Silicone Hinges

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While reading the September 2002 issue of Southeaster, the article by Brian Sharp about the "Spoiler System" he uses, made me think that I should share with others how to make silicone hinges that I learnt about while building my Prodij and Voltij slope soarers.

At first I was sceptical about using silicone hinges, but Eric assured me they work and gave me some useful advice, so I decided to use the system, and I'm glad I did. They are simple, clean and surprisingly strong.

You all know how, after several months, the standard taped hinge system starts coming loose and bits of grass seed and dust get between the wing and the tape and eventually you have untidy-looking floppy ailerons — especially near the horn area. Well, with this silicone hinge system there is none of that. The gap is completely sealed and slop free. And an added advantage is that you have a very small gap, unlike the wide "V" normally associated with aileron hinges. Another advantage, and I have actually seen this save a model, is that the stiffness imparted by the silicone will keep the aileron in the neutral position, should the linkage malfunction during flight.

This method is for glass-skinned, foam-cored wings, but I'm sure the system could be modified to work for other types of construction. It might need the more normal "V" gap in the case of a built-up wing, but basically, it's the way the silicone is distributed onto the two surfaces that makes it work.

For glass-skinned wings, the secret is to get a perfectly straight hinge line and to cut through at about 25 degrees from vertical (Fig 1). This is important so that the gap in the bottom skin can be kept as small as possible.

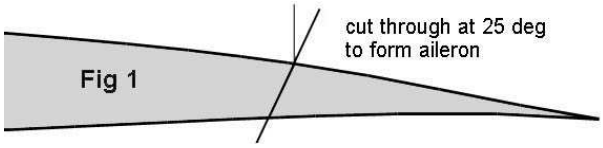
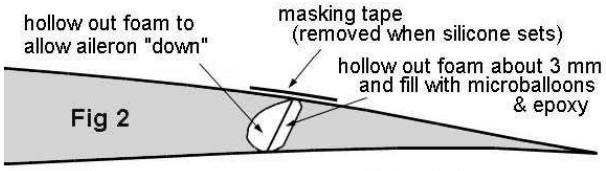


Fig 1

The cutting can be a problem unless you have a circular saw with a very thin blade like they use in the factory, so Eric devised a method of doing this using a blade. First, mark out the hinge line on the top of the wing. Then measure the distance from the trailing edge and calculate the distance from the trailing edge on the bottom surface to give the 25 degree angle. Now cut just through the skins on both surfaces with a sharp blade. Then carefully cut through the foam, using the cuts on the skins as a guide. It doesn't really matter if you damage the foam a little while cutting, as you will be digging out some later anyway. The most important thing is to make sure you have a very straight cut through the fibreglass skins. Use thin double-sided tape to hold your straight edge firmly in place while cutting.

Dig out about 3mm of foam from the LE of the aileron and then fill that trench with a mixture of microballoons and epoxy resin (Fig 2).

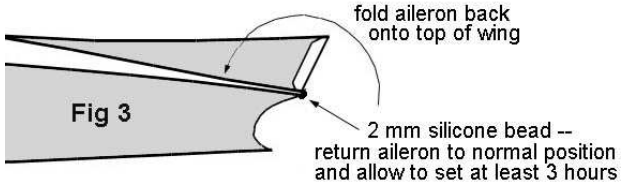
Don't use the normal quickset epoxy glues, as you will not have enough time before it sets. Use one of the slow-set types that you would use for the fibreglass lay-ups. Make the mix quite thick. You don't want it running out of the trench. A firm, putty-like mix is best. But before you fill the trench, decide where the horn will connect to the aileron and dig out some extra foam there so the microballoons and epoxy mix can reinforce that area as well. Once the trench is filled, clean off any mess, lay the ailerons on a flat surface and leave them to cure properly before continuing. Once set, you should have a nice strong, stiff aileron that will not flutter. A very simple but effective horn system is described later. (It might be worth applying a length of masking tape over the resin / microballoons in the trough to prevent any chance of sagging. Laying the aileron flat on a table or plank is important so the finished job is dead straight. JL)



Now dig out some foam from the TE of the wing to provide clearance for the downward movement of the ailerons (Fig 2&7). You will also need to sand the bottom skin on the wing back about 1mm to allow the aileron to clear as it moves (Fig 4).

Tape the aileron and wing together with masking tape (Fig 2) and test the movement — correct any problems before you continue. Now fold the aileron back onto the top of the wing so you can make the hinge (Fig 3).

Fill a syringe with silicone (normal clear Bostick silicone — Home or Marine) and apply a 2mm bead onto the rail formed by the two fibreglass skins at the joint line (Fig 3).

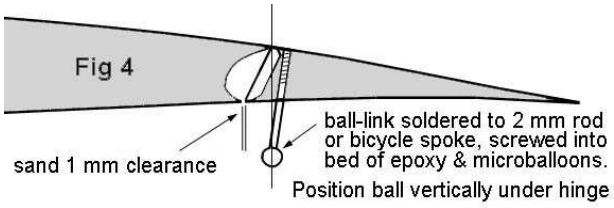


It is a good idea to first shape the nozzle of the syringe so that it can hook over the skins while you are moving it along. Smear this bead down with your fingertip. Make sure it is distributed onto both the aileron and wing. Immediately apply another 2mm bead on top of the first layer, but don't smear it down this time. Then fold the aileron back into its neutral position and let the silicone set undisturbed for at least three to four hours.

When the silicone is set you can remove the masking tape and you will have the most perfect hinge you have ever seen. You may have to file a bit more off the bottom fibreglass skin on the wing to make clearance for the aileron if you didn't create enough of a gap earlier, but on both of my wings so far the gap is only 1mm.

You can use standard horns to actuate the aileron if you like, but a really neat and simple solution is to use the ball link system
(Fig 4).

I use standard 2mm bicycle spokes and cut them to about 20 to 25mm long on

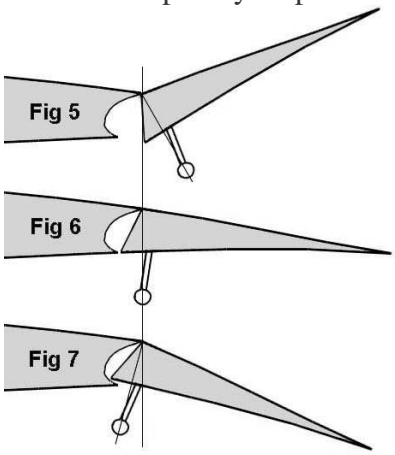


the threaded end depending on the requirements. The thread is normally about 10mm of that. A standard brass ball link is then soldered onto the unthreaded end. Remember to separate the ball from the plastic part before soldering. And don't do any soldering while the spoke is attached to the wing either. You risk melting the micro-balloons and epoxy mix.

Drill a 2 mm hole at an angle through the aileron in the area where you added the extra reinforcing and then screw the spoke with ball attached right through until it is flush with the opposite skin (Fig 4). The angle must be sufficient to allow the ball to line up with the hinge line.

Now connect up to the servo. Bicycle spokes make very nice, stiff push rods and screw nicely into the plastic part of the ball links. I am extremely happy with this system and will be using it wherever I can on other models. It is very neat and completely slop free.

Figs 5, 6 and 7 show extremes of movement.



It must be remembered that this is a top hinged system. The same technique can easily be used for a bottom hinged system.

Another tip would be to coat the inner surface of the wing TE, where it was hollowed out with a skin of epoxy and microballon mix.

Evan