

CHAPTER 19: FINISHING TECHNIQUES

REVISIONS

From time to time, revisions to this assembly manual may be deemed necessary. When such revisions are made, you should immediately replace all outdated pages with the revised pages. Discard the out dated pages. Note that on the lower right corner of each page is a "revision date". Initial printings will have the number "0" printed and the printing date. All subsequent revisions will have the revision number followed by the date of that revision. When such revisions are made, a "table of revisions" page will also be issued. This page (or pages) should be inserted in front of the opening page (this page) of each affected chapter. A new "table of revisions" page will accompany any revision made to a chapter.

ARROWS

Most drawings will have arrows to show which direction the parts are facing, unless the drawing itself makes that very obvious. "A/C UP" refers to the direction that would be up if the part were installed in a plane sitting in the upright position. In most cases the part shown will be oriented in the same position as the part itself will be placed during that particular assembly step. However, time goes on and changes are made, so careful attention should be paid to the orientation arrows. That old cartoon of the guy agonizing over the plans for his canoe, built one end up, one end down, should not happen in real life. Especially to you.

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1. **INTRODUCTION**

The final look of your airplane is obviously an important aspect. It will affect performance but its primary effect is on ones ego. Luckily, it is not difficult or expensive to achieve an attractive finish on your Lancair, after all, you're starting with the best looking airframe in the air! Some very simple hints and techniques are all it will take.



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2. PROCEDURE
A. BID Tapes

1. The BID tapes that are applied to the exterior joggles will naturally require the most finishing and a little blending.

One simple trick in starting the process off is to apply an epoxy/micro blend (heavy on the micro here) to the tapes within just a few hours of application. When the tapes are still tacky, mix up a small batch of micro and apply it to the joint area. Be sure that the tapes are set up enough that you won't disturb them with the application of micro. Of course, you can always wait until they are fully cured, that's perfectly acceptable.

You'll probably find that it is a good idea to perform the basic finish on the BID tapes as you progress through the assembly of the airframe as opposed to waiting until all the glass work is completed and then starting on the finish. If you break it up a little, the task will seem much easier and in fact it will likely be easier.

2. As you are progressing through the assembly processes, you will usually have some excess epoxy mixed up from time to time and it should not be wasted. Simply mix it with generous amounts of micro and find a BID tape somewhere that can use it.

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B. Mixing the micro

1. When you are applying the initial micro to an area, you should mix it quite thick. Thick means LIGHT and inversely thin and runny means HEAVY. The thick micro should have the consistency of bread dough (or perhaps just a *little* bit less thick). You might next experience a bit of difficulty in the application of this thick micro. It may want to roll up behind your squeegee. If that proves to be an unsolvable problem, then perhaps it is just a little too thick, thin it back down with a little more epoxy. (But always premix the epoxy thoroughly before adding it to an existing batch of epoxy/micro.)

One final method of evaluating the micro blend is by its sheen. If it smooths out, sags or runs on vertical surfaces and/or achieves a nice smooth shiny look to it as it sets up, then it definitely is too thin. You can usually determine this quickly after an application since it will quickly smooth out and get shiny on the surface. If you see that, then you will still have time to remove it and add some more micro to the mix and reapply. Generally, one or two applications will be all that is required to "get the hang of it". And that's why it is best to start with small areas first so if you didn't quite get the blend figured out, you won't be stuck with large areas to deal with.

2. In general, the first applications of micro will be the thickest mixture. As you apply a second coating for "fine adjustments", the mixture should be somewhat thinner since you don't need much "build" and you don't want to trap any air bubbles in the mixture. Any trapped air bubbles, if they are too large or too close to the surface can result in popping the paint loose in that small area as the air in the bubble heats up, expands and loosens the grip of the finished paint. That's obviously of no structural concern but you sure don't want any shiny bumps in your otherwise smooth paint job.

3. The micro will often take a couple of days to cure. It has such an insulating effect on the epoxy it's mixed with that the epoxy tends to cure much more slowly than it would with no micro mixed in. Again, heat will play a major role in the cure time, basically, the hotter the better - up to about 200°F that is. At that temperature, it's just a couple of hours! And luckily, your Lancair is about the only composite kit plane on the market that can take that kind of heat with no structural damage, in fact we always recommend such a post cure since the laminating resin will also post cure to 197°F.

