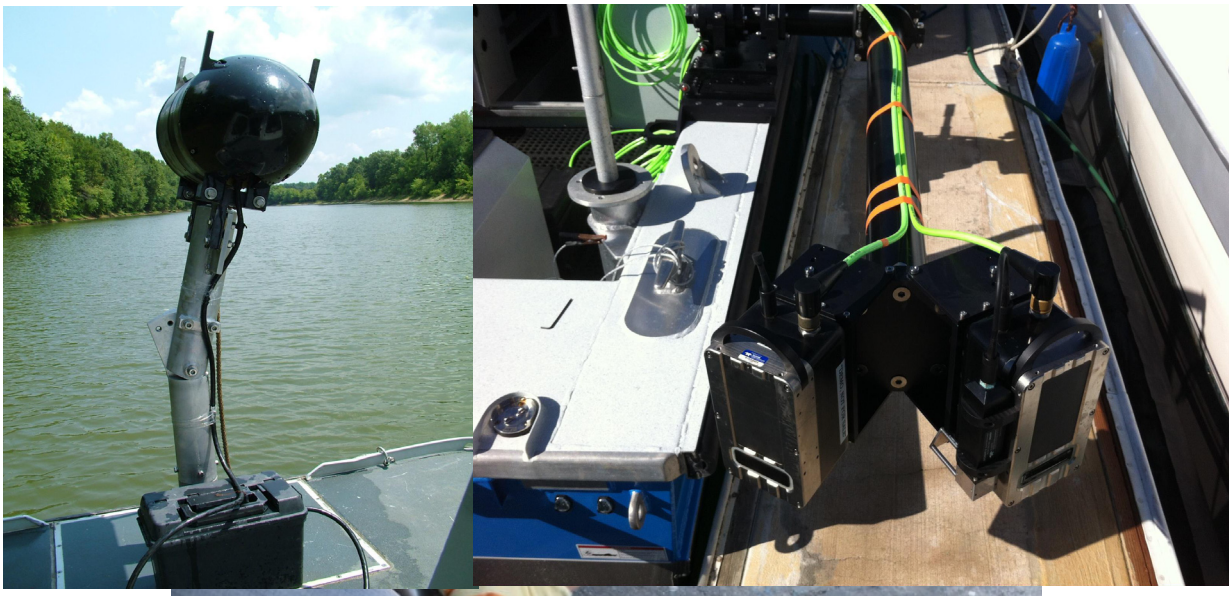
Multibeam System Tilted Sonar Head Data Collection and Calibration (Patch Test)

By Joe Burnett

Back in 2013, I wrote an article about how to collect your data with a standard “straight-down” multibeam setup. (http://www.hypack.com/new/portals/1/pdf/sb/07_13/Multibeam%20System%20Setup%20and%20Calibration.pdf)

What I neglected to include, was the explanation of how to setup and collect data for a “tilted multibeam sonar head.” This document will describe how to do this, so you can achieve the best Patch Test results for your “tilted head” setup.

FIGURE 1. *A Few Views of What Tilted Multibeam Systems Look Like:*

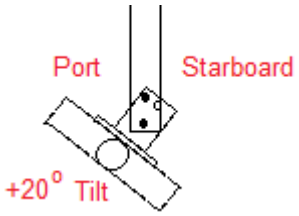


The ‘Tilt’ brackets come in all shapes and sizes. How yours is built, will be up to you. However, once it is built, it will need to be properly setup and calibrated (patch tested).

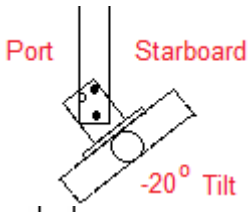
HARDWARE OFFSETS

Prior to collecting your tilted patch test data, make sure you do the following in HYSWEEP® HARDWARE:

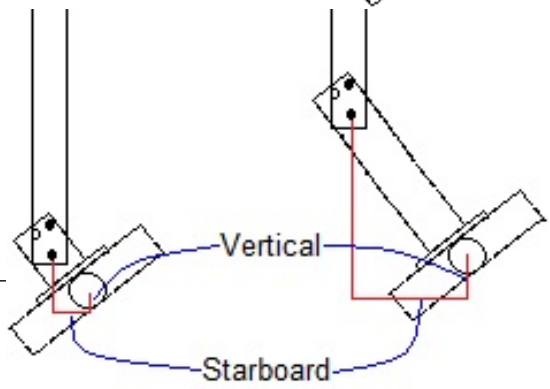
1. **Enter the approximate roll tilt for the multibeam**.
   - **Roll tilt is positive (+)** when the Head is “rolled” downward on the Starboard side. Typically, this means that the head is mounted on or oriented more to the Port side of the boat.



