1457.47



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# Why Sound Velocity Matters....

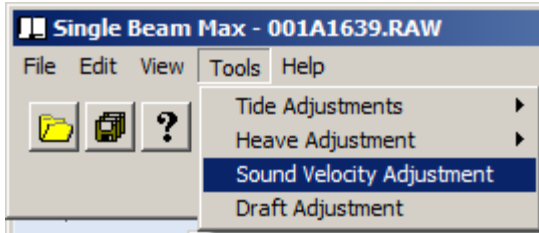
The green bars indicate the 0.3 foot change in depth based upon changes in Sound Velocity

**Sound Velocity Error Chart (Feet)**  
( Difference in Sound Velocity in Feet per Second from Initial Setting )

	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200
5	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.11	0.12	0.13	0.14	0.15	0.16	0.17	0.18	0.19	0.20
10	0.02	0.04	0.06	0.08	0.10	0.12	0.14	0.16	0.18	0.20	0.22	0.24	0.26	0.28	0.30	0.32	0.34	0.37	0.39	0.41
15	0.03	0.06	0.09	0.12	0.15	0.18	0.21	0.24	0.27	0.30	0.33	0.36	0.40	0.43	0.46	0.49	0.52	0.55	0.58	0.61
20	0.04	0.08	0.12	0.16	0.20	0.24	0.28	0.32	0.36	0.41	0.45	0.49	0.53	0.57	0.61	0.65	0.69	0.73	0.77	0.81
25	0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.41	0.46	0.51	0.56	0.61	0.66	0.71	0.76	0.81	0.86	0.91	0.96	1.01
30	0.06	0.12	0.18	0.24	0.30	0.36	0.43	0.49	0.55	0.61	0.67	0.73	0.79	0.85	0.91	0.97	1.03	1.10	1.16	1.22
35	0.07	0.14	0.21	0.28	0.35	0.43	0.50	0.57	0.64	0.71	0.78	0.85	0.92	0.99	1.06	1.14	1.21	1.28	1.35	1.42
40	0.08	0.16	0.24	0.32	0.40	0.49	0.57	0.65	0.73	0.81	0.89	0.97	1.05	1.14	1.22	1.30	1.38	1.46	1.54	1.62
45	0.09	0.18	0.27	0.36	0.46	0.55	0.64	0.73	0.82	0.91	1.00	1.09	1.19	1.28	1.37	1.46	1.55	1.64	1.73	1.83
50	0.10	0.20	0.30	0.40	0.51	0.61	0.71	0.81	0.91	1.01	1.12	1.22	1.32	1.42	1.52	1.62	1.72	1.83	1.93	2.03
55	0.11	0.22	0.33	0.44	0.56	0.67	0.78	0.89	1.00	1.11	1.23	1.34	1.45	1.56	1.67	1.78	1.90	2.01	2.12	2.23
60	0.12	0.24	0.36	0.49	0.61	0.73	0.85	0.97	1.09	1.22	1.34	1.46	1.58	1.70	1.83	1.95	2.07	2.19	2.31	2.43
65	0.13	0.26	0.39	0.53	0.66	0.79	0.92	1.05	1.19	1.32	1.45	1.58	1.71	1.85	1.98	2.11	2.24	2.37	2.51	2.64
70	0.14	0.28	0.42	0.57	0.71	0.85	0.99	1.13	1.28	1.42	1.56	1.70	1.85	1.99	2.13	2.27	2.41	2.56	2.70	2.84
75	0.15	0.30	0.45	0.61	0.76	0.91	1.06	1.22	1.37	1.52	1.67	1.82	1.98	2.13	2.28	2.43	2.59	2.74	2.89	3.04
80	0.16	0.32	0.48	0.65	0.81	0.97	1.13	1.30	1.46	1.62	1.78	1.95	2.11	2.27	2.43	2.60	2.76	2.92	3.08	3.25
85	0.17	0.34	0.52	0.69	0.86	1.03	1.21	1.38	1.55	1.72	1.90	2.07	2.24	2.41	2.59	2.76	2.93	3.10	3.28	3.45
90	0.18	0.36	0.55	0.73	0.91	1.09	1.28	1.46	1.64	1.82	2.01	2.19	2.37	2.56	2.74	2.92	3.10	3.29	3.47	3.65
95	0.19	0.38	0.58	0.77	0.96	1.15	1.35	1.54	1.73	1.93	2.12	2.31	2.50	2.70	2.89	3.08	3.28	3.47	3.66	3.85
100	0.20	0.40	0.61	0.81	1.01	1.22	1.42	1.62	1.82	2.03	2.23	2.43	2.64	2.84	3.04	3.25	3.45	3.65	3.85	4.06

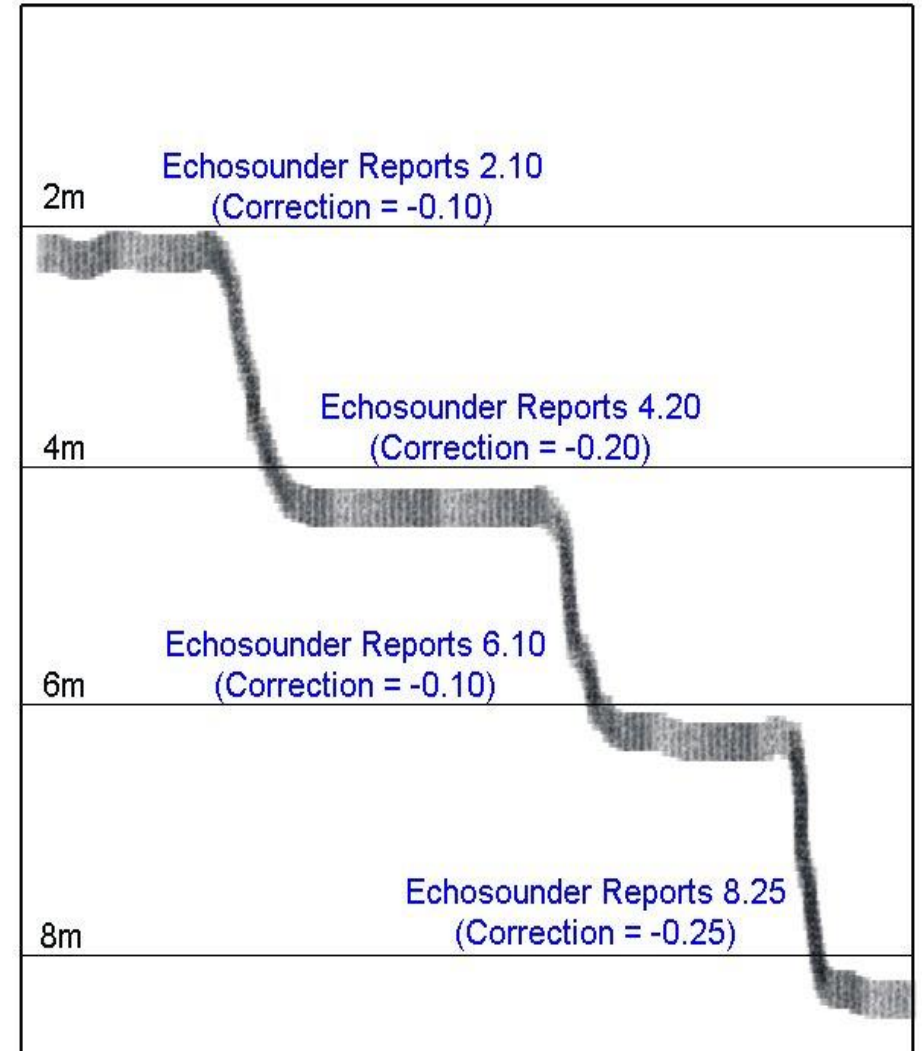


# SOUNDING ADJUSTMENTS Routine



- Lower a bar to specific depths beneath the static water line.
- Note what the echo-sounder reports.
- SOUNDING ADJUSTMENT reads edited data files and inserts the appropriate 'Correction' based on the measured depth.
- This same routine is now available in the SINGLE BEAM EDITOR (SBMAX)

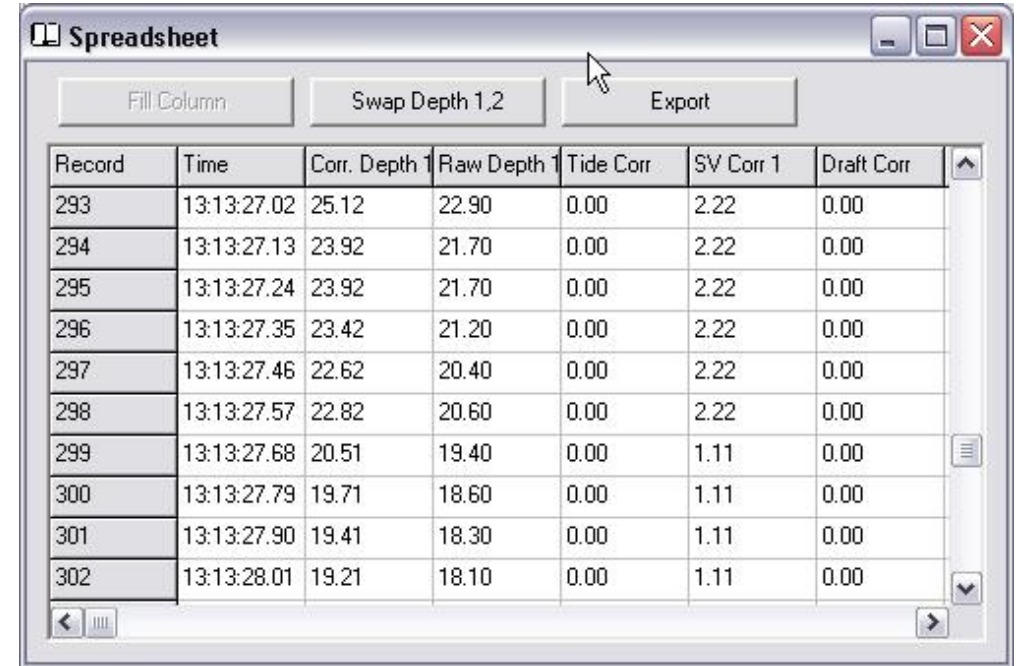
SOUNDING ADJUSTMENT is available as a separate program, or as an integrated routine in SBMAX.



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# SOUNDING ADJUSTMENTS

1. Process the data in the SINGLE BEAM EDITOR.
2. Enter your Depth and Error information into the SOUNDING ADJUSTMENTS program.
3. Take the resulting edited 'ALL' format data files and process them through SOUNDING ADJUSTMENTS.



Record	Time	Corr. Depth	Raw Depth	Tide Corr	SV Corr 1	Draft Corr
293	13:13:27.02	25.12	22.90	0.00	2.22	0.00
294	13:13:27.13	23.92	21.70	0.00	2.22	0.00
295	13:13:27.24	23.92	21.70	0.00	2.22	0.00
296	13:13:27.35	23.42	21.20	0.00	2.22	0.00
297	13:13:27.46	22.62	20.40	0.00	2.22	0.00
298	13:13:27.57	22.82	20.60	0.00	2.22	0.00
299	13:13:27.68	20.51	19.40	0.00	1.11	0.00
300	13:13:27.79	19.71	18.60	0.00	1.11	0.00
301	13:13:27.90	19.41	18.30	0.00	1.11	0.00
302	13:13:28.01	19.21	18.10	0.00	1.11	0.00

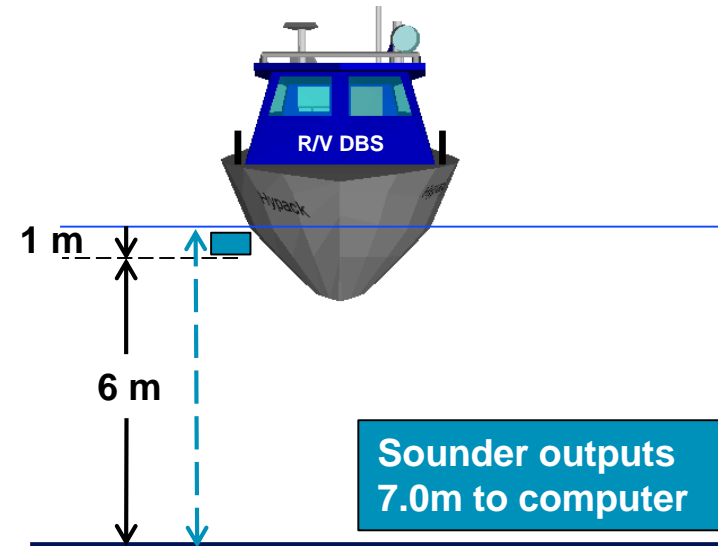
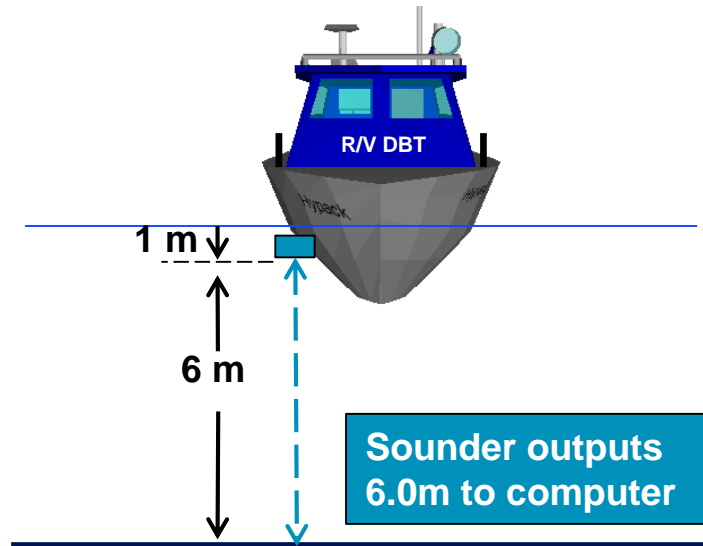


# Echosounder Setup



# Echosounder: Vertical Offset

Correct for the Static Draft (depth of transducer below the static waterline) either in the echosounder (bar check) or in HARDWARE (Vertical Offset). **DO NOT USE IN BOTH PLACES!**



Outputting **Depth Below Surface (DBS)**:

Vertical Offset is set to 0.0



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# Echosounder Configuration: Offsets

Survey Devices | Survey Connect | Offsets

GPS NMEA-0183

Position

Enter Device Offset From Boat Reference Point (Center of Mass).

The Vertical Offset is Positive Downward and Measured From Waterline.

Starboard	<input type="text" value="0.25"/>
Forward	<input type="text" value="1.85"/>
Vertical	<input type="text" value="0.0"/>

## Offsets:

Enter the offsets of the echosounder transducer, relative to the boat origin.

## Vertical Offset:

- If your echosounder outputs the Depth Below Surface, then enter a Vertical Offset = 0.0
- If your echosounder outputs the Depth Below Transducer, then enter Vertical Offset = Static Draft.
- Z = positive downward!

## Latency:

For almost all single beam sounders, enter Latency = 0.00.

Enter the combined latency between the GPS and Echosounder determined in the SINGLE BEAM LATENCY program as the latency for the GPS device.



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# Echo Sounder Configuration

## Functions:

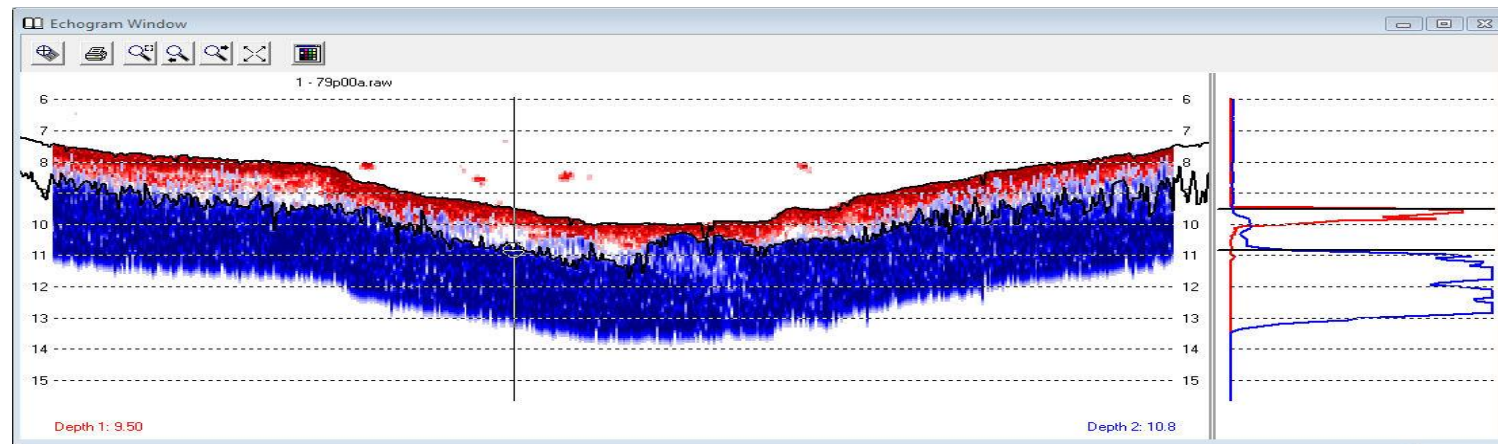
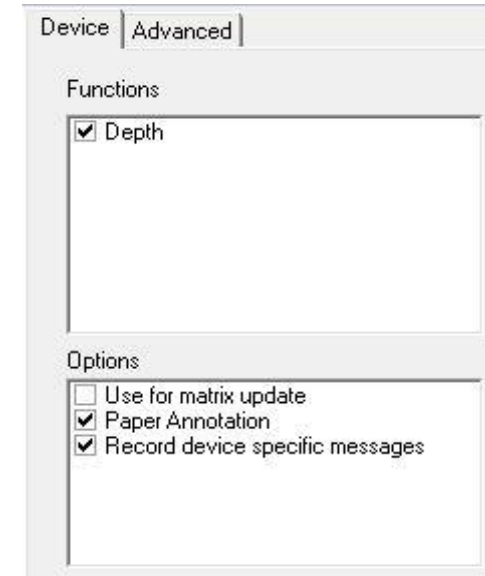
Available functions may differ, depending on the echo sounder. As a minimum, you want to select '*Depth*'.

## Options:

**'Use for matrix update'**: Paints a matrix with the color-coded depth data.

**'Paper Annotation'**: Enables the output of annotation to the echo sounder at event marks.

**'Record device specific messages'**: Enables the storage of acoustic data for certain sounders.



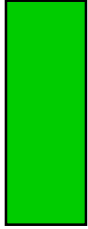
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# MRU use in HYPACK



# Motion Reference Units (MRUs)



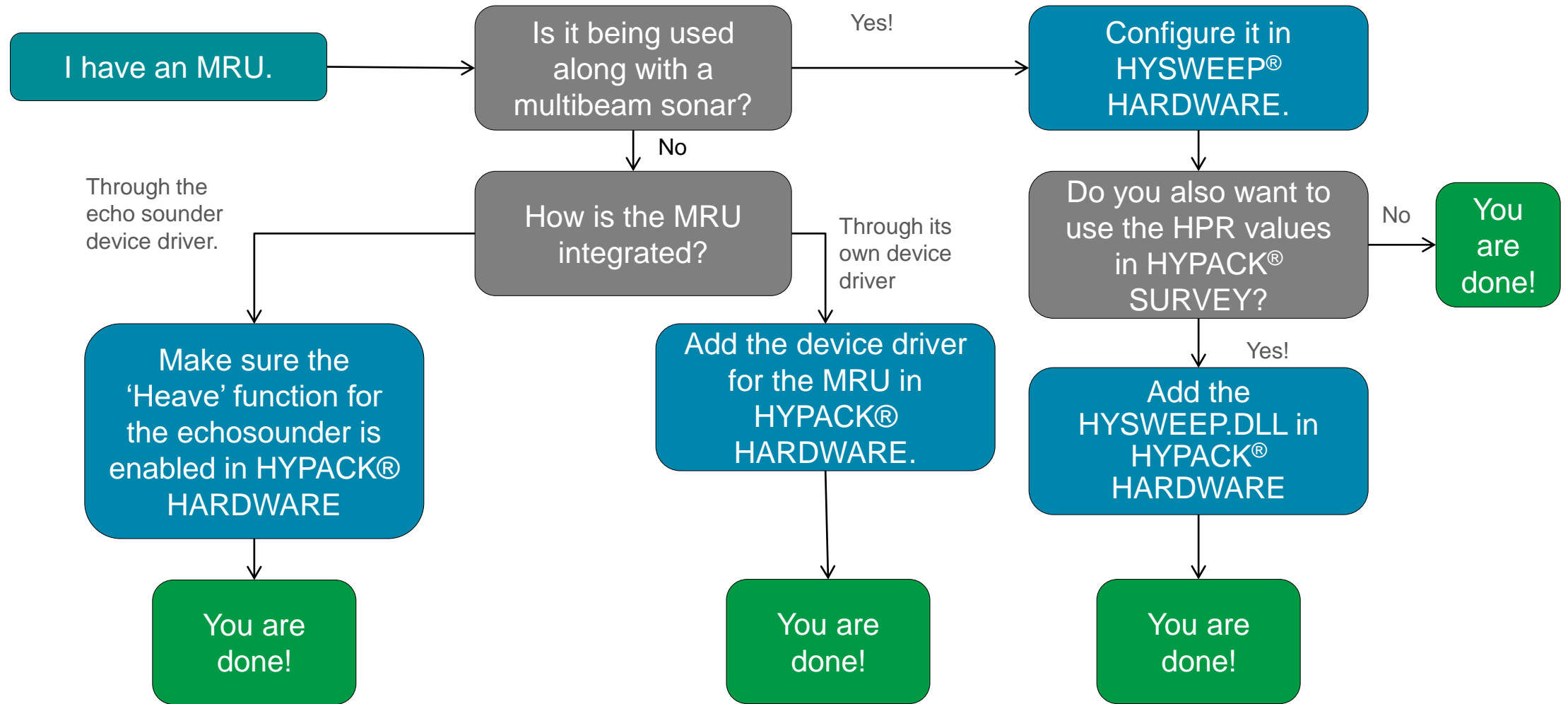
————— Heave Vertical Reference

- A heave sensor (or MRU) outputs its height above or below its current vertical reference.
- The vertical reference slowly changes based on the range of motion of the sensor.



