A COMPREHENSIVE AND SPECIFIC GUIDE TO TROPHY WINNING FINISH FOR THE SCALE MODELLER

BY Dave Platt

INTRODUCTION

Covering and finishing a model can be as absorbing and pleasant a job as any that our hobby has to offer. Indeed, it could be true to say that a percentage of scale modellers may unconsciously be artists—they love to paint, and a scale model provides an incomparable opportunity to follow this desire. The airframe itself becomes, in effect, a three-dimensional canvas. Upon this base, the builder can find intense fascination in creating what may. in every respect, be called a living work of art.

Why. then, is it also true that, for another modeller, this same process is a hated chore? This poor fellow's past experience makes him foresee the potential ruination of his finely-made air-frame . . . and he dreads every minute of it.

We believe there are three distinct ways for the unfortunate guys in the second category to place themselves among those in the first. These are:

a). Skill
b). Technique
c). Expectation

The first two are fairly obvious, and the remainder of this booklet will describe ways for improving these. Let's take a look at Expectation.

It is very unfortunate that the covering and finishing process is often regarded as an important but *minor stage* in model building. The feeling is: "Okay, the model is built—let's get it covered and we can fly it tomorrow!" To some extent, members of the model trade tend to encourage and foster this belief. They advertise materials as "instant answers." It seems that many things today are designed to produce quick results, and they sometimes work. But. by and large, there is no "free lunch." Rapid methods often lead inevitably to miserable consequences, and the trusting modeller thinks it's his fault.

We'd like to set the matter straight with a few home-style truths:

Fact—Covering and finishing is a *major* stage of model building.

Fact—It takes as long to do a good job on the exterior as it does to build the airframe (we figure that a model which is built, with engine and radio installed, is 50 percent complete).

Fact—The above estimate applies to *experienced* builders.

Fact—The pleasure derived is directly proportional to the quality received. Thus, while you may spend more time, the job will be better and you'll enjoy it more.

By now, if you've always had nightmares with covering and finishing, you should be saying something like this: "Wow, no wonder I've never done too well! If it lakes the experts a while. I didn't have a *chance* of a good result in the time I spent!"

True! And all because nobody told you what to *expect* and regard as normal. Our hope here is that we've got you convinced that the trick is to *slow down.* This is the way of the experts.

Before we get into a blow-by-blow account of the methods we use to cover and finish a scale model, we'd like to explain one other important thing. Although! we used the term *"trophy-winning finish"* in the title, we wouldn't want to be misunderstood in this matter. We are not necessarily referring to a rich, deep 20-coat gloss. The true art of scale modelling is to "tell it like it is."

In seeking to model a full-size subject in miniature form, we should contrive to reproduce that subject as it really looks—good, bad or indifferent.

Indeed, it will be found that to copy the scruffy look of a well-used plane convincingly can be much more difficult than to get a smooth and glossy finish. Of course, if our subject is indeed clean, bright and shiny, we want our model to be so. But we might be modelling, say, a combat warplane with a victory tally or mission-count to its name. If this were the case, it is obvious that this subject didn't get these credentials overnight . . . it took time, and time puts a toll on the outside of an airframe.

With (his in mind, remember that the somewhat battered and very dirty scale model, when wed done, can in every way qualify as having "a trophy-winning finish. "Alright then, with the above qualifications made, let's proceed to this worthy aim. It has been truly said that you can't make a silk purse out of a sow's ear. Neither can you get a beautiful finish on a roughly-built airframe. This is why we'd like to begin with a chapter on "Preparation."

PREPARATION

The essential difference between a poor model and a great one can all be summed up in one word ... *sandpaper!*

There never was a ding in an air-frame that couldn't be filled and sanded level, or a protruding spar that couldn't have been sanded flush.

One horror we sometimes encounter on all-sheeted subjects is what we might politely call the "starved-horse" look. When sheeting sags between the ribs in a wing or the bulkheads in a fuse-lage, that undulated surface is what we call a starved-horse. There are a number of defences against this. Two that are obvious are

a) use more ribs or bulkheads, to shorten the unsupported span, or

b) use firmer wood for the skins.

