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Sounding Better!

New Features in HYPACK® SUB-BOTTOM PROCESSING

By Peter Ramsay

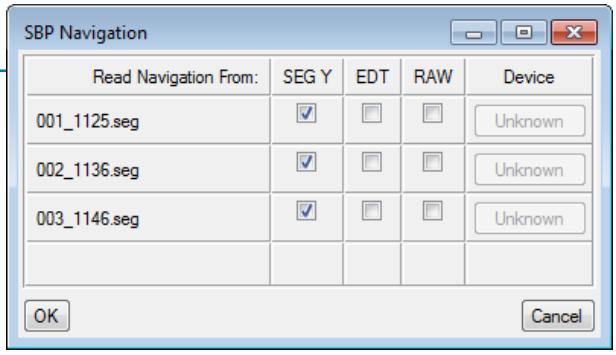
INTRODUCTION

Basic sub-bottom profiling acquisition & processing has been available in HYPACK® for the past few years, but during the first quarter of 2017 a considerable amount of effort has been put into improving the stability, memory allocation and features of the program. The new HYPACK® SUB-BOTTOM will be launched at the end of May 2017. This *Sounding Better!* article will delve into some of new features and functionality of HYPACK® SUB-BOTTOM.

BASIC FEATURES

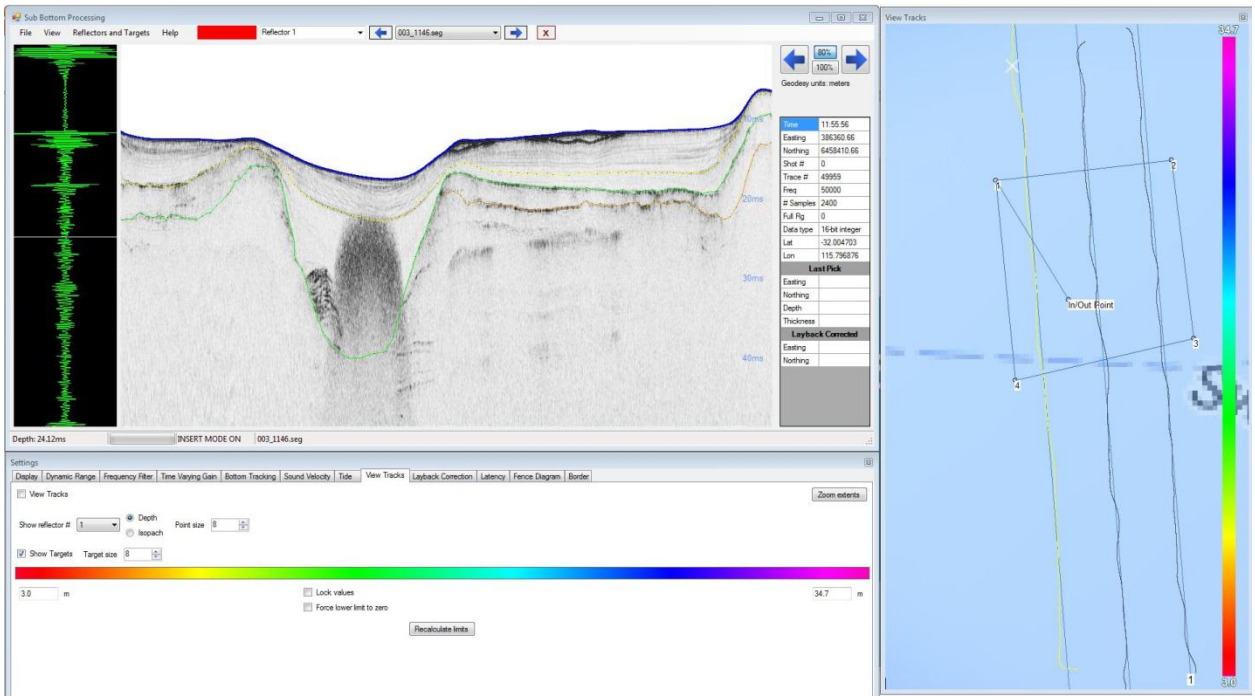
HYPACK® SUB-BOTTOM has the ability to load large sub-bottom profiling datasets in SEG-Y or JSF format. The program stores the project data file lists and user-defined processing parameters in XML and Configuration files, which makes it easier when re-opening the project. HYPACK® SUB-BOTTOM can read navigation from the SEG-Y (or JSF) file, RAW file or EDT file (Figure 1). In HYPACK® MAX (SBMAX), one can edit the navigation in a RAW file for “spikes” and apply the corrected EDT navigation to the sub-bottom profiling data.