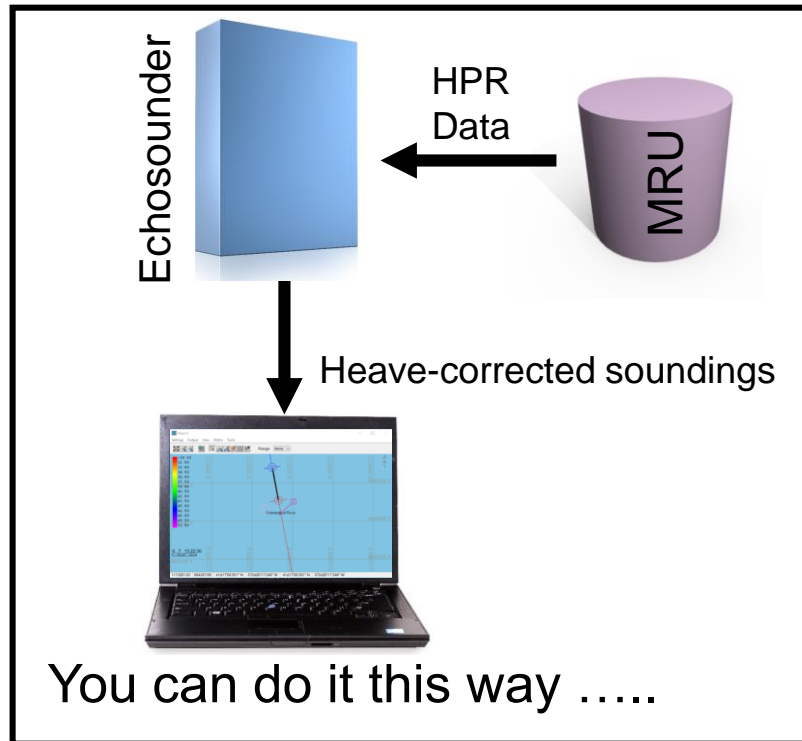
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# MRU Decision Tree

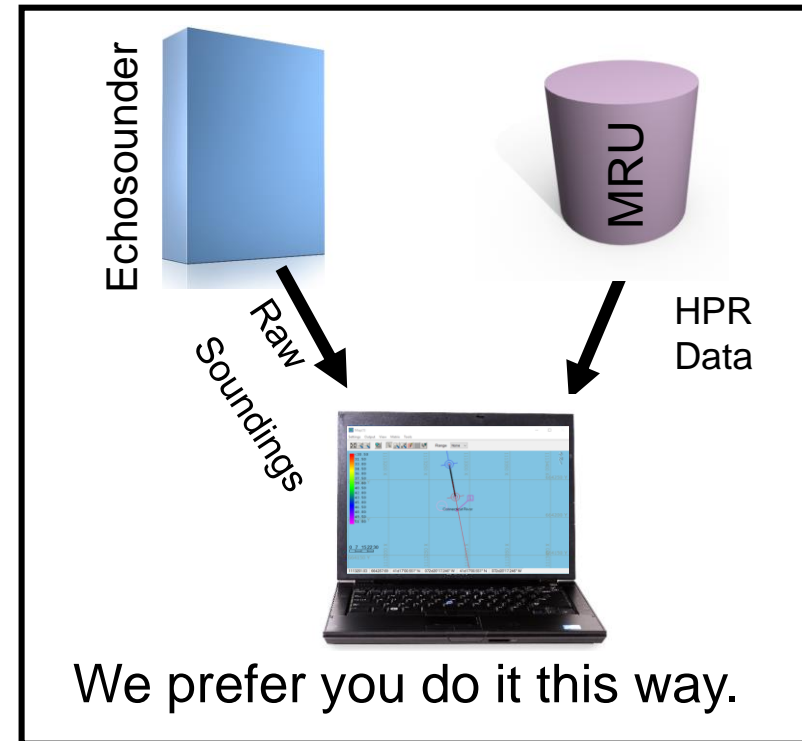


# Connecting your MRU

If your echosounder can output uncorrected depths and MRU data, then we have no objection!



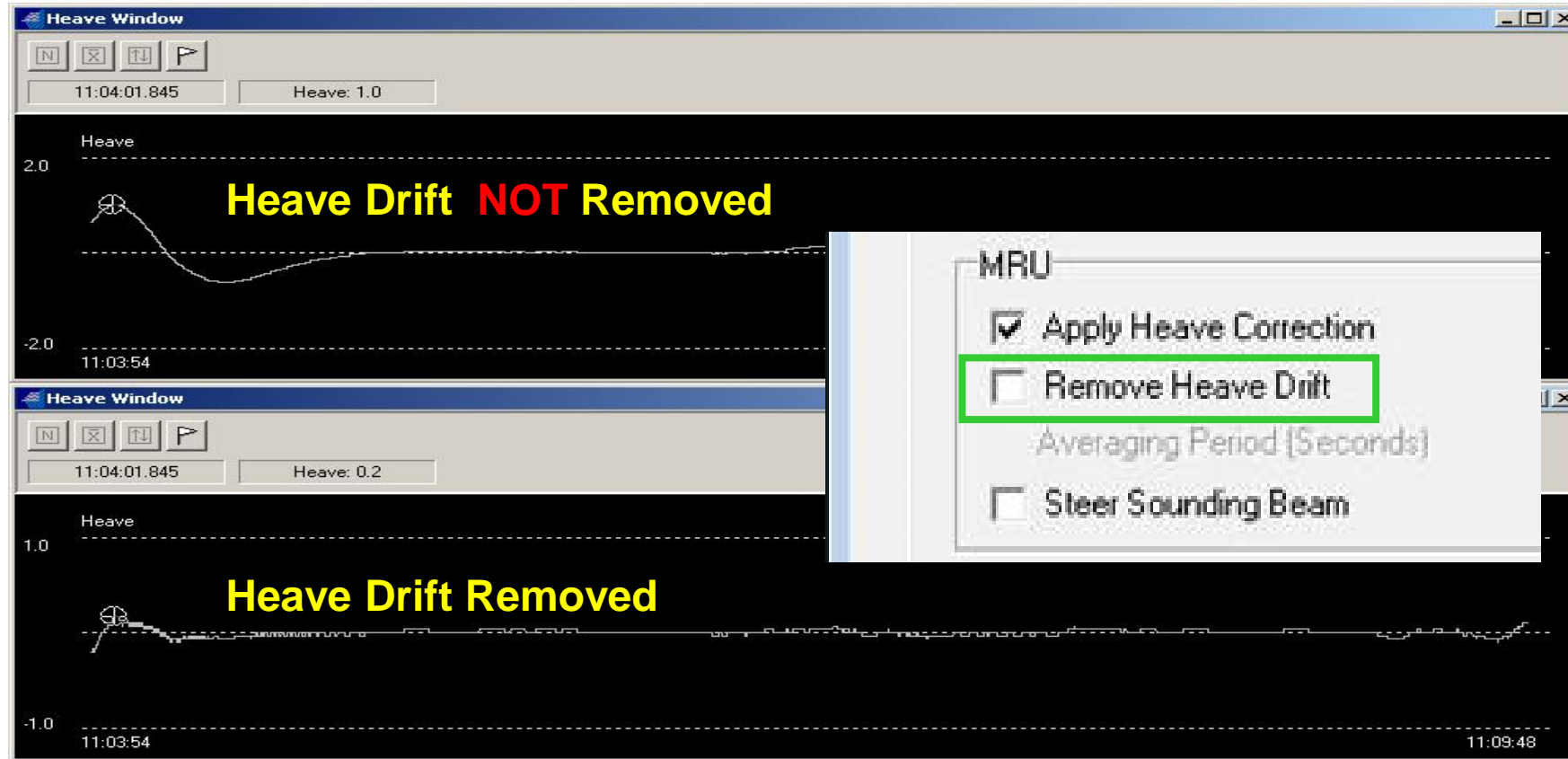
This is recommended only if your echosounder can output the raw depth and heave measurement as separate entities.



Select the specific device driver for your MRU and configure it!



# Correction of Heave Drift

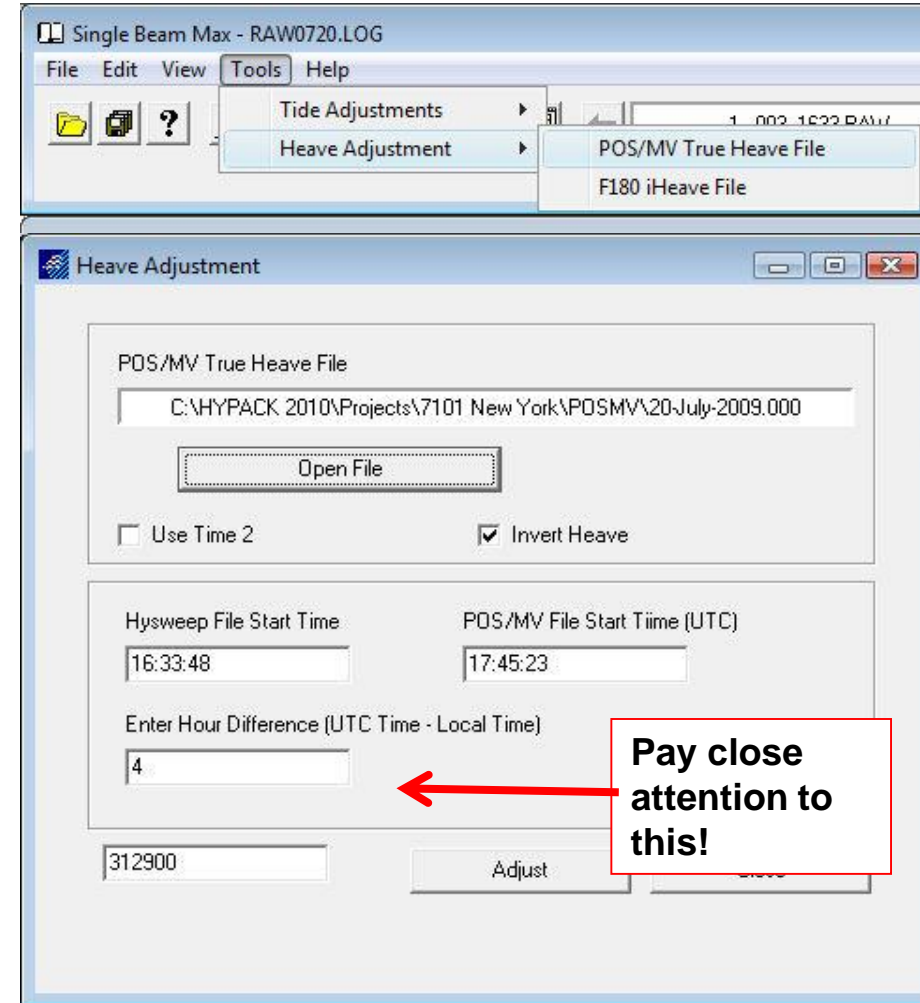


Heave values can drift 'off-center' due to rapid accelerations or changes of direction.



# Correcting with Post-Processed Heave

- Applanix POS M/V and other IMUs can internally log raw data that can be post-processed into more accurate heave data (= True Heave or iHeave).
- SBMAX (and MBMAX) can read these files and apply the new heave values.
  - You MUST synchronize the HYPACK SURVEY clock and the IMU clock in order for this to work!





# HYPACK Timing/Synchronizing

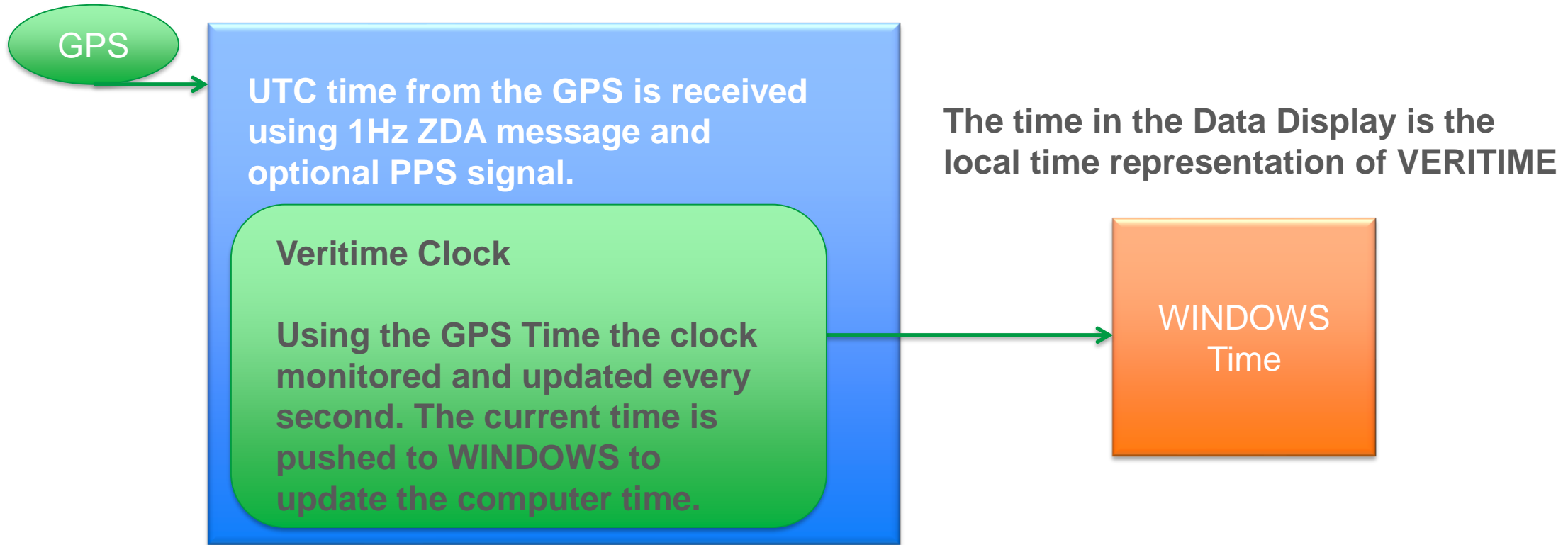


# HYPACK® Timing Basics

- The internal clock on your computer is a poor time device.
- HYPACK SURVEY and DREDGEPACK® use a proprietary clock model called **VERITIME**.
- When you start SURVEY or DREDGEPACK®
  - VERITIME is initially set to the Windows clock time.
  - VERITIME and Windows clock times slowly drift apart.
- In ‘Normal’ mode, all devices receive their time tags from the VERITIME clock model.
  - All devices are time tagged off the same time standard.



# How Clock Synchronization Works



The device timing uses the VERITIME time for record time. If the time push to WINDOWS fails the device time is still in synch with the GPS time.



# Clock Synchronization: How it works

## When the ZDA sentence arrives: (1 Hz only!)

- HYPACK SURVEY compares the UTC time from the GPS (corrected with the time zone offset) with the time from the VERITIME clock model (HYPACK SURVEY).
- It can speed up the VERITIME clock model, or slow it down so that it matches UTC.
- You should wait one or two minutes after starting HYPACK SURVEY before starting to survey to allow the VERITIME clock model to synch to UTC. SURVEY will show a “No Synch” error until it locks on.

## When the GGA sentence arrives (any rate):

- HYPACK SURVEY uses the time tag in the GGA sentence (corrected for local time zone offset) as the position time tag.

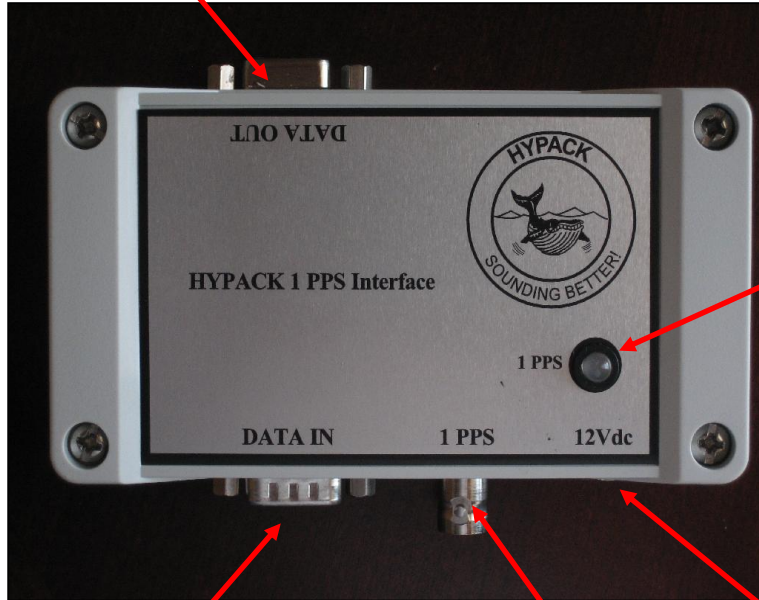
## When a message arrives from your echosounder, MRU or other non-GPS device:

- HYPACK SURVEY gets a time tag from the VERITIME clock model, which has been ‘synched’ to UTC less the local time zone offset.



# The 1 PPS Box

RS232 Out  
(to computer)



1 PPS Receipt  
Strobe

Alternates  
**RED/GREEN**  
every 1 second  
when operating  
correctly

RS232 In  
Requires ZDA at 1 Hz  
May also carry 1PPS  
pulse on Pin 8 or 9

1 PPS In  
(from GPS)  
BNC  
Connector

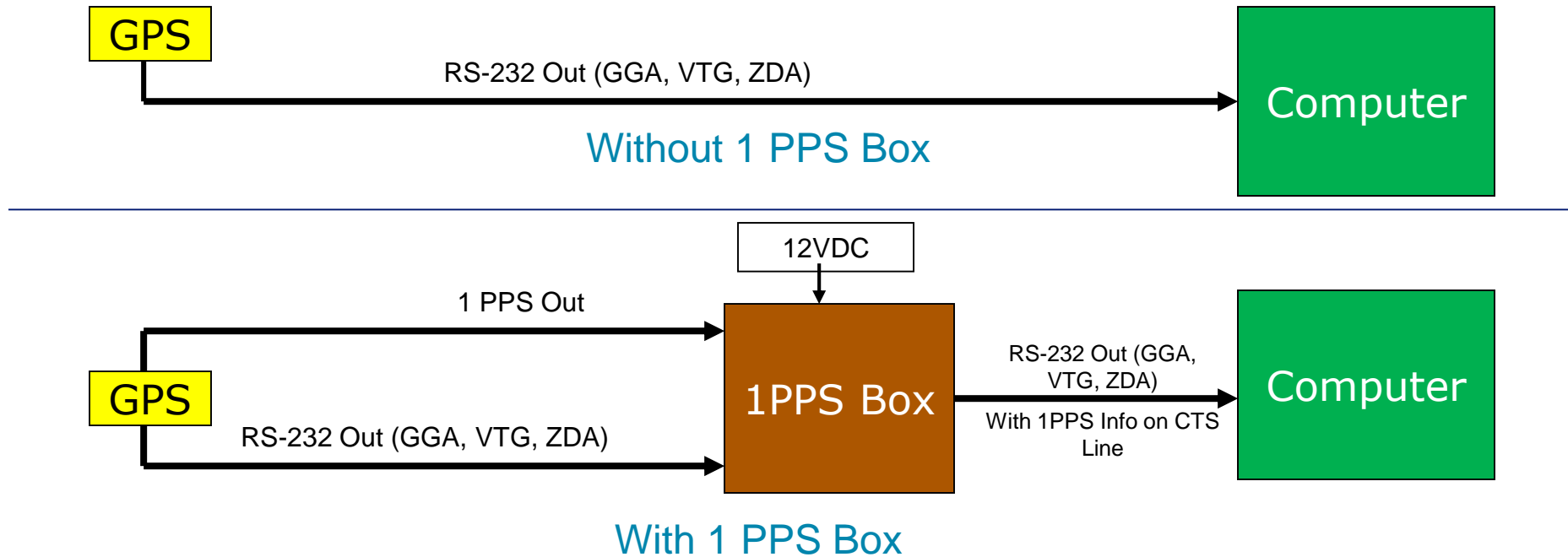
12VDC In

- The use of the PPS box is to allow the computer time to detect the PPS signal.
- The PPS box converts a short pulse into a stable, detectable signal.