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4. If you want to post cure or accelerate the micro cure so you can proceed with sanding, simply lay a tarp over the area (supported off the micro, of course) and place a small space heater under it. Be sure to protect is so that a fire can not start on the tarp. This will create a mini-oven and achieve a nice, fast post cure. The smallest available space heater will work very well. And you don't have to worry about a fire starting in the prepregs, unlike the vinylester kits that are common on the market and burn with a fury, your Lancair's prepregs will not sustain a flame at all.
5. When you're ready to first sand the micro, use a 50 grit paper on a long board. These "long boards" are available in any auto body repair shop and use the standard 3" x 14" sanding sheets. It's a good idea to buy a pack of 50 grit and 80 grit.
6. You should always sand on a 45° angle to the contour and run the sanding board in a bit of a diagonal direction. Also, change directions of stroke regularly so that you achieve a nice smooth transition across the BID tapes thus not generating any grooves or waves.
7. If you start with a 50 grit sandpaper, you should use that to only get the lumps and bumps off of the micro then switch to an 80 grit to get down to a nice smooth blend. Any second applications of micro will usually be best treated with only 80 & 120 grit.
8. A small 3" x 6" sanding block is also quite helpful as is a "half round" sanding board. The half round is used along sharply rolled surfaces like at the wing to fuselage joggles, etc. The half-round sanding boards will use 1/4 of a standard sheet.
9. With micro well dressed over the BID tapes, etc., you're ready for primer.

C. General surface preparations

1. As mentioned above, the general means to attaining good smooth transitions is with micro. Small spot touch-ups can be made easiest with the light weight body fillers available in auto supply stores. Use only the light weight types (typically about 5-7 lbs. per gallon), these will have micro balloons mixed into them already - but to a much lesser degree than with our epoxy/micro. This type of filler should NOT be used in large amounts, but only for small touch up areas. It dries very quickly and thus allows for final prep on a fast basis.
2. To achieve the best possible adherence of paint, all surfaces should be cleaned with a suitable cleaner to remove dirt and oils. After cleaning, sand the surfaces with 80-120 grit prior to applying any primers.

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D. Priming materials

The best filling primers are of an epoxy basis. The lacquers should generally be avoided. Polyesters are acceptable, however they will shrink and the shrinkage will allow imperfections to eventually begin to show through the finished paint job. Again, epoxies are highly recommended.

We have tested a wide variety of filling primers. There are surely many excellent types available that we have not had the opportunity to test out, however we have found one that does work very well. It is our WLS system and is generally stocked by Neico, consult our options catalog.

The WLS system is a two part epoxy system and can be reduced by up to 30% for thin applications. When applying the last coat of primer, it is generally best to thin it. Thinner / reducer is supplied with each WLS set.

1. The first application of primer is primarily to fill the small depressions in the weave. These are very shallow and are very small. It is generally effective to first squeegee a filling primer onto the surfaces, this helps to get the material down into the tiny depressions. Do not bother to sand this, simply allow it to dry and follow up with a standard spray application of filler / primer. Allow that to cure.

If you were to spray a heavy first application of filling primer onto the surfaces, it could tend to bridge the small depressions and, when it was sanded back down, the bridging would be sanded away and the depression would reappear. One first spray technique does work satisfactorily. Spray a very light coat and allow it to set up a bit, then follow with another very light coat. These coats should be so light that it requires about four passes to get a solid color change. Then allow that to cure. This process helps allow the filling primer to get into the depressions and exclude the air that must be displaced without causing any bubbling on the surface. If you see any bubbles occurring, it is because the primer is displacing small amounts of trapped air which causes a bubble in the too thick application of primer.

2. After cure, use either a machine sander or sand it by hand. Start with 120 grit and progress up to 150 grit for this sanding (if you are careful, you can speed the process by starting with 80 grit, but don't sand with that course of a paper too long or you'll not have anything left to sand with the finer grits.). This sanding will go quite quickly since you are not doing any contour work, just knocking down the primer. We generally will sand an entire wing surface down in about 30-40 minutes. An air driven dual action sander (DA) will work the best. Use the 8" diameter size. The 6" orbital sanders will take *much* more time. The 8" DA will require a 2 hp compressor and it will work that compressor pretty hard, but it usually can just keep up with the air demand. Keep the sander moving and use a similar diagonal motion so that no grooves or waves result.

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3. You should sand this application down until you just begin to see the cream color of the prepreg starting to show through.

NOTE: It is very important to keep the primer applications THIN. Excess amounts of primer could easily increase the weight of your aircraft by as much as 30 lbs.

Also, remember that the goal should be to achieve a finish on the bottom surfaces that is conducive for good aerodynamics *only*.

4. With that first application of primer sanded down, go over the surfaces and look for imperfections. Use a spot light at a low angle to the surfaces in a dark room to quickly point out any imperfections. You should use compressed air to blow off the surfaces first. Wiping them will leave sanding material down in any imperfections and you'll miss seeing them.