Other factors that may not be so well known, but are equally important in sag prevention, are

c) use only curing-type finishing products, i.e., avoid air-evaporating materials where possible (more on this in our "Materials" chapter), and

d) sand all skins thoroughly *after* joining and cutting to size, but *before* attaching them to the model.

Sanding of skins after I hey are in place must be held to a minimum. Never join skins on a wing, for example. (What happens is this: Naturally, you have to sand the joints. The sheeting is pressed down by the sanding block between the ribs, and the area supported by a rib is sanded very thin. These thinned areas then show later as depressions which give a rippled appearance. Obviously, strength is affected too).

Prior to covering, break down the model into the greatest number of individual components possible. Remove engine, radio, servos, horns, hinges, links, etc. Mask off the window areas only (but not the frames) with tape.

Finally, lightly hand-sand the component you're about to cover with 220 paper. Get it really smooooth! Ready? Lay the part down on a foam pad or similar soft surface (watch out for loose pins that will ding the weak bare balsa) and you're ready to start.

MATERIALS

Over the many years we have been around model building, we've seen more "new and miraculous" ways of covering and finishing a model than there are P-51 kits on the market. A few of these have stood the test of time. Many haven't. Some are around that have useful applications in other areas of modelling, but do not give good results on scale models. Let's list the various materials and see if and how they'll work in our special situation.

Plastic films: One of these (Super Monokote) is extremely useful as a parting film when making fillets, etc. (To be discussed later). Other than this, films should be avoided for covering a scale model. Many fine airframes have been spoiled by plastic film covering, which invariably wrinkles badly sooner, or later. I personally feel that mylar imparts a "toyish" look to a scale model. Plastic does have good (perhaps too good) gloss but. if you're reproducing a glossy subject, there are better ways, as we shall see.

Silkspan: Probably the oldest and most "traditional" of all coverings, silk-span (a rag paper) still is very useful to the scale modeller. It has the virtues of lightness, easy working, resiliency, and it's inexpensive. On the minus side it is, of course, weaker than nylon, and requires the use of dopes, which we'd rather avoid. We use silkspan on "fabric covered" control surfaces. A totally fabric covered subject (many biplanes, for example) can be very nicely done by "double covering" with heavyweight silkspan, or a layer of silkspan first, then lightweight silk over that.

Silk: Silk is useful mainly when applied over a base layer of silkspan, as

just mentioned. Silk alone does not do an entirely satisfactory covering job. This is because its open weave allows too much dope to soak through—this forms drops or "tears" of dried dope on the inside of the silk. Needless to say. the appearance is terrible.

Nylon: Nylon solves many of the problems of silk, having a close weave which keeps dopes or

paints from penetrating too far. *Dacron* and several other man-made fibers fall into this same category. For a covering material on a fabric-covered model, one very suitable material is *polyester.* This is sold at fabric stores as a lining material . . it is inexpensive and very strong.

Coverite: Coverite is a model-trade material, being a man-made fibre with an adhesive backing. This is ironed on and is heat shrinkable. Quite expensive, but a fine product that will give very good results when you follow the directions that are supplied. One small point of dissention is that the *Coverite* manufacturer recommends against using nitrate dope on his product. Our experience indicates this not to be a problem.

Taking all of the factors into account, our own order of preference for fabric-covered subjects would be:

1). Silk (over silkspan)
2). Coverite
3). Polyester
4). Nylon
5). Silkspan (double layered)

It should be noted, however, that *all* of the above materials will give good results on a fabric-covered subject, depending on your skills in working with them.

Fiberglass cloth: Glass is found in hobby shops in two weights: 3/4 oz. per sq. yard, and 2 oz. per sq. yd. Generally speaking, the 2 oz. is useful for wings and fuselages of large (over 6' span) models. The *V** oz. cloth is best used for empennages on these larger models, and as an overall covering for any smaller model. Glass cloth is the standard material for covering any all-sheeted airplane, since it works well with resins to produce a strong and durable finish. This technique is superior, in every respect, to any other method.

