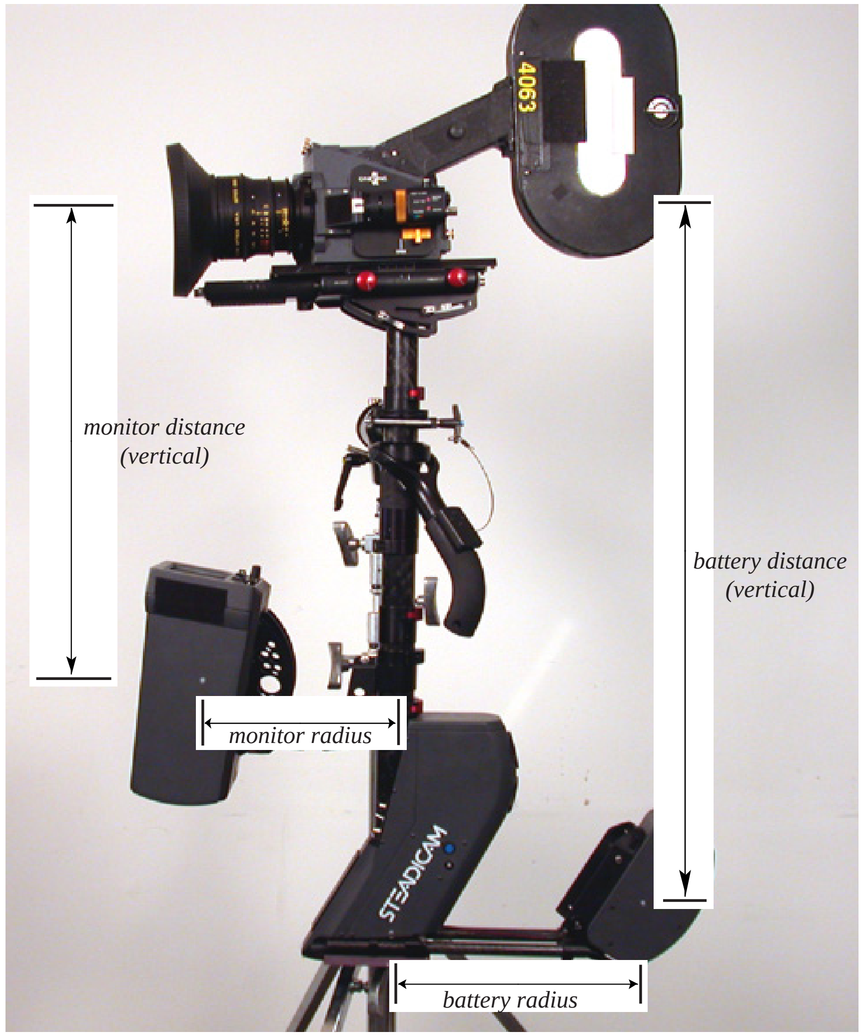
# Instructions for Using The Dynamic Balance Spreadsheet

*It's a good idea to download and view the "Dynamic Balance Primer" for a detailed discussion of the forces affecting dynamic balance. Also download the Tiffen Ultra Manual for a general discussion of all types of balance (static, dynamic, and inertial) and how to set up a Steadicam. Both are available on the Tiffen website (www.steadicam.com). I will repeat as little as I can of the information contained in those documents, and I assume everyone can refer to them. That will keep these instructions reasonably short.*

The spreadsheet assumes the sled is configured in a conventional manner, with all component c.g.'s in one vertical plane fore and aft. See the Primer if you don't get this concept.

The spreadsheet can be used in two primary ways to help the operator get his rig into dynamic balance. First, it can be used away from the set in an "educational mode" to demonstrate how any specific change of a component's weight or position would change the battery and camera position of a rig in dynamic balance.

Secondly, it can be used on set to calculate the proper position of the battery each time the operator reconfigures the sled.




*Length and radius measurements of the monitor and battery components. The battery radius is a computed field.*

Either way, the spreadsheet should be customized for your particular sled and the accessories you carry. Although a lot of numbers are pre-programmed into the spreadsheet, you will need to change most of the entries based on the sled you own.