FIGURE 1. *Navigation options in HYPACK® SUB-BOTTOM.*



Once the data files have been loaded, the sub-bottom profiling data is displayed in the Sub-Bottom Processing window and the navigation data in the View Tracks window; the Settings window is used for the application of data processing parameters (Figure 2). The sub-bottom profiling data can be trimmed to a border file which is very useful if one is only interested in viewing and interpreting a section of the dataset.

FIGURE 2. *Window layout of HYPACK® SUB-BOTTOM.*



The Settings window is used to correct the dynamic range of the data, apply band pass frequency filtering, time varied gain (TVG), bottom tracking, water column blanking (removing water column noise) and swell filtering to the data (Figures 3 & 4). The Dynamic Range tab controls have options to view the data in Bipolar, Rectified or Unipolar modes and apply different color palettes. These controls allow one to visually enhance various geological surfaces (or strata) without altering the original raw SEG-Y or JSF data. Various exponential TVG curves can be applied to the data as well as user defined TVG curves. These curves can be saved for each line or project and re-imported/applied at any later stage. There is an Auto Range, TVG & Bottom Tracking button under the Display Tab in the Settings menu which can provide initial settings for the data display.

FIGURE 3. *Raw boomer data (left image) and processed boomer data (right image). The processing involved changes to the image dynamic range, band pass frequency filtering, TVG, bottom tracking, swell correction and water column blanking*

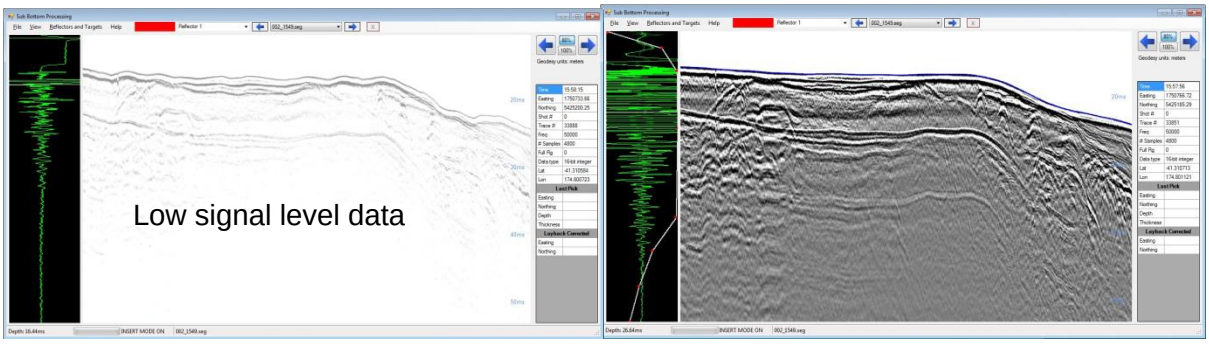
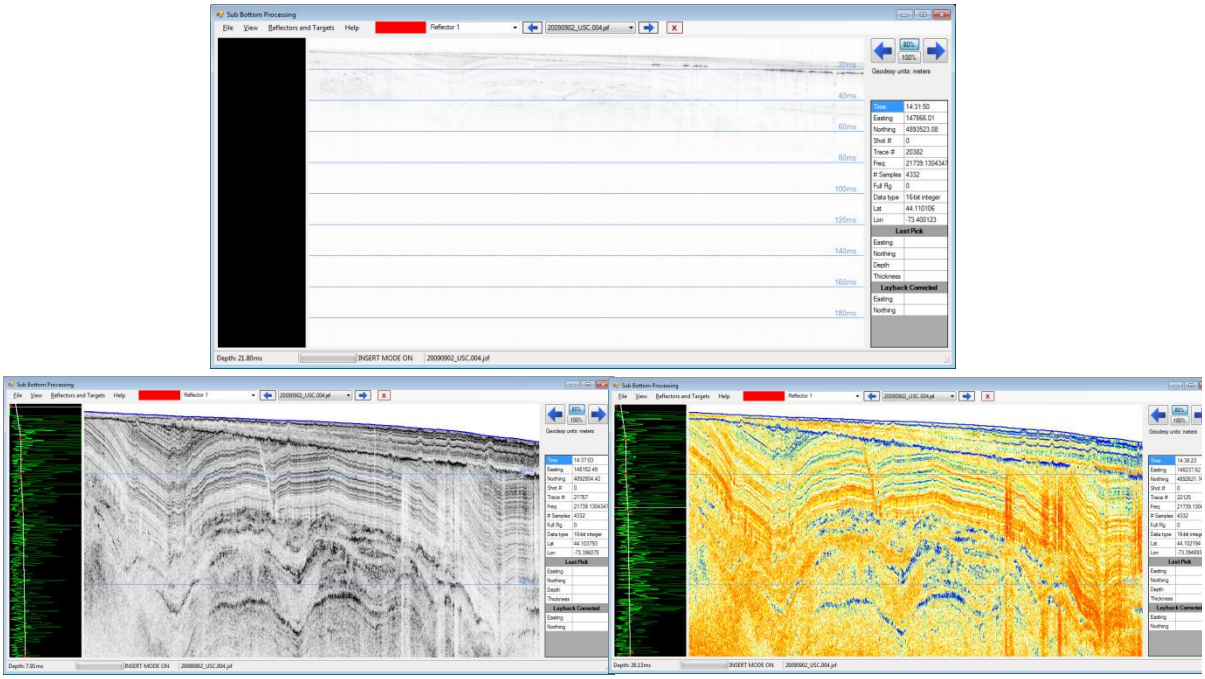