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# Clock Synchronization – 1PPS Box



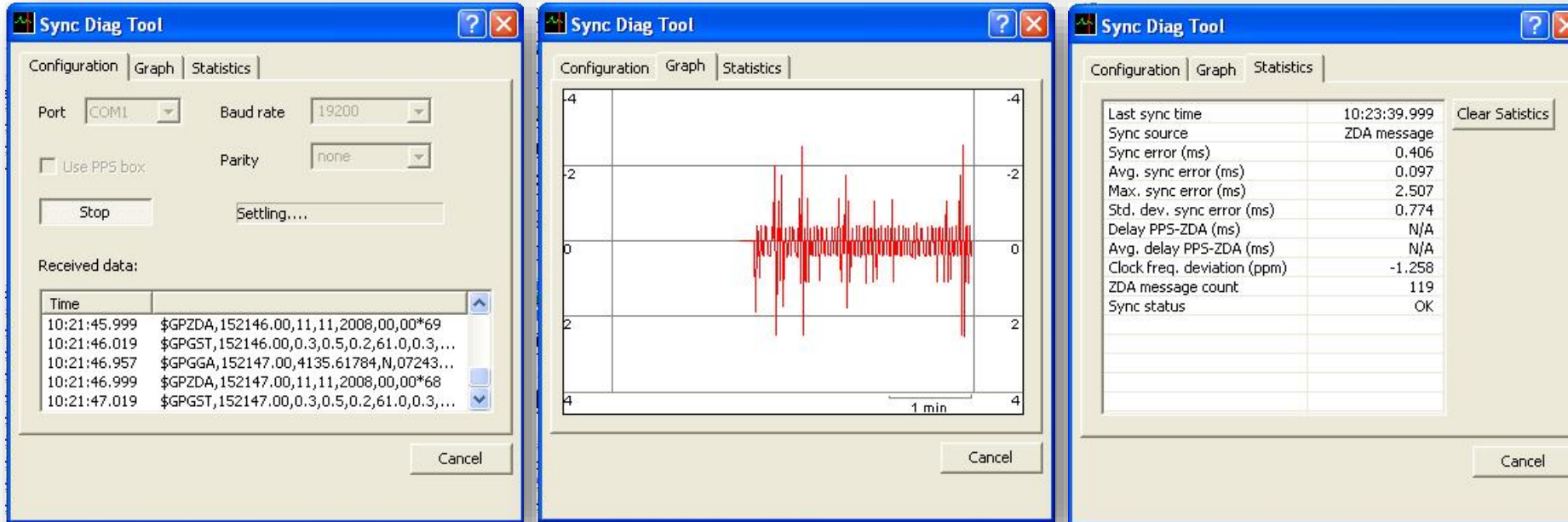
**Without a 1PPS Box:** Time of ZDA sentence is based on the arrival of first character of ZDA transmission.

**With a 1PPS Box:** Time of ZDA sentence is based on arrival of 1PPS pulse.



# ZDA – 1PPS Testing: Utilities

Test the consistency of your ZDA message for synchronization.  
Located under 'Utilities – Calibration' menu item.



Graph shows 'Sync Error' in mSecs. Sync Error equals the difference between VERITIME and the time of arrival of the ZDA message

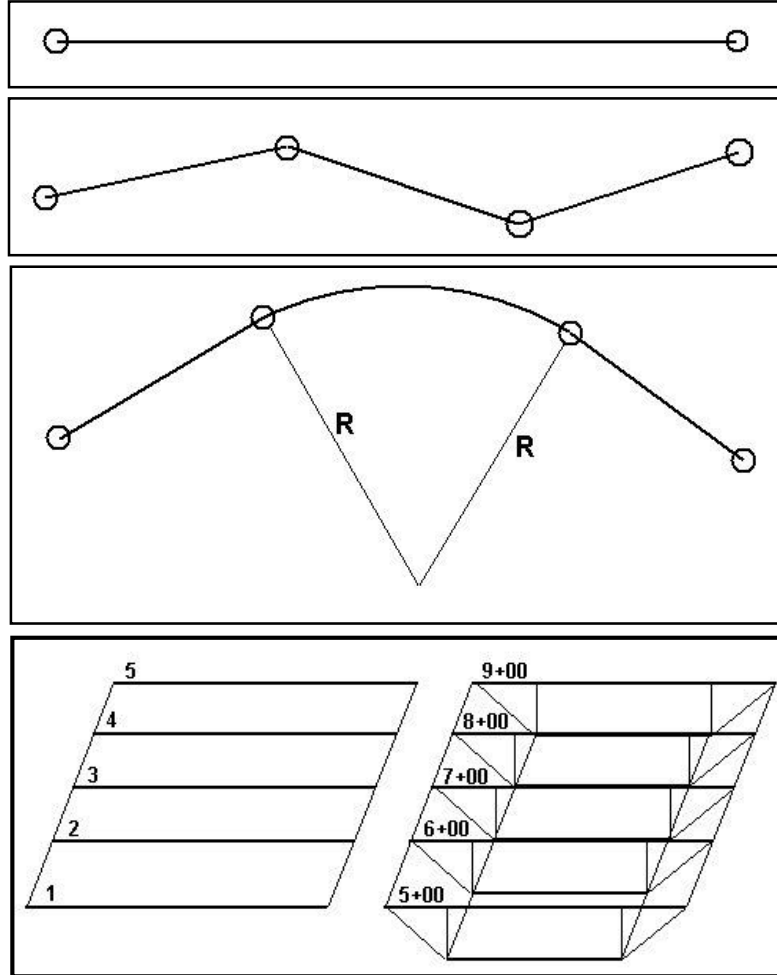


# Planned Line Editor





# Planned Lines Basics



A planned line needs a minimum of two waypoints.

A planned line can have over 100 segments.

Internal segments can be made as arcs by entering the radius for the arc.

Lines can be:

2D: Only X-Y at waypoints

3D: X-Y at waypoints and design depth at Distance Along Line

You can survey without Planned Lines. Many multibeam surveys do not use them and rely on a MTX file(s) to ensure 100% coverage.



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# Offsets: Centerline

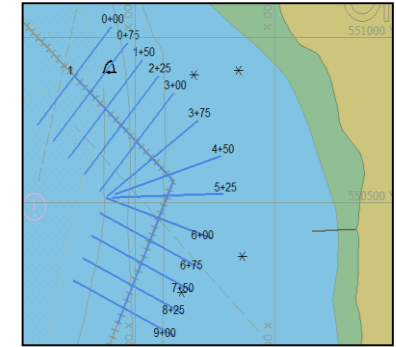
Line Editor

File Edit Line Template Mission Planning Help

Cursor Preview Add Line Offsets Clip Lines

Lines	Points	Template	
1			
#	Easting	Northing	Arc
0	1204688.20	227186.06	0.00
1	1206962.70	226333.12	0.00
2	1208484.62	226249.49	0.00
3	1209839.29	227328.21	0.00

Depth Mode Chart Datum: 0 US Survey Foot Length: 5685.08



Smart Corners,  
Centerline Offsets.

Select Offset Method

Center Line | Parallel | Radial | Search Pattern | Stair Step | Extend Lines

Starting Chainage: 0.0 Naming Scheme: ###+###

Distance Port: 150 Angle: 90

Distance Starboard: 150  Use Smart Corners

Line Spacing: 0.0

OK Cancel

Create your centerline, Select Offsets: Centerline, Generate perpendicular lines.



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# Offsets: Parallel Lines



- Enter your initial line.
- Select Offsets: Parallel
- Generate your parallel lines.
- You can now stagger the offsets:
  - 50m, 100m, 50m, 100m, etc.

For Parallel Offsets, lines are renumbered North to South and West to East.

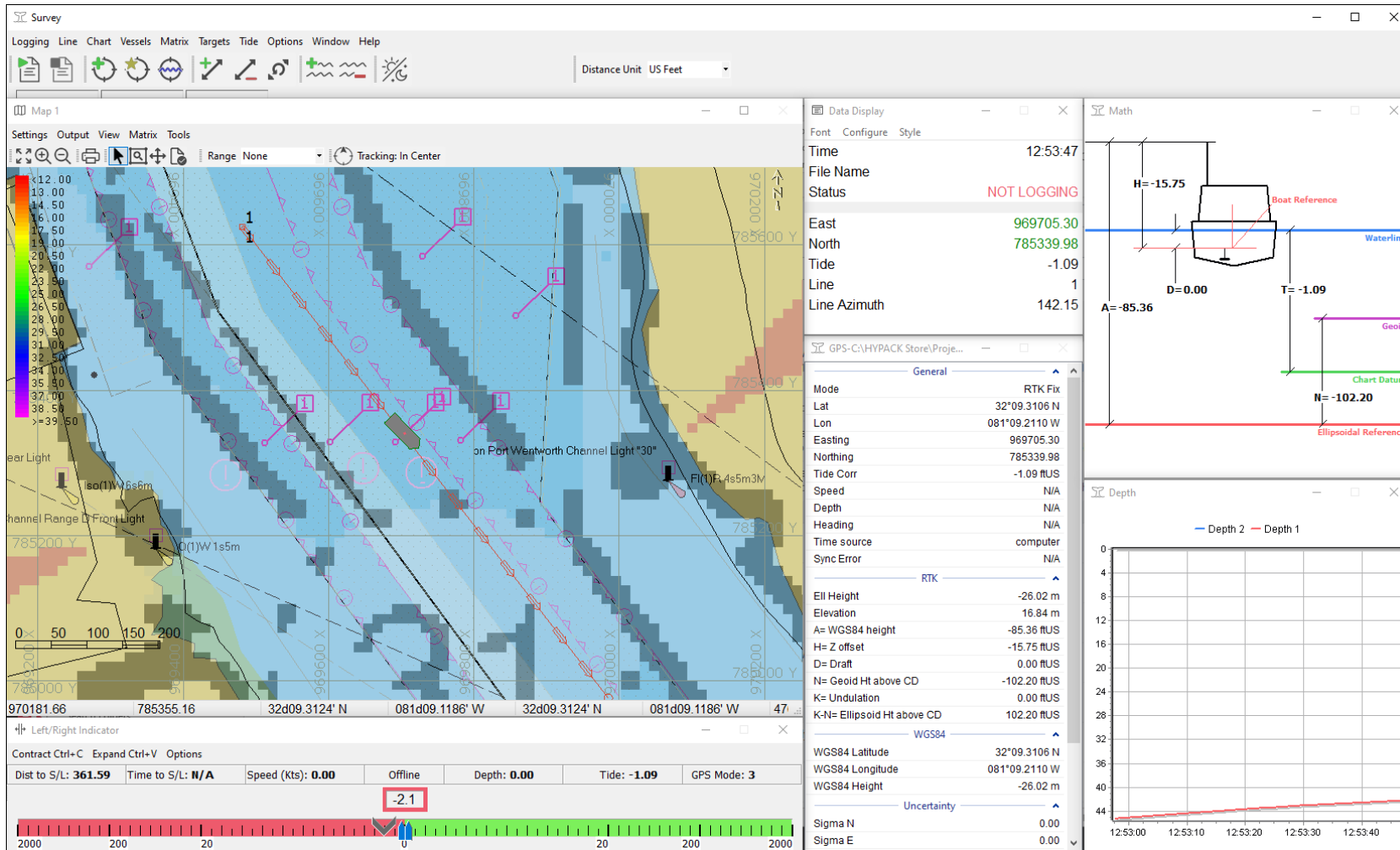


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# SBES – Collecting data



# New Survey Program for 2022!



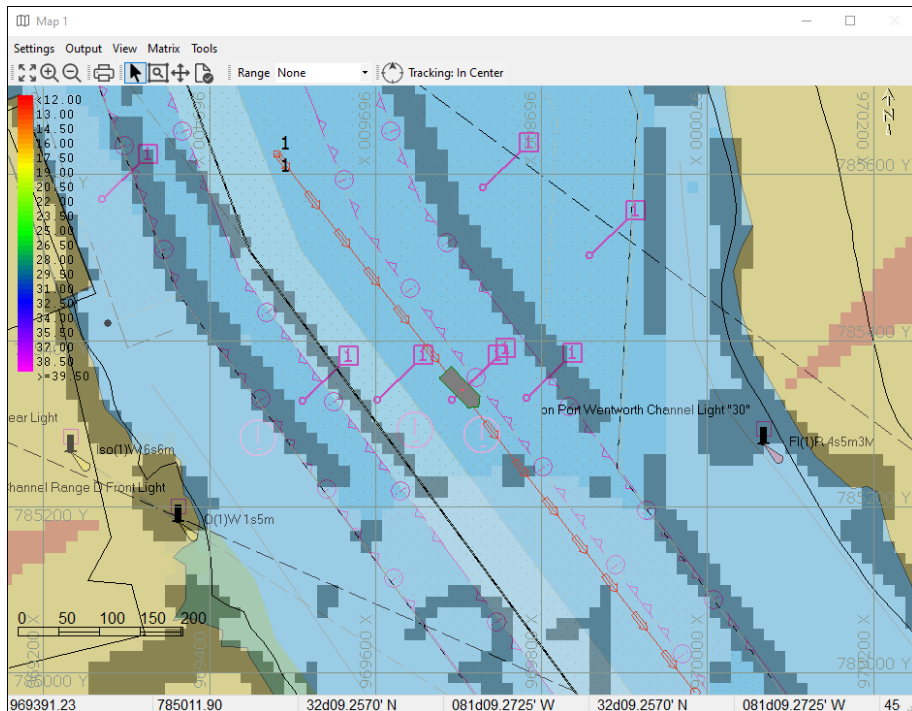
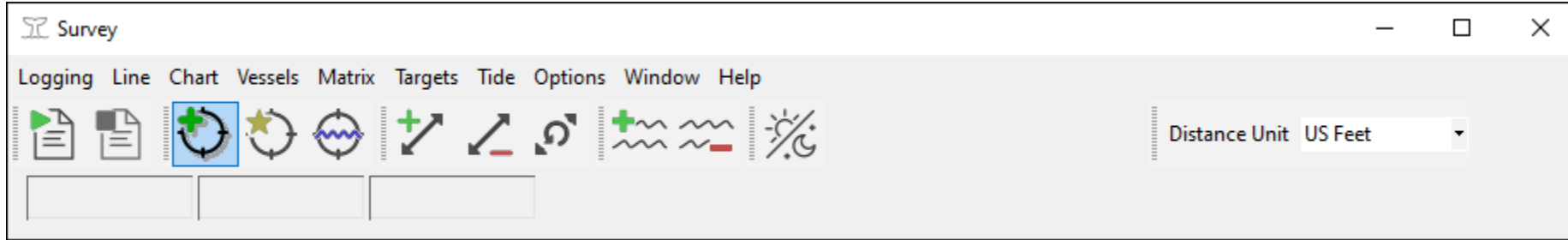
- Codename: RAD Survey
- Released as 'Beta' in 2021.
- New codebase makes it easier to make changes / updates.
- Modern icons.
- Same hot keys as 'classic' Survey.



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# Main Window



The **main window** is the control panel for HYPACK Survey. Access all settings dialogs, data displays, and driver windows from the menus. The primary buttons allow quick access to

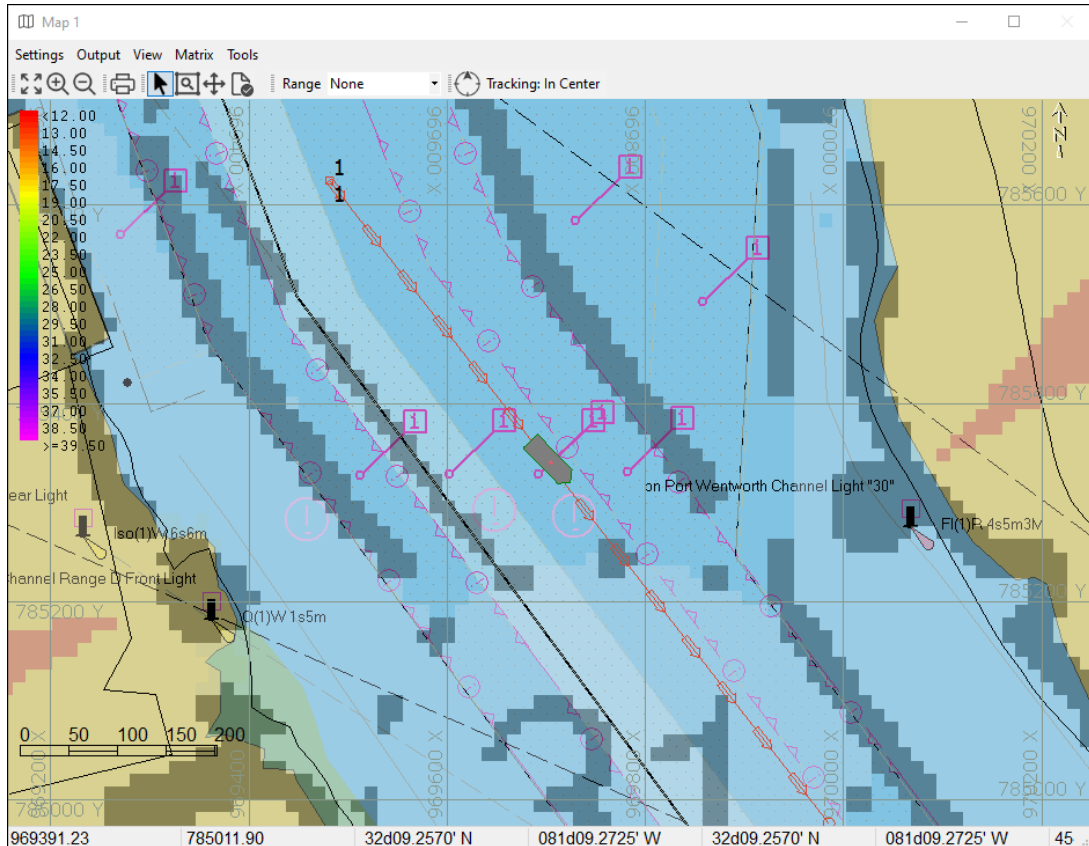
- Start & stop logging
- Select the active planned line
- Mark targets and set the tide correction
- And enable real-time data overlays like matrix coverage and side scan mosaicking.



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# Area Map Windows



The **area map** windows contain a plan view of your survey area.

The area map displays

- Background files active in the SHELL
- ECDIS Symbols for each configured mobile
- Overlaid grids
- Planned lines
- Targets
- Channels
- Matrix files
- And more...

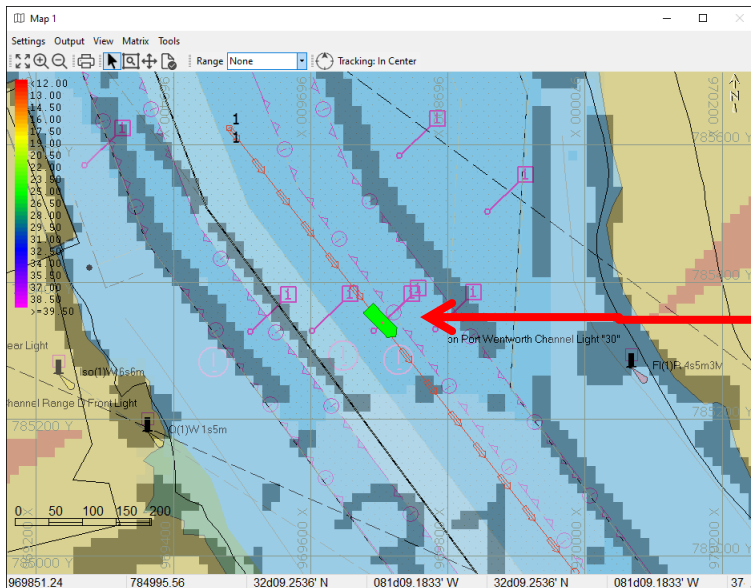
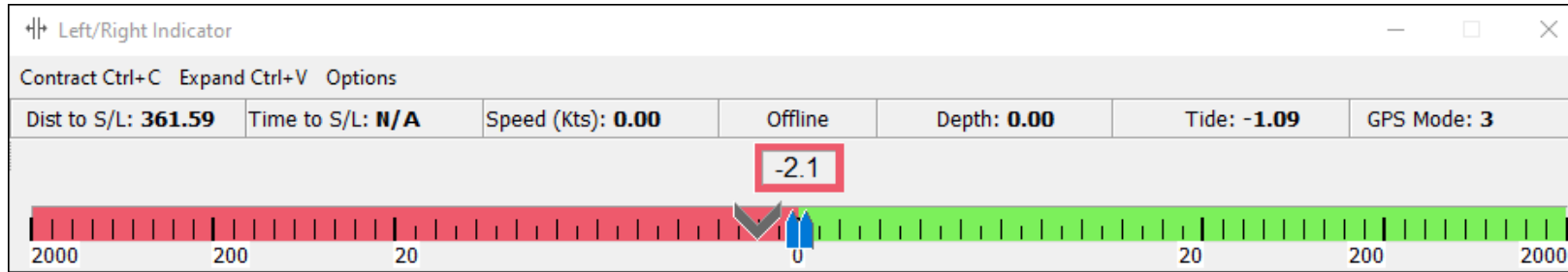


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# Left-right Indicator Windows



The **left-right indicator** windows only appear when you have planned lines loaded. They show the **position of the main vessel relative to the planned survey line**, as well as certain information of particular interest to the helmsman.

In this example, the helmsman is following the planned line closely. He is less than a foot off line.



