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Interfacing Bathyswath to Hypack



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Section	Notes

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1 INTRODUCTION

1.1 REFERENCES

- Ref 1 ITER Systems website, at <http://iter-systems.com/>
- Ref 2 Hypack website, at <http://www.hypack.com/>
- Ref 3 ETD_2002 Bathyswath Technical Information,
- Ref 4 Bathyswath File Formats, in “Bathyswath File Formats.pdf”
- Ref 5 Bathyswath Parsed File Format, in “Bathyswath Parsed File Format.pdf”
- Ref 6 Bathyswath Getting Started manual, in “Bathyswath Getting Started.pdf”
- Ref 7 Bathyswath Online User Guide, installed with the Bathyswath software
- Ref 8 Hypack Interfacing Reference page, at <http://www.hypack.com/File%20Library/Resource%20Library/Driver%20Interfacing%20Notes/2018-Hysweep-Interfacing.pdf>

1.2 GLOSSARY & ACRONYMS

ACRONYMS	DEFINITION
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1.3 SCOPE

This document provides instructions for interfacing Bathyswath systems to Hypack and Hysweep.

1.4 CONTEXT

Bathyswath [Ref 1] is a swath bathymetry sonar system. Hypack [Ref 2] is a software package for processing sonar data, and Hysweep is the module that is used with Hypack to process swath bathymetry data.

Hypack and Hysweep can be used to interface to Bathyswath in real time, and store and process its data. This document describes how to set up the interface.



1.5 FUNCTIONS OF THE BATHYSWATH SOFTWARE

The Bathyswath Swath Processor program receives raw sonar data from the Bathyswath hardware, converts it to a format that Hypack can read, and sends it to Hypack using TCP/IP packets.

Swath Processor is also used to start and stop the Bathyswath sonar and to set its operating parameters.

Swath Processor can perform all the functions needed in survey operations and postprocessing, that is, everything that Hypack can do. But if the surveyor is more familiar with Hypack, then the processing and display functions of Swath Processor can be disabled, so that it operates as a simple data conversion application.

Even when used with Hypack in this way, the extra functions of Swath Processor can sometimes be useful for diagnosing problems with the sonar or its configuration.

1.6 OTHER INFORMATION

The technical details of Bathyswath are described in Ref 1. When starting with a Bathyswath system, read the Getting Started Guide first [Ref 6]. When running the Bathyswath Swath Processor application, you can get context-sensitive help for each window and dialog box by clicking on the item of interest and pressing the F1 key on the keyboard. This opens the “online help” [Ref 7].

Data is sent from Bathyswath to Hypack using the “Parsed Data” format; see Ref 4 and Ref 5.



2 INSTALLING THE HARDWARE AND SOFTWARE

2.1 SOFTWARE NEEDED

The Bathyswath Swath Processor program (bathyswath.msi) is used to interface the Bathyswath hardware to Hypack. The Bathyswath software installation application installs it. See section 8 of the Getting Started manual [Ref 6].

2.2 OPERATING SYSTEM

Both Hypack and the Bathyswath Swath Processor program run on Microsoft Windows, although a Linux hardware interfacing program is available for Bathyswath from ITER Systems, on request.

2.3 SOFTWARE CONNECTIONS

The Bathyswath hardware is connected to the Bathyswath Swath Processor program using UDP messages sent over an Ethernet link. Swath Processor converts these messages into a format that Hypack can use, and sends them via TCP/IP, which can work either on the same computer or over an Ethernet link. Therefore, Swath Processor and Hypack can run either on the same computer or on different computers.



