$14 Steadycam
"The Poor Man's Steadicam"

By Johnny Chung Lee

(click to enlarge)

Why build a cheap steadycam?

Steadycams (or camera stabilizers) are attachments used to capture smooth looking video even when the camera and camera operator are in motion. The camera operator may walk (or even jog), move through tight hallways and doorways, and even climb up and down stairs without shaking the camera. Unfortunately, professional steadycams cost around $1500. Even the cheap 3rd party ones cost $600+. Not exactly a bargain considering many of us use cameras in that price range. So, I decided to make my own version. It turns out, it only costs $14. Not too bad. And I'll show you how to build your own right here (or you can buy a ready-to-use steadycam from me through this website [littlegreatideas.com]). Whether you are an aspiring filmmaker, a videographer, the family documentarian, or just want more utility out of your video camera, you'll appreciate a steadycam.

If you know what you are doing, you can probably build one of these in about 20 minutes. It might take you an hour if you have to read this web page while you do it and aren't very good with tools . This steadycam design works with anything that has a tripod mount and should be fine with cameras that weigh less than 5 pounds. For heavier cameras, I would recommend building a large sled for better support and easier mounting or considering adding a professional tripod head . If you make it out of steel or iron as I recommend, you will have to worry more about the solidity of your camera than the solidity of the steadycam. But before we begin, I should warn you that improper or irresponsible use of a steadycam can quickly result in damage to your equipment and/or injury to yourself and others.

Side Article:

A brief article about my experience using the Sony HDR-FX1 with an iMac G5

Tools

The main tools you'll need to get your hands on are a drill and a stationary vise. It's possible to do it without the vise, but it's far more difficult and potentially dangerous. You can buy a vise for about $15 from Home Depot or Lowes and it's well worth the money if you are going to do any future projects. It's meant to be table mounted, but I just bolted it to a big board that I can stand on while I use it. Mounting it is important. I tried doing this once without mounting it (didn't have spare board at the time) . It was a **p-a-i-n**.

You'll need drill and a 1/4" drill bit that can go into galvanized steel. So, cheap wood bits will probably not survive this project. This happens to be a very nice drill in this picture, but any power drill will do.

You also need a wrench, screwdriver (type depends on the bolts you get), and a hammer. I had a little combo thingy I got from the dollar store. It actually works pretty well because the wrench part is a little bit clawed, so it grips pipes really nicely.

Parts

Pipes

First you'll need three pipes. I like to use 1/2" galvanized steel or black iron. It's strong, threaded at the ends, and a comfortable thickness. You can use any length pipes you like, but this project uses three 10" pipes (about $1.50 each).

End caps

You'll also need three end caps. You can get away with just two, but the last one is used to cover up those nasty sharp threads on the end of the pipes. I've gotten cuts while building these things by accidentally grabbing the threads too hard . These are about 80 cents a piece. Make sure they fit the pipes, 1/2" diameter.

Tee

Basic T-joint. Again, make sure it fits the pipes. If your standard hardware store doesn't have this, you can try a plumbing store. About $1.30.

Weight
This is just a simple barbell weight from a sports store. The one shown in the picture is 2.5 pounds, but you can buy any weight you want. But, anything heavier than 5 pounds starts getting too heavy to carry around. Get a weight that has a 1" diameter hole. These are about $3.

Other small parts
Here's a break down of what you'll need:
A - two 1-1/2" 1/4" machine bolts
B - one 1/4" wing nut
C - three 1-1/2" diameter flange washers for 1/4" bolts
D - three lock washers for 1/4" bolts.
E - two 1/4" machine nuts.

All these together costs about two dollars. You sometimes can find these for really cheap at a specialty hardware store. General hardware stores tend to charge a lot for the specialty washers and nuts.

Total Cost: 3 x $1.50 + 3 x $0.80 + $1.50 + $2.00 + $3.00 = **$13.40** (yours will vary)
There you go. Can't get much cheaper than that!