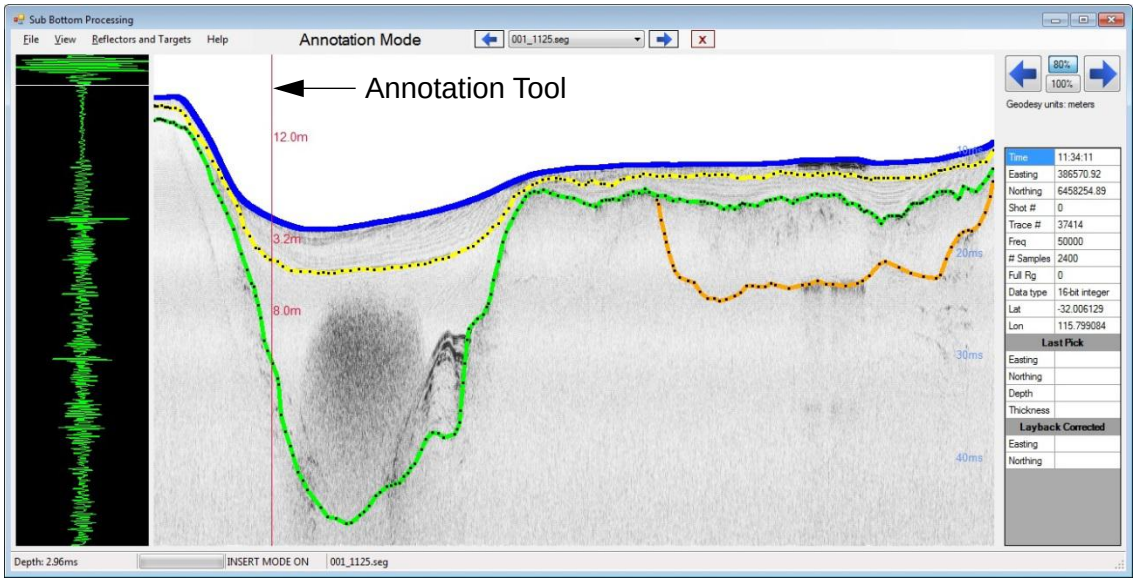
FIGURE 4. *Raw (top image) and processed Chirp data (bottom right & left images). The processing involved changes to the image dynamic range, TVG, bottom tracking, water column blanking and the application of a color palette (bottom right image). Data courtesy of EdgeTech*