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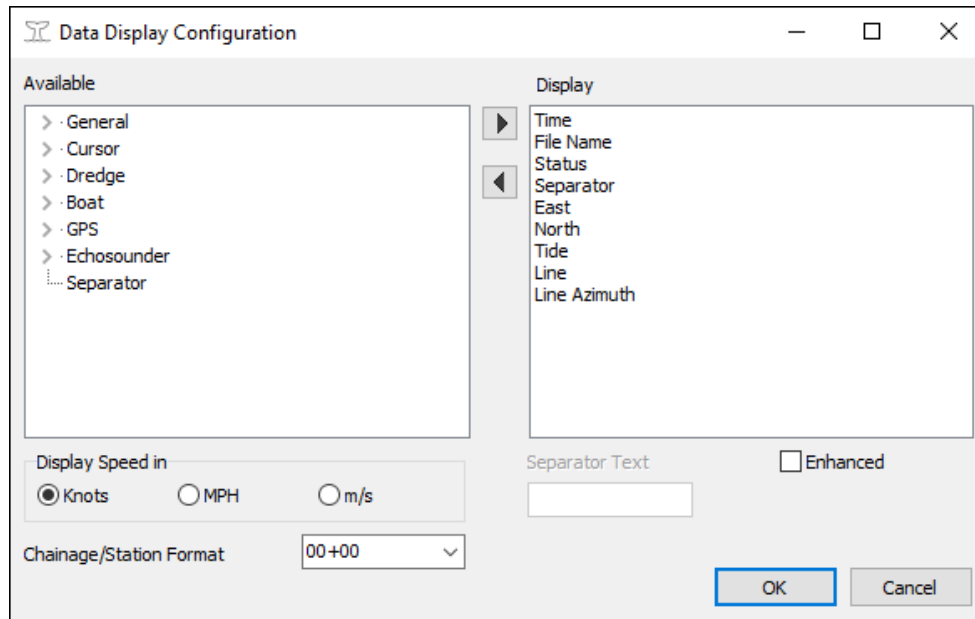
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# Data Display Windows

The **data display** windows show **textual information** about the survey or dredge project.

Select the items to display, their font, and the style of the display. Survey will restore the items and font in the same way when the program is restarted.

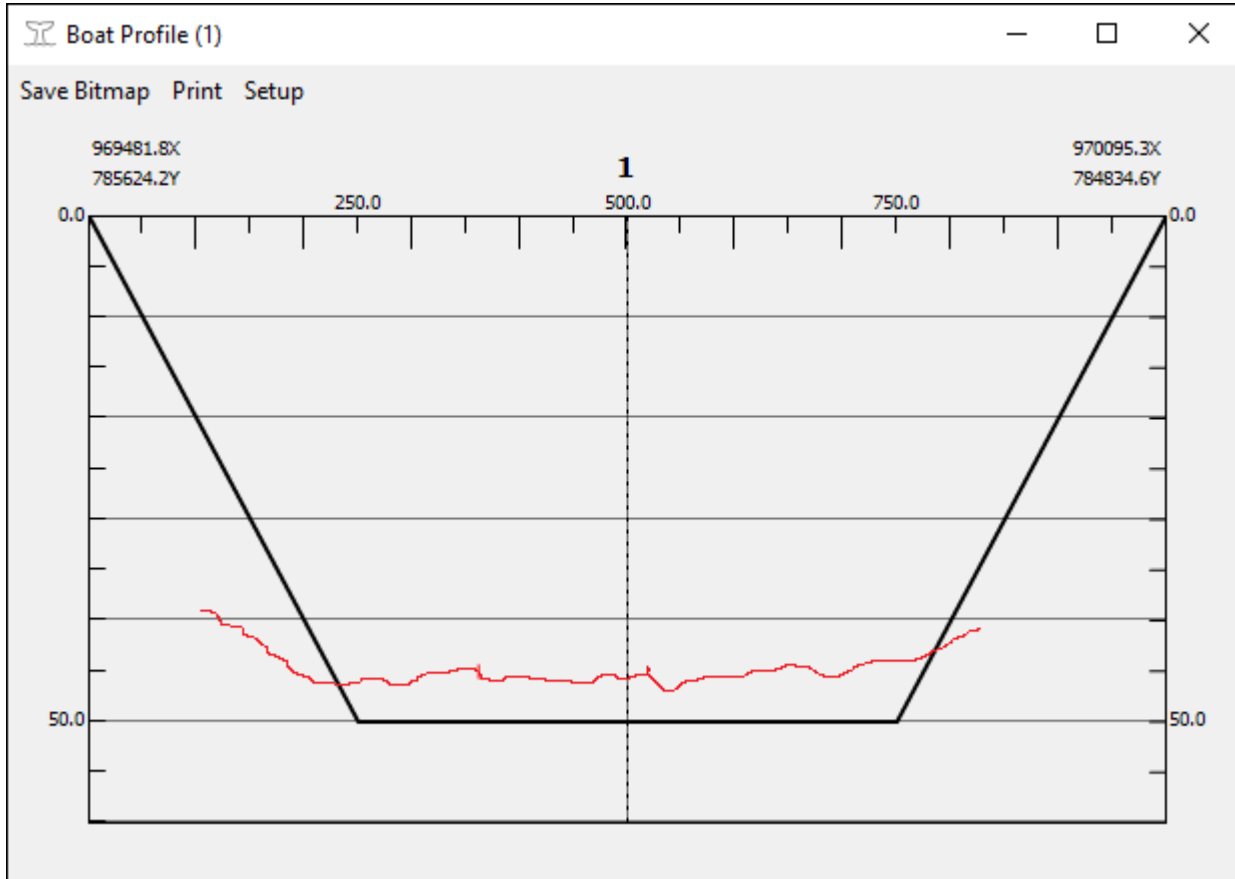


The screenshot shows the 'Data Display' window with a table of data. A red box highlights the 'Configure' button in the top right corner. A red arrow points from this box to the 'Data Display Configuration' dialog box. The table contains the following data:

Font	Configure	Style
Time		14:18:25
File Name		
Status		NOT LOGGING
East		969705.30
North		785339.98
Tide		-1.09
Line		1
Line Azimuth		142.15



# Boat Profile Window



The **profile window** shows a **cross section view** of the entire planned survey line.

If the planned line contains template points or a separate channel plan is loaded, this information will be overlaid on the depth graph.

When a new planned line becomes active, the profile will update accordingly.



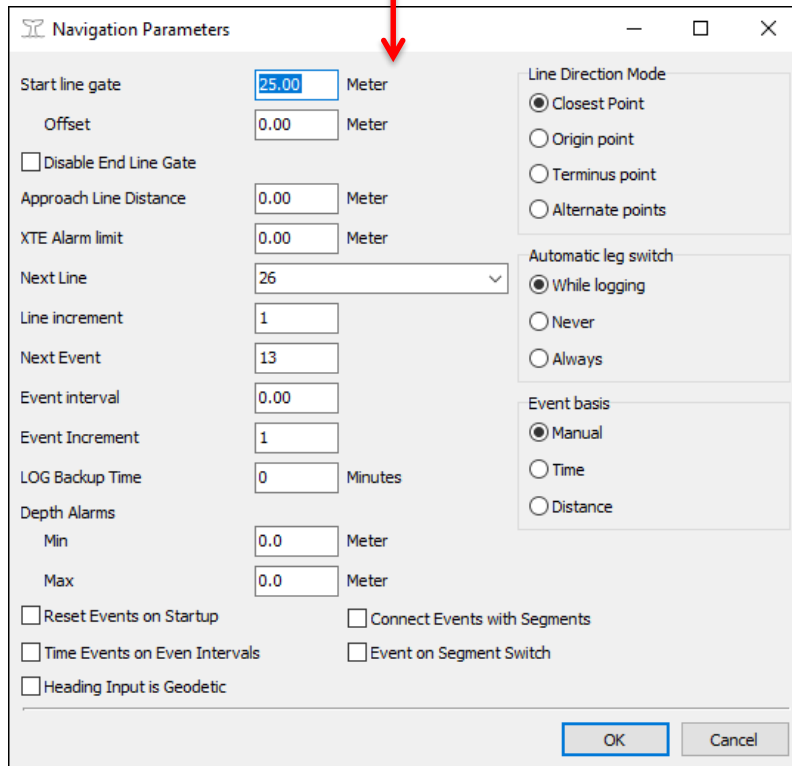
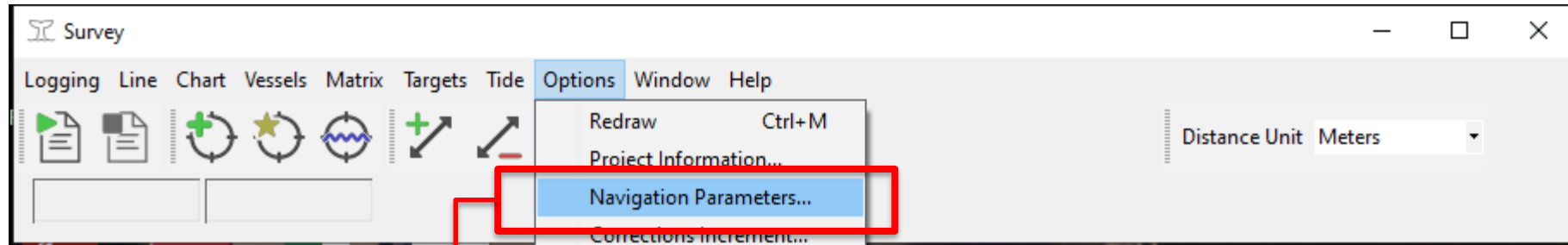
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# Navigation Parameters



# Navigation Parameters



The Navigation Parameters dialog in Survey provides options to

- Automate planned line navigation
- Customize data logging
- Configure backups
- Configure depth alarms
- Set event markers



# Navigation Parameters - Start Line Gates

Navigation Parameters

Start line gate  Meter

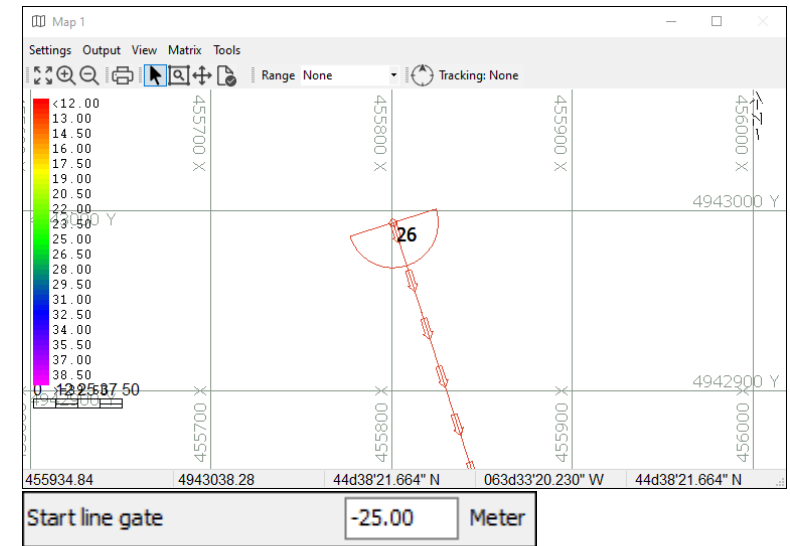
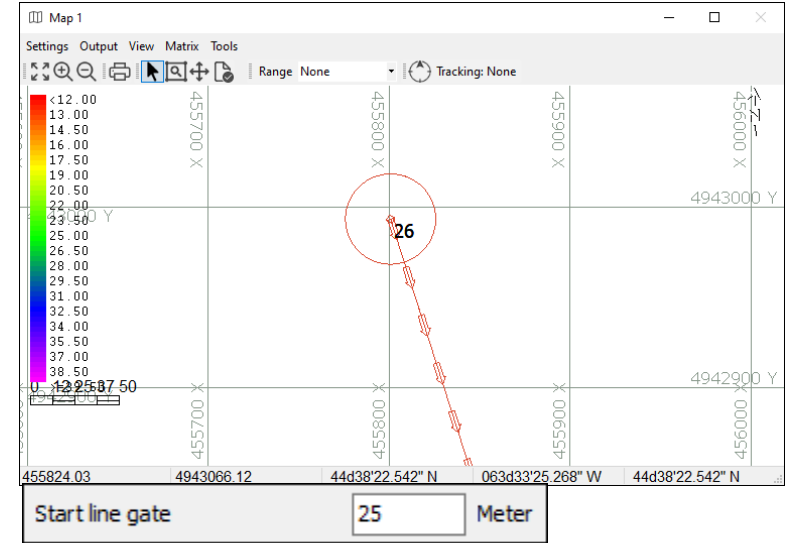
Offset  Meter

Disable End Line Gate

A **line gate** specifies an area that, when entered, triggers a start or stop logging action.

- **Gate = 0** — Gate is disabled.
- **Gate > 0** — Go on-line when vessel breaks into circle with radius = gate.
- **Gate < 0** — Go on-line when vessel breaks inward semi-circle with radius = |gate|.

**Offset** — Moves the gate up or down the line.



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# Across Track Error Alarm

## Across Track Error (XTE)

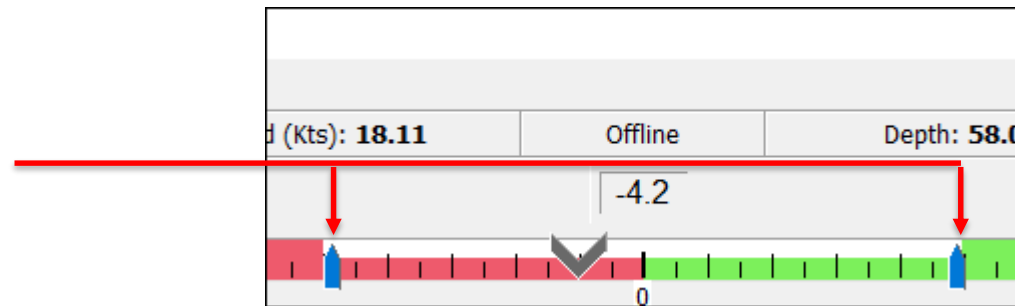
HYPACK Survey will generate an “XTE” alarm if the tracking point moves outside of the limit specified in Navigation Parameters.

The limit is relative to the active planned line.

Setting the limit to zero disables the alarm.

Moving the sliders on the LR Indicator also adjusts XTE.

Approach Line Distance	0.00	Meter
XTE Alarm limit	20	Meter
Next Line	26	



# Event Marks

Navigation Parameters

Start line gate: -25.00 Meter

Offset: 0.00 Meter

Disable End Line Gate

Approach Line Distance: 0.00 Meter

XTE Alarm limit: 20.00 Meter

Next Line: 6

Line increment: 1

Next Event: 14

Event interval: 0.00

Event Increment: 1

LOG Backup Time: 0 Minutes

Depth Alarms: 0.0 Meter

Line Direction Mode

- Closest Point
- Origin point
- Terminus point
- Alternate points

Automatic leg switch

- While logging
- Never
- Always

Event basis

- Manual
- Time
- Distance

**Next event** — The next event number to use.

**Event interval** — The time in seconds or the distance along line in grid units between events.

**Event increment** — The number added to the prior event number to generate the next number.

**Manual** — Make event marks at start/end of line and manually (CTRL-N).

**Time** — Make event marks at start/end of line and every  $n$  seconds.

**Distance** — Make event marks at start/end of line and every  $n$  grid units along the planned line.



# Line Information

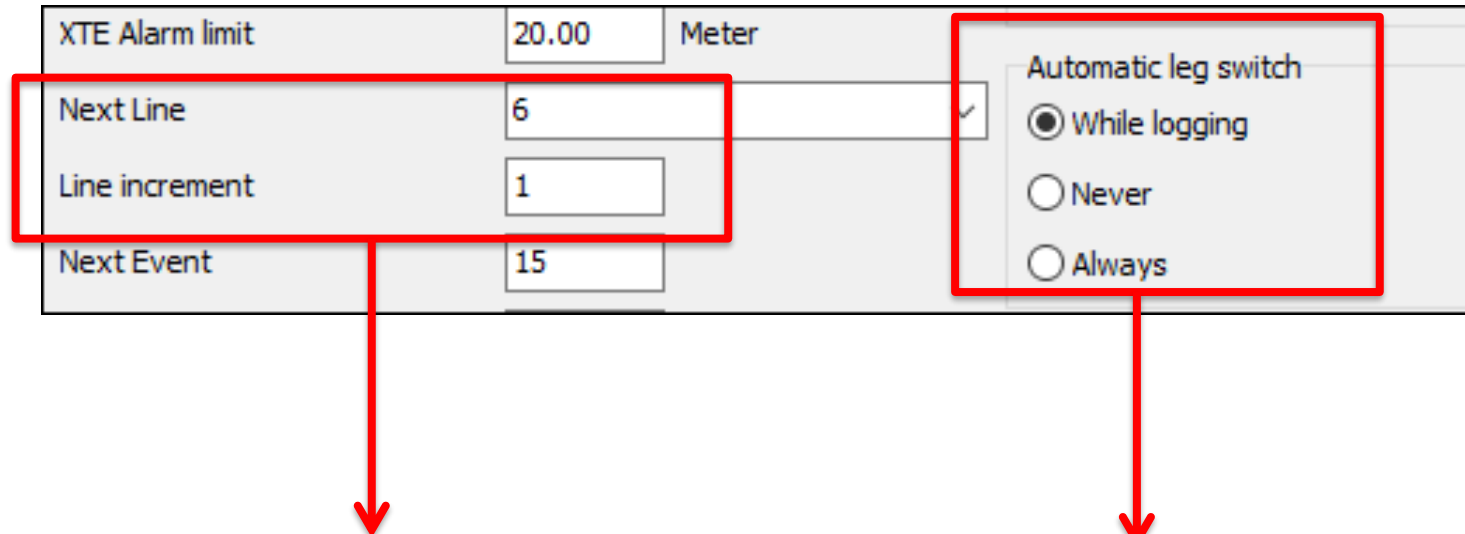
XTE Alarm limit	20.00	Meter
Next Line	6	<input checked="" type="checkbox"/>
Line increment	1	
Next Event	15	

Automatic leg switch

While logging

Never

Always



**Next line** — The name or number of the next line to be run.

**Line increment** — The number of lines to move down the line queue when selecting the next line.

- If = 1, sequence = 1, 2, 3, 4
- If = 3, sequence = 1, 4, 7, 10
- If = -2, sequence = 9, 7, 5, 3

**While logging** — Select the most appropriate segment of the active line only while logging.

**Always** — Always auto-select active leg.

**Never** — Survey never changes line segment. User must use CTRL-B & CTRL-F.





# Other Options

Event Increment	<input type="text" value="1"/>	
LOG Backup Time	<input type="text" value="0"/>	Minutes
<b>Depth Alarms</b>		
Min	<input type="text" value="0.0"/>	Meter
Max	<input type="text" value="0.0"/>	Meter
<input type="checkbox"/> Reset Events on Startup		<input type="checkbox"/> Connect Event

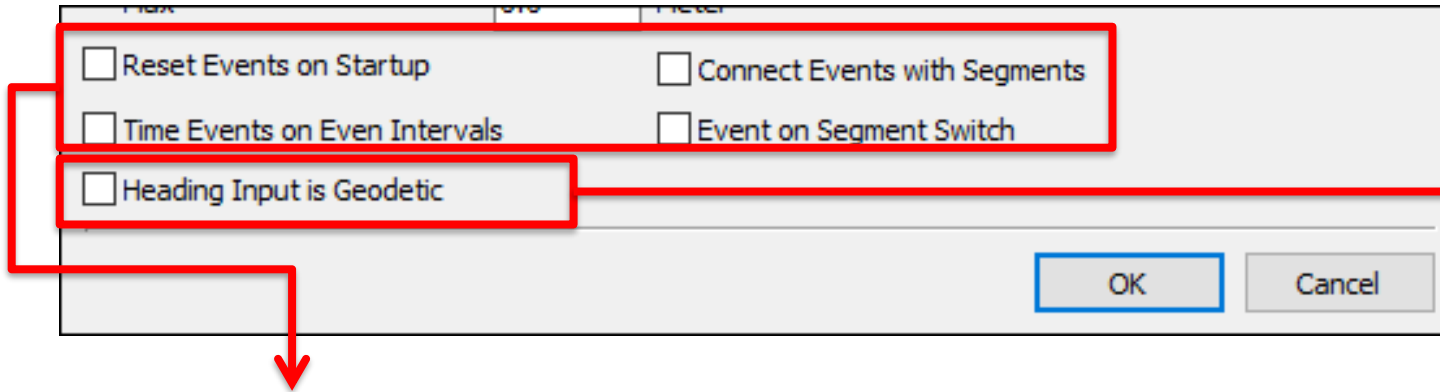
**LOG Backup Time** — Prevents large contiguous file sizes and protects data loss on long lines. Performs an immediate end line & start line.

**Depth Alarms** — Generates an alarm if the depth reported by the echosounder is less than the minimum value or greater than the maximum value. Set to 0 to disable an alarm.

**MTX Backup Time** — Moved to MATRIX – OPTIONS dialog..



# Other Options



**Reset Events** — If enabled, events will begin at 1 on startup. Otherwise, Survey will remember the last used event number.

**Even Intervals** — Event time will be adjusted to the specified event time interval.

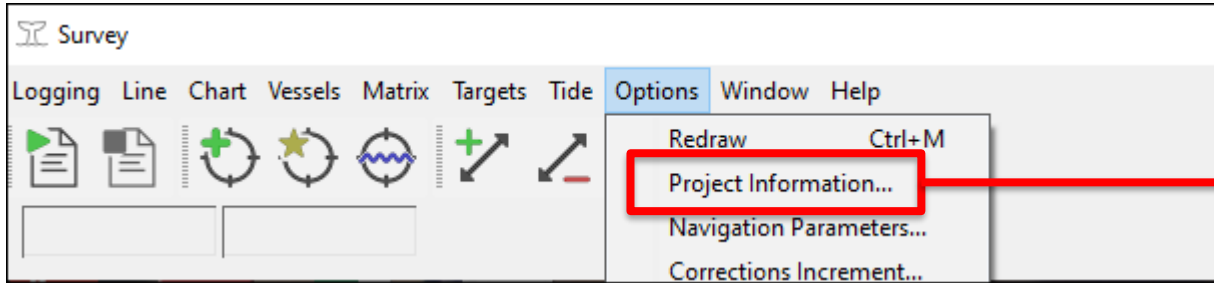
**Connect Events** — The Survey map will connect event marks with line segments.