   - **Roll tilt is negative (-)** when the Head is “rolled” downward on the Port side. Typically, this means that the head is mounted on or oriented more to the Starboard side of the boat.

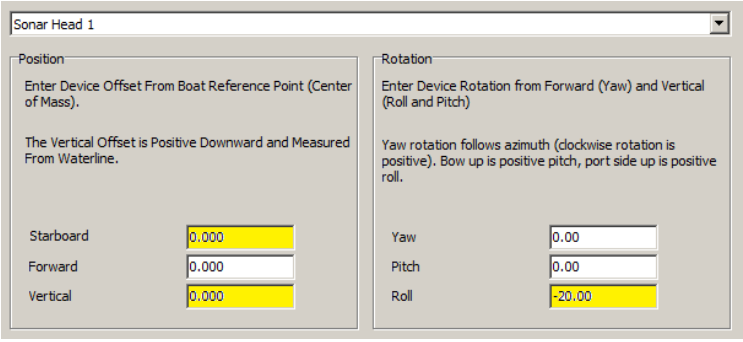


2. **Enter the corrected starboard and vertical offsets for the multibeam acoustic center**, in order to compensate for their change from the normal “straight-down” setup of the sonar head. The location of your pivot point, determines how significantly these values change.



NOTE: The Roll values shown here are an example and may not be the values that you believe your sonar head is “tilted”.

FIGURE 2. *Entering the Roll Offset for the Sonar Head*



Once you have these values measured and entered, you are now ready to collect your “tilted” patch test data.

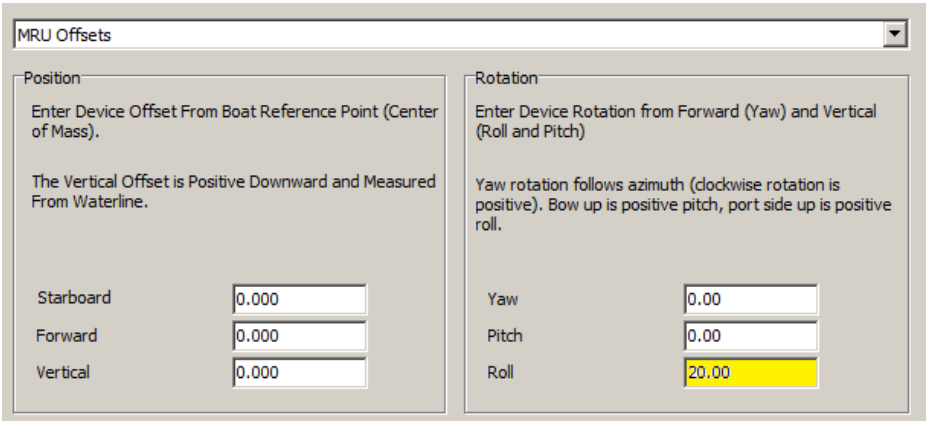
SYSTEMS WITH INTEGRATED SONAR AND MRU

As technology has advanced, and equipment has gotten smaller and more compact, components are being integrated onto/into one another. One of these integrations is the motion sensor (MRU/IMU) with the multibeam sonar head.

If you have one of these 'integrated' systems where the MRU/IMU is attached to the sonar head, you will need to enter another offset value—the roll offset for the MRU/IMU Device—in HYSWEEP® HARDWARE. It will be the same roll value that you entered for the sonar head, except it will be the inverted value.

For example, if you entered a value of (-20.00) for the roll value of the sonar head (Figure 2), you will enter a value of (+20.00) for the roll value of the MRU/IMU device.

FIGURE 3. *Entering the MRU/IMU Offset*



This compensates for the values from the MRU/IMU device, so that they are now oriented around 0.00 degrees. It is also very important for the calculation of RTK Tides and the Lever Arms that will be applied.

IMPORTANT: Once you calibrate your system with this roll offset for the MRU/IMU device, *you cannot change it*. If you do, you must perform another patch test, as you have changed the values and their relationship between the MRU/IMU and the sonar head.

