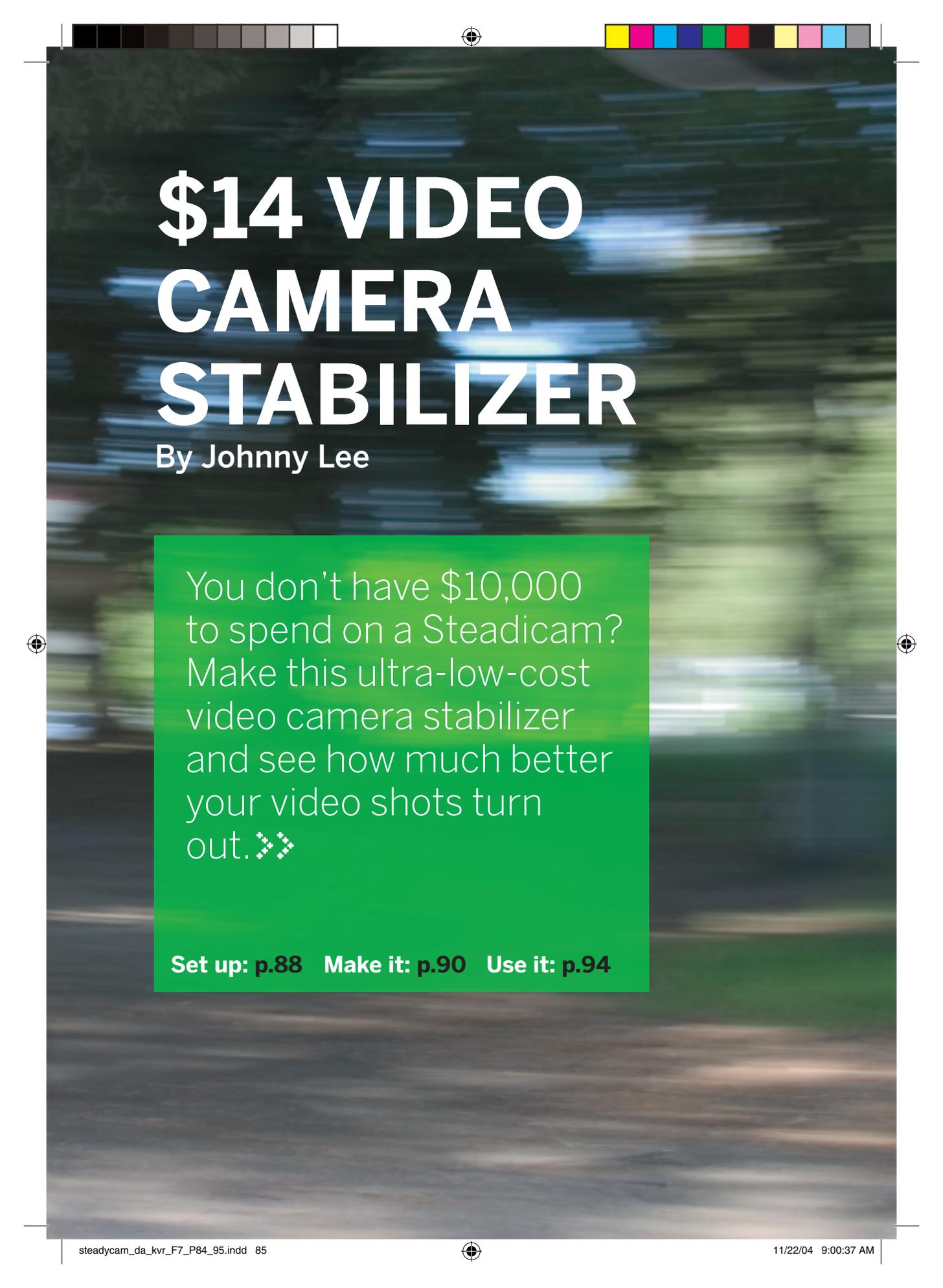




Photograph by Mike Martin





# \$14 VIDEO CAMERA STABILIZER

By Johnny Lee

You don't have \$10,000 to spend on a Steadicam? Make this ultra-low-cost video camera stabilizer and see how much better your video shots turn out. >>>

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# WHY I BUILT A CHEAP VIDEO CAMERA STABILIZER

Professional camera stabilizers use a complex, levered arrangement 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 climb up and down stairs without shaking the camera.

Unfortunately, professional Steadicams cost upwards of \$10,000. Even cheap, third-party stabilizers cost at least \$600. So I decided to make my own. It cost me \$14. Here's how you do it.\* Whether you're an aspiring filmmaker, a videographer, the family documentarian, or if you just want more utility out of your video camera, you'll appreciate this video-cam stabilizer.