This about covers the coverings, so to speak. Let's move on to the paints.

Nitrate dopes: When it is necessary to use dopes, this is the one to use. Nitrate dopes are not fuel proof. nor even fuel resistant.

Butyrate dopes: Bulyrates are claimed to be fuel proof. but this is not true. Also, they have several more serious deficiencies. They have a rubbery texture (like rubber cement or contact glue) and it's difficult to apply butyrate dope smoothly unless you spray it. The bond is miserable, and masking tape, etc.. will immediately pull it up. This is so even after you have applied the colour coats . . . the dope pulls away from the covering itself.

Another problem with dopes (nitrate or butyrate) is that they have poor colour intensity, and it is necessary to apply many coals to get a solid colour.

In summary, our judgment is that you will do well to steer clear of butyrale dopes altogether.

Dopes (generally): We regard dopes as an inferior choice of paints, where there is a choice. There

is good reason for our opinion. Cellulose-based materials shrink as they air dry. Though they appear to be dry within a short time, actually the process of evaporation continues for several weeks, or even months. During this time, the filler material (the paint's "vehicle") "sinks" ever more into the wood. The good level surface you worked hard to get will eventually show wood-joints and even, in some cases, the wood grain itself. This is an inherent characteristic of all evaporating-solvent type paints. It seems that no amount of care can prevent the inevitable deterioration of the surface smoothness.

Added to this is the naturally poor chemical resistance of dopes to the fuels we use. Though labelled "fuel proof," dopes are *resistant,* at best— fuel will eventually cause stickiness and premature deterioration of the finish.

A third disadvantageous trait of dopes is that a freshly applied coat will "melt" (reactivate) a previous coat. This necessitates a prerequisite of several coats of "sanding sealer" (a grain-filler usually made by mixing talcum powder or other powder into cellulose or butyrate dope). You sand one coat smooth and. as you apply the next, it melts the previous coat, partially destroying the smoothness. Sure, you eventually win, but it's time-consuming.

The answer to all of these problems with dopes is to use a material which chemically cures instead. It is for this reason that today's scale modeller uses epoxy and polyester resins (we will describe these in detail later). While it is true that many "old-time" modellers can get good results with dopes, by and large we believe them to be outmoded. We restrict their use to occasions when we have *no* better alternative and. Even then, only to the use of clear.

Acrylics: One attractive feature of acrylic enamel or lacquer is that they are available (from auto paint outlets) in a bewildering variety of colours. They also are generally inexpensive, dry fast and work easily. Colour intensity is moderate, but the bond is generally poor. Of the two. acrylic enamel is preferable to lacquer, as it shrinks less. Some acrylics have a tendency to "crack" or "craze" as they age. To overcome this problem, we mix in a flexible additive (plasticizer) used when painting rubber bumpers.

Polyurethanes: These come in two varieties: single-part and two-pan. Single-pan polyurethanes are available on the model market but have proven, for the most part, unsatisfactory. Their most serious fault is poor bond, and we have seen paint literally flaking-off models that were only a few weeks old. Colour intensity is good and the materials work easily, but their fuel-proof qualities are highly questionable. By and large, we think it's wise to avoid them.

Two-part polyurethanes: on the other hand, are very satisfactory, but they have one unfortunate disadvantage. The vapours are highly toxic (poisonous might be more accurate) and *extreme caution is necessary when using them.* We cannot over-emphasize the importance of this. Polyurethanes can give magnificent results—second to none— but heck, this is a hobby; something we're doing for pleasure. It doesn't seem sensible to risk our bodies. Nevertheless, *provided* that the proper procedures are followed to make the job safe, a two-part polyurethane (best exemplified by DuPont's "Imron") simply cannot be beaten for a first-class job.
What are "safe" procedures? Some manufacturers recommend a back-pack (this is like an aqualung, where you carry your own air and breathe no outside air). No doubt, this would be best, rendering you immune from harm. It's not too practical for the average R/C fan. though. We have sprayed "Im-ron" with no ill-effect, wearing a gas mask and applying it outdoors, letting the breeze carry all overspray and vapours away downwind. It should be noted that the mask (get one that will give protection in a poisonous-gas environment—not just a "particle mask") must be worn while mixing the paint, too.