GEOLOGICAL INTERPRETATION

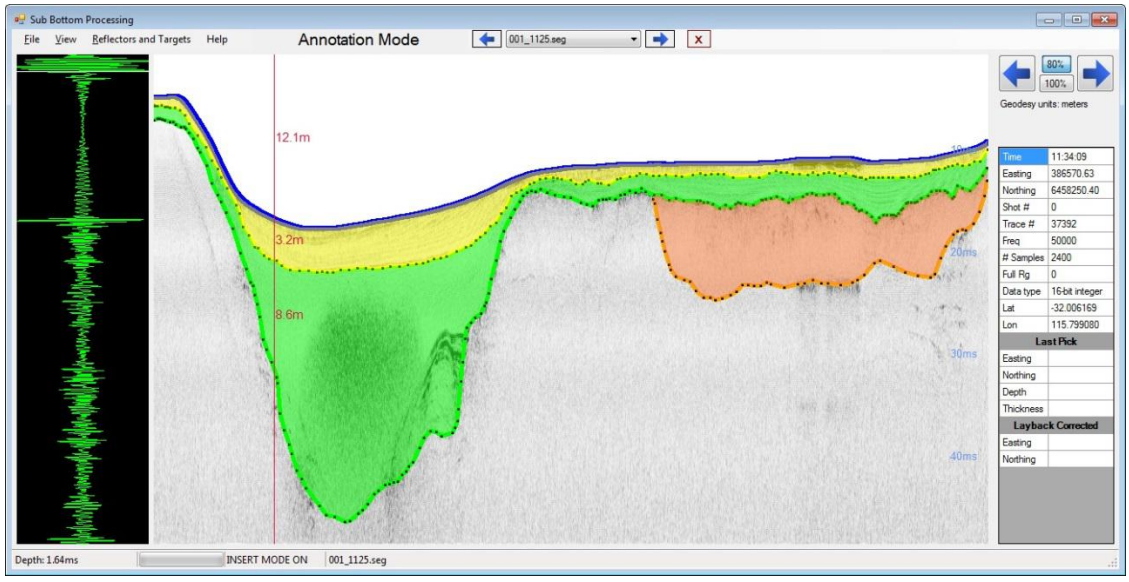
Geological interpretation of sub-bottom profiling data involves reviewing the different reflectors which are evident below the seabed. Individual reflectors represent changes in the reflection amplitude which are generally related to the density of the sub-surface material. By digitizing these reflective amplitude anomalies, one can separate the sub-surface geology into units with different sediment/rock characteristics. This thickness of a discrete geological unit, such as an unconsolidated sandy unit, is termed an isopach. HYPACK® SUB-BOTTOM supports the digitizing of 20 unique reflectors which can be assigned custom names and colors (Figure 5). Reflector digitizing points (“picks”) can be edited or deleted at any time to modify the interpretation. A handy annotation tool is also provided which gives the depth and sediment thickness values, at the cursor location point, of each discrete geological unit.

FIGURE 5. *Sub-bottom profile showing the interpretation of three distinct geological units. Note the annotation tool which shows the depth to the seabed and the thickness (isopach) of each geological unit. Data courtesy of Marine GeoSolutions.*



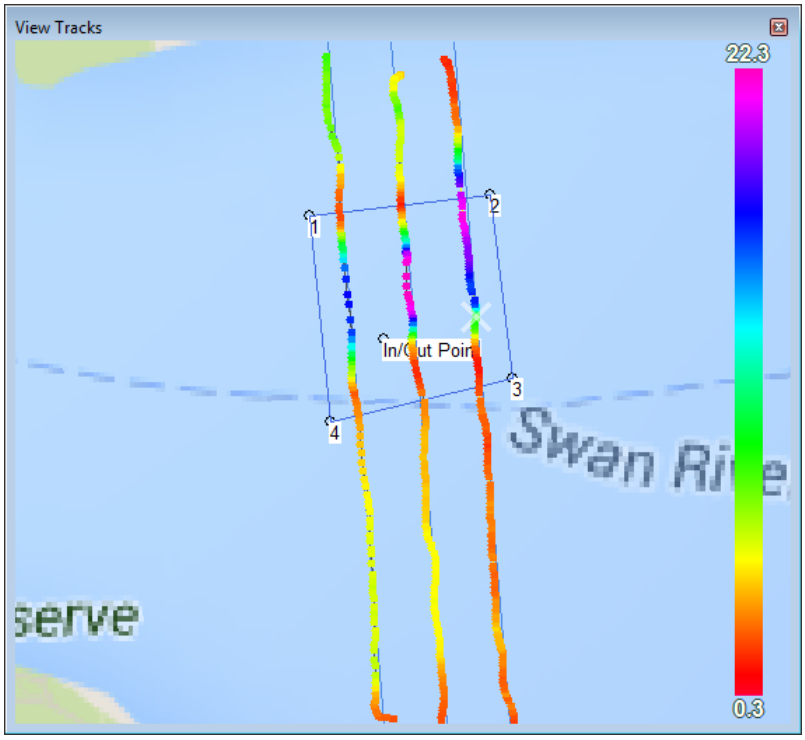
Another useful feature is the ability to be able to color each geological unit as an isopach polygon using a custom color palette and transparency (Figure 6).