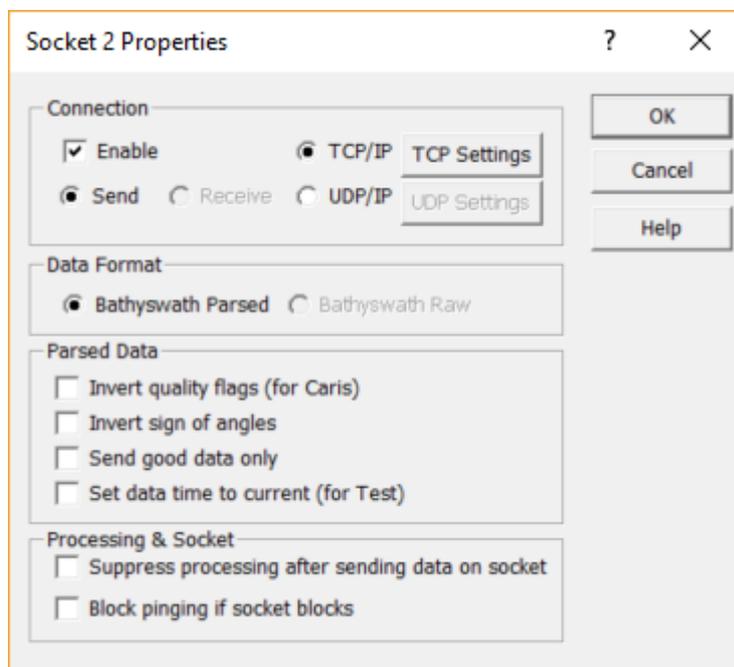
3 CONFIGURING THE SOFTWARE

3.1 CONFIGURING BATHYSWATH SWATH PROCESSOR

Swath Processor can be configured either to run all its processes and displays, as per standalone operation, or the processing and displays can be suppressed to save on memory and processing power. The latter is usually preferable if both processes are running on the same computer.

To use Bathyswath with these applications:

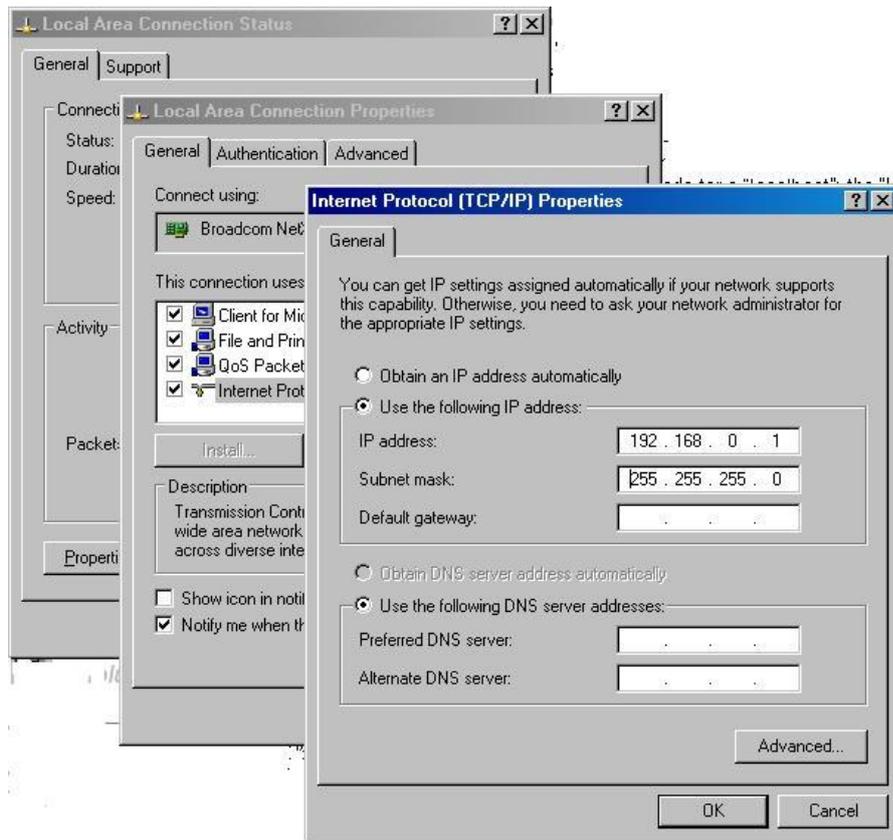
1. Install the Bathyswath hardware and software for a standalone operation.
2. Start the Swath Processor, and click on the '**Socket 2**' button in the Main Dialog Bar. (See section 3.1.1 for an explanation of why Socket 2 is used).