By now, you're probably saying something like "Holy smoke. Platt. what are you telling us here? Isn't there a good safe paint that will do what we want, without our wives collecting our life insurance?"
Good news. There are. and have been for a long time. Klass Kote a manufacturers on the American model market make excellent paints that pass the most critical trial. Let's examine Klass Kote them in a little more detail.

Klass Kote primer: Comes in two colours namely White and Gray This is a two-part Primer , is applied after the resin is sanded. We have found this to be the best primer on the model market
Klass Kote colours: Consists of a colour paint (Part A) and a atalyst (Part B). Until mixed, the shelf-life of the Part A and Part B seems indefinite. Once the parts A & B are combined, the paint is going to cure—even if you leave it in the can. In other words, it works just like epoxy glues.
Now. the colour Part A comes only one way, but the Catalyst Part B comes in two different kinds—there is a Gloss variety and a Satin (Catalyst) hardener. Depending on which catalyst you use your model will have either a glossy or a dull finish. Either way, it's fuel proof.
There are a few things to note about this paint:

A). Mixed paint will keep for several days in a refrigerator.

B.). Colour catalyzed with Satin Part B will dry faster on the model than when the gloss Part B hardener is used.
Thinners/Reducer : Klass Kote thinner works well — if you don’t have any on hand a good quality Thinners will also work

Clear paint:: Klass Kote do a clear paint which is used with a catalyst just like the colour. The

clear is used for a final spray over the colour.

There are a couple of other very useful products which we use extensively.

One is micro-balloons. This is an ultra-light powder filler which, mixed with Polyester resin, makes excellent fillets. It's handy for a number of other jobs too. which we'll mention later.
Another excellent product we'd like to recommend is "Liquid Masking Film . This is a material used during final painting for markings, etc. and it b basically a water-soluble sprayable paint mask. Well get into this later on.

METHODS

Over many years of building scale models, we have evolved various methods and procedures for the covering/finishing process. The one that is chosen will depend upon the subject we are modelling.. Although we are giving detailed step-by-step suggestions, it is not intended to imply that these are the only ones which work. Variations can be made without risking disaster, and if you have developed techniques which work well for you, it may be as well to continue with them. However, if your experience is limited, or the covering / finishing process has always given you a hard time, we'd suggest you follow the steps without modification. You'll be starting out with a proven method and can devote your attention entirely to improving your skill level.
Fabric-covered aircraft: The covering material you have chosen will be one of two kinds: either iron-on be it shrinkable (Coverite), or one of the fabrics previously discussed.
In the early stages of covering, the methods vary somewhat. For Coverite. follow the detailed instructions supplied with the material. An imperfect covering job with this product is almost always the result of not reading or following the instructions. Take special care with the grain direction, or a loose covering job can result. Once you have the ship covered and are ready for finishing, switch from the manufacturer's instructions to those described later.
For silkspan. polyester, silk or nylon, proceed as follows:

1). Sand airframe very carefully at all points of covering contact. Use 220 aluminium oxide paper. Fill any dings with a micro-balloons and resin mix (or Dap brand vinyl-spackle paste), and sand out. Be very fussy with this job—the final appearance of the finished model depends on it.
2). Brush a coat of full-strength nitrate clear dope over all areas where the covering will contact wood. Allow to dry.
3). Lightly sand off raised fuzz with 220 grit sandpaper, and apply a second coat of clear. Allow to dry, then repeat the sanding.
4). Cut the panel of covering material a little oversize. Soak with water and squeeze out excess (leave the material only damp). Now, working as quickly as possible, smooth out damp material over area. Gently tug out any wrinkles. Do not be particularly concerned to get the material drum-tight but be sure to get it smooth and wrinkle-free.
5). Brush a coat of nitrate dope onto the fabric, but only where it contacts the wood. As the damp

material and the dope dry, the covering should adhere well and shrink fairly tight.