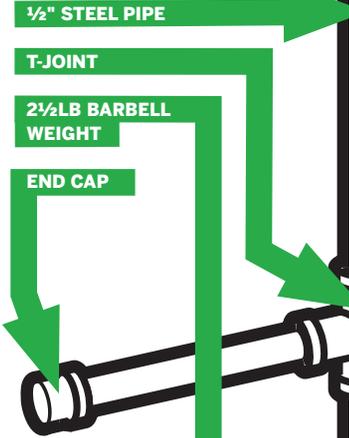
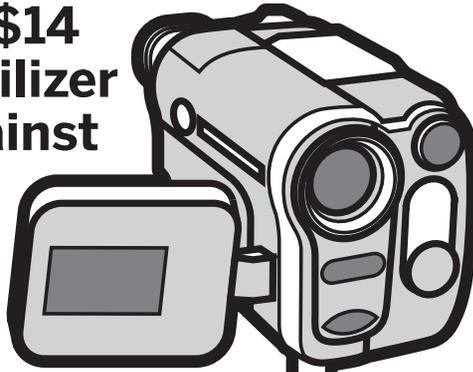
\*Or you can simply buy one from me at [johnnylee.net](http://johnnylee.net).

**Johnny Lee** ([johnnylee.net](http://johnnylee.net)) graduated from the University of Virginia with an engineering degree and an interest in film as a hobby. He ran the student film organization, taught classes in digital filmmaking, assisted in film festivals, and has won several regional awards for his own short films. He is now in graduate school at Carnegie Mellon University pursuing a doctoral degree in Human-Computer Interaction.





# How does a \$14 camera stabilizer stack up against a \$10,000 Steadicam? Surprisingly well.



The \$14 video camera stabilizer doesn't have the vest or the iso-elastic arm. Instead, the human arm adds stability.

# \$14



**All camera stabilizers** take advantage of the property of inertia (see *Physics 101*, below). A real Steadicam, costing thousands of dollars, has additional features that make it well suited to professional use, but our simple camera rig works on the same basic principles.

**A professional Steadicam** has a high moment of inertia to maintain stability. It also uses small motors throughout to dynamically balance the system.

**The iso-elastic arm** works like a shock absorber, and keeps the camera pointing in the same direction while the camera operator moves across uneven terrain. Contrary to popular belief, Steadicams do not use gyroscopes.

**PHYSICS 101:** A system's resistance to change from an applied force is called inertia. In the case of camera stabilizers, equal mass at the top and bottom of the pole results in greater stability (less shakiness).

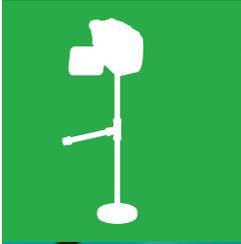
Illustrations by Nik Schulz





## SET UP.

Visit [makezine.com/01/stabilizer](http://makezine.com/01/stabilizer) for source list.



### TOOLS

**1/4" Drill bit:** Must go through galvanized steel. Don't try this with a cheap wood bit; you'll ruin it.

**Electric drill.**

**Pliers.**

**Screwdriver:** The type depends on the bolts you get.

**Hammer.**

**Stationary vise:** It's possible to do it without the vise, but it's far more difficult and potentially dangerous.





## MATERIALS

**One weight:** A simple barbell weight with a 1/4"-diameter hole. I used one weighing 2 1/2 pounds, but you can buy any weight you want. Anything heavier than 5 pounds is too heavy to carry around.

**Three end caps:** Make sure they fit the pipes. 1/2" diameter.

**One T-joint:** Again, make sure it fits the pipes. This might be a little harder to find than the pipes and end caps, which should be at any good hardware store. A plumbing supply will have a T-joint.

**Two machine nuts:** 1/4".

**Three pipes:** I like to use 1/2"-diameter galvanized steel. It's strong, threaded at the ends, and a comfortable thickness. You can use any length of pipe you like, but this project uses three 12" pipes.

**Two machine bolts:** 1 1/2" long to fit 1/4" nuts.

**Three flange washers:** 1 1/2" diameter for 1/4" bolts.

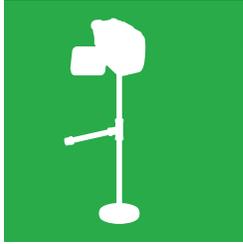
**One wing nut:** 1/4".

**Three lock washers:** For the 1/4" bolts.





## MAKE IT.



# BUILD YOUR STABILIZER IN 5 EASY STEPS

## START

**Time:** 45 min. **Complexity:** Low

**1. MAKE THE HANDLE.** This first step is pretty easy. Just attach the T-joint and one end cap to one of the pipes to form a basic handle.



