

Dynamic Balancing

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A Steadicam sled is in dynamic balance when the center post remains vertical as the sled is panned (and this is critical) at any and all panning speeds..

Dynamic balance is extremely important for precise operating and also for whip pans.

For each arrangement of camera, monitor position, post length, accessories, etc., there are many possibilities for statically balancing the Steadicam.

However, for each arrangement of camera, monitor position, post length, accessories, etc., there is only one combination that also balances the sled dynamically.

There is some leeway as to the required precision of dynamic balance. What is

acceptable depends upon the operator and the situation.

Dynamic balance can easily and quickly be achieved by the trial and error method. You can also use the Dynamic Balance Spreadsheet on your computer.

In all cases, when a sled is in dynamic balance, both the camera's c.g. and the battery's c.g. will be to the rear of the center line of the center post. This rule gives you some point to begin balancing the Steadicam.

First, set up your sled at the proper length for the shot and place the monitor where you want it for proper viewing and inertial control. Position the camera so that its c.g. is about .75 inches (19mm) behind the center post. The center post is 1.580 inches in diameter, so you can use the back of the post as a guide.

Three figures to study for understanding dynamic balance

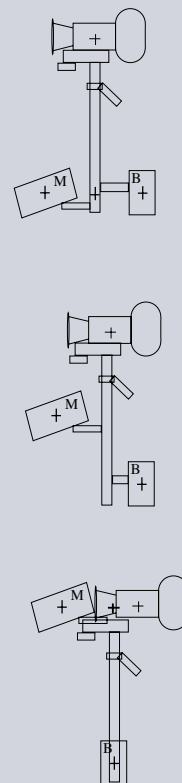
The top figure looks like the Model One or the SK. The camera c.g. is centered over the post; the monitor and battery are on the same horizontal plane, and their common c.g. is in the post. This unit is in dynamic balance and pans flat.

The second figure has the monitor raised a bit. This looks like most Steadicam configurations, high or low mode. Note that the battery c.g. is closer to the post, and the camera c.g. has moved to the rear. Why?? See the third figure.

In the third figure, the monitor has been raised all the way up in front of the camera. It's absurd, of course, but it makes a point. Now the common monitor and camera c.g. is over the post, and the battery's c.g. is directly under the post.

So you can see that as the monitor is raised, the camera c.g. must move to the rear and the battery c.g. must move towards the post. With the Ultra² (and most Steadicams), the monitor is always raised above the battery. Therefore camera is always to the rear of the centerpost.

It typically works out that the camera c.g. is pretty close to .75 inch to the rear — a bit more if the camera is light or the monitor is higher, and somewhat less if the camera is very heavy or the monitor is lower.





Next, static balance with the battery so the sled hangs perfectly vertical fore and aft. Use a slow drop time (3-4 seconds).



Trim side to side with the camera, using the knobs on the stage. You can also use the stage motor remote control, as shown. Fine tune fore and aft balance with the motors as well. Double check that the post is perfectly vertical. Give the sled several careful test spins. Very important: do not spin the rig very fast – certainly not any faster than your usual panning speed.

Note the results. Good or bad, flat pan or wobbly? Is it your technique or is the sled out of dynamic balance?

If the sled is out of dynamic balance, **move the battery – not the monitor or camera! – in or out a bit.**

There are only two directions to choose from: you have a 50% chance of getting it right. Be sure to make a note of which direction you move the battery.

Rebalance statically with the camera (racking it in the opposite direction), and spin the sled again. Better or worse? Again, you have two choices. Re-rack, rebalance, and spin again (and again!) until the sled pans flat. This should not take a lot of time.

When the battery is within about 1/4th inch of ideal, the sled will behave nicely and feel “sweet.”

Adding any accessory to the sled will affect both static and dynamic balance.

How much? It depends on the mass and position of the object, and the masses and positions of everything else on the sled. You will discover that as the monitor is placed higher towards the camera, the closer the battery c.g. gets to the center post, and the more the camera c.g. moves away from the post to the rear.

See the Dynamic Balance Primer and play with the Dynamic Balance Spreadsheet included on the Ultra² CD, or available at www.steadicam.com.

Three tips:

- The monitor pivots close to its center of gravity, so changing the angle of the monitor will not affect dynamic balance.
- The tilting head nearly preserves the camera's center of gravity, so tilting the camera also has very little effect on dynamic balance.
- Changing lenses or adding accessories to the camera (or even changing cameras) will not mess up your dynamic balance. Just re-balance statically (rack the camera) and you will be back in dynamic balance.

Make sure to give it an even spin. Use your thumb and first finger up at the gimbal.



Spinning a bit wobbly. Looking good!