First things first.

Make a copy. Then open the copy in Excel. If you don't have Excel, perhaps the spreadsheet can be imported into a program you have. Otherwise, get Excel.

| Setup name | R battery | R camera | W mon | R mon | L mon | W battery | L battery |
|---|---|---|---|---|---|---|---|
| **Standard setup** | **-6.77** | **-1.06** | 4 | 12 | 20 | 5 | 30 |
| **see L monitor** | -5.17 | -1.38 | 4 | 12 | **15** | 5 | 30 |
| **see L monitor** | -8.37 | -0.74 | 4 | 12 | **25** | 5 | 30 |
| **see L monitor** | -9.52 | -0.51 | 4 | 12 | **28** | 5 | 30 |
| | | | | | | | |
| **Standard setup** | **-6.77** | **-1.06** | 4 | 12 | 20 | 5 | 30 |
| **see R monitor** | -3.57 | -0.74 | 4 | **6** | 20 | 5 | 30 |
| **see R monitor** | -5.17 | -0.90 | 4 | **9** | 20 | 5 | 30 |
| **see R monitor** | -7.84 | -1.16 | 4 | **14** | 20 | 5 | 30 |
| | | | | | | | |
| **Standard setup** | **-6.77** | **-1.06** | 4 | 12 | 20 | 5 | 30 |
| **no acc's** | -6.23 | -0.80 | 4 | 12 | 20 | 5 | 30 |
| **some acc's** | -6.72 | -1.12 | 4 | 12 | 20 | 5 | 30 |
| | | | | | | | |
| **Standard setup** | **-6.77** | **-1.06** | 4 | 12 | 20 | 5 | 30 |
| **See W camera** | -6.77 | -1.76 | 4 | 12 | 20 | 5 | 30 |
| **See W camera** | -6.77 | -0.75 | 4 | 12 | 20 | 5 | 30 |
| **See W camera** | -6.77 | -0.38 | 4 | 12 | 20 | 5 | 30 |
| | | | | | | | |
| **Standard setup** | **-6.77** | **-1.06** | 4 | 12 | 20 | 5 | 30 |
| **Long sled (+44")** | -8.17 | -0.78 | 4 | 12 | **64** | 5 | **74** |
| **Long sled w/no acc's** | -7.78 | -0.43 | 4 | 12 | **64** | 5 | **74** |

*This is what the spread sheet looks like when you first open it. There are many more columns to the right that are not represented here.*

## What the spreadsheet does

The spreadsheet contains a formula to calculate the proper horizontal extension of the battery (the battery radius or $R_b$) to get the sled into dynamic balance, based on the placement of all the other components of the sled.

The operator extends the battery to this position and then balances the sled on the stand statically with the camera. When the sled is in static balance, it also will be in dynamic balance, or very close to it. Usually the calculation is within a quarter inch (6mm).

A quick spin test will fine tune the sled's dynamic balance. See page 12 of the Primer for details on this process.

It is always assumed that the operator will carefully balance the sled on the stand at the end of the process.

The spreadsheet also calculates the camera radius ($R_c$) based on the weight of the camera. Generally the weight of the camera is not known. However, knowing the camera weight is pretty much irrelevant on set.

Operators must balance their sleds statically, so they don't need a computer to tell them where to place the camera. Enter an approximate – or an exact, if you wish – weight for the camera into the data field.

Off set, the computed camera radius has more value, as it can demonstrate what happens to the battery and camera radii if the camera weight changes.

Give each configuration of your sled a name. In the spreadsheet are 18 examples of various setups. See above.

You may delete all but one of these rows if you wish, but before you do, take a look at what is already there.

**Do not delete any columns.**

The "W" columns are the weights of the various components on the sled, the "R" columns are the radii, and the "L" columns the vertical distance from the camera c.g. to the c.g. of the component.