Use the vise for final tightening. Don't use your hands to tighten the T-joint and end cap on the pipe. You'll just hurt yourself and not get it tight enough.

**2. DRILL HOLES IN 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 doesn't have to be perfectly centered, 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 to mention it can get hot. Protective eyewear such as safety goggles should ALWAYS be worn when using any power tool. Also, a little bit of machine oil (or even vegetable oil) can make this easier and help preserve your drill bit.



Do your drilling in an area that's easy to clean up. You'll produce lots of metal shards. And don't use your fingers to wipe away the shards! They'll get in your skin. Use a brush or a vacuum.



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 for two end caps.





### 3. ASSEMBLE THE MOUNTING.

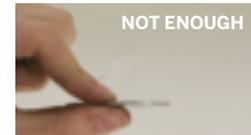
The mounting requires a bolt, two lock washers, a flange washer, a nut, the wing nut, and a drilled end cap. Put a lock washer on the bolt and then put it through the end cap. You need to have the bottom of the bolt coming out the top of the outside part of the end cap, as shown here. Put another lock washer on and then the nut. Put the end cap in the vise and tighten the nut with pliers. The lock washers 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 the camera could fall off, but because putting the camera on and taking it off requires lots of turning action. If this mounting loosens, the bolt will pivot around, as will your camera, making it hard to keep still. If this happens while you're filming, you'll have to stop and find the pliers.



Use a hammer to dent the center of the flange washer. You can do this by putting the washer over the hole in the weight, putting the head of a bolt on the hole, and hammering the bolt. The washer will distribute the force away from the single point of contact. 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 put a great deal of stress on this one tiny spot. It could damage your camera, so if you lose this washer, don't use the stabilizer.



Use your fingers to tighten the wing nut on the mounting. **DO NOT** use the pliers. You could strip the threads on your camera or break the tripod mount. Both are bad.





## 4. ASSEMBLE THE BASE.

You'll need the barbell weight and a lock washer, two flange washers, a bolt, a nut, and a drilled end cap. They'll go together in the pattern shown to the right. The bolt goes through two washers that sandwich the weight. Then stick on the end cap, put on the lock washer, and finally the nut. Hand-tighten the parts until they are snug.

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. Then stick the cap in the vise, and 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 the bolt until the outer washer starts to bend inward. This reduces the amount the bolt sticks out, which makes the base more stable when you set it down.



If you use the base as a stand (not 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's easy to knock over from experience. My camera still works, though.

## 5. ALL TOGETHER NOW ...

Lastly, take the remaining two pipes, screw them into the T-joint of the handle, and attach the base and the mounting. And you're 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-pliers tightening. The only reason not to use the vise and pliers is if you want to be able to collapse the stabilizer 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 its 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. (See *Alternative Weights and Pipe Lengths*, page 95.)



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



## FINISH X

NOW GO USE IT >>

## A MAKE STAFFER'S EXPERIENCE

A mechanically minded friend and I spent about 45 minutes building this camera stabilizer in my modestly equipped garage workshop. It was generally easy, and we didn’t get hung up anywhere.

The hardest part was drilling the holes in the end caps. We used a stationary drill press instead of a handheld drill, which helped considerably. Unfortunately, we didn’t do a very good job of centering the drill bit within the end cap. The hole was straight, but it wasn’t close enough to the middle for my liking.

Our second drilling attempt fared better because we center-punched the end cap to know where to drill. **One thing, though — you’ve got to add oil to the end cap as you drill to keep the drill bit from getting dull from the heat.** Luckily, you only need two end caps with holes. If you mess up on one, you can use it as the bottom cap, and try again.

End caps are bulged on top. We flattened them with a file. We could have avoided this step and it would have been fine, but we figured a flat top would make the camera more stable.



We came up with a different way to bend the flange washers. **Our method involved bolting two washers together through the center of the weight like a sandwich (the weight in the middle and the washers on either side, held together by a bolt).** We put this contraption in a vise and used a vise grip to tighten the nut on the bolt until we’d bent the flange washers adequately. The downside of this was that both flange washers ended up bent instead of just the one that we needed. Not the end of the world, but if you’re

concerned about having a flat flange washer for the bottom piece, pick up an extra one at the store.

I used a 5LB weight and tested it using the video feature on my Olympus D550 camera (which weighs under one pound). The counterbalance was much too heavy for my camera so there was a lot of camera movement in the video. Still, it was better than if I’d been running with just the camera. I plan to buy a lighter weight the next time I pass a sporting goods store so I can give the stabilizer a real workout.

—Robin Outis

MAKE staffer's photo courtesy of Robin Outis

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