**Events on Segment Switch** — Survey will generate an event at every waypoint of a multisegmented line.

**Geodetic Heading** — Survey will convert the input heading from geodetic to grid heading by applying the grid convergence and then use the grid heading for all computations on the grid.

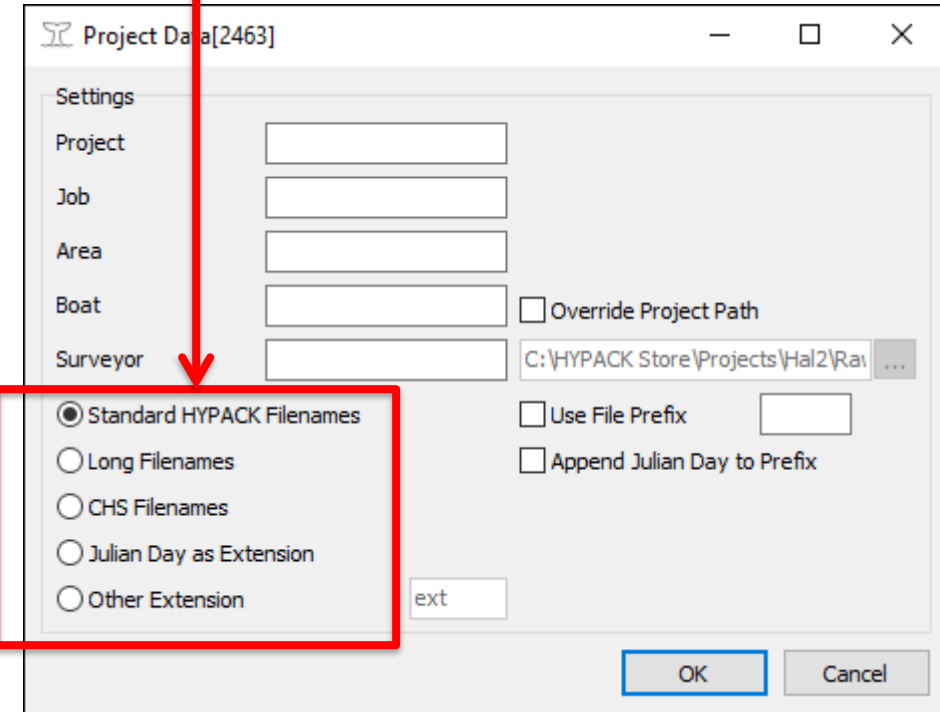


# Naming Schemes



HYPACK provides several naming convention options for data files.

Method	2D Lines	3D Lines	No Lines
<b>Standard</b>	002_1607.RAW	10P00.RAW	000_1607.RAW
<b>Long</b> (Vessel Name is NANCY)	2003NA0061607_2.RAW	2003NA0061607_2.RAW	2003NA0061607_0.RAW
<b>CHS</b>	2003NA0061607.RAW	2003NA0061607.RAW	2003NA0061607.RAW
<b>Julian</b> (Julian day is 006)	002_1607.006	10P00.006	000_1607.006
<b>Other</b>	002_1607.ADB	10P00.ADB	000_1607.ADB

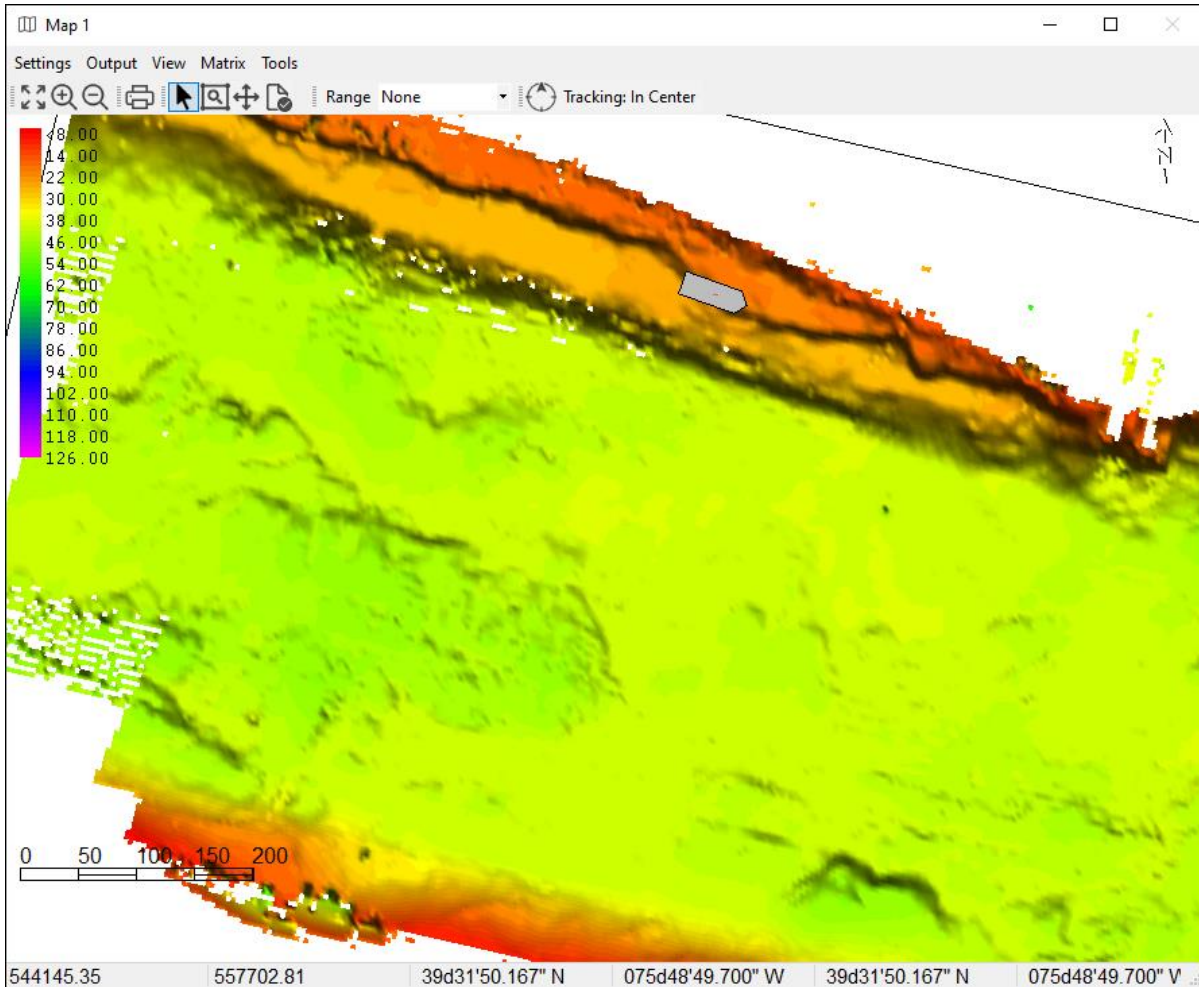


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# Matrix Files



# Matrices in HYPACK Survey



A HYPACK matrix (MTX) is a **gridded rectangular area** for recording depth information and other data during acquisition.

A matrix is used to:

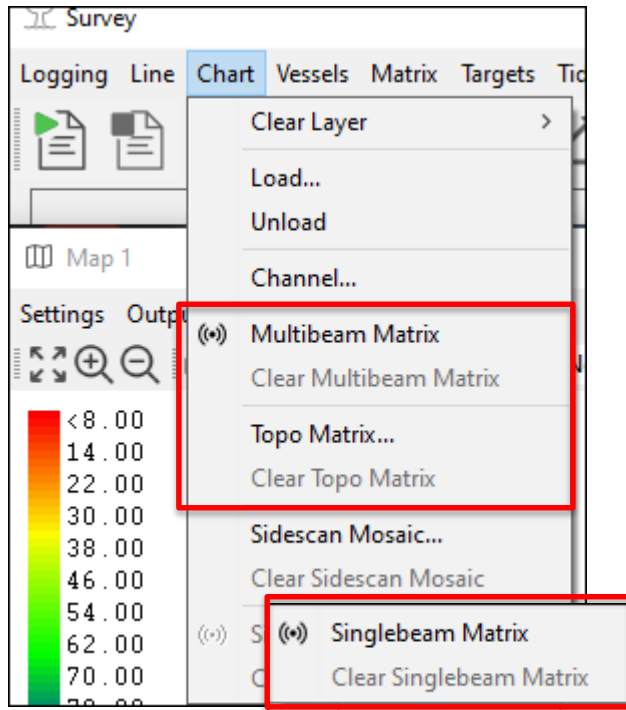
1. Track coverage
2. Calculate cell statistics for multibeam bathymetry
3. Display a real-time surface as data is logged.



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# Matrix Configuration Options

	SURVEY	DREDGEPACK	HYSWEEP
MTX File	✓	✓	✓
Auto MTX single beam	✓	✗	✗
Auto MTX multibeam	✓	✗	✗



User-defined MTX files will work with all HYPACK products, but their bounds need to be pre-defined.

HYPACK Survey can auto-generate a set of matrices, This option is available for multibeam, topographic LiDAR, and single beam data.

You cannot change method mid-survey.

Singlebeam Auto Matrix now available in HYPACK 2022!



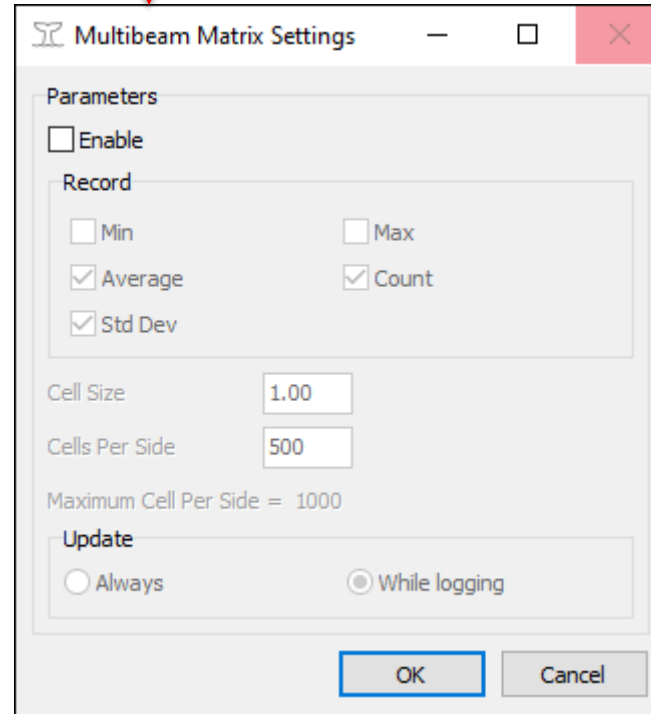
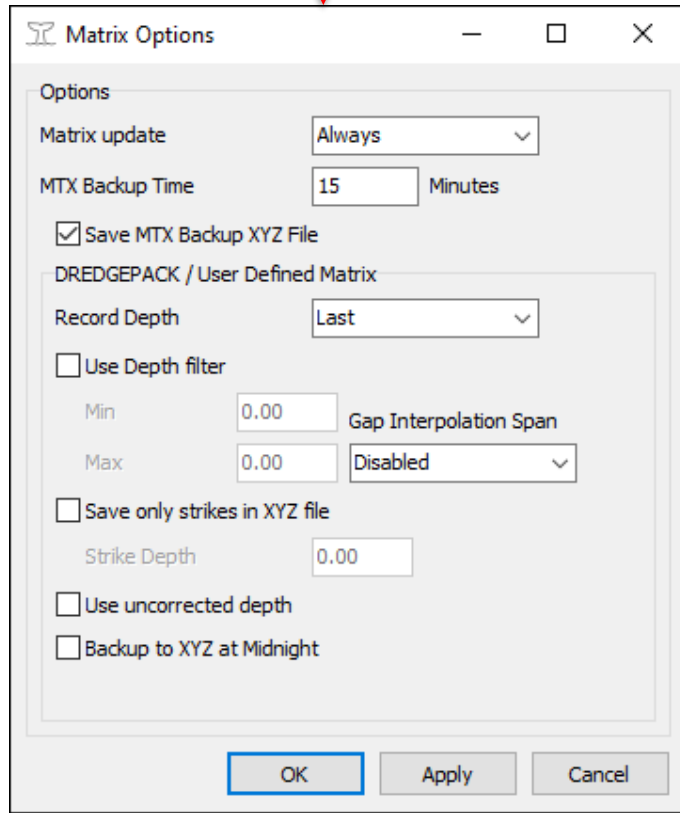
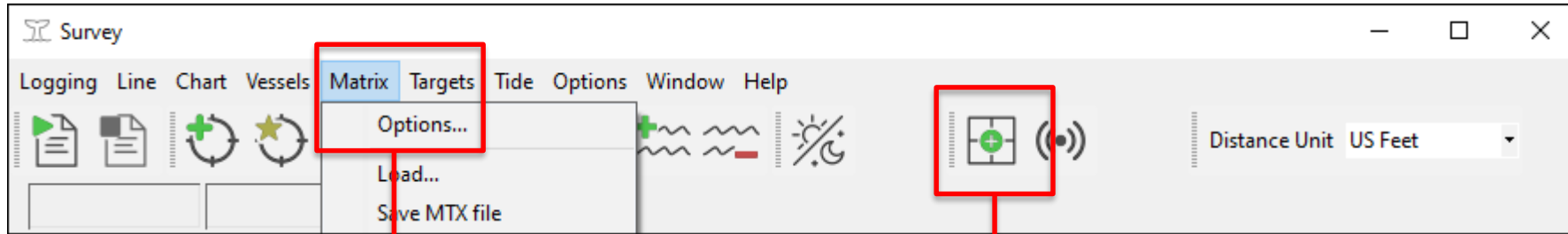
HYPACK 2022

# Programs That Can Use MTX Files

Program	Usage	Comments
<b>Matrix Editor</b>	Creates blank MTX files.	Make sure you designate usage in HYPACK or HYSWEEP!
<b>MAPPER</b>	Can fill MTX files with depths.	Does not 'infill' blank matrix cells.
<b>TIN Model</b>	Can fill MTX files with depths.	Can 'infill' blank cells on the interior of the model.
<b>HYPACK Survey</b>	Can update MTX files with depths.	Minimum, Maximum or Latest value. Corrected or Uncorrected depth.
<b>HYSWEEP</b>	Updates MTX with depths to show coverage.	Tracks minimum and maximum depth values in each cell. Tracks 100% or 200% for each cell.
<b>DREDGEPACK</b>	Updates MTX with depth of cutting tool.	Minimum depth for 'depth-based' projects. Maximum depth for 'elevation-based' projects.
<b>XYZ to MTX</b>	Automatically creates a filled MTX file.	TIN Model for Dummies.



# Configuring Matrix Options in HYPACK Survey





# Map Window: Matrix Display Options

The screenshot shows the HYPACK 2022 software interface. The main window displays a bathymetric map with a color-coded depth scale on the left. A context menu is open over the map, with the 'Display Options...' option highlighted. A red arrow points from this option to the 'Matrix' tab of the 'Display Options' dialog box. The dialog box has four tabs: 'Layers', 'Grid', 'Matrix', and 'Tracking/Orientation'. The 'Matrix' tab is active and contains the following settings:

- Options**
- Show:** Survey Depth (dropdown menu)
- Quick Draw
- Transparency:** A slider between 'Transparent' and 'Opaque'.
- Sun illuminated model:**
  - Enable
  - Gray
- Z Scale Factor:** 5.00
- Light Azimuth:** 20.00
- Light Incination:** 20.00

Buttons for 'OK', 'Apply', and 'Cancel' are at the bottom of the dialog box.

Each Map Window can display the matrix information differently according to the appearance settings dialog.

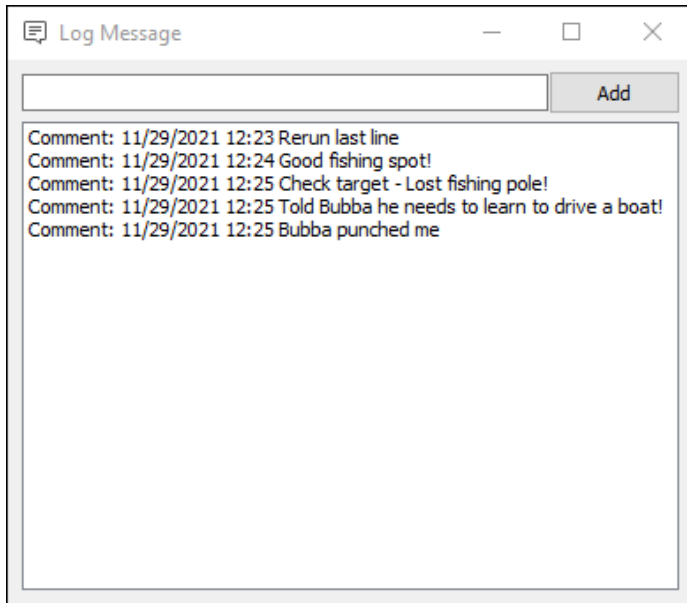
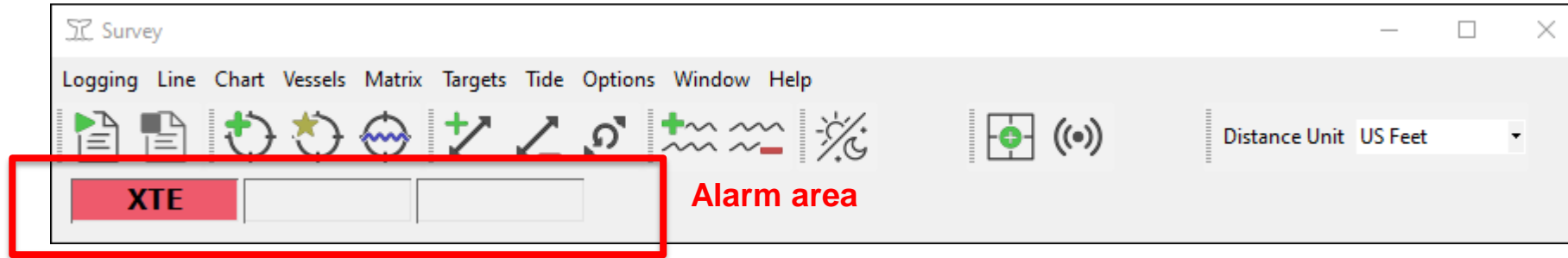
- Cell Depth
- Cell Hit Count
- Transparency
- Z Scaling
- Sun illumination



# Extended Information



# Comments and Alarms



The **comment** window allows the operator to [store text notes](#) in the project log. Comments can be referred to during the editing process.

**Alarm** conditions are reported on the bottom of the main window. An alarm sound will repeat until the ESC key is pressed. The alarm will be displayed until the condition is rectified.





# Anchor Handling

The screenshot displays the HYPACK 2022 software interface. On the left is a map window titled 'Map 1' showing a yellow landmass with several anchor markers labeled 'West 1', 'West 2', 'North 1', 'North 2', 'South 1', and 'South 2'. A red crosshair is visible on the map. On the right is the 'Boat Anchor Manager' window, which contains a table of anchor data and several control buttons.

Anchor	Status	Marker X	Marker Y	Radius	Floats
■ West 1	Racked	N/A	N/A	N/A	N/A
■ West 2	Racked	N/A	N/A	N/A	N/A
■ North 1	Racked	N/A	N/A	N/A	N/A
■ North 2	Racked	N/A	N/A	N/A	N/A
■ South 1	Racked	N/A	N/A	N/A	N/A
■ South 2	Racked	N/A	N/A	N/A	N/A

Buttons in the Boat Anchor Manager window include: Drop, Raise, Drop at Target, Targets (dropdown menu showing 12:43:11), Place on Tug, Tug Boats (dropdown menu showing None), Drop at Marker, and Edit Anchor.

The Anchor Manager window is accessed from the Vessels window.

From this window, you can drop and raise anchors and transfer them to other mobiles (support vessels).

You can also place floats on anchor wires or radius circles about dropped anchors.



On an anchor or marker to drop or raise it.

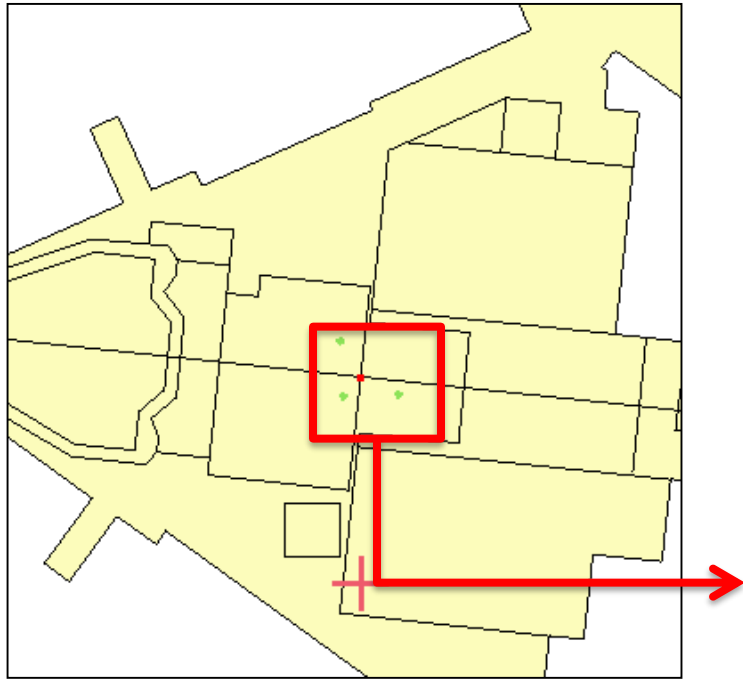


Click and drag an anchor to set a **marker**.  
Markers are planned anchor positions before deployment.