FIGURE 6. *Colored isopach polygons being applied between various digitized reflectors representing different geological units. Data courtesy of Marine GeoSolutions.*



The reflector digitizing depths or isopachs (sediment thickness) can be seen plotted on the View Tracks window as digitizing is progressing (Figure 7). This is a useful quality control tool as the consistency of the interpretation can be gauged by reviewing the interpretation on adjacent or cross-lines.

FIGURE 7. *View Tracks window showing the digitized reflector isopach interpretation values represented as colored isopach (thickness) points for three survey lines. A color scale bar is provided too.*



DATA OUTPUTS & CORRECTIONS

The data interpretations generated from digitizing the various reflective sub-surfaces can be output as ASCII XYZ or HYPACK® EDT (All format) files. Various corrections can be applied to the data outputs such as:

- **Sound velocity** correction in the water column (average value or apply a sound velocity profile) and separate velocity corrections for saturated sediment or rock.
- **Tide** corrections using a HYPACK® tide file.
- **Layback** corrections to the data outputs if these were not specified in HYPACK® hardware. If the data were acquired in HYPACK® and HARDWARE was correctly figured then the coordinates in the SEG-Y file will be corrected for the SBP sensor position.
- **Latency** corrections between measurement and transmission to the data acquisition computer.

Interpretation outputs can also be trimmed to a border file.

A separate reference file is generated with each ASCII XYZ file highlighting the corrections applied to the data.

Screen shots can be captured in various image formats (PNG, JPG or BMP), with or without the superimposed reflector interpretation. A coordinate reference file is produced with each image, which allows the image to be used as a vertical seismic curtain in third party software packages.

ADVANCED VISUALIZATION FEATURES

HYPACK® SUB-BOTTOM has the ability to produce 3D fence diagrams of the sub-bottom profiling lines with superimposed reflector interpretation and colored isopach polygons. The fence diagram can be rotated in any direction and the transparency of the data controlled. The fence data can also be trimmed to a border file to highlight a particular area of interest. This is a useful tool for visualizing the data in three dimensions to provide a better understanding of the sub-surface geology.

FIGURE 8. *3D Fence Diagram of Two Intersecting Sub-bottom Profiling Lines. Data courtesy of EdgeTech.*

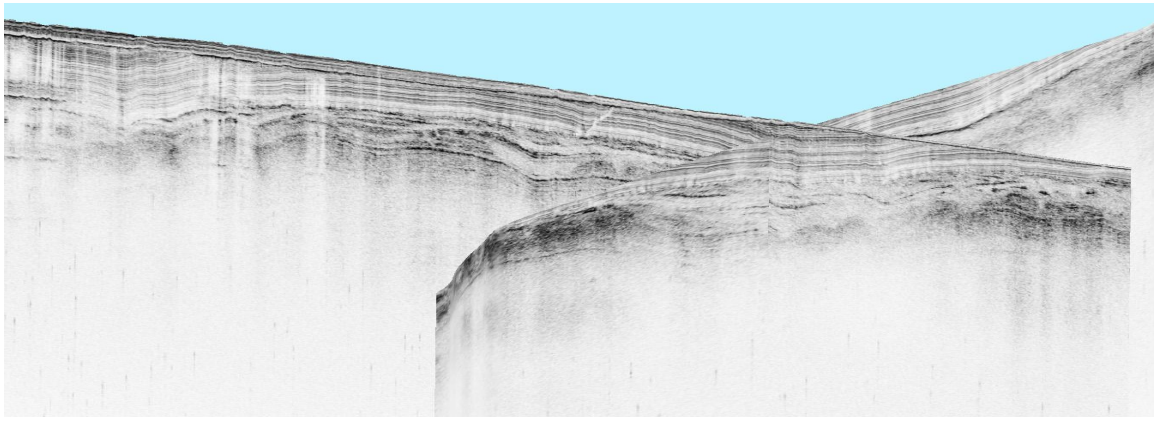


FIGURE 9. *3D fence diagram of three parallel sub-bottom profiling lines showing superimposed interpretation and scale bars.*