6). Inspect the results. Any imperfect areas (wrinkles or obvious looseness) can' be re-dampened and again doped. Only when the job is perfect can you proceed. DO NOT expect later coats of dope to improve a problem area! The covering job will never be any better than it is right now. If in spite of extra attention, problems with wrinkles remain, remove the cloth, panel and try again. You may have areas of blushed (white) dope. Do not be concerned, this is a normal reaction between dope and water.

The following steps apply to not only the fabric covering being discussed, but they should be followed when finishing a model in Coverite once the Coverite is already applied per manufacturer's instructions.

7). Brush, or better, spray a coat of thinned clear dope over the completely covered model. As this coat dries, the covering job should gain a little tightness and some of the blushed effect will disappear. *Lightly,* sand the entire model with 220 grit paper.

8). If you are double-covering (silk-span), this is the time to apply the second layer of material. Wet the material and cover, using an overall coat of clear as adhesive.

9). Now apply three or four more coats of clear, by spray if possible. The last coat should be well thinned (25 percent dope. 75 percent thinner).

The covering and clear doping now being completed, lightly sand the model in preparation for priming. The primer must be sprayed for best results. When the primer is dry sand very carefully. It is advantageous to use 220 or 320 grit silicon carbide "wet & dry" sandpaper on the primer. Using it wet will prevent the paper from clogging. Remember the surface quality you are now seeing represents the quality of the final job—the colour coats will not correct surface imperfections. If there are any flaws remaining, attend to them now with extra primer or filler, and sand out

By now the model should be looking great. At this time, add surface details (such as rib stitching and tapes) as required.

Rib stitches: These are best represented by white PVA glue applied in thin lines across each rib at a suitable spacing. The glue is applied with a hypodermic needle.

Rib tapes: A number of methods have been evolved. Our favourite uses the serrated cutter from a wax-paper package to cut strips of paper (tracing vellum). The strips are soaked in water until they become limp, and are doped down over the glue "stitches." An additional coat or two of clear dope will make the paper ready for colour.

When the colour needed has been acquired or mixed (we'll discuss colour mixing later), the model may now be painted. For the best effect of realism, pay close attention to the degree of gloss you need. Many full-size aircraft are matte or satin—in these cases, use the Klass Kote Part B Satin Catalyst.

However, even in cases where the prototype is "glossy," it is unwise to use straight Part B Klass Kote Gloss Catalyst.

Very few full-size subjects have the rich deep gloss that model epoxy paints normally achieve. A much more convincing effect is produced by dulling the shine to some degree by pre-mixing the Gloss Catalyst with 10-20 percent Satin Catalyst.

The actual technique we use is to paint the model entirely using *only* Satin catalyst in the paints, achieving the final degree of sheen required by means of a final clear coat. This makes use of the faster drying-time of the Satin paints referred to earlier. If a Gloss effect is wanted, give a last coat of clear, using the gloss catalyst.

This brings up one important point: ALWAYS apply one coat of clear paint, over the whole model, after it is completely painted There are several reasons for this:

A.) The model feels, and is. Smoother. Masking tape leaves a slightly raised edge on succeeding colours and this is diminished by an overall clear coal.

B.) The fact that we are going to apply a clear coat allows wet-banding (with #600) the colour paint. We don't have to worry about the loss of gloss produced by the sanding. The result is an even smoother finish than

(a) alone will give.

C.) The final sheen will be consistent over the whole model. The degree of gloss between various colours on a model tends to vary somewhat. This is particularly true when applying camouflage finishes with Satin paints, and is due to variations in "dryness" of the paints as they hit the surface. Soft mottling, for example, is applied very "dry" (99 percent air. 1 percent paint) and will appear more matte than overall base colours which are applied wetter. The final clear coat, satin, glossy or anywhere between, will cover these

dull-and-shiny areas with a consistent overall sheen.