Assembling the Handle

This first step is pretty easy. Just attach the tee and end cap to one of the pipes to form a basic handle. Feel free to tighten these parts together as much as you like. I recommend using the vise and a wrench. Don't use your hands, you'll just hurt yourself and not get it tight enough.

Drilling the End Caps

Put one of the end caps in the vise as shown. Then drill a 1/4" hole in the center of the cap. It's doesn't have to be perfectly in the center, but the closer the better. You really want to use the vise because you're drilling through a quarter inch of galvanized steel. It's enough to bring weak drills to a dead stop and will definitely do a number on your hand if you just try to hold it. Not mention it can get hot. Protective eyeware such as safety goggles should AWLAYS be used when using any powertool! Also little bit of machine oil (or even vegetable oil) can make this easier as well as preserve your drill bit.

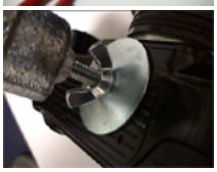
I like using a slow speed because when the bit comes out the other side it'll jerk from grabbing onto the metal. It's far more pleasant to have a slow jerk than to have the drill suddenly fly out of your hand. Do this in a place that's easy to clean up. You'll make lots of metal shards. Outside is where I did it. And don't use you fingers to wipe away the shreds!!! They'll get in your skin. Use a brush, or blow the shards away.Do this for two end caps.

The Camera Mount

The mounting requires the parts in the picture on the left. Bolt, two lock washers, flange washer, nut, wing nut, and a drilled end cap. Put a lock washer on the bolt and the put it through the end cap with the bottom of the bolt coming out of the top of the outside of the end cap like in the middle picture. Put another lock washer on and then the nut. Put the end cap in the vise and tighten with a wrench. The lock washer will keep the bolt from turning.

You'll want to make this really tight because this is where your camera attaches. You want it tight not because it'll fall off or anything, but because putting the camera on and taking it off requires lots of turning action. If it loosens, the bolt will pivot around as will your camera making hard it to keep still. If this happens while you're filming, you'll have to stop and find a wrench. This schematic view may be a little clearer than the pictures.

Use a hammer to dent the center of the flange washer. You can do this by putting the washer across the hole of the weight, putting the head of the bolt on the hole, and hammer the bolt. You want to have the center area of the washer higher than the rim. So when you attached the mount to the camera, as shown in the right picture, the rim of the washer pushes up against the area around the bolt. This washer will distribute the force away from the single point of contact. So, the wider the washer the better. If you don't use the washer, the camera will shake a lot right at this connection as well as putting a great deal of stress on this one tiny spot that could damage your camera. So if you lose this washer, I don't recommend using this steady cam without it.



Use your fingers to tighten the wing nut on the mounting. DO NOT use a wrench. You may risk stripping the threads on your camera or breaking the tripod mount. Both are equally bad.

The Counter Weight

You'll need the barbell weight and the parts shown in the pictures below. They'll go together in the pattern shown in the next picture. The bolt goes through two washers that sandwich the weight. Then stick on the end cap, put on the lock washer, and then finally the nut. Hand tighten the parts until they are snug. This schematic view may be a little clearer than the pictures.

The lock washer deep inside the end cap will keep a grip on the nut. So, you don't have to stick pliers down there to turn it. Just turn the cap. Stick the cap in the vise shown on the bottom left. Then you can use the screwdriver to tighten the bolt, or just grab the weight and turn it. The weight should turn the bolt, and the vise will keep the cap from turning.

I like to tighten it until the outer washer starts to bend inwards. This reduces the amount the bolt sticks out - good for when you want to put it down on the base. If you do use the base as stand (not highly recommended because it's easy to knock over), you can buy rounded bolts and little rubber feet. These will make a much nicer base that won't wobble. You can tell I like to do this and I say it easy to knock over from experience. My camera still seems to work okay, though.






All Together Now...