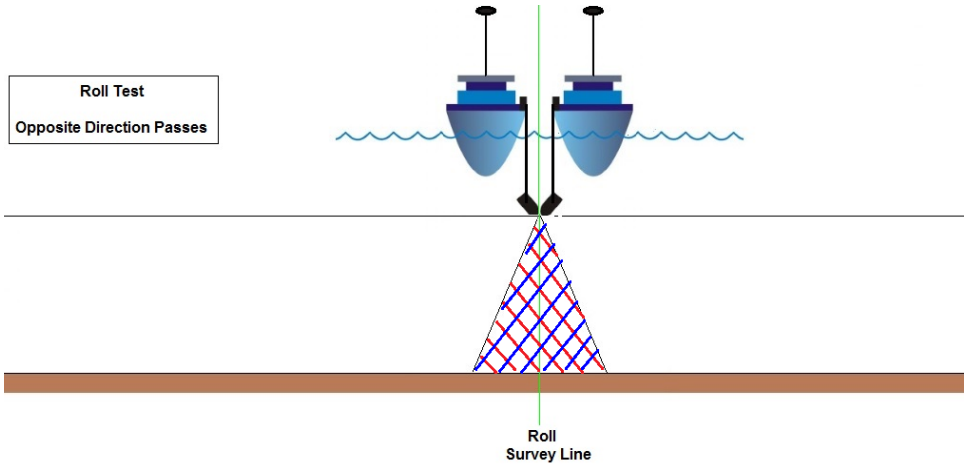
DATA COLLECTION

One can assume that the only thing that has changed, with respect to the setup of the multibeam system and its mounting orientations, is the roll offset. However, you should always perform all four tests (latency, roll, pitch and yaw), to verify any change in any of the tests.

With that said, there are some considerations to be understood, when you collect the patch test data:

- **For latency and pitch**, collect the data exactly as you would for a “straight-down” setup. There is no change for these tests, because they are comparing the overlap at the nadir beams, and the ‘tilt’ will not affect this. It will cause the boat operator to be more aware of the navigation of the boat, and to drive the boat as close to nadir on top of nadir, as possible, for all the passes.
- **For yaw**, collect the data the same as for a “straight-down” setup.
- **For roll,** collect the data the same as for a “straight-down” setup; however, be aware that your overlapping data is now greatly decreased due to the “tilted head”.

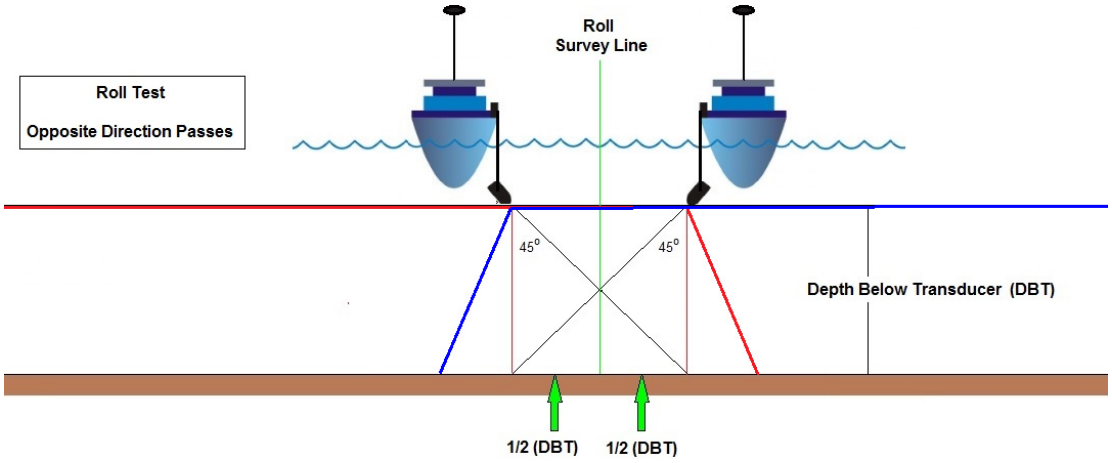
FIGURE 4. *Collecting Data for the Roll Test*



NOTE: You will want to have deeper water, if you decide to collect it this way.

Alternatively, you can spread the spacing of the reciprocal passes, so that you have more soundings overlapping rather than collecting with nadir over nadir.

FIGURE 5. *Collecting Roll Test Data with Wider Spacing*



In this example, I used a spacing of half the water depth for a 45 degree tilt, to increase the overlap. My suggestion is that you use your own judgment in the spacing you choose, with the understanding that more overlap will, more than likely, give you better results.

Processing the Patch Test data

Once you have collected the “tilted” patch test data, you will process it the same as you would the normal straight-down data. Follow the directions in this article:

http://www.hypack.com/new/portals/1/pdf/sb/09_13/Patch%20Test%20in%20MBMax64.pdf

The big advantage is that you already have the roll value very close, by pre-entering its approximate value, and you should be able to quickly solve any small adjustments that are needed to get it to its best value. As I previously stated, I would expect the other three (3) tests to stay the same, but perform and process them, just the same.