5. Apply a second coat of primer. This coat can be a thinner application. After cure, sand it down with 220 grit. You can either wet or dry sand. If you wet sand, the sandpaper will not tend to clog up (use 3M wet/dry - black sandpaper). However, with wet sanding, you should allow at least one to two weeks for the surfaces to fully dry before painting. If you dry sand, use the aluminum oxide sandpaper (light grayish color).

6. If you are intending to use a urethane type of paint, then generally a 220 grit finish is acceptable as a paint base. If you choose an acrylic/enamel type of paint, you should go to a 360 grit finish since it will show the scratches more readily than a urethane.

7. The second coating of primer should also be sanded down quite thoroughly. If you begin to show the prepreg through, spray a touch-up with primer and lightly resand the touch-ups. This will assure the thinnest possible primer coat, yet allow full coverage.

8. If you have some (few) imperfections located after everything else is readied for paint, limited use of a lacquer spotting putty is acceptable. This should be used sparingly. It is packaged in a tube and will set up in about 20 minutes. Use a small squeegee to apply it, then spot sand with 220 grit. Make sure that it is feathered out nicely or else an edge will result and show through in the paint. The two part spotting putties are much better though and will set up equally fast.

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E. Painting

This is not intended to be a painting instruction, we will only touch on a couple of basics. You should consult local sources or available technique books for tips on painting.

1. Generally, the urethane paints are preferred. That is because they will allow the greatest amount of flex without cracking or chipping. You will generally use less spraying volume of them but they are heavier, with less evaporative solvents, so the weights come out about the same in the end. Imron is the most readily identified name brand but there are several excellent brands available such as Sterling and Ditzler.

Another acceptable type is the acrylic / enamels. These, when used with the catalyzed hardeners, produce an excellent finish. One such paint type is DuPont's Centari. Often, the acrylic / enamels are easier to touch up and blend in with the existing paint finish. The urethanes often do not blend very well together when making any spot repairs. On aluminum, (rivet-bucket) aircraft, that problem is more easily dealt with since you could mask off individual panels. But, with our composite airframes, there are no "panels" since all parts are fully flowing and blended into one another and thus there is simply no convenient place to stop a spot repair short of an entire wing surface or fuselage.

2. A word of caution, when preparing to paint, be sure to read the safety instructions and follow them carefully. The fumes from these paints can cause serious harm. Among other precautions, you **MUST** wear a good charcoal filtering type respirator with new cartridges installed.

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F. Paint preparation

1. It is generally recommended to disassemble the airframe as much as possible for painting. This will make for more pieces but a better paint job when it's all put back together.
2. Remove the control surfaces, gear doors, wings, canopy and cowling. Mask off all appropriate areas. Tape off the gear wells and wrap plastic bags around the wheels. If you roll the plane up onto some stands, the lower surfaces of the fuselage will be easier to spray but be sure that you can still reach the top or have a stool available.
3. Blow off everything with compressed air and be extra careful to blow off areas that are near any possible spray gun blast even if they are not destined for paint such as in the gear wells, back by the flap attach locations along the aft spar webs, etc. Sometimes these areas can have big cakes of dried sanding residue that is just waiting to be launched into the air when your spray gun hits it. And that can make a huge mess on a nice clean, wet paint surface. Also check the hose near the area of the spray gun since it will likely be suspended over some wet paint as you make your spray passes.
4. Wings, control surfaces, etc. can be hung on wires or clamped up to make-shift fixtures. Again, be sure these fixtures are also dirt free.
5. It's not easy to paint all surfaces at the same time but it is recommended to at least mix all the paint cans so that the color is guaranteed to be identical from one gallon can to another.
Generally, two gallons of top coat paint (plus its recommended thinner and catalyst, etc.) is sufficient. So, mix the two gallon cans together by pouring them into a bucket, mix them and then pour them back into their own gallon cans again. Even though the colors are supposed to be the same, they often have slightly different hues from one can to another. Whites are particularly susceptible to this problem.

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G. Base Colors

1. Keep your color choices to **LIGHT pastels ONLY**. Yes, you've seen other darker colors on aircraft and one of our company planes has had a darker color but that was for a testing program and **IS ABSOLUTELY NOT RECOMMENDED**. In **fact by policy, we prohibit dark base colors on all Lancairs**.

Yes, our Lancair materials are better suited to higher thermal tolerances but as with all composites with any type of resin system, strength will drop as temperature rises.

The biggest difference with Lancair materials involves the core materials. Our high temperature cores will not sustain any permanent damages from elevated temperatures, the common low temp cores would. However, if you are using the white Clark foam for ribs and bulkheads, it is **NOT** a high temperature core and must not see elevated temperatures. If you have chosen to use the optional high temperature prepreg bulkhead sheets, then it will tolerate elevated temperatures without any permanent damages but, as with all resin systems, a temporary strength drop will result as temperatures rise. This temporary drop reduces the effective safety margins until the composite cools.