Lastly, take the remaining two pipes, screw them into the T joint of the handle, and attached the base and the mounting. And your done! You can tighten these parts as much as you'd like. Either give them a good hand tightening or the full fledged vise and wrench tightening. The only reason not to do the vise-wrench tighten is if you want to be able to collapse this or swap components. You can vary the pipe lengths and barbell weight however you like.

I would probably refer to this combination as the sport model. Mostly because it's balance point (with camera) is near the T-joint and can be spun around by the handle pretty well. It's really agile. Longer bars and heavier weights change the handling.

When you store it without the camera, the mounting washer is left hanging on the end. I recommend taking off the wing nut, putting on the washer, and then screwing the wing nut back on. That will help keep it from getting lost.

Using Your Steadycam

The side handle is used to stabilize side-to-side rocking. The vertical shaking is pretty much dampened by the weight. You may hold it however you'd like. The way I like holding it is shown in the picture. How you use it is 80% of the smoothness. This even is true for the professional stuff with all the fancy shocks and hydraulics. Don't expect this thing to perform miracles, you have to practice using your arms and body to create a smooth motion. Watch your hands while you walk, and see how level you can keep them relative to the ground. Watching the shadow of your hands on a sunny say is an easy way to isolate thier movement. Keep your legs bent and learn how to "glide". I talked with someone who has used professional steady-cams and they said this was, "really, just as good." Getting good results is not so much about the equipment, but how you use it. That's really true about everything.

WARNING: Improper or irresponsible use of a steadycam can quickly result in the destruction of your equipment and/or injury to yourself and others. Be careful, watch where you are going, pay attention to where you are swinging your camera, and just try not to do anything stupid for your own sake.

Here is some example footage of the steadycam in use. These are for educational and demonstration purposes only. If you really enjoy the music used in these clips, I encourage you to support the artists by purchasing thier recordings.

Duration/Size:0:13/617KB
Description: Sprinting down a hallway with camera about 3-6 inches from the ground. Uses the inverting bracket to position the camera near the ground.
Notes: The vertical motion is clean, even around the turn and up the ramp. There is a little side-to-side motion because I was only using one hand and not using the side handle. I did this run cold without any practice. You should really practice a scene a few times and get used to what you'll have to do before you try to record it.

Duration/Size:0:33/1.2MB
Description: Tracking fast moving/running subjects playing soccer.
Notes: This involves running along side and around a soccer player during practice. The steadycam and the inverting bracket are the only pieces of equipment used. Also demonstrates some of the dangers of field recording in active environments.
Music Credit: Squirrel Nut Zippers [amazon.com]

Duration/Size:1:00/1.4MB

Description: Competitive squash player practicing. The reason she is hitting softly is because she would probably kill me otherwise. :)
Notes: Lots of circular panning around a moving subject. Uses inverting bracket to dramatize viewing angle.
Music Credit: YoYo Ma [amazon.com]

Duration/Size: 1:31/4MB
Description: Tracking a subject walking through various environments.
Notes: Fairly complex camera control, some not acheivable with many commerical stablizers. Rising from ground level to shoulder level while in motion, steep camera pitching, stair navigation, circular panning around subject while ascending a stairwell.
Music Credit: Take Care of My Cat Soundtrack [yesasia.com]

Duration/Size: 1:38/5.5MB
Description: A two camera view of a hallway walk through scene at a radio station. The top view is from a camera using a Poor Man's Steadycam. The bottom view is an observer camera watching me use the steadycam. The bottom camera is partially stabilized using a tripod with its legs folded together. You can see the difference in quality of stabilization, particularly in the stationary moments and the tripod also makes a "clacking" sound you can hear in the recording when we move. This is from the loose legs hitting each other. Tripods can help a little to stabilize moving shots, but they have a lot of shortcomings.

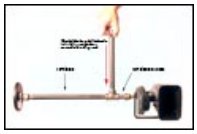
Useful Add-Ons and Modifications

These are some additional things you might want to consider making because they make the steady cam more versatile. Click on the images to enlarge.

