# Induced Heave -- What is it? and Why do I need to calculate it ?

By Joe Burnett

By definition, an “Induced Heave” is a heave artifact that is caused by a vertical lever arm motion caused by the mounting of the MRU (Motion Reference Unit) in a location other than the “center of gravity”.

You must place the boat reference point (BRP) at the center of gravity (rotational pivot point) to enable HYPACK® to compensate for “Induced Heave”. This can apply to both single beam and multibeam data collection, but it is more significant in multibeam data.

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**NOTE:** There is one exception to the rule for having offsets measured from the center of gravity. If you have everything mounted on the same over-the-side pole, AND you have an RTK antenna mounted on the same pole, AND it is recording your vertical heights thru RTK, then and *only then*, will HYPACK® compensate for the “Induced Heave” by other means than those discussed here.

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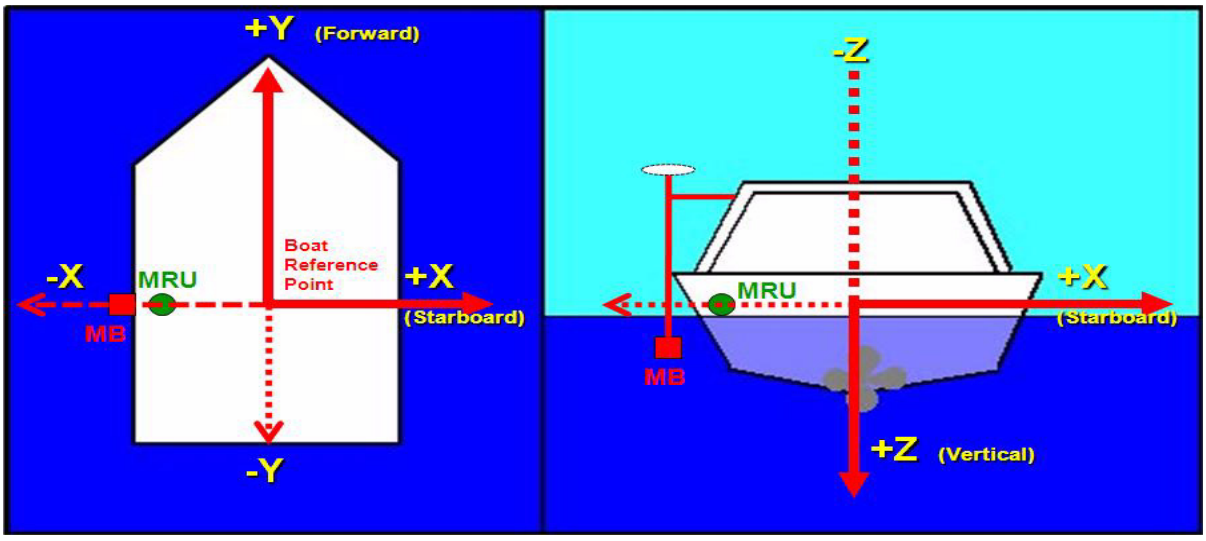
In most cases, it is NOT possible to mount your MRU at the center of gravity. Therefore, you have to mount it in a location where it will not become a safety-hazard, but as close as possible to the center of gravity. Sometimes, this is not possible and the MRU has to be mounted near the side of the boat, a fair distance from the center of gravity.

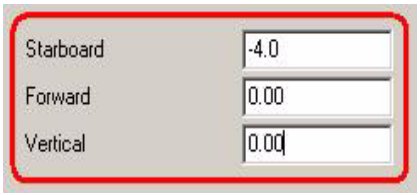
When the MRU can NOT be mounted at the center of gravity, measure the starboard and forward offsets (from the BRP) and enter them in the hardware offsets in HYPACK®. (If it is at the center of gravity, the offsets should be all ’0’.)