# Multiple Position Sensors Per Mobile

Name	X	Y	DX	DY	NSat	HDOP	ElipH
Current Position	1095284.7	3014243.8					
<input checked="" type="checkbox"/> GPS 1	1095284.7	3014243.8	0.0	0.0	7	1.200	-1.5
<input type="checkbox"/> GPS 2	1095304.7	3014244.4	-20.1	-0.6	7	1.200	-1.5
<input type="checkbox"/> GPS 3	1095283.7	3014263.9	1.0	-20.1	7	1.200	-1.5



HYPACK Survey allows you to assign multiple positioning sensors to a mobile.

The Boat Multi Position window is used to select one or more sensors to determine the final vessel position. If multiple sensors are selected, an average position is calculated.

The **green** dots show the three GPS positions.  
The **red** dot denotes their average.



HYPACK 2022



# Remote Viewing (New!)

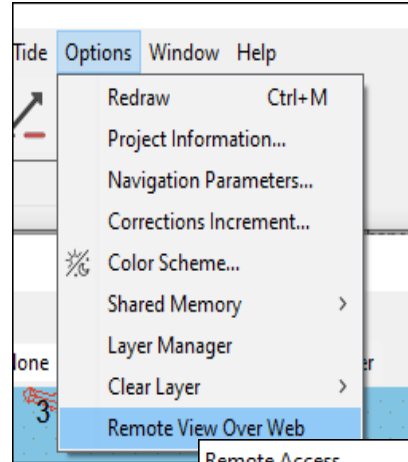
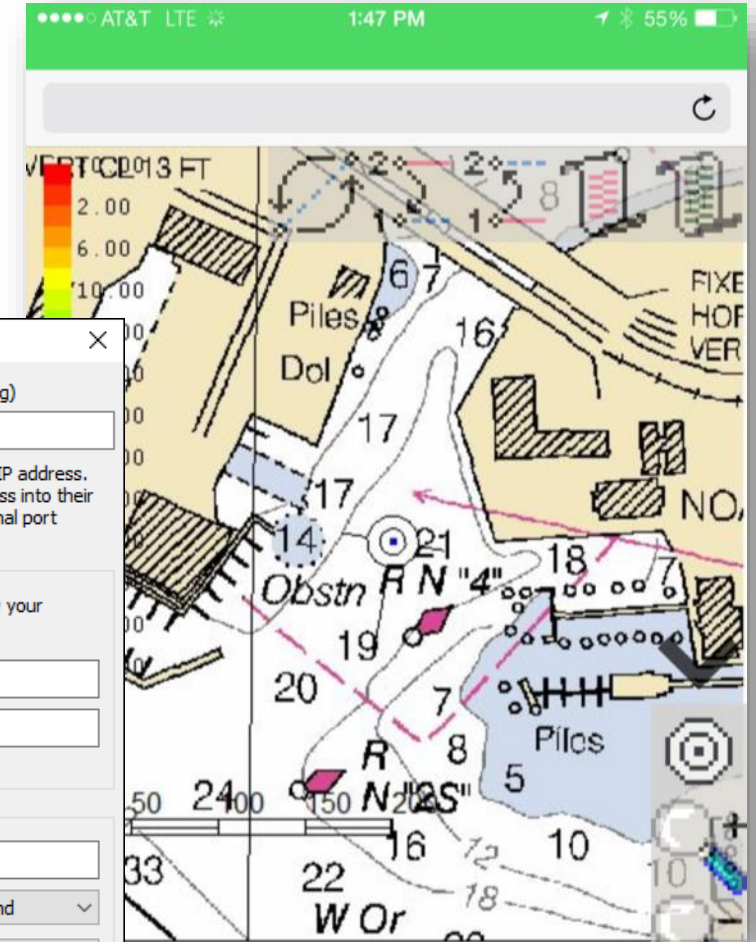
Observe & interact with HYPACK Survey using remote view tools

- View vessel position
- Manually control logging

Use any web enabled device

- smartphones, tablets, computers

Controlled access and secured views

A screenshot of the 'Remote Access' dialog box in HYPACK. The 'Enable Remote Access (test before surveying)' checkbox is checked. The 'Internal port number' is set to 4972. The 'Remote Credentials' section has 'Username' and 'Password' both set to 'admin'. The 'Allow remote users to start/stop logging' checkbox is unchecked. The 'Performance' section has 'Maximum simultaneous users' set to 4, 'Remote refresh rate' set to 'Once per second', 'Image quality' set to 'High', and 'Max image size' set to '800x600'. 'OK' and 'Cancel' buttons are at the bottom.

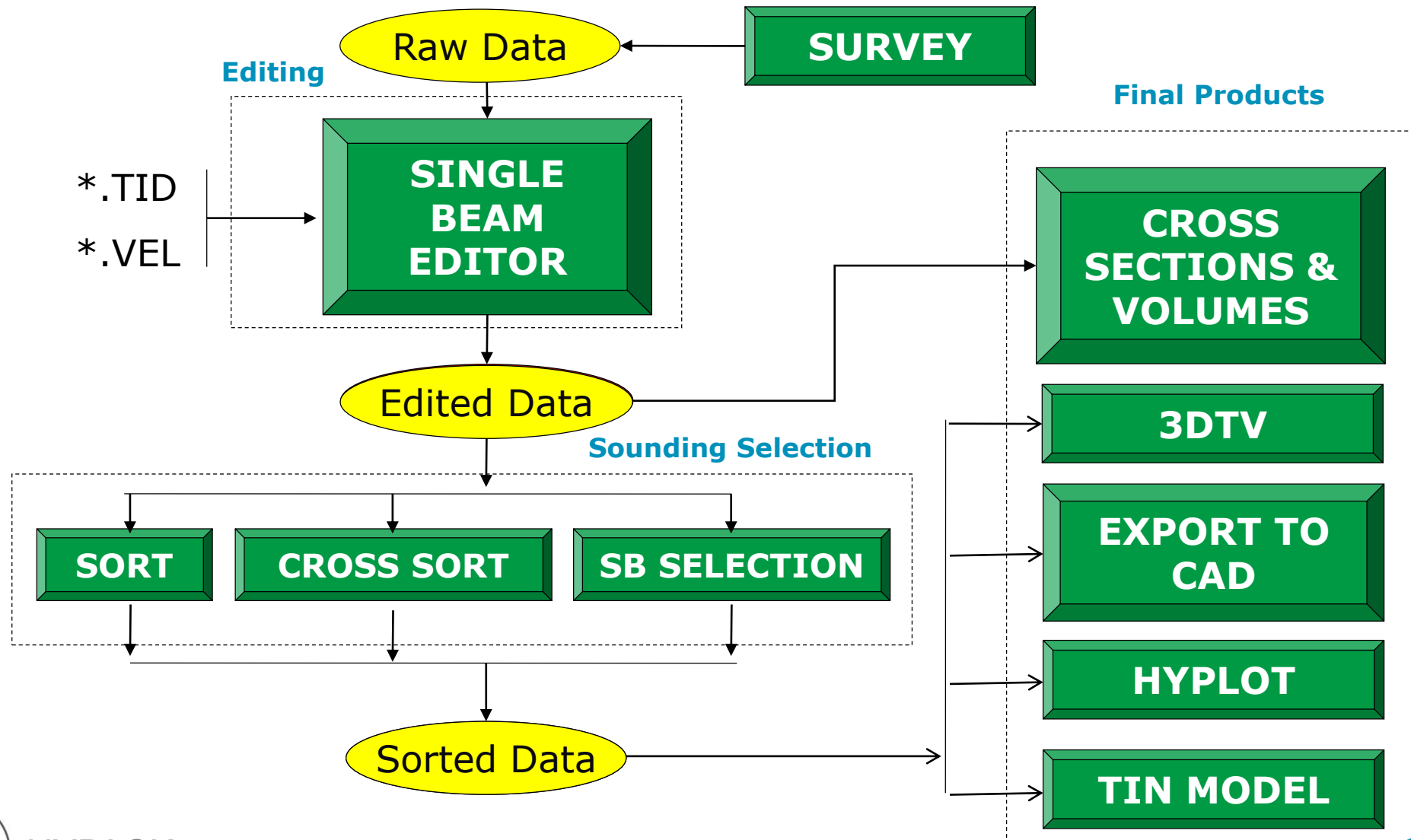
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# SBES - Processing Data





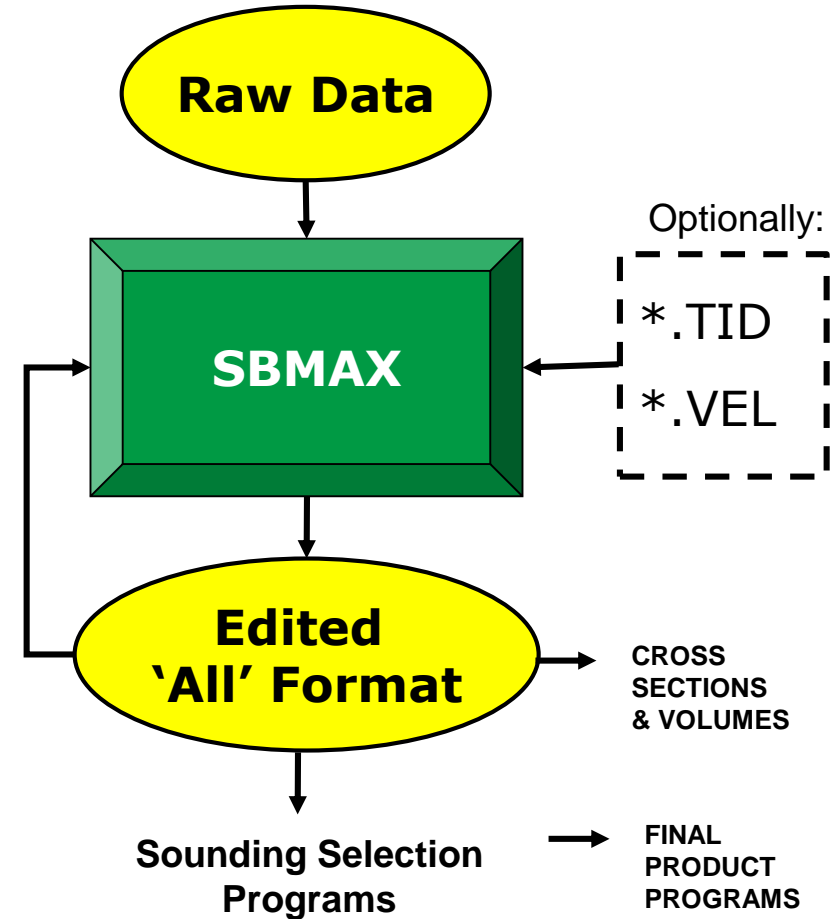
# Single Beam Editing Flow



# Single Beam Editor (SBMAX)

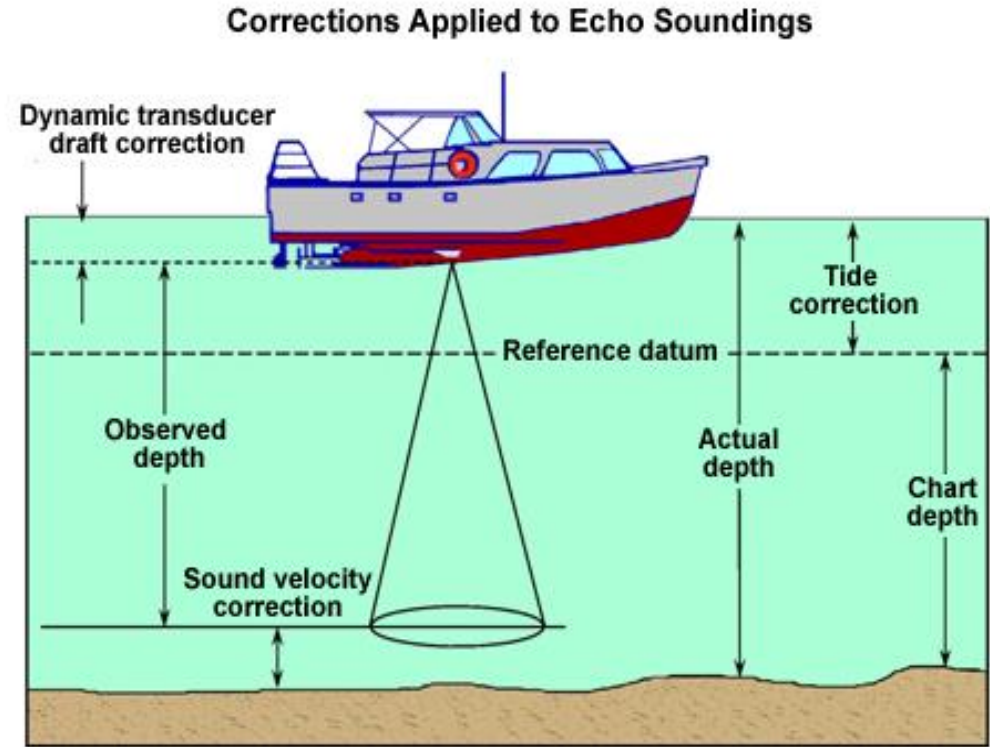
- Based on the time of the depth measurement, SBMAX interpolates:
  - Position
  - Tide
  - Draft
  - Sound Velocity
  - Heave-Pitch-Roll
- Eliminate or Smooth Positions.
- Eliminate or Smooth Depths.
- Save each depth with associated position and corrections.

You can process your data in SBMAX with predicted tides (or no tides). When you get your final tides, you can load the processed data back into SBMAX and insert the final tides.



# Corrections to Soundings

- Static / Dynamic Draft
- Motion Reference Units
- Sound Velocity
- Tide \ Water Level



NOAA



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# Single Beam Editing – 64 Bit





# SBMAX64 Highlights

Uses HYSWEEP HS2x format for saved data. (Same dataformat as Multibeam data)

What you can do now (that you couldn't before):

- Recalculate RTK Tides from edited data.
- Properly adjust device offsets of edited files.
- All raw data available for every sounding.

More Sonar Options Without a HYSWEEP Key

- Multiple Transducer Systems.
- Sontek M9/HydroSurveyor ADCP/Multibeam.

Change Read Parameters any time during Editing

- Don't need to reload to fix a mistake.

Common User Interface With MBMAX64 Multibeam Editor

- No need to learn two edit programs.
- Modernizes single beam editing.
- Edit all lines at once in the Survey Window.



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# Data Flow

## Reads:

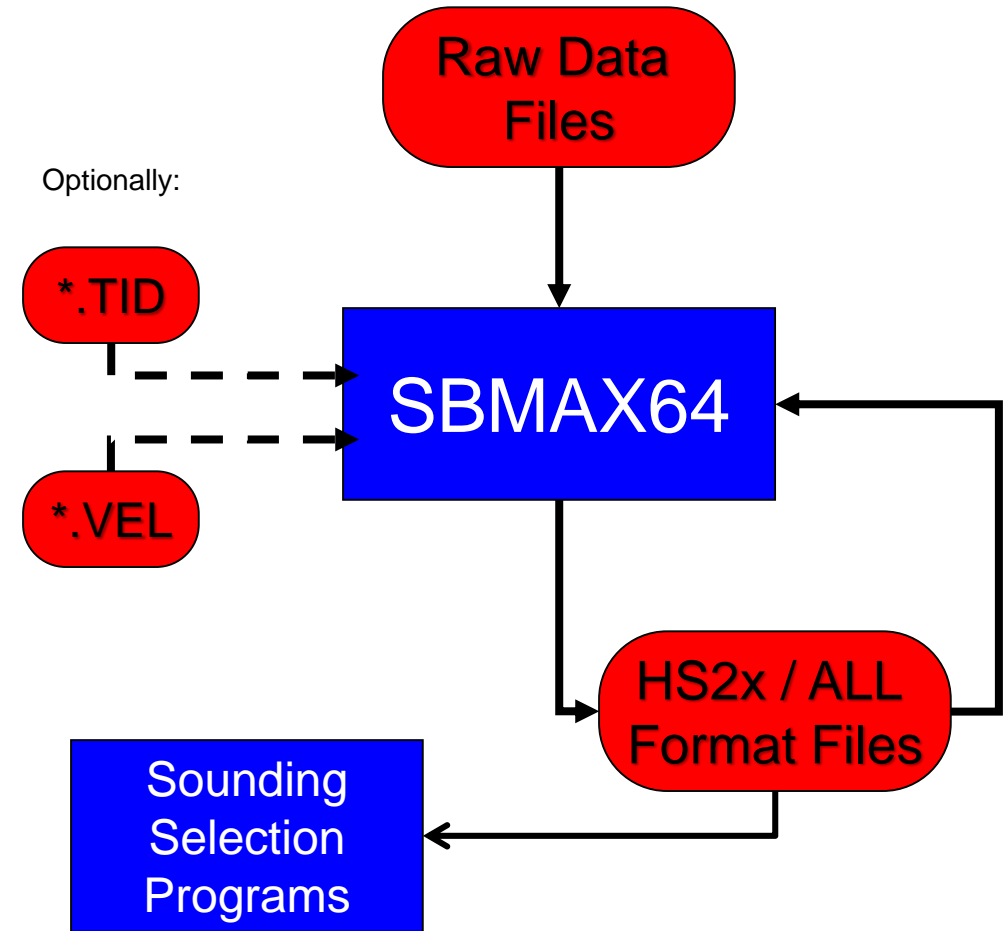
- Raw Data Files
- HS2x Edited Single Beam Files
- ALL2 Format Data Files
- Old ALL Format Data Files

## Applies (optionally):

- Tide Correction Files
- SV Correction Files

## Saves:

- HS2x Format Files (Default)
- ALL2 Format Data Files (Export)
- XYZ Format



Read a single file, selected files from a \*.LOG, or the entire \*.LOG file.

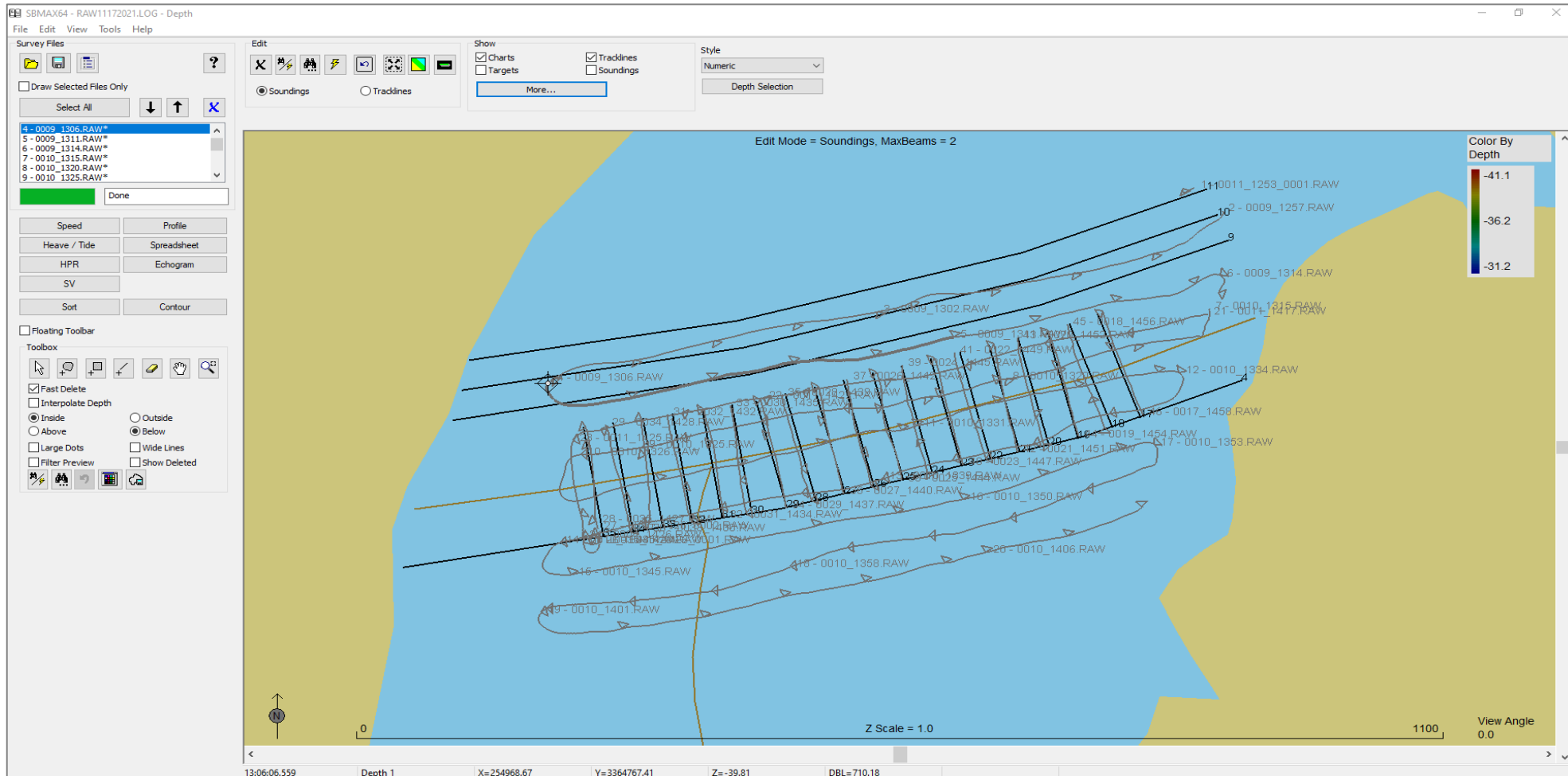


# SBMAX64 Layout

Top Panel: Mostly Applies to the Survey Window and Data.

