



AUV Operations – Checking Navigation Accuracy

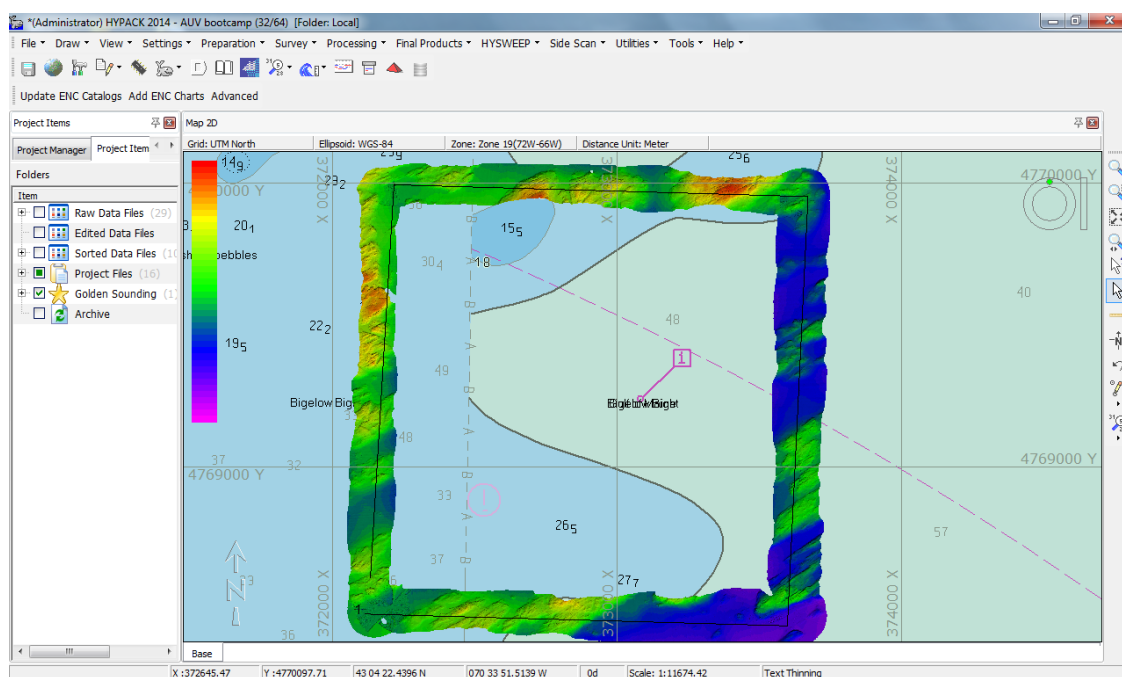
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HYPACK recently attended the AUV Boot Camp, held in Portsmouth, NH. The week-long class ran through exercises using the Hydroid 600 AUV. Each day, we had a chance to plan the mission and process the data once offloaded from the vehicle. The data files (Kongsberg ALL files), were converted through the SIDE SCAN DATA REFORMATTER and then processed in MBMAX64 (the 64-bit HYSWEEP® EDITOR) for the bathymetry.

One of the missions was to determine, on consecutive passes, the drift that may occur during each mission. Using MBMAX and TIN MODEL, we can see the drift that occurs on the subsequent missions.

The AUV, aided by an INS and DVL system, can keep track on the position very well. But it is not perfect. A series of 4 lines in a pattern of a square, each about a mile long, was run. At the completion of each set of 4 lines, the entire process was done again, for a total of three times. The result of the passes are shown in Figure 1.

FIGURE 1. Three Passes of the Same Four Lines



One way to measure the position offset is to view the entire data set from above and compare it to another one. Matching up colors is difficult; contours proved to be the best method.

In TIN MODEL, each set of 4 lines (one complete circuit around the square), was processed to create a contour file of 2 meter depth increments. Each of the passes was color-coded: blue for the initial run, black for the second and red for the third loop.

With AUV operations, this shift can be viewed, not as a random jump of positions (think of a GPS scatter plot), but more as a sum of errors as the vehicles transit through the mission. The initial line would be considered the best position. The second pass, had an average offset of just under 3 meters. The third pass had close to 2.3 meters of position difference. It

is also noted that the offset is not in the direction of the line, with the shift to the west-south-west.