What happens is this:

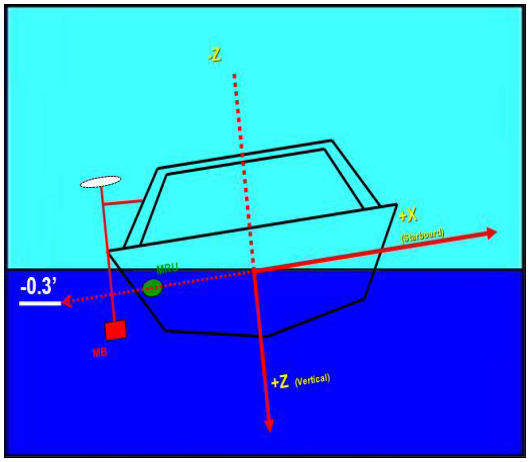
The MRU is mounted away from the center of gravity; let’s say it is mounted 4.0’ to the port side of the vessel, but in line with the center of gravity. This would cause it to have a starboard offset of -4.0’ and a forward offset of 0.0’.

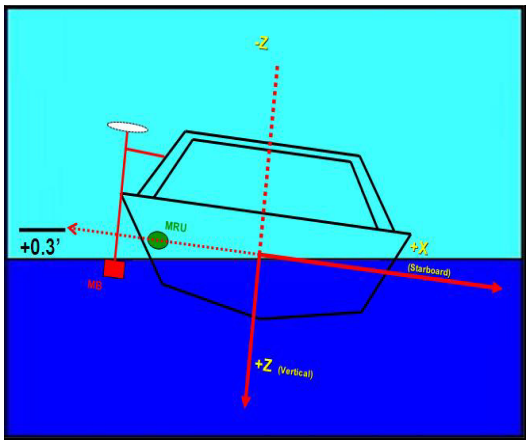
***FIGURE 1.*** *MRU Hardware Offsets*




The MRU measures the heave, pitch and roll values during data collection. The MRU measures the pitch and roll in angular values, and the heave in vertical distance, both from accelerations that it realizes in vertical movement. This is very good in dynamic sea-states, but when the MRU does not measure any noticeable vertical motion, it "settles" its heave measurement back to zero (0.0'). This is where the "Induced Heave" comes into play.

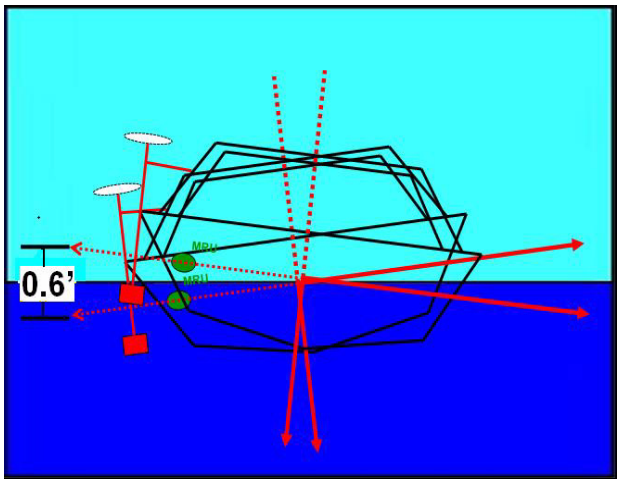
Let's say that the surveyor decides to sit on the port side of the vessel during the data collection (Remember, the MRU is on the port side). The MRU instantly measures the downward heave, but after a short time (usually around 30 seconds, depending upon your settings within the MRU), it "settles" back to zero (0.0'). However, the vessel now has a 4.290 roll to the port side, and is maintaining this roll value. This 4.290 roll is causing a vertical error of -0.30' to the soundings that are currently being collected.




To make matters worse, the surveyor decides to move to the starboard side of the vessel, during data collection. The MRU instantly measures the heave upward then, about 30 seconds later, "settles" back to zero (0.0'). However, the vessel is now experiencing a -4.290 roll and a vertical error of +0.30' to the remaining soundings collected.

Now, collection for this file ends. But, during its collection, vertical errors of +/- 0.30' were introduced into the data set, for a total error of 0.60' because the offsets for the MRU were set to starboard=0.00 and forward=0.00 in the hardware configuration.




**Can we compensate for induced heave after the fact? YES.** In the Read Parameters Window of the editor programs, you can enter the correct starboard and forward offsets for each sensor; the editor will take care of the rest. In HYSWEEP® projects, even if you have already edited the files, the starboard and forward offsets can be changed and re-applied to the edited files.