When it cools, all strength will return. But, due to this temporary, potentially in-flight drop in margins, we only recommend light pastels for a base color. We cannot stress the importance of this enough. Keep your colors **LIGHT** and let us do the testing.

However, with your Lancair, you can enjoy a much wider color choice than any other kit plane on the market since all the vinyl ester / low temp foam kits should **ONLY** be painted white since any other color choices, even light pastels, could run their expected surface temperatures too high thus causing permanent structural damages. This will never happen with your Lancair and it is just one of the many reasons why we have chosen these superior, high temperature advanced composites for the Lancair. That is also one of the key reasons why virtually all of the commercial composite industry uses **ONLY** high temperature epoxy based composites for airframe applications.

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H. Trim colors

1. There really is no problem with any of the trim colors provided you keep them down in size. It is recommended that you not paint any trim on the fwd 50% of chord along the wing. This is because the resultant paint edge, even though it might only be .010" thick, could trip the laminar flow and cause added drag. Fwd / aft orientated wing tip striping is however acceptable.
2. Generally, the trim is painted onto the airframe after the base coat has been applied. Usually, the more simple the trim design, the better it looks. Designs that have a lot of vertical direction changes within them generally tend to break up the smooth flowing lines of the Lancair and detract from it in the process.
3. It is highly recommended that you use the 3M type "fine line tape" for masking the paint areas. This should be used for the base coat colors as well, such as around the canopy and windows, etc.
This fine line tape is usually found to be slightly greenish / gray in color and of a mylar type material. It is much thinner than the masking tapes and produces a very nice, crisp line.

WARNING: When you are finished with the painting, etc., be sure to check your pitot and static ports, especially the static. Verify that it is still clear and functioning as primer and paint could plug it up.

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I. Interiors

1. The interiors of the aircraft are generally painted and upholstered. The primary point here is to stress the importance of covering ALL exposed surfaces of fiberglass with either paint or upholstery or both. The fiberglass must be shielded from ultra violet rays to insure longevity of the structure.
2. The inside of the canopy frame is generally finished with micro, primered and painted. This is usually applied to the longerons and around the canopy latches as well since the upholstery panels will generally tuck under the longerons on each side and are cut out around the canopy latches.
3. In the baggage compartment, the side walls can be either upholstered or painted. Paint is cheaper and lighter but will allow for more noise to bounce around in the cabin during flight, upholstery looks better but it's heavier, and more costly. The same thinking applies to the upper "head liner" in the baggage compartment. Painting it is probably the more standard approach. We generally then use simply a filling primer and paint it with Zolotone paint. This type of paint is also referred to as "trunk paint". However, most trunk paints that come in rattle cans (aerosols) are not nearly as attractive as the Zolotone brand of speckle paint. This type has smaller flecks and looks very attractive. It also hides a lot of "sins" since it covers very well. With these types of paints, there is no need to sand beyond the 80 grit stages.
4. Once again, it is recommended that these interior colors be kept to light pastels as well. Also, on a hot day, you will definitely appreciate a light colored interior. However, the instrument panel should be painted with a darkish color. The canopy will have the ability to reflect the instrument panel and a light colored panel will really distract from good visibility along the lower fwd portion of the canopy during certain natural lighting conditions.

J. Upholstery

1. A nice upholstery need not be elaborate to look good. What is most important is that you use materials that are suitable for an aircraft interior. The important issues are fire resistance, toxic smoke given off and weight. Interiors can become very heavy if you are not careful in your upholstery selections. Carpeting can be particularly heavy but luckily, there is not much in the way of square feet of carpeting required. Seat cushions can range from 1 lb. to over 5 lbs. depending on type of foam cushioning and type of fabric chosen so think "weight" when selecting upholstery.
2. Seat cushions and back cushions should be removable. A velcro strip will secure them to the front of the main spar web. The seat back panels can simply lay against the seat back bulkhead and a panel attached that wraps around the top and attaches with velcro under the top support. Side panels are generally self contained panels that are glued into position. If you run the side panels fwd under the instrument panel about one foot, the look will be better. Also a small side close out panel on each side of the nose gear tunnel that extends back and attaches to the sides of the instrument panel make for a nice finished look. Make an oval cutout for where the free-fall valve is accessed from the pilot's side.
3. From the instrument panel forward, we generally cover the sides of the fuselage with a sound proofing material along with the complete nose gear tunnel and the back of the firewall bulkhead. The nose gear tunnel is a particularly important item onto which good sound proofing is important for a quiet cabin. Also the "D" section of the stub wing can become a sounding box and it should be closed off from the cabin area with a bulkhead and soundproofing.