

SILK APPLICATION TO MODEL AIRPLANES

By Jim Adams – 1985

The application of silk to a model structure must be approached with confidence. Most beginners feel defeated before they start. You must put apprehensions out of your mind and convince your head and hands that this is going to be a piece of cake.

SILK APPLICATION

Pre-dope all structure where you want the silk to adhere. Use full strength tautening Nitrate dope; apply at least 3 or 4 coats. Pay special attention to the bottom of ribs and the tops of the dihedral joint ribs. If your wing has a flat bottom such as a Clark-Y, you do not have to apply dope to the rib bottoms or tops, except at the dihedral ribs. I use 4 coats right out of the nitrate can. Allow to dry well, at least 30 minutes between coats. The entire framework should be lightly sanded (400 paper) to eliminate all rough spots that might snag the silk and prevent you pulling the silk across the surface.

Cut the silk about 1" bigger all around than the panel you are going to cover. Silk has a "grain" which is the lengthwise direction of the fabric wrapped on the bolt. The chordwise direction is the 36" width of the material. Silk seems to work best if the lengthwise direction runs along the span of the wing or the lengthwise direction of the body. I personally prefer covering the entire upper or lower surface of the structure in one piece. Some people prefer starting with the bottom of the wing if it has undercambered ribs. This is insurance in the event that they have trouble with the lower concave surface not sticking completely to the silk and they want to add more adhesive during the job. Most beginners are afraid to tackle more than a single panel at a time. This may seem simpler, but it increases the number of overlap joints that have to be made. Trimming and applying silk with a straight edge over another silk surface (overlap joint) is very difficult unless you know the secrets that I will give you later.

When the wing is all pre-doped, smooth and dry lay the piece of silk on the surface to be covered and spray with water using a small commercial hand spray. Get it wet!! Don't worry about wetting the structure that you have pre-doped. Some people even dip the silk in water before applying. I have in recent months found that some silk had not been washed sufficiently before it was packaged and after it is sprayed with water it appeared dirty. I have started washing out my silk before I use it. Test a piece of your silk before you start and see if stains when you apply water. I find it easier to wet it on the structure. Very carefully spread the silk over the structure, using light fingertip pressure till the overhang all around is about the 1" you started with. Pull it lengthwise and chordwise until your happy with the fit. Pulling lengthwise will reduce the amount of sag between the ribs. You should eyeball the wing from the front and be sure that the sag is uniform for all rib bays. Don't be afraid to pull out all the wrinkles. The worst thing that can happen is to have one area not as tight as another. Silk is tough unless you get some poor quality lightweight silk that will sometimes separate if you use too much finger pulling pressure. When you are satisfied that you have it on smooth, you are ready to stick it permanently. Note; if the silk doesn't stay where you pull it don't be afraid to apply more water.

Water is your best friend at this point. Sticking the silk to the frame is done by applying thinner with a brush to the silk and the framework only where you want it to stick. The reason we use thinner is because it dries quickly. Using dope to soften the preapplied dope takes much more time to dry. Note; good modelers put vent holes in all ribs and one in the lower surface of the center section to equalize the air pressure in all the rib bays and allow air movement during the drying process. This also prevents the wing covering from puffing up when it's in the sun.

Covering the Upper Wing Surface

Start by applying thinner at the center rib. Put tension chordwise on the silk until the thinner dries. After the center rib is secured you can again pull lengthwise and chordwise on the silk. Apply the thinner to the dihedral rib and keep tension on it until the adhesive sets. The setting can be speeded up by using heat from a MonoKote heat gun. Keep the gun at least 12" from the silk. When the dihedral rib has set, put thinner on the leading edge and the trailing edge and apply pressure to the silk fore and aft to set it where you want it. Caution; too much pressure fore and aft will cause excess sagging between the ribs.

After you have the silk firmly attached to the polyhedral rib you can rewet the tip area silk and pull it out tight over the tip outline and leading and trailing edge. You are down to the easy part now. Silk will pull out easy over the compound contour of the tip and will not wrinkle like paper will. Apply thinner to the outline and hold until the adhesive takes hold. Don't forget the heat gun if you get impatient. Do not try to shrink all the silk on the structure using the heat. Silk is funny; if you use a lot of heat to shrink the silk it will later relax at room temperature and go slack and all the dope in the world will not tighten up the silk again. Now the excess silk should be rolled over the edges and attached to the lower surfaces. Pulling the silk tight around curved tips is no problem. Hold it there momentarily until the adhesive takes hold. Run a NEW razor blade around the structure about 1/8" inside of the edge and trim the excess silk. MonoKote makes a tool that will cut the silk exactly at the dimension that you want. Stanley used to make a tool that would scribe a line at a certain distance from the edge. Perhaps you can adapt one of their old tools to the job. (I use my fingers and a thumb.) Next apply thinner liberally to the area and pull off the excess silk. Before you forget apply another coat of full strength dope to this narrow area. This will assist in adhering the next layer of silk to the bottom of the wing.