3. Select 'Enable'
4. Select 'Send'
5. For Hypack, select **TCP/IP** (the UDP link to Hypack has not been tested at the time of writing)
6. Click the **TCP/IP Settings** button to set the parameters of the TCP/IP link
 - a. Select **Server**
 - b. If using the Swath processor and Hypack on separate computers, set the IP address of the other computer in the '**IP Address**' box. Otherwise, enter '127.0.0.1'. This is the code for a 'localhost': the '**Local PC**' button enters this address for you.
7. To configure a network between two computers:
 - a. Connect the Ethernet ports of the two computers. This must be either through a network hub, or using a crossover cable.



- b. Configure the IP address of the two computers so that they are on the same sub-net. For example, two computers might be set '192.168.0.1', and '192.168.0.2', and the sub-net mask of both set to '255.255.255.0'. The IP address of a Windows XP computer is set using 'Start > Settings > Network Connections > Local Area Connection > Properties > Internet Protocol (TCP/IP) > Properties'



8. Select '**Bathyswath Parsed**' (this is the only option for Socket 2).
9. To use the displays and processing in the Swath processor, alongside Hypack, de-select '**Suppress processing after sending data on socket**'. Otherwise, select this option.
10. If the third-party application is the main processing, visualisation and data storage tool in the set-up, enable '**Block pinging if socket blocks**'. This causes the Swath processor to wait until the previous data packet has been sent over the socket link before sending the next one. If this option is left clear, the Swath processor continues to the next ping when the socket blocks, and the receiving process will miss pings.
11. Click '**OK**'
12. Watch the Status view for information about the state of the link. When the link is configured as a Server, to receive connections from the other process, the following message appears in the Status view:



13. When the other process makes a connection, the following status message appears:



14. The status of the socket can be checked at a glance using the 'traffic light' indicators in the Main Dialog Bar. However, a green light is no guarantee that the other process is successfully receiving and processing data, only that it is being sent without errors. The indicator goes amber if the socket 'blocks'.
15. Save the session file to save these settings.
16. The connection can also be tested by using a second copy of the Swath processor as the receiving process. Configure the second Swath processor with 'Receive', and 'Client'. Both Swath Processors will need to be configured with session files specifying the correct attitude and position decode methods, etc.

If using Bathyswath and the other process on two separate computers, make sure that the two computers' clocks are well synchronised. This can be achieved using an NTP server and client. For example, if the computer running the other process is synchronised to GPS time with PPS signals and ZDA messages, run an NTP server on the other computer and an NTP client on the Bathyswath computer. NTP server-client applications can be obtained cheaply as Internet shareware packages.

3.1.1 Using third-party tools for both bathymetry and sidescan

Most third-party surveying software tools can process both bathymetry (depth) information and sidescan imaging data. However, the input requirements of these tools are often different for the two tasks. Bathymetry data is usually best filtered and down-sampled in the Bathyswath Swath Processor software before sending to the third-party tool. This prevents that application from being 'swamped' with too much data. Sidescan data requires all the 'raw' data to provide good images. The filtered and down-sampled data does not provide high-resolution sidescan images.

Swath Processor provides a second TCP/IP port (**Socket 2**). This is useful for third-party applications that handle sidescan data on a separate port to the bathymetry data. Socket 2 sends out unfiltered data. (Socket 1 sends filtered data).



Some third-party programs, including Hypack/Hysweep, do not support the use of two separate input channels from Bathyswath. However, Hypack includes filtering software that keeps the full resolution of the sidescan data while intelligently reducing the data volume of the bathymetry data, so Socket 2 should be used to interface Swath Processor to Hypack.

3.2 CONFIGURING HYPACK

Please refer to the Hypack documentation; we do not claim to be experts in using Hypack. The Hypack Interfacing Reference [Ref 8] is useful, but its description of how to set up Swath Processor is out of date: use the instructions above instead.