D). A clear coat protects the colours from wear due to rubbing on car seats. etc. Such protection is especially vital over weathered paint jobs.

E). An overall smooth, level clear coat makes the airplane easier to clean, and thus more fuel proof.

Okay, you ask. if one clear coat is necessary, might two be better? Perhaps. We'll leave this to your judgment . . . we use just one.

One last technique we use and recommend is to pre-mix the Catalyst Part B with thinner. This only applies in the case of *Satin* Catalyst—it is not necessary with Gloss Part B. As supplied in the can. Satin Part B is very thick and sludgy. This makes it difficult to stir to an even consistency, and can lead to wide variations of sheen from paint batch to batch.

Since we will be thinning the paint before application anyway, we have found it an advantage to pre-mix the Satin catalyst with an equal volume of thinner. Indeed, we normally keep a good quantity (a quart or so) of this mix ready to be combined with any of the numerous colours on a

typical model. The ratio, instead of 1 part colour to 1 part catalyst, is now of course changed to 1 part colour to 2 parts mix. This gives a 1-A to 1-B to 1-thinner final ratio, which is an ideal viscosity for spraying.[1]

Naturally, that can of "mixed" Part B will settle out fairly quickly, but a vigorous shaking is all that is needed to properly blend the "powder" in the solution. While on the subject of settling, we should mention that combined paint, in the gun. should be shaken or stirred periodically when using the satin hardener or variations of sheen and drying time may be encountered.

Metal or wood -covered aircraft:

In order to properly prepare the modeller (fore-warned is fore-armed), we preface this section with a warning. Compared to fabric-covered aircraft, the achievement of a grade-A job on a metal subject requires infinitely more skill and technique. Many new features present themselves. Among these are such typical surface details as panel lines, hatches, and rivets. Weathering techniques, particularly, are much more advanced for metal subjects: it is notable that several acknowledged R/C Scale experts are reluctant to jeopardize their position by accepting this challenge . . . instead; they stay with safe, easy-to-reproduce fabric or wood-covered subjects.

That's the bad news. Now for the good news. Whereas the fabric-covered models obliged us to use some materials we'd rather avoid, we don't have this limitation on solid-surface subjects. We can use fibreglass covering and resin finishing materials throughout. Then too. the extra technique shows, and these aircraft have a tendency to look prettier and possess more character.

However, before we get into a detailed description of the fibreglass finishing process, there are two very important areas which need to be handled first. These are fillets and landing gear doors.

Fillets: Remember a while back, we mentioned Super Monokote? Go buy a roll—we're going to put it to work!

Here's how to make a truly outstanding fillet which will fit so well that you'll hardly see the seam:

1). Cover the wing's upper surface with the Monokote. from the root rib to a little further out than the width of the fillet. Iron firmly down to the bare balsa, being careful to remove all air bubbles.

2). Mount the wing in place on the fuselage. Lay a strip of masking tape on the fuselage at the upper line of the required fillet and also across the wing at the outer edge of the fillet. Mix a small batch of Polyester Resinr and Micro-ballons balloons, making a *thick* mix.

3). Add Epoxy Hardener and trowel into the wing / fuselage junction with an artist's spatula.

4). After about 10-20 minutes, the balloons will reach a "gel" point. This occurs when the material solidifies, but is not fully cured. Later it will get very hard, but at this point it can be cut like soft cheese. Using a knife, coarse sandpaper, or even the blade of the spatula. pare away the balloons

to the approximate shape of the fillet.

5. Once you get the feel of this, mix more balloons and proceed until you have both fillets roughed out.

6). Let the fillets harden totally (overnight is best), then sand to final shape and smoothness. Sand to the limits prescribed by the masking tape. Remove the tape.

7). Now the good part. Remove the screws holding the wing. Stand the model on its nose, with a helper holding the aft fuselage under the stab. Holding your hands with flat palms. FIRMLY rap both wings at once near the T.E. The wing will break free of the body.
3). Remove the Monokote from the wings. You now have the best fitting fillet you ever saw.