Silk is surprisingly tough if you are using medium or heavy-duty silk. If you have very light silk, use caution in pulling too hard. On poorer quality silk the threads will sometimes separate where your thumbs are pulling. The real secret in a good silk job is getting it on uniformly snug so that you don't have to require the dope to tighten the covering. Some fellows do such a nice job with this that they don't need to use tightening dope. When you get to that point you will know that you have become an expert.

If you decide that you are going to put on just one panel at a time, which is what most beginners do, there are ways to assure straight edges on the silk that you are going to apply over a previous joint. If you have ever cut dry silk and then tried to apply it in a straight line you know that it can't be done. Say that you have covered the inboard wing panel and you are ready to cover the tip. The silk has to be trimmed to overlay the polyhedral rib, say 1/4". One way to do this is to make a balsa frame bigger than the panel of silk you are going to use and attach the silk to the frame and apply one coat of thinned dope and allow to dry. When it has dried it will be firm, that is, the threads will be locked in the position they were in on the frame. You can now cut out a piece of silk to fit the polyhedral rib and the tip.

Make a paper pattern by laying a piece of paper on the wing and trace the curve of the polyhedral rib, and you will see that the cut is not a straight line, but is a mild curve. Trim your dry doped piece of silk to this pattern. Use a piece of plastic or metal that can be curved to the shape. Apply pressure to the pattern piece and the silk, and using a very sharp razor blade cut the piece of silk out of the sized piece of silk. Leave an excess of 1" around the front, back and tip. Lay the silk on the tip and spray with water. The sized silk will work wet just as well as the dry silk. First carefully attach the silk with thinner to the polyhedral rib, overlapping the rib and the previously applied silk. To be absolutely safe and avoid grief later don't forget to apply three coats of full strength dope to the top of the rib before you start this operation, and be sure the dope is thoroughly dry before starting to attach this tip piece of silk. After this is done the rest of the tip can be attached as described before for dry silk. Please follow these last steps carefully. Of all the places silk is most likely to pull away, when you start to dope the covering, is the silk attached to the top of the polyhedral rib.

Another way to do this same job is to attach a piece of silk to wax paper with water before you cut out the piece to fit the wing tip. I attach the wax paper first to a smooth surface using 3M tack spray adhesive. Then the silk is spread over the wax paper and sprayed with water. Carefully check and align all the silk's threads square and neat to your satisfaction. Next use your pattern and metal straight edge and very sharp razor blade and cut out the silk and the wax paper together. It's wet so they will adhere to each other. Pick up this assembly and flop it over and apply it to the wing where you want it. I usually allow about 3/16 to 1/4" overlap at the rib. Smooth out the wrinkles with your fingertips, it is easy if the silk was wet enough. Using a small brush apply thinner to the edge of the silk where you want it to adhere. Wait until that edge is attached firmly and then pull off the wax paper and proceed with attaching the rest of the silk to the wing. Part of the secret to getting nice sharp edges when your cutting silk is to place a piece of soft cardboard on the table under the stuff you are going to cut. The razor blade will not dull as soon. I learned this from cutting out tissue letters from Jap tissue.

Both of these methods are very good and especially if you are making a patch to cover a rectangular hole in an existing wing. There are other ways. The quick and dirty method is to repair a section removed from the wing covering because of damage as follows. Take a large oversize piece of silk and cover the open area and then after it is dry trim the excess silk with a razor blade. Some are successful if the blade is laid flat on the wing surface and then the silk is folded back 180 degrees over the sharp edge. The blade is then slid along the silk and cut. Sometimes in the field you have to do whatever you can. I carry sticky Mylar patches for this purpose (sometimes called Scotch tape). If you are the fussy kind that likes everything perfect, try either of the methods described above.

Covering the LOWER SURFACE of the WING

The instructions for the lower surface are similar to the top except that it is much easier since you can pull the entire piece of silk at each tip and you don't have to make those reverse bends at the polyhedral joints. Apply the dry silk and wet it thoroughly and stretch it out lengthwise and chordwise to smooth out all the wrinkles. Attach the silk to the undercambered ribs first by applying thinner with a small brush to each rib and spar and trailing edge and leading edge. If the undercamber is reasonable (like 6409 or similar) the silk can be adhered with not too much trouble. Use a little heat if some of the pre-doped ribs don't want to stick. Use it sparingly and don't try to shrink the covering. Just make it

stick! I have heard fellows tell me they use Cyano thin adhesive to stick down troublesome areas. Don't put Cyano adhesive or accelerator on wet silk or wet dope - wait till it's dry. If you do you will have a discolored mess. Additional nitrate adhesive can be applied to the ribs by pressing the stuff through the silk with your fingertip. Use a fast rubbing motion to apply heat to the joint to get it to set up. I recommend that you have something on your hands that will not stick to the adhesive. I have heard that Avon Silk So Soft bath oil will not allow even Cyano to stick to your fingers. The best thing to do is to be sure that you have plenty of pre-dope on the ribs to begin with. When you first cover with wet silk you will be shocked when the covering blushes when the thinner touches the wet silk and it turns all white in color where they meet. This is not permanent and will disappear when you put on the first thin coat of dope. After the silk has been adhered to the silk that you rolled over from the top around the edges, allow it to dry and then last thing is to trim the excess overhanging silk around the structure. This is done with a NEW razor blade held at right angles to the stiff silk and while you hold it out away from the surface slide the blade along the edge and neatly trim away the excess silk. This is effortless when the silk is supported properly and the blade is sharp. Caution-don't nick the first layer of covering. The biggest problem with doing this simple operation is that you won't have enough hands. Try holding the structure between your knees or with some holder of your own design.

