



### *Buoyancy and Ballast Overview*

The buoyancy of an ROV will be affected by attached options or accessories, the type of tether connected at the ROV and the salinity of the water. With that in mind, VideoRay ROVs are designed with an adjustable ballast system so that users can fine-tune the buoyancy to accommodate different operating conditions. Too much or not enough buoyancy may make it difficult to control the ROV. An improperly ballasted ROV will take extra power to hover, and tend to overshoot the desired depth when changing depths.

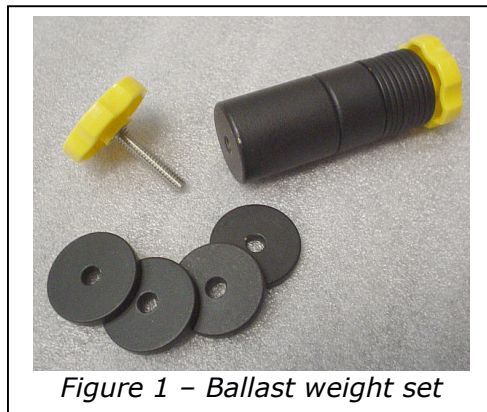
Typically, it is desirable to have the ROV ballasted so that its buoyancy is slightly positive. This allows operations near the bottom without stirring up a lot of sediment. Also, the ROV will tend to surface on its own if it loses power for any reason.

In addition to adjusting the general buoyancy, ballast must be positioned so that the ROV is balanced and not riding nose high, nose down or rolling to one side (unless a specific orientation is dictated by the mission requirements). Ballast position will directly affect the static balance of the ROV. Dynamic balance is the tendency of the ROV to pitch up or down when thrust is applied, and it is caused by offset centers of thrust and drag. Using ballast to overcome a dynamic balance problem will only be successful if the added ballast creates drag in the appropriate place.

When attempting to ballast a VideoRay, users are reminded that VideoRay tether can be negatively or neutrally buoyant. The tether connected to the ROV will also impact the buoyancy and balance and must be taken into consideration.

### *VideoRay's Ballast System*

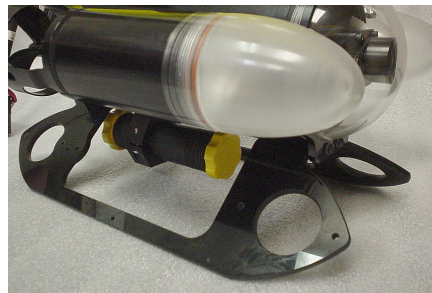
VideoRay uses disk shaped weights mounted underneath the ROV on a ballast rack between the skids. Figure 1 shows a picture of the weights and rack. As you can see, the weights are secured using a screw with a knurled knob so that tools are generally not needed to adjust the ballast.



*Figure 1 – Ballast weight set*

## How to Ballast a VideoRay ROV

Figure 2 shows the ballast rack mounted on the underside of the ROV.



*Figure 2 - Ballast rack mounted on the ROV*

Figure 3 shows a supplemental ballast technique that allows users to fine tune the static balance. In this photo, you can see that a weight has been mounted directly to the skid using an 8-32 screw. There are several threaded holes on the skid for this purpose.



*Figure 3 - Skid mounted ballast for fine-tuning balance*

## ***Ballast Procedure***

Whenever options or accessories are changed on a VideoRay, or when moving operations from salt to fresh water (or vice versa) the buoyancy must be checked and the ballast adjusted. In order to check the buoyancy, the ROV should be lowered into the water so that it submerges at least a foot (0.3 m). This will allow you to better estimate the amount of ballast to add if the ROV is light. If you just place it in the water on the surface and it floats, you will not be able to judge how quickly it rises, and consequently, how much ballast to add.

When testing the buoyancy it is also suggested that you add enough tether into the water to more closely simulate the actual conditions during operations.

Once you determine the buoyancy, add or remove ballast to achieve a slow ascent and proper attitude of the ROV.