Inverting bracket
One of the disadvantages of this steadycam is that it makes it difficult to get low angle shots such as those hovering just above the floor or looking up at a person. To fix this, you can build a U-shaped inverting bracket that wraps around the camera allowing it to be attached on the top rather than the bottom. Click on the picture to the left to enlarge. This makes the steadycam many times more useful and versatile. You can buy the aluminum bar at most hardware stores, cut it to length with a hacksaw, drill the holes, and bend it using a table mounted vise. Try to make the sure the holes are aligned to keep it balanced. Heavier cameras will require steel rather than aluminum. Because this attachment is so useful, I include a steel inverting bracket in the steadycams packages I sell designed to accomodate nearly all consumer grade cameras.

Alternative weight and bar length
Here I used a 24" tube at the bottom and a 5 pound weight. This reduces vertical vibration producing smoother walking shots. But the overall rig gets heavier and tilting the camera becomes much harder because the center of gravity is now well below the handle. If you want more agility, use the sport version with all 10" bars and the 2-1/2 pound weight. Having a variety of lengths and weights is a reason you may not want to tighten everything with a wrench. Hand tightening is usually good enough to keep everything together. You can see this version is pretty tall. Using the inverting bracket, you can get nice near ground video like the sample videos above.

Large Sled for Bigger Cameras
Here's a simple way to add a big platform to the top of the steadycam for use with larger cameras (or simply so you can turn the mounting bolt rather than turning the camera). Cut a rectangular piece of wood at least as large as the base of your camera. Buy a 1/2" flange to replace the mounting cap on top. Put screws through 3 of the 4 holes of the flange into the wood platform. Drill a 1/4" hole all the way through the platform where the 4th hole in the flange is and use that for your mounting bolt. You can see a close up of this on the left (click to enlarge). This is a quick and easy way to really beef up the camera support for bigger cameras (ex: 16mm film, Canon XL1, Sony VX2000, etc.). Unfortunately, you can't the use inverting bracket in combination with this.



Rebalancing for Bigger Cameras
If you have a heavier camera, like the Sony FX1 or Canon XL1, you can rebalance your steadycam rather than use a bigger counter weight. The benefit of rebalancing is that it doesn't increase the overall weight of the rig but retains the same level of control over shaking and movement. Make the counter-weight arm longer and the camera arm shorter such that the center of gravity is in the handle. Click on the image to get a visual explaination of this using a 2.5 lb wieght and an FX1. When properly balanced, the handle should hang down perpendicular to the floor with the other section of the steadycam parallel to the floor. The exact pipe lengths to accomplish this will vary depending on your camera.

Use a Professional Tripod Head
The mounting bolt can also fit many professional tripod heads shown on the left (click to enlarge). This allows you to quicky and easily add the benefits of a true tripod mount such as greater

mounting security, tilt control, and a quick-release platform. This may be useful for attaching bigger cameras.

Feedback and Comments

Over the years I've gotten a fair amount of email from people thanking me for putting up this tutorial eager to share thier experiences. I'm not able to acknowledge every single one of them, but I have gathered a few and put them up here if you would like read them..

I've also gotten many emails that I would place in the question/criticsm category from people either wanting feedback on thier own design descisions or outright bashing on this particular design. If you are an amateur physicist, or even a mechanical engineer ready to write me an email criticizing my design or asking a specific question about your own personal design, please read the Advance Steadycam Discussion first. There's a good chance you'll find what you are looking for. Thanks!.

As an experiment, I've just created a discussion forum for users of this steadycam to chat and share thier experiences. Did you make one that you want to show off? What did you think of making it? What do you think of using it? Did you create anything with it that you want to share? It's brand new as of 8/26/06. So if there isn't much there yet, give it time - or add your own post!. So...

User's Forum closed due to too many spam bots.

~~**Visit the User's Forum!**~~

"Can I pay you to build one for me?"

I get this question a lot because many people don't have the resources or skills to build one of these themselves. So by popular demand, I now sell them through this website [littlegreatideas.com]. There you can find information about the ready-to-use steadycams that I have available and how to purchase them. Thanks a bunch!