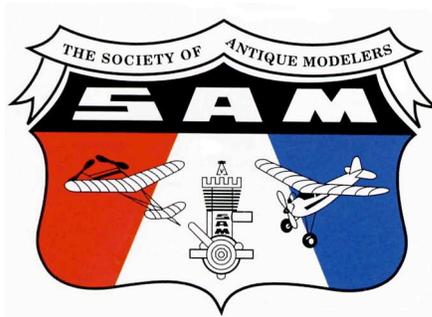
APPLYING THE DOPE

Finally we get to dope the wing. I assume that you have allowed the structure to lie in the sun for a day or so to insure baking out all the moisture and the silk has tightened up very nicely. You don't want any of the next layers of thin dope that you are going to apply to soften any of the overlap joints. If you still have some wrinkles, it is a little bit late to worry about them, and you can just hope that the dope will pull out any that remain. Doping the wing you should proceed slowly taking your time on these first coats. Do not place large amounts of dope on the silk. The dope should be thinned about half and half with thinner. I use the "dry brush" method, the brush isn't really dry, but it should not be dripping with dope. Using the side of the brush bristles apply it sparingly using a scouring motion. *(Editors note...Modern procedure-use a sponge brush and avoid the grief that Jim mentions -See Tips and Comments in Preface section)* Keep a light touch and do not force large blobs of dope thru the silk. The reason for this care is to avoid large heavy spots in the dope that will appear darker than the other silk. If you goof and get too much on and it drops thru the silk and starts to run around on the under side of the silk, dry the brush with a paper towel and wick off the excess dope. Another trick is to tilt the surface vertical and get gravity to help pull the dope down to a balsa member on the inside. Foam brushes can also be used to wick up surplus dope. If you are going to color dope the structure later you don't have to be so particular because the dark spots won't show. After applying 4 or 5 coats of thinned dope the pores in the silk will begin to fill. Hold the surface up at an angle to a strong light (like the sun) and you will be able to see if most of the pores are filled. Another way to tell if the pores are filled' is to watch closely as you apply the thin dope. If pores exist they show up as little bubbles of dope that drop thru the silk. I use thinned tautening nitrate dope for these early coats. When the pores are mostly filled I switch to non-tautening dope and add four more coats of dope. This is also thinned with about 40 percent thinner. Once you get to this point dope should be applied quickly and quite wet. Even though you will feel that you are slopping the dope on, it will smooth out and dry with a nice appearance. Dope can also be applied with a spray gun once the pores have been filled. Do not attempt to apply color dope until all the pores have been filled. When you are applying these last coats and you are using a brush and it feels that the dope is dragging on the brush it means that you need to add more thinner.

SEALING the FINISH

When applying the finish coats, full size aircraft mechanics switch to Butyrate dope. It will go over the nitrate, but nitrate dope will not go over butyrate. Nitrate dope is not fuel proof, the butyrate dope is more fuel proof, but a surface that has a butyrate finish is very difficult to repair because you have two types of dope on the silk. I prefer sealing the surface with a light sprayed coat of epoxy or polyurethane. This is clear and should be applied after all the trim has been added. It will enhance the gloss on the surface and can be sprayed right over windshields and other plastic parts. A two-part polyurethane that must be mixed is best, especially if you are going to be using glow fuels. Polyurethane that comes in spray cans is not fuel proof. A product that I recommend is Fuller-O'Brien's "Fullerplast varnish". It has the unique ability to deliver a water clear finish and is available in either satin or gloss, and does not yellow with age. Water, chemicals, abrasion or abuse does not bother it. This product dries dust-free in 15 minutes. It is expensive and comes in gallons only (a lifetime supply). The Fullerplast varnish is a two-part finish requiring a Fullerplast catalyst to set it off. It's available in an 8-ounce container. Both Epoxy and polyurethane have more solids than dope and so should be used sparingly. When applying them, thin them well and put them on wet for the best gloss finish. Putting them on too thin or with too much pressure will give a pebbly look or will look and feel rough. Both polyurethane and epoxy finishes can be repaired with nitrate dope. If you only plan on using gasoline fuels, the nitrate dope finish is excellent. Some modern gasolines have additives that attack nitrate dope finishes, if that happens, switch gasolines or give the polyurethane a try.

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