Landing Gear Doors;
Having introduced you to the usefulness of Super Monokote as a release agent for polyester materials, we will now use it to help fashion doors.
1.) On the wing bottom sheeting, the areas where the L.G. doors are should be marked out and covered with Monokote.
2.) Brush a coat of resin over the Monokote and let harden.
3.). Lay up and resin 2-3 layers of 10 oz. glass cloth over the Monokote.
4.) When cured, sand the outer surface smooth. Prime and re-sand.
5.) Break away the fibreglass lay-up from the wing. Mark out the exact shape on the door and cut to size.
6). Remove the Monokote. Lay the completed door on the wing, noting that it follows every curve or twist, and exactly fits the wing where the door will be in the retracted position. Trace the door outline and cut away the appropriate area of sheeting from the wing. Mount the door on the L.G. leg.
Landing gear doors made in this way, in addition to fitting very precisely, have good strength and cannot be bent out of shape.
There are also other occasions when "the Monokote trick" can be used to engineer very exact mating fits between two parts. Removable cowls, hatches, and flap lines are some more examples. Bring the parts together with the Monokote between them as a barrier, trowel in a little micro balloons each side, sand flush while together . . . then break the part free and remove the Monokote.

Let's move on now to the details of fibreglass covering. At first encounter, this sometimes proves a little messy. As experience is gained, the mess diminishes and you'll enjoy it more. Here's the procedure:

1.) Gather the necessary items. You'll need glass cloth. Epoxy Resin & hardener, a "12 artist's hog-hair brush, mixing cups and stirrers. Put some clean acetone in a jar for cleaning the brush. Pair of scissors , sanding block with 220 grit paper, some paper towels or a toilet roll.

2.) Prepare the bare wood with the usual fine-sanding and filler and re-sanding till the parts are really smooth.

3.) Cut a piece of glass cloth to fit the section to be covered. No material takes compound curves so easily as glass, so you can cover a large section —half a fuselage for instance—with one piece.

4.) Mix the Epoxy resin I oz. at a time. Use 8 drops of hardener. Brush the resin on the cloth. "Pull" the resin

much as possible (make it go as far as you can). Work quickly.

5.) When the 1 oz. of resin is used, clean the brush and blot any "wet" looking spots with the toilet roll.

6.) As the resin cures, trim or feather the cloth's edges with the sanding-block.

Proceed with more covering, mixing 1 oz. of resin at a time and cleaning the brush immediately after each mix.

Some resins have one slightly disturbing characteristic They will not tolerate oils, and you'll get an uncured mess if you try to apply them over "oily" substances. These include epoxies. butyrate dope, greasy fingerprints, etc. All epoxy seams should be sealed with *nitrate* dope, ambroid or white glue and allowed to dry for 24 hours. A rag dampened slightly with acetone should be used to swab the fuselage prior to the resin application.

Also, if any "wet" spots appear after the first coat is applied, sand these to remove the oily skin which characteristically forms as the resin cures. Wiping again with acetone prior to brushing on the second coat is prudent.

7.) With the entire model covered, lightly sand and mix a batch of resin sufficient to give an overall "flow-coat."

8.) When this cures, sand carefully using 80 or even 60 grit paper at first, finishing with 220. Resin cuts sandpaper as much as the paper cuts the resin: Replace the aluminium oxide paper frequently. Note: we want to fill the weave of the cloth only. Sand all excess resin, till you can see the weave (but don't cut into the cloth). This is where many first-timers go wrong and get a heavy finish—they don't sand off enough resin.

9). Examine the results critically, and re-resin and sand out any bad areas.

So far. so good. The worst part is over. Now we can proceed to spray on the primer coat. When the primer is cured, sand lightly with 220. Usually, bad areas will now show where we didn't notice

them before, due to the colour of the primer. Treat all of these areas with more primer.