Left Panel: Applies to All Windows and Data

Survey Window: Tracklines or Soundings.



Status Bar: Point Data and Measurement Between Points.



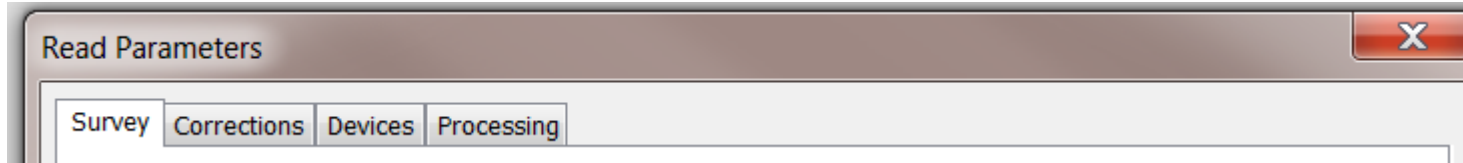
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# Read Parameters

## Everything Required to Process the Data



Tabs:

- Survey: Applies to all loaded files.
- Corrections: Tide, Sound Velocity and Dynamic Draft.
- Devices: Device Selections and Offsets.
- Processing: Heave and Sonar Settings.

In SBMAX64: Any of the Read Parameters can be updated *After Files are Loaded!*



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# Survey Tab

## Summary of Survey Info

- Depth or Elevation: [Select Your Work Mode.](#)
- Details: [Click to see additional survey information.](#)
- TPU: (Future) [Calculate Total Propagated Uncertainty of each Sounding.](#)
- Depth Conversion, etc.: [To be used as needed.](#)

Read Parameters

Survey Corrections Devices Processing

Survey

Depth Mode  Elevation Mode

09:22:16 07/10/2012

Project 1 | Area 1 | Boat 1 | Surveyor 1 |

Details

TPU

Calculate TPU

Accuracy Standard

Not Specified

TPU Editor...

Reload TPU

Depth Conversion

None

Snap to Line

Invert Tide Values

Ignore Depth Records Before First Event

Ignore Planned Line Information

Ignore Echogram



# Processing Tab, Heave

Select All Files

Select Survey Files Before Making Changes

400P00.RAW  
405P00.RAW  
410P00.RAW  
415P00.RAW  
420P00.RAW  
425P00.RAW  
430P00.RAW

**Heave**

- Apply Heave Correction
- Correct Induced Heave
- Remove Heave Drift

**RTK Tides**

- Avoid Double Heave
- Average Tide Data to Remove Heave  
Averaging Period (Seconds)
- Merge Tide Data with Heave

**Single Beam**

- Apply Pitch and Roll Corrections
- Steer Sounding Beam  
Transducer Beam Width in Degrees

Default Values

- **Apply Heave Correction:** Use Heave Correction From MRU.
- **Correct Induced Heave:** Required When MRU is Not Mounted at Boat Reference.
- **Remove Heave Drift:** Apply Averaging to “Fix” Heave Drift.
- **Avoid Double Heave:** When RTK Tide and MRU Both Measure Heave.
- **Average to Remove Heave:** Use Averaging to Remove Heave From RTK Tide.
- **Merge Tides With Heave:** Use Heave to Fill Gaps Between RTK Tide Points.



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# Correction of Heave Drift

The image displays two screenshots from the HYPACK software interface. The top screenshot, titled 'Heave Window', shows a plot of 'Heave Corr' with a red line that is significantly off-center, labeled 'Heave Drift NOT Removed'. The bottom screenshot shows the 'Read Parameters' dialog box with the 'Correct Induced Heave' option checked and highlighted by a green box. Below this, a red text box states: 'Heave values can drift 'off-center' due to rapid accelerations or changes of direction.' The bottom screenshot also shows a plot of 'Heave Corr' where the red line is centered, labeled 'Heave Drift Removed'.

Heave Window  
18:22:50.03 Heave Corr: -0.0  
Heave Corr  
1.0  
Heave Drift NOT Removed  
18:25:48

Read Parameters  
Survey Corrections Devices Processing  
Select All Files Select Survey Files Before Making Changes  
012\_1502.RAW  
016\_1510.RAW  
020\_1517.RAW  
024\_1525.RAW  
028\_1531.RAW  
031\_1539.RAW  
Heave  
 Apply Heave Correction  
 Correct Induced Heave  
 Remove Heave Drift  
RTK Tides  
 Avoid Double Heave  
 Average Tide Data to Remove Heave  
Averaging Period (Seconds) 30  
 Merge Tide Data with Heave  
Single Beam  
 Apply Pitch and Roll Corrections  
 Steer Sounding Beam  
Transducer Beam Width in Degrees 5  
Default Values  
OK Cancel Apply  
Heave Drift Removed  
18:25:48

Heave values can drift 'off-center' due to rapid accelerations or changes of direction.



# Processing Tab, Single Beam

The screenshot shows the 'Processing' tab in HYPACK 2022. On the left, a list of survey files is shown, with '400P00.RAW' through '430P00.RAW' selected. The main area contains several configuration sections:

- Heave:**
  - Apply Heave Correction
  - Correct Induced Heave
  - Remove Heave Drift
- RTK Tides:**
  - Avoid Double Heave
  - Average Tide Data to Remove Heave
    - Averaging Period (Seconds): 120
  - Merge Tide Data with Heave
- Single Beam (highlighted in red):**
  - Apply Pitch and Roll Corrections
  - Steer Sounding Beam
    - Transducer Beam Width in Degrees: 5

A 'Default Values' button is located at the bottom of the settings area.

Apply Pitch and Roll Corrections: Use Corrections from the MRU to calculate transducer draft change.

Steer Sounding Beam: Use pitch and roll corrections to steer the beam. Otherwise depth is considered directly below the transducer. More in the next slide.

Transducer Beam Width in Degrees: From manufacturers specs.

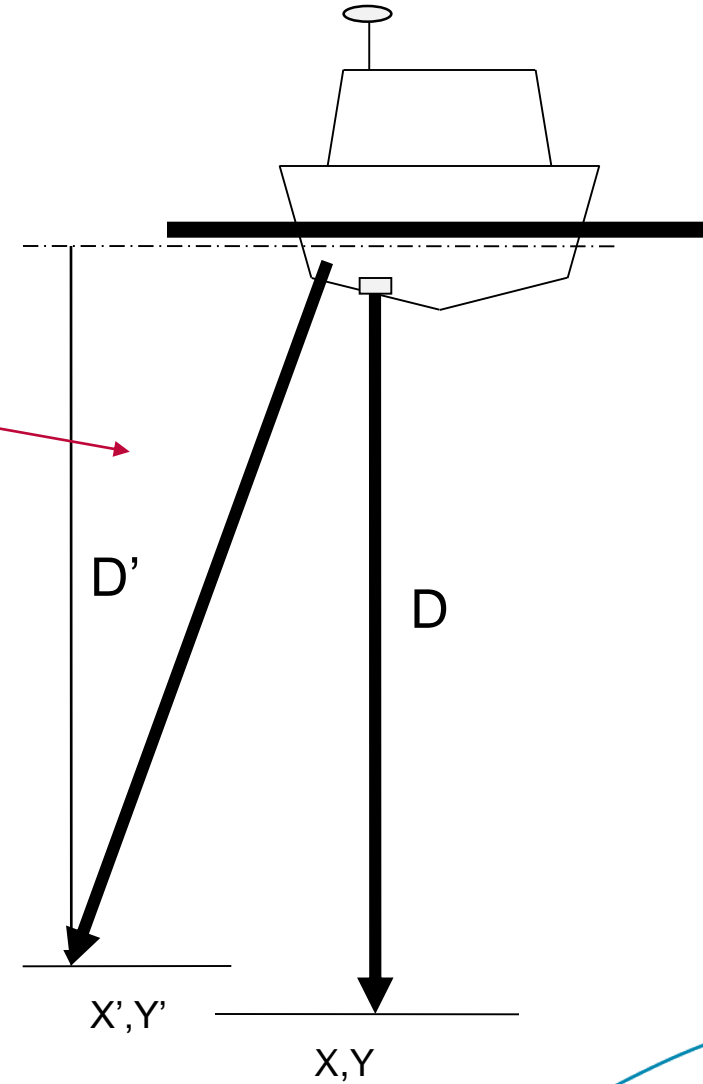


# Single Beam Steering

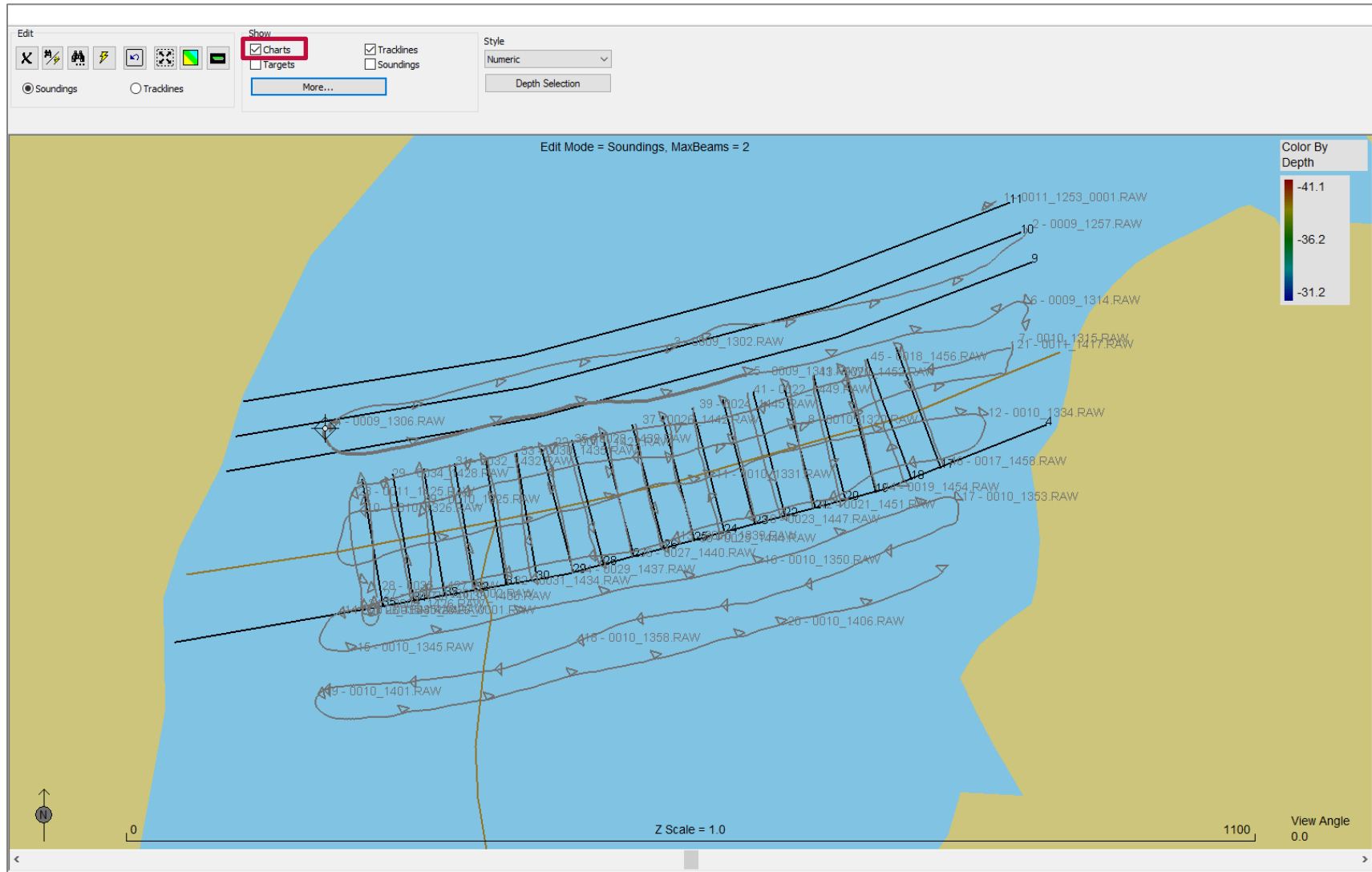
The position of the sounding is based upon the center of your transducer beam.

'Steer Sounding Beam' computes a new location for the center of your transducer beam, based on the pitch and roll values, and the beam width of your transducer.

$$D' = \text{COS}(\text{pitch}) * \text{COS}(\text{roll}) * D$$



# Background Files in Survey Window



Users can display all background files in the main window.

Check the box at the top of the map.

Hit 'F9' to get to the View Options window.



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# Depth Filters

Search and Filter Options

**Depth**

Min Depth 10.0  Max Depth 100.0

Spike Limit 5.0  Offline Limit 5.0

Gate Step 1.0  Pitch Roll Limit 15.0

Keep Events Only

**Basis**

Depth 1  Depth 2  All Beams

Apply Min/Max Filter to  Corr. Depth  Raw Depth

Do Not Filter at Events

**Search Only**

XY Change / Time 1.0  Depth Change 1.0

Begin Search Find Next

**Spike Limit:** Uses a gating method to detect outliers. Spike Limit is the depth gate, Gate Step controls how fast the gate expands.

**Offline Limit:** Removes soundings beyond the set limit from planned line.

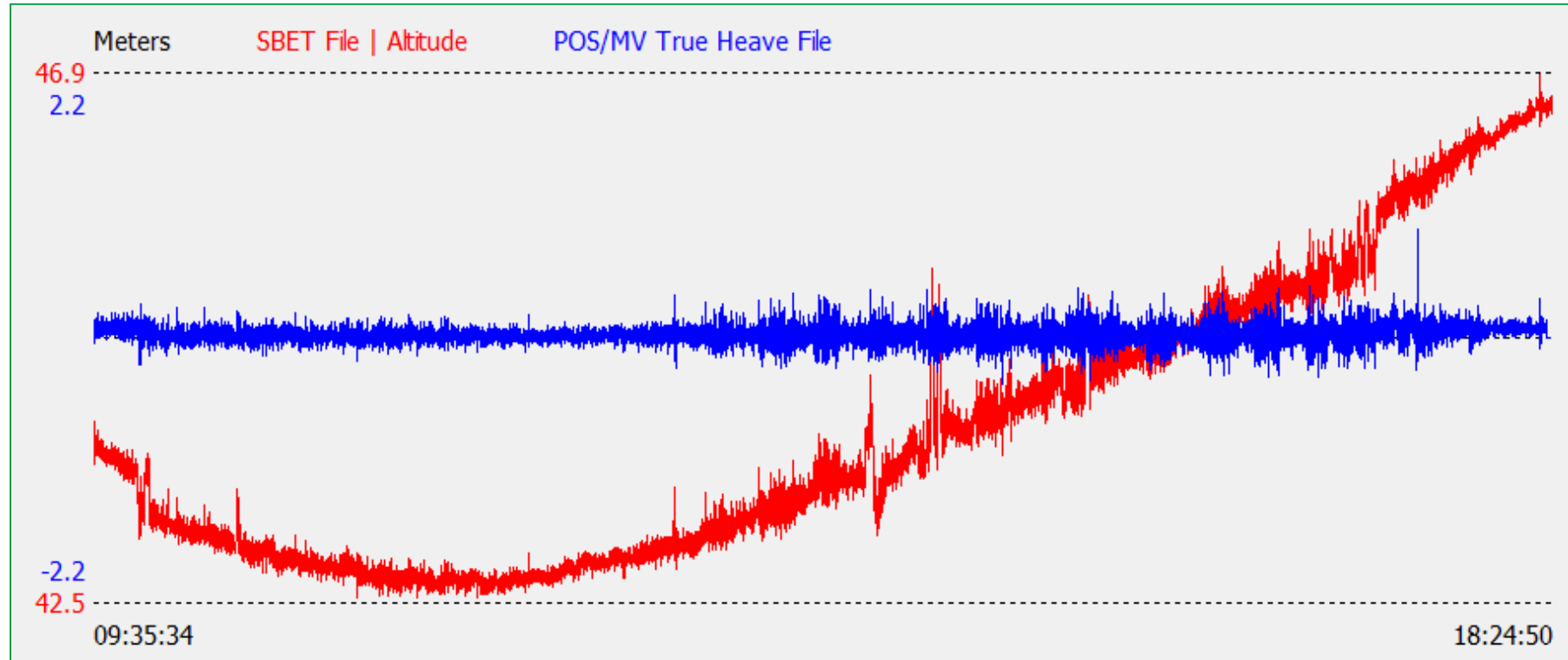
**Basis Depth 1/2/All:** Controls which beams filters are applied to.





# SBET Editor

Use Tools Menu, SBET File Editor



Clean and Save SBET files

True Heave Fills Gaps Between Interpolations



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# Post-Processed GPS Correction

Allows the user to apply enhanced Post-Processed positions and RTK tide data from an ASCII file.

	A	B	C	D
708	57:27.3	-33.6226	151.192	25.603
709	57:27.4	-33.6226	151.192	25.603
710	57:27.5	-33.6226	151.192	25.603
711	57:27.5	-33.6226	151.192	25.603
712	57:27.6	-33.6226	151.192	25.603
713	57:27.6	-33.6226	151.192	25.603
714	57:27.7	-33.6226	151.192	25.603
715	57:27.7	-33.6226	151.192	25.603

GPS Adjustments

PPK File

File Date...

Time  
 Latitude  
 Longitude  
 Ellipsoid  
 Easting  
 Northing  
 Ignore

Add Ignore Field

Delimiters  
 Comma  Space  Tab

Units  
 Ellipsoid In Meters  XY In Meters

Format  
Time  
HH:MM:SS.MMM (AM/PM)  
Latitude / Longitude  
Decimal Degrees

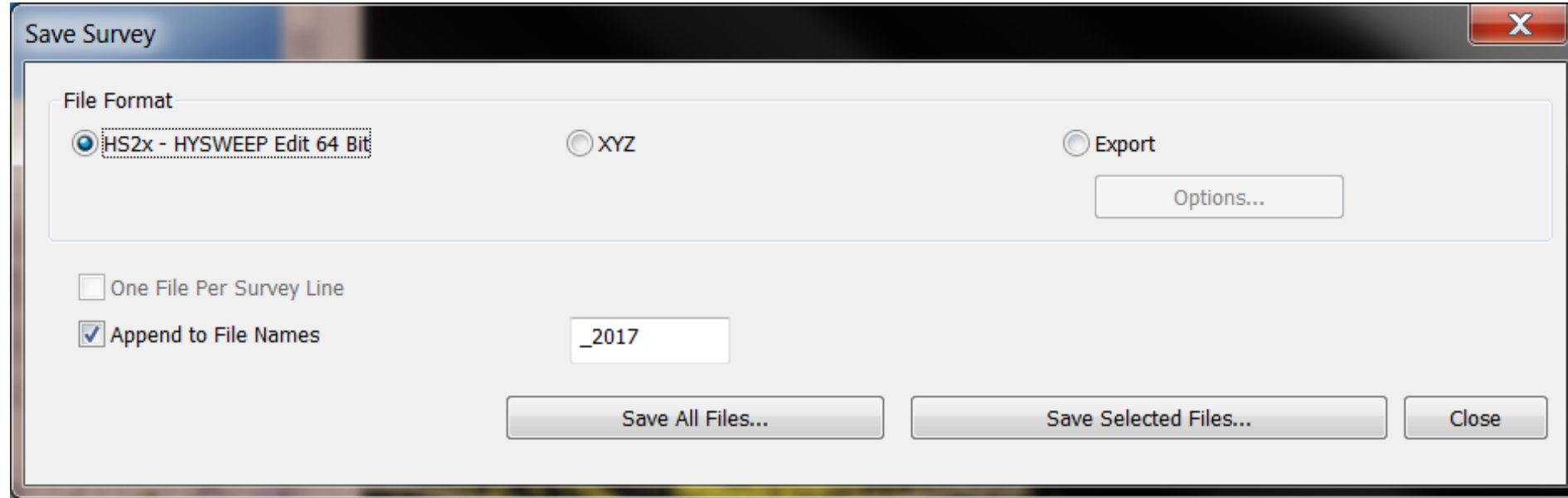
Device Offsets  
Starboard 0.00 Forward 0.00 Vertical 0.00

HYSWEEP File Start Time 15:36:05 06/16/2010 PPK File Start | End Times (UTC)

Enter Hour Difference (PPK Time - HYSWEEP Time) 0.0 Test Adjust Close



# Saving Files



- HS2x – HYSWEEP Edit 64 bit: Default save format. Saves all raw data for adjustment or replacement in re-editing.
- XYZ: Soundings may be saved to XYZ as well.
- Export: Save to HYPACK ALL2 format for compatibility with older programs.
- One File Per Survey Line: Option for XYZ.
- Append to File Names: Option for HS2x and XYZ. Helps create unique file names when surveys are saved for differing purpose.