3.2.1 Hypack Interface

Bathyswath uses the “SEA SWATHplus” interface in Hysweep. SWATHplus was a previous version of Bathyswath, and the same interface is still supported.

SXI format files can be logged alongside HSX by checking the “Record Raw Message” option on the Connect tab. These files can be read back into Swath Processor later for re-processing, if required.

3.2.2 Hypack Offsets

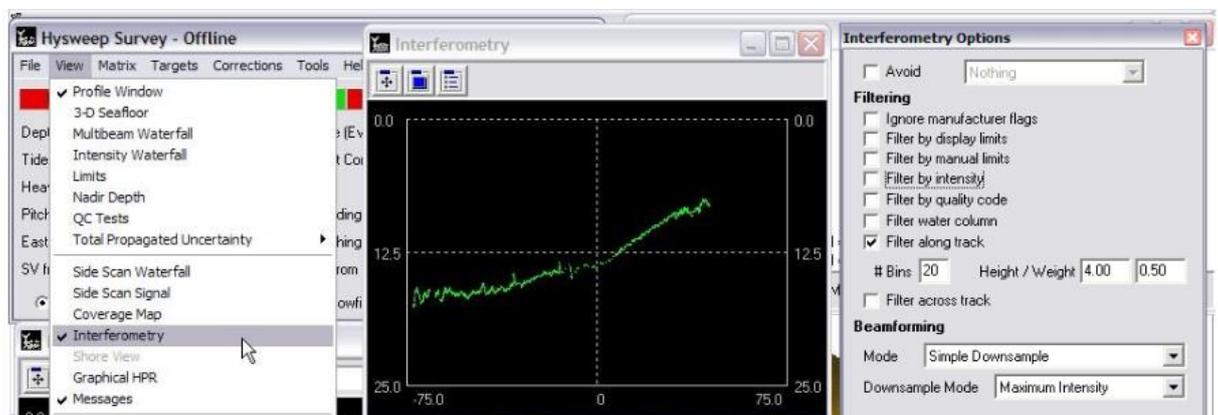
In Hypack, set the Offsets as follows.

Offsets – Sonar Heads 1 and 2:

- Starboard: Sonar head locations starboard of boat reference.
- Forward: Sonar head locations forward of boat reference.
- Vertical: Sonar head locations relative to waterline (positive).
- Yaw, Pitch, Roll: Sonar head rotations - enter values determined by patch testing.
- Latency: Enter 0.

3.2.3 Interferometric Processing in Hypack

HYSWEEP has an internal limit of 1440 beams per ping for multibeam data. Of course, interferometry provides us many more points than that. Our task then is to intelligently reduce this data to something manageable by HYSWEEP which we accomplish through a combination of filtering and downsampling. Below is a screenshot of the new windows added to HYSWEEP. The “Interferometry” window displays all the points before any decimation. Points flagged as bad or filtered will be coloured red; good data is coloured green. It will also show any filter boundaries in blue if any are enabled.

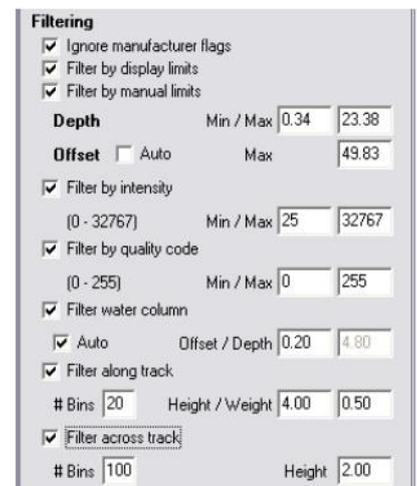
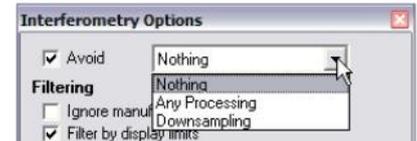




Clicking the third button on this window will open the “Interferometry Options” window. This controls how HYSWEEP will process the data. The processing chain moves from the top of the form to the bottom. Once a point is flagged, it is ignored in the rest of the chain.