Note that the numbers for the camera and battery radii are negative, which means that these components are to the rear of the center post. This seems obvious, but the spreadsheet will need to know when you add accessories if they are ahead of, or behind, the post. We decided that "–" means behind the post, and that "+" means in front of the post.)

Take a look at the setups. Each group of setups has the "standard setup," and then an instruction, such as "see L monitor." Look across the row and note the entry in bold type. This is the element that is changed from the standard. Note what happens in the two computed fields, the battery radius and the camera radius.

These are just examples, and do not closely model any actual Steadicam.

Now try entering some data and see what happens to the computed battery and camera radii.

Do not try to change the two computed fields.

Using the program in this manner will give you a feel for what happens to the battery radius when any element is changed or accessories added.

To use the program for your particular sled, you must enter accurate weights for your components and mark all the c.g.'s. This will take a bit of time. Some weights for accessories follow, and weights are often published by the accessory's manufacturer.

The good news is that you only need to do this work once.

You may find that you do not have a component corresponding to one or more of the fields in the spreadsheet. Enter a zero for the *weight* of any nonexistent component.

See the picture on page one. These are the sorts of measurements you must take to enter the proper length and radius of each component. Note that the measurements are vertical and horizontal, and that the vertical measurements are from the camera's c.g. to the component's c.g. – not from the top of the sled.

Small tip: If you are not working with a specific camera, you can assume that a typical camera's vertical c.g. is 4 inches (100mm) above the top of your sled.

Big Tip: If your sled has components that always move in unison, you can reduce the number of measurements you need to take. For instance, if when changing sled length, the battery and the electronics always move together, make the electronics length field a formula, such as the sum of the battery length minus two inches. (See the instructions with Excel on how to do this.)

| **Weight chart for some accessories** | **pounds** |
|---|---|
| Preston large motor | .94 |
| Preston small motor | .72 |
| Heden motor with idler gear & mounting bracket | .62 |
| FMG-6 motor | .72 |
| Staton motor with hardware | .44 |
| Preston MDR-1 receiver/amp | 1.50 |
| Preston MDR-2 receiver/amp | 1.34 |
| Bartech receiver/amp | .75 |
| Genio receiver/amp | .89 |
| Seitz receiver and amp with cables | 1.25 |
| Modulus 3000 transmitter with antenna | .44 |
| Coherent CVT-500P transmitter | .30 |

Make some notes about your sled. How much you can extend your sled vertically? How high or low you can position your monitor relative to the battery? How far can your monitor be positioned in or out? How far can your battery can be positioned in or out?

If your battery is a “compound element” (multiple batteries, or the battery and electronics always move together fore and aft like the IIIA) use the compound weight and the compound c.g. in the battery weight and length fields.

Now take your standard setup (a row of data) and copy and paste it a few times. Then make changes to the data based on how your sled can physically be configured. You may have few choices, or a lot.

*Measuring the new monitor length.*

For instance, make a setup with your sled as long as possible and the monitor low and with the largest possible radius. Then make another setup (row) with the monitor low and with the smallest possible radius.

Now look at the computed battery radius for each configuration. Can the battery be placed there? (Is it physically possible?) If the answer is yes, then that configuration is possible to get into dynamic balance. If the answer is no, then the rig can’t get into dynamic balance. (It may still be possible to get it into static balance).

*Finding the camera’s fore and aft c.g.*

Note that changing the camera weight has no effect on changing the battery radius in any configuration.

Try to model as wide a variety of setups as your sled will allow. What happens to the battery radius when you extend or compress the sled a couple of inches - both when it’s long and when it’s short?

*Finding the camera’s side to side c.g. To find the vertical c.g., lay the camera on its side.*

The various setups you create on the spreadsheet will give you a really good idea of what happens when you change or add something to your sled.

If you like, use the information to make a chart for your basic setups, and this will save you lots of time on set.

If you like, you can also use the spreadsheet on set. If you’ve altered the spreadsheet to represent your sled and what components always move together, you generally only have to take two measurements, – and at most three – to determine where to place the battery. A simple spin test fines tunes the balance.