FIGURE 2. Initial Run

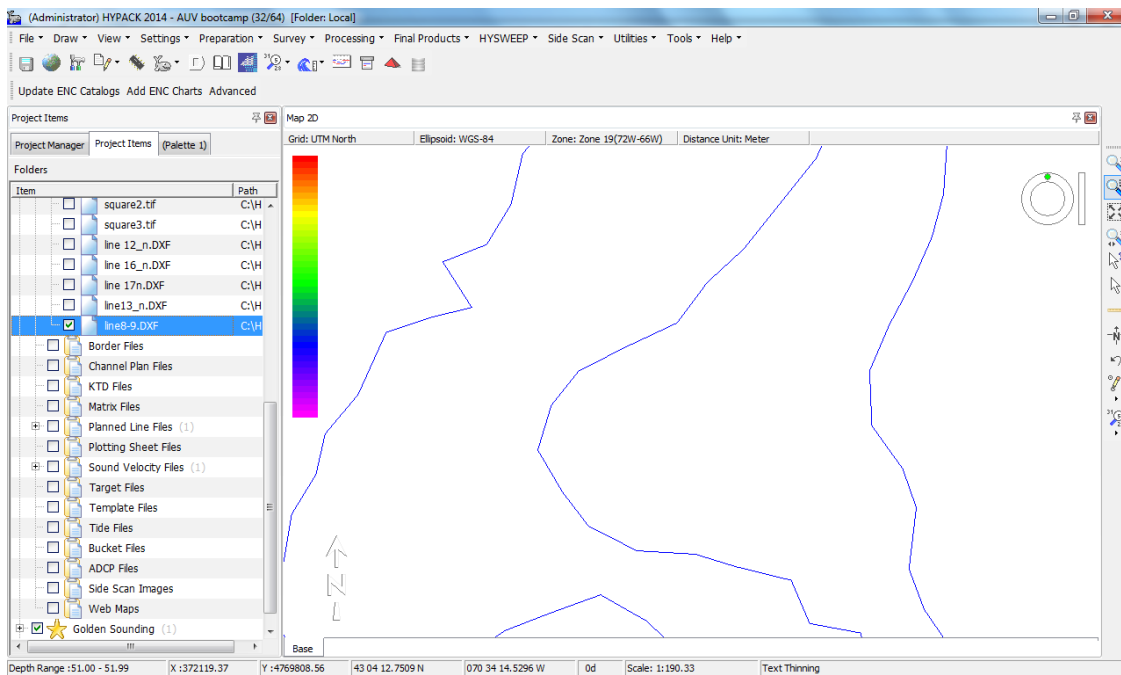
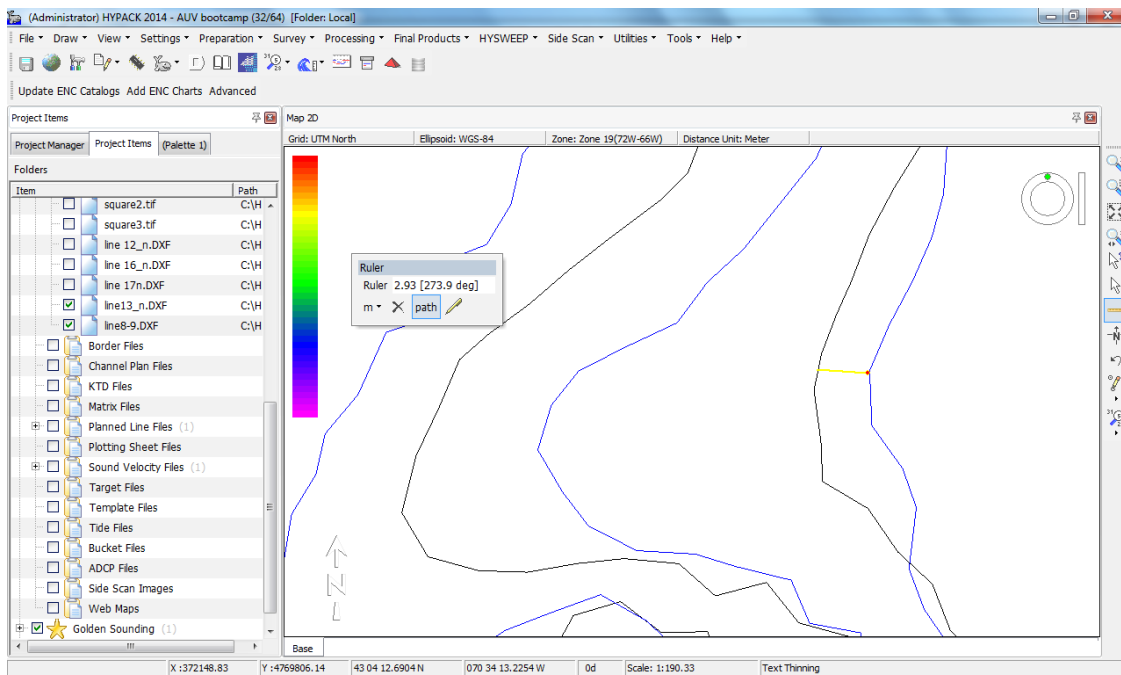
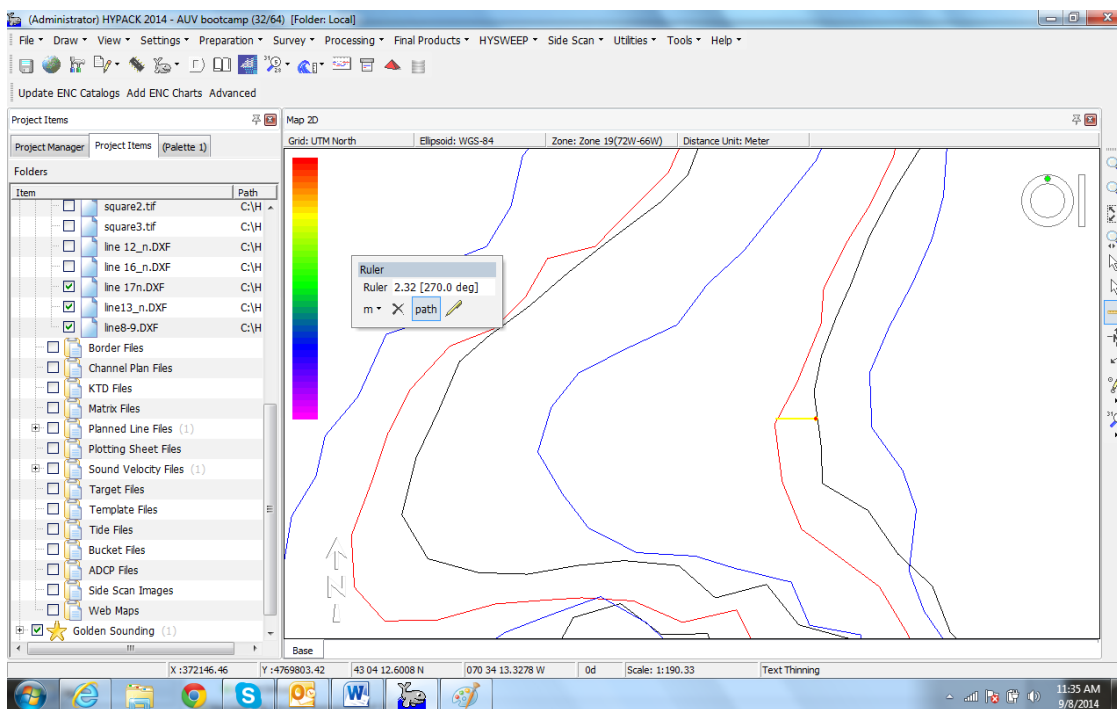


FIGURE 3. Second Pass—Shift is to the East, 3 meters



Third Pass shifts another 2.3 meters, for a total of a 5.3 meter shift from the first mission.

FIGURE 4. Third Pass



The next step is to apply this shift to the data. There are two methods; both are available through the tools in the SIDE SCAN REFORMATTER:

- **Re-insert navigation.** If we extract the navigation, and create a new position file with offsets matching those of the mission, we can re-insert this file (The POS fields of the first file are removed, and replaced with the new position file).
- **We can set an offset (an X and Y) to be used as a scaled offset adjustment.** This takes the final offset and adjusts each position slightly to match the value. As an example: on a mission of 1000 meters and a total shift (offset) of 2 meters, the positions would move proportionally—at 500 meters there would be a shift of 1 meter.

As AUV operations run great for minimizing manned operations, the problem of positioning becomes apparent with the underwater vehicle. Even the best INS and DVL system will show some drift. The job now is to determine this offset, and adjust the data the best we can.