WARP FREE FLYING SURFACES

By Ramon Alban

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With Vintage Model Airplanes there is very little latitude within competition rules to add anti-warp elements to a basic structure. Thus it may be difficult to prevent unwanted warps appearing in flying surfaces at the building and covering stage. Indeed I would venture that if one can build and cover a vintage wing or tailplane that is inherently warp free then it will also be much easier to prevent warps at later stages. From my early experiences building rubber powered models for competition use I realised I needed them to fly "out of the box" on full chat with total confidence often without benefit of trimming flights on the day and that flying surfaces had to be guaranteed warp-free. What follows is how I solved this problem using sound techniques and practical prevention.

It is axiomatic that flying surface components are made from materials having conventional grain and weight characteristics appropriate to their need i.e.: straight grain, hard enough spars/edges, 'C' grain ribs, etc. In addition joints must be accurate, correctly glued, with suitable dihedral braces and gussets. Vintage rules may allow "local strengthening" making it possible to add discrete gussets to rib/trailing edge joints so all the above is common practice but what follows may not be.

My technique requires the use of high quality Jap tissue with grain running lengthwise (see note 1) on all flying surfaces (i.e., 90 deg to the ribs), pre-doping (60% viscosity) top/bottom of all ribs and outline components and cellulose thinner as the adhesive catalyst. Cut all tissue in advance about 1/2" larger than individual panels. Cover the bottom of every panel first. Proceed by laying the tissue, shiny side down (see note 2), over the surface lightly pinning each comer to prevent movement. Use a fine brush and cellulose thinner to touch a TE comer and spot-fix the tissue. Wait a few seconds, ease the tissue lengthwise to do the same at the other TE comer. Now spot-fix at each TE/rib junction. Readjust the LE pins to remove wrinkles, repeat the above for the LE. Do not flood the tissue.

Starting at a centre rib, gently push down on the tissue and run a fine bead of thinner along the rib (undercambered or not) rubbing with a finger until the tissue is grabbed. Work outwards one rib at a time until all ribs, tip and root are fixed. Do not flood or adhesion will fail. Now run a bead of thinner along the LE and TE rubbing with a finger to encourage adhesion. Do not fold tissue around edges, use fine wet n' dry abrasive paper to trim waste and redope the feathered edges.

From the top, run a fine bead of thin (30%) dope along both sides of each rib/tissue junction to enhance adhesion. (Ed Note: It isn't clear what he means by that.) Check (that) all outline edges remain doped (60%) and recheck the same with the top of each rib. Use exactly the same technique to cover the upper surfaces except **DO NOT** run thinners across the top of the ribs. For a wrinkle free wingtip lightly damp covering with a damp facial tissue and ease it around the curve securing with thinners as before. Trim and seal as before.

Lightly water shrink (steam is good) and pin down on small raised scraps of 1/16" balsa sheet to allow air circulation. Any pre-built-in warps should be replicated now. When dry and whilst still pinned down, brush thinner over the top edge of each rib to enliven the dope and fix the tissue. Allow to dry for a minute and repeat for all panels of the flying surface. Unpin and dope with 40% shrinking dope (be quick) and just as it dries pin it down on the same balsa scraps and allow to dry for 1 hr.

Now do the same again with 30-40% dope or better still 30% banana oil which is waterproof and non shrinking. Pin down for several hours or longer if possible. A problem here with di(poly)-hedral surfaces, it may not be so convenient to have one surface pinned down for too long so move on a little sooner if needed. Each rib bay is now a unique doped section (or "torque box") that cannot warp in isolation and for that reason the whole flying surface is highly warp-resistant.

Now make a keeper (including any built-in warp characteristics) from 3/16" or 1/4" balsa sheet and strap the flying surface to it for the whole of its life - except for flying or course. When flying is over replace it on the keeper and ensure the model is stored in a stable atmospheric environment.

Note 1 - "Grain running lengthwise" ensures a stronger structure with less dihedral warping tendency. Because tissue tears easily along the grain it virtually eliminates chordwise splits caused by twigs or stubble and by the kinetic energy of the wing mass during hard DT arrivals.

. Note 2 - "Shiny side down" ensures that dope amalgamates readily with tissue fibres on the dull side whereas dope on the shiny side has less penetration thus tending to remain more on the tissue surface. Consequently, shiny side down produces a stronger covering.

"Too much trouble?" Think about it. Warped surfaces make an airplane impossible to fly so time spent as suggested will save countless hours repairing crashed models later.

Ramon Alban is an active British modeler and this information is borrowed from his web site located at *www.vintagemodelairplane.com*