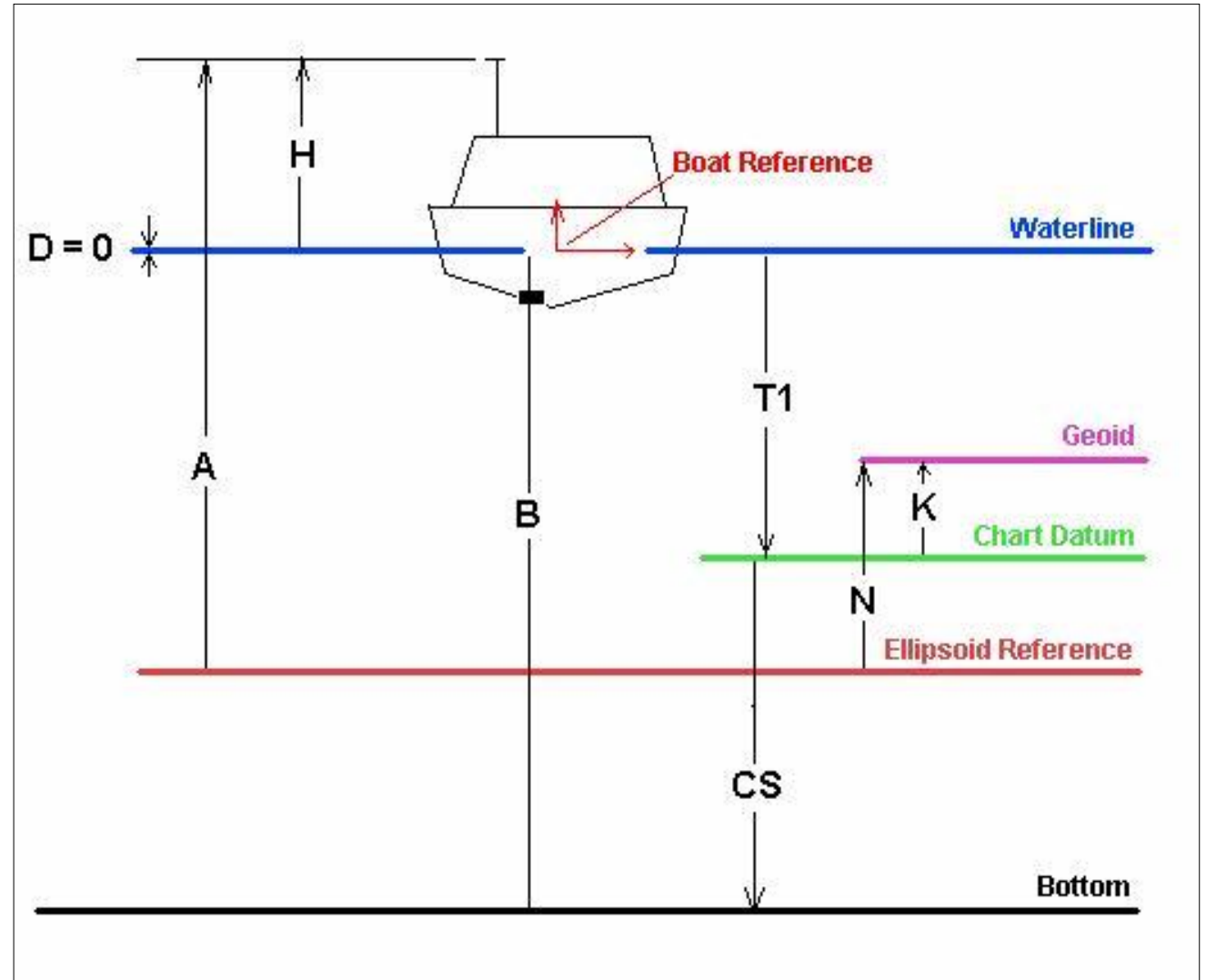


# Water Level Corrections



# RTK Tides

- Computes the Tide correction based on vertical movements of the GPS antenna.
- RTK TIDES has its own presentation.



# Manual Entry in Post-Processing

- Enter times and corrections into the MANUAL TIDES program.
- Generate corrections based on:
  - Linear
  - B-Spline
  - High/Low Water Times and Heights
- MANUAL TIDES can create tide correction files for a single day or for multiple days.
- Input of dates (multi-day) allows for US or International format.

Table data is stored in a \*.TDX file.  
Tide corrections are stored in a \*.TID file.

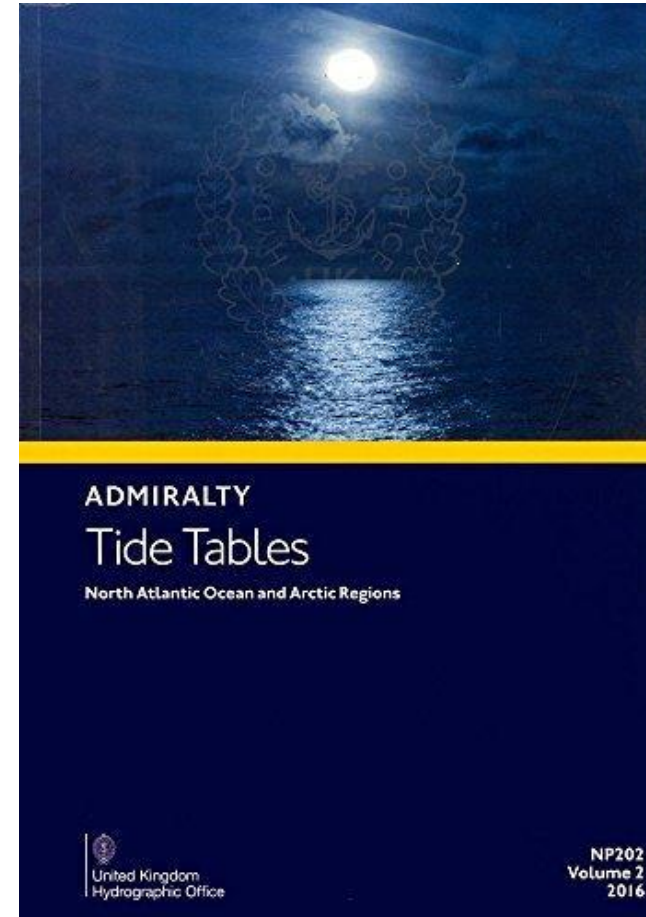


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# Harmonic Predictions

- Uses Port Factors and Day Factors from British Admiralty Publication NP 203.
- Computes a predicted tide, based on harmonic constituents.
- Saves result to a \*.TID file.
- Do not use French constituents, as they are not 'combined'.

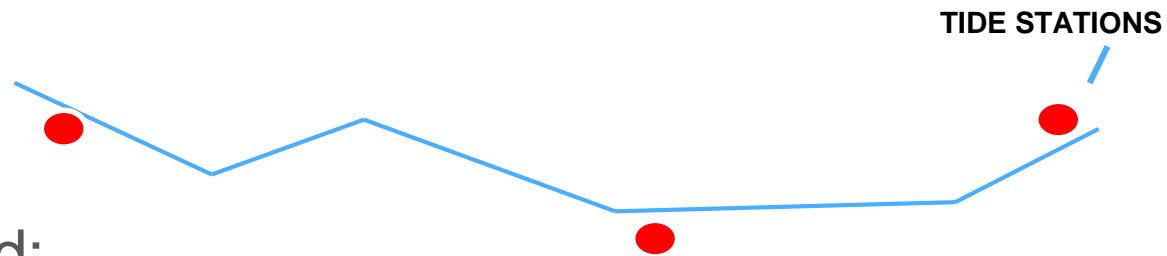


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# Tide Adjustments

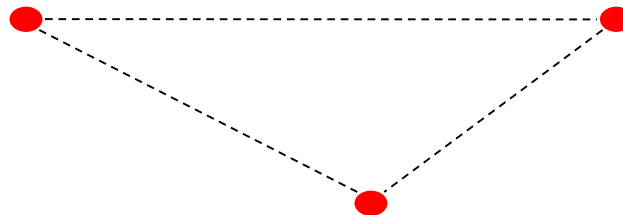
## Centerline Method:

- Interpolates a tide correction based on the position of the sounding along a centerline and the distance from gauges referenced to the centerline. Two or more gauges.



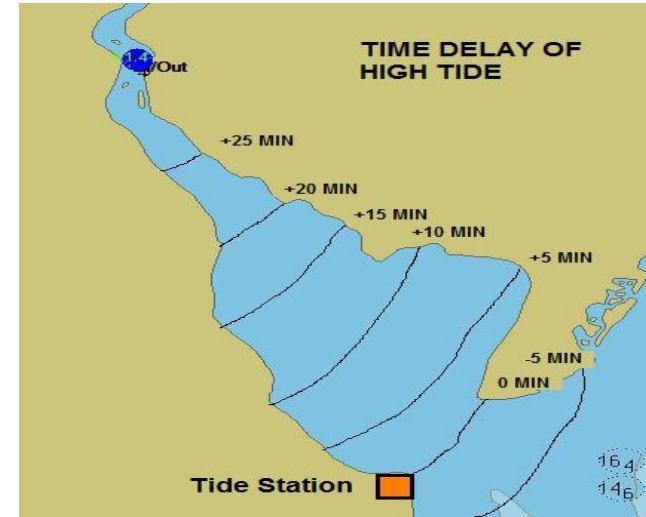
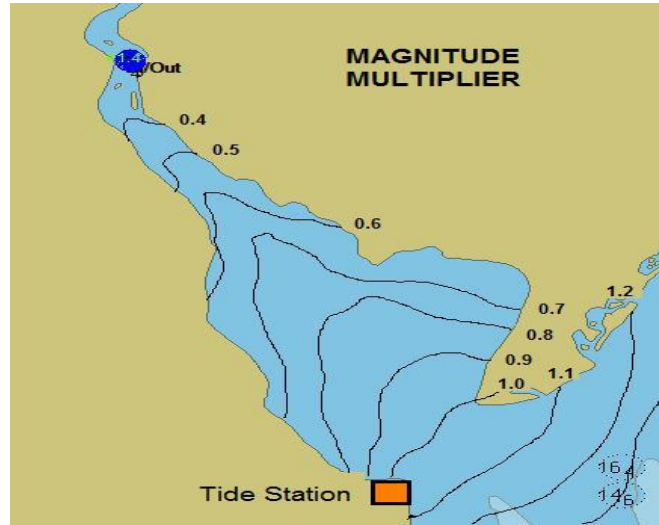
## 3 Point Method:

- Interpolates a tide correction based on the position of the sounding and a triangular tide surface created between three tide stations. Three gauges.





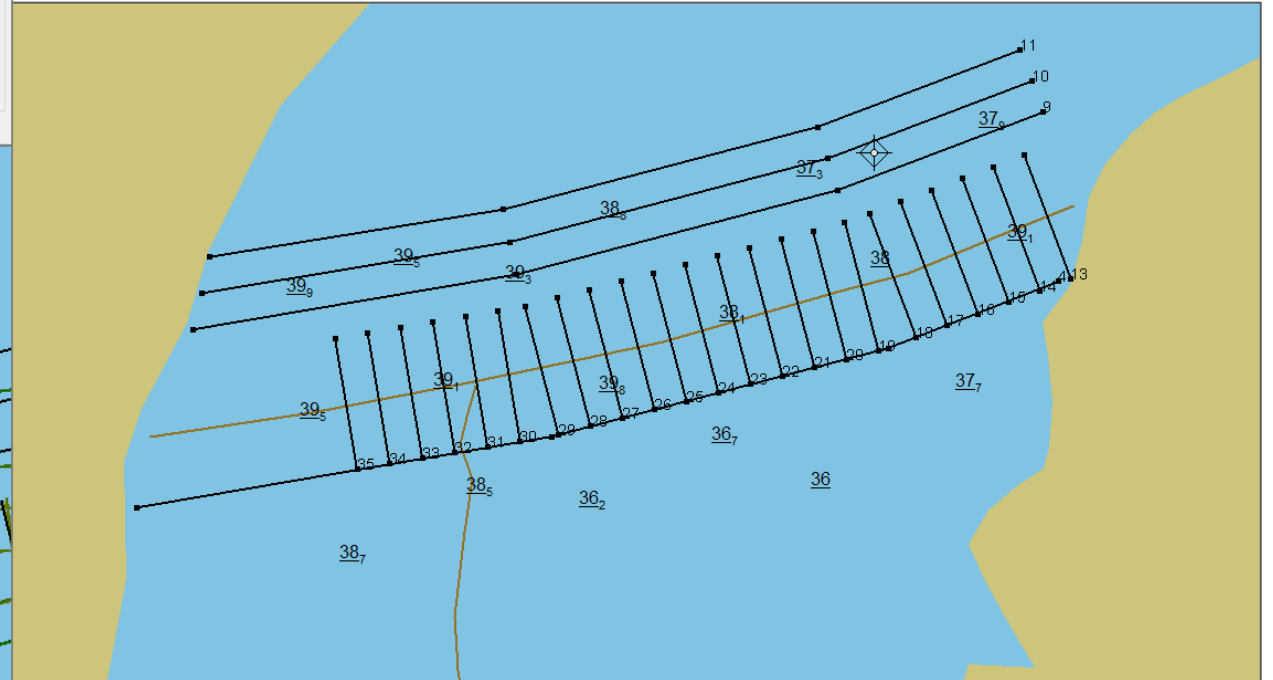
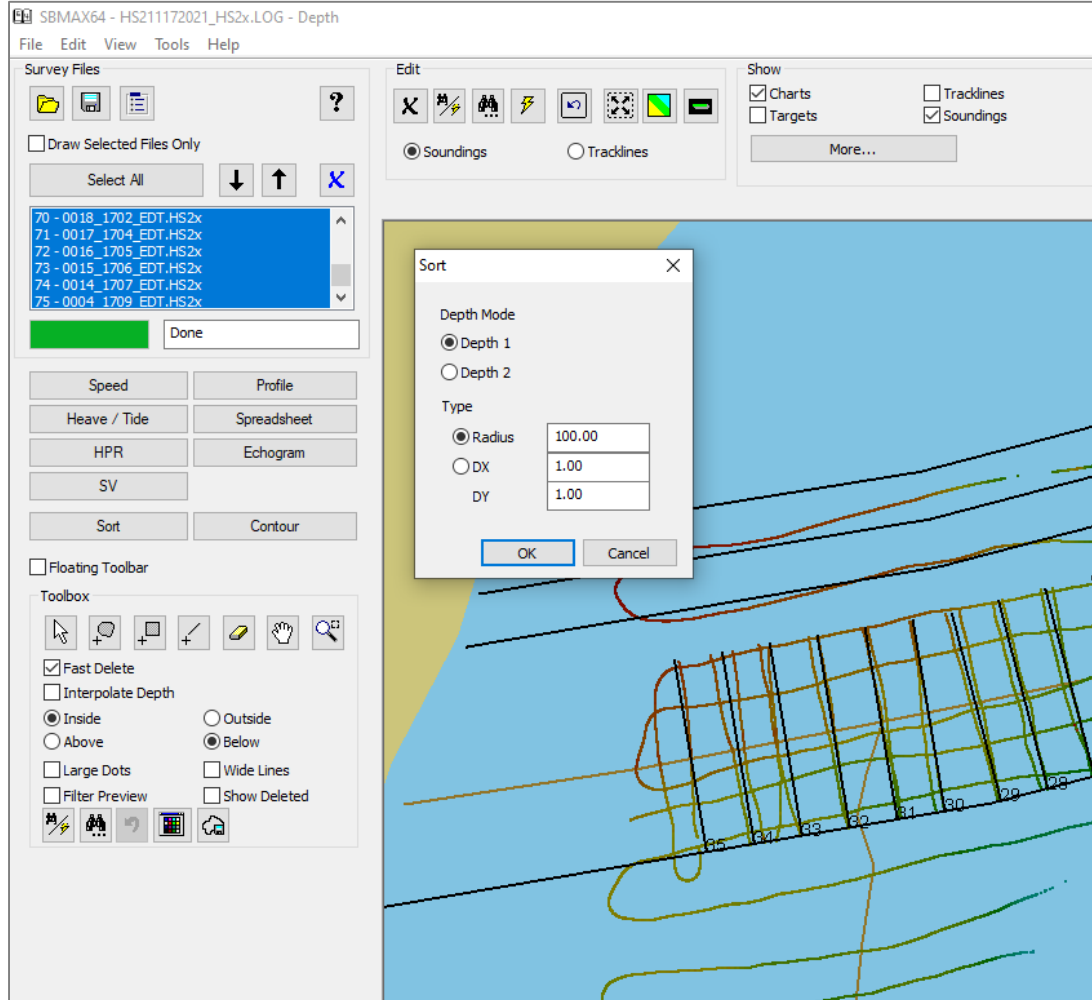
# Tidal Zoning



- Generates Tide corrections at the boat location based on Magnitude and Time difference models from primary tide location.
- Magnitude and Time Difference models are created in TIN MODEL and stored in the \HYPACK 20xx\TideModel folder.
- Check the HYPACK Help files for detailed information about the setup and application of the TIDAL ZONING program.



# New Integrated Sort Routine



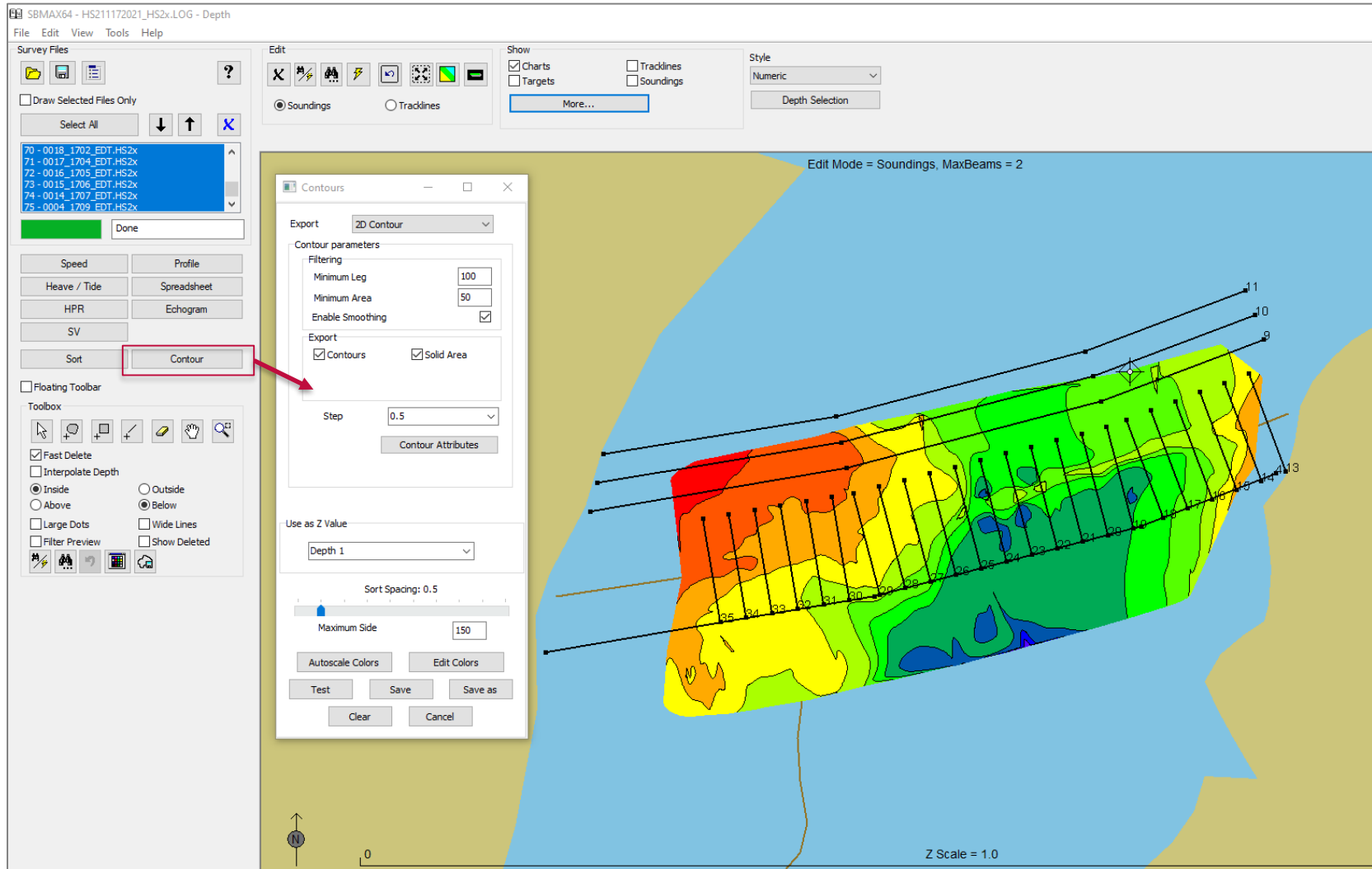
- This Sort routine allows basic sorting of the data
- No need to save and reload files



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# Generate DXF Contours inside SBMAX64



The SBMAX program now has the ability to generate the contours

The TIN MODEL export dialog allows users to test the contour and make adjustments before saving the DXF



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# Thank You !

## Links to more information:

[HYPACK on Youtube.com](#) ( Historical Sessions )

[HYPACK on Youtube.com](#) ( Newer Sessions )

[HYPACK SUPPORT Site](#)

[HYPACK Live Chat](#)

[HYPACK Ustream](#)

[HYPACK Website](#)

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