Processing Options

- **Avoid.** These options allow you to skip some of the processing if the data is already sufficiently thin (ie < 1440 points). “Avoid Any Processing” will try to do nothing if it can. “Avoid Downsampling” will filter, but try not to beamform.
- **Filtering.** This section provides ways to remove noise. Typically one need not use all of these. Points can be flagged on the basis of depth, offset, intensity, or quality code. If the sonar pre-flags bad points you have the option to honor or ignore these.
 - Display limits filters based on the depth, offset, and angle limits specified in the view options.
 - Manual limits allows you to specify limits that are not tied to your viewing limits. You can also set your offset limits to be a multiple of water depth.
 - Intensity and quality code simply filter by a specified min/max. Note that the drivers will scale intensity to a 0—32767 range and quality code to a 0—255 range. The meaning of these vary somewhat depending on the sonar.
 - The along track filter makes N bins across track of a specified height. Those samples falling within the bin are flagged good and affect the depth of the bin by a specified weight. The lower the weight, the slower the filter reacts to change.
 - The across track filter works similar to the along track, but it does not remember bin depth from ping to ping. This filter is meant to be used with the along track filter but with a smaller height.



The water column filter can track a single beam echosounder depth and reject points with a range less than that value.

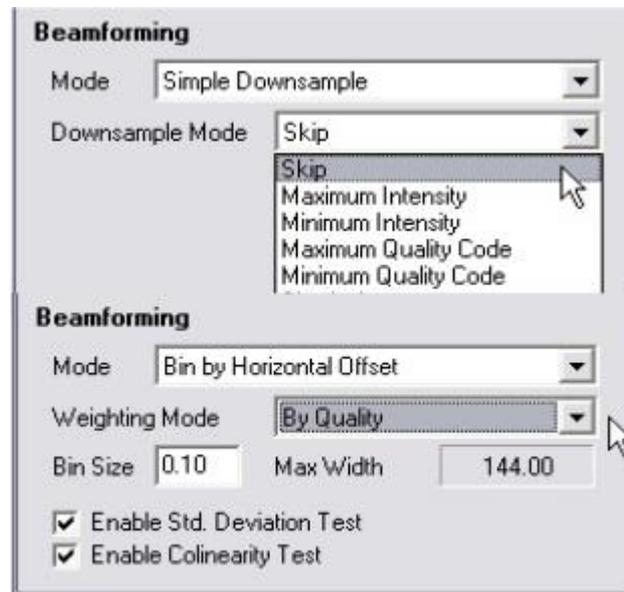


- **Beamforming.** Two modes of beamforming are provided: simple downsampling and binning. Simple downsample will take the results of filtering and downsample to 1440 beams. You can opt to select by intensity, quality code, or average.

The second option, binning by horizontal offset, is the method used by the SWATHplus drivers in 2009. Given a bin footprint size, it will form a beam for each bin by averaging the good points in each bin, optionally weighted by intensity or quality. In this mode, the beam

quality is set to the bin point count. Also provided for this mode are standard deviation and colinearity tests which, if failed, set the beam quality to 1.

Note that these modes can be seen as opposites. In the first case, the entire swath coverage will be retained, but the beam footprint will be necessarily reduced to compensate. In the latter, footprint resolution is guaranteed at the expense of a swath width limited to $1440 * \text{bin size}$. Also, simple downsampling will retain vertical features such as quay walls while binning will average them out.



The result of this processing is what will be displayed in the rest of the HYSWEEP windows and logged to the HSX.

3.2.4 The Interferometry Display

The display window allows you to view the raw interferometry points and the enabled filters. In this example, the manual limits, water column, and along track filters are enabled. Manual limits and water column (if not automatically tracking a SBES depth) show handles which can be clicked and dragged to modify the filter.

The along track filter can be reseeded to the current SBES depth (or raw nadir of multibeam if no SBES) by simply turning it off and on again. However, double-clicking a point on the display will force the corresponding bin to that depth. This is handy for helping the filter “lock on” to the bottom.

Finally, right-clicking provides a simple menu to quickly turn on/off the filters.

