

Building a Better Tiedown

Improving an airplane anchor

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While planning my first pilgrimage to EAA AirVenture Oshkosh 2003, I reviewed all the information on the EAA website. Since I was considering flying our club plane, I traced through all the links about taking a plane and discovered the sections on tiedowns (www.vintageaircraft.org/magazine/aircraft_tiedown.pdf)—various types and recommendations.

I found the design with the triangular plate with steel stakes intriguing—just the kind of design pilots could make themselves. Because I didn't have a set of tiedowns for the club plane, I started to make this set, using 5/16-inch rod instead of the specified 1/4-inch stock for the stakes. What bogged me down was the idea of cutting out the metal plates the stakes anchored to the ground: 1/8-inch steel is not trivial stuff and my shop is minimal.

As things worked out, I caught a ride to Oshkosh with a friend in his plane. After our arrival we had a Dickens of a time getting his single flute screw-in tiedowns in the ground. The sod clogged up the



This is how the head worked out. It makes a fantastic stake.

flute, the ground was hard, and the flute wouldn't dig in. Then we hit rocks. We finally got something to hold and went on our way to being overwhelmed at our first visit to EAA AirVenture.

As we wandered around, I looked at tiedowns. Many of them were simple dog anchors; some actually tied to the little metal swivel. I even saw some only half-installed.

Many planes were dubiously anchored with single steel stakes set at an angle from the plane. Fortunately, we didn't have any strong winds.

With the stakes fully embedded, the tiedown makes a nice low profile anchor that rests fully flat when not being used.



The heart of the tiedown: three sets of five links of 3/16-inch proof chain with a 5/16-inch repair link.

When it came time for us to depart, we pulled up the tiedowns, and I do mean pulled them up. One had deformed its flute so badly in the stony ground that it wouldn't back out at all. None of them wanted to back out—they just spun round and round. So with a pull, they came right out of the rain-softened dirt. While it did take a bit of twisting and pulling, it wasn't very reassuring.

A Better Design

After returning home I resumed work on my steel stake tiedowns. It had occurred to me that the small plate in the original design allowed little leverage for the stakes and while it did allow changing the



With the stakes pounded in at a slight angle, the chains pull sideways and won't slip up the stakes.

angle of the stake to miss rocks, etc., it limited the choices of location with respect to each other. How could I spread the stakes further apart, reduce the construction labor, and keep it compact for storage?

One day at the hardware store I had "the idea." Combining three sets of five links of 3/16-inch proof chain with a 5/16-inch repair link, I made the tiedown anchor pictured. This standard chain has a link size

that accepts a 5/16-inch rod nicely. Simply slip the three chain segments onto the repair link and hammer it shut, peening the end where it comes through the loop. These chains are not coming off.

The repair link provides a nice loop for a rope or tiedown hook. The chains provide more separation of the stakes giving more leverage and no direct pull.

With a little slack in the chains and the stakes at an angle, the chains pull sideways and try to slide down on the stakes. Even if you can't

get them all the way in, the chains won't slip up on the stakes. The angle of the stake, while it should be about 45 degrees, is not critical and again can be varied to suit the condition of the ground. With the stakes fully embedded, the tiedown makes a nice low profile anchor that rests fully flat when not being used.

Those 18-by-5/16-inch steel rods dig deep and make a strong, redundant anchor.

The angle of the rope to the plane is not critical, but a direct upward pull would make the force on each stake more uniform and thus give the best theoretical anchor. If you want or need an angled tiedown, simply fan the three chains out so the rope pulls evenly on all three. The tail can be tied down with only two stakes and two chains since the

forces are lower. (The logic of using 8 stakes is pure economics since steel rod comes in 36-inch lengths at your hardware store, making two stakes per rod.)

Those 18-by-5/16-inch steel rods dig deep and make a strong, redundant anchor. With the blunt taper on the rod, a small 8-ounce hammer will put them down. A bigger hammer works faster, but it is heavier to carry in the plane. When you need to pull them out, the standard claw



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on the hammer slips under the head. With a direct pull, the smooth steel rod will come out easily. If there's a reluctant stake, leave it for last and use the rope to pull it out.

After making the first set, I realized there are other options. You can use a split repair link to give a larger loop for the rope or hook. Or you could simply string the chain segments onto the rope and make a



A small hammer in the tiedown kit bag will be handy to both pound in the stakes and get them back out.

good loop. This is the simplest method but it wouldn't work as well with tiedown straps with hooks. I prefer the split link as it's easier to close and gives more options for tiedown styles. The chains collapse nicely to bundle or bag for storage. The total weight of the chains and stakes is about 5 pounds.

Are there good tiedowns on the market? Sure, but it seems that



The completed tiedown kit is easy to make and is reasonably lightweight. Best of all, it works.

most pilots aren't using them. In the spirit of homebuilding, this system would perform with some of the best and they're made with less than \$20 of material. The most sophisticated mechanical task is threading the end of the rod for the nuts and washer. When you buy the chain, get the hardware store to cut it for you (they usually have some bolt cutters on hand); it's much easier than doing it yourself. The rest of it is pounding with a good hammer to close the repair links and locking the nuts onto the rods. Be sure you have the nuts tight against the end of the threads and against the washer so they won't loosen when the end is peened over.

All of these designs offer excellent retention, redundancy, easy installation and removal, and simple construction. Enjoy this simple and practical homebuilding project!



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