Really deep dings or holes can be filled with acrylic auto glazing putty. Sand lightly overall.

At this point the model should look really great. Indeed, it needs to. because this is as good as it is going to get. However, the ship still looks bare, so let's add some details to it.

Hatches: Cut to size from aluminium air-conditioning tape. Peel off the paper backing to expose the adhesive, and smooth down onto the model, using a nylon prop as a burnishing tool. This material will follow compound curves to some degree, as it is .003# thick and soft-tempered.

Panel Lines: Mark out the panel lines directly onto the primed model with a soft lead pencil Over these, lay 1/64” wide chin-tape (obtainable at drafting or office supply outlets). Use the flexible type (Formaline #5000 A. or equivalent), which will form around flat curves. J & Z also makes a panel line tape.

This tape may be left on the model permanently or (as we prefer) it can be removed again after the model is painted and prior to the final clear coat This latter method gives a very realistic simulation of panel joints.

Rivets: As with the ribs stitches previously described, use PVA white glue applied with a hypodermic needle. Note that the glue droplet is held to the surface, which will pull it off the needle the needle must not touch, or the rivet will lose *its* roundness and assume a "fried egg" appearance. Thin the glue with water if necessary, but go easy.

Other Details: Many small details can be made with micro-balloons. Fairings for antenna masts, streamlined forms on aileron mass balances, air-scoops and blisters are a few examples. Put a blob of mixed balloons and resin in place, and simply carve to shape and sand when cured. Small touches like this take a little extra effort, but they add much to the effectiveness of the finished model

Mixing Colours: We need to begin this section by explaining why an oft-requested item is not available. Modellers frequently ask for "formulas" for certain colours (military shades, for instance). These fellows suppose that if they could have a formula (so-many parts white, so-many blue, and so on) they could match a colour without difficulty. The reason that such formulas are not available is that *they won't work.* Minute variations of shade in any ingredient will spoil everything. So would variations of strengths (pigment-to-carrier relationship). No paint manufacturer will claim zero variation in either of these qualities for his product. Consequently, formulas won't work, and indeed it would be a disservice to the modeller to attempt such an idea because it would only mislead, rather than serve.

Bearing this in mind, it becomes necessary to custom-mix a batch of paint for any given model. This is not particularly a hard thing to do. given a basic understanding of how colours work.

There ore only three primary colours: red, yellow, and blue. Any other colour can be made from these. The primaries cannot be made by mixing any colours. Black and white are not colours (they are tones) but we must consider them as essential in colour-matching, since tone must be matched too.

Let's give a couple of basic mixing facts and show now these ore incorporated to get the colour we want:

RED + YELLOW + BLUE = BROWN
YELLOW + BLUE = GREEN
YELLOW + RED = ORANGE
BLUE + RED = VIOLET
WHITE + BLACK = GRAY
WHITE LIGHTENS. BLACK DARKENS

Simple enough. Let's take an example and see how we'd match a colour. Suppose we want to make R.L.M. #75, a *Luftwaffe* colour. This is a violet gray. Gray is white + black, so to this we add some blue and red. Proceed as follows:

Start with 1/2 can of white. Add a small amount (by trial and error) of black for a pale gray. Add a small amount of blue and a good slug of red (Klass Kote Bright Red *).* Take samples as you go.

It takes a while to zero in on any colour, even a simple one. Small dabs of correction will do once an approximation is obtained. The vital thing about learning to match colours is to *get in there and start!* No amount of hand-wringing gets the job done, but *mixing point* will. At first, start with small amounts, and plan on spending an evening or two to learn this essential skill.

In some ways, this is a more difficult subject to describe than any other, since it is essentially a visual process. Well give one more example, and leave it for practical experiment by the modeller.

R.LM. #76: .Start with white. Add black to get a pale gray. Add a little blue, resulting in a pale blue-gray. This colour has a faint greenish tinge, so we need to add a small amount of yellow (which, combined with the blue in the mix. will send the colour in a green direction). So we see that *#76* consists of four paints. Use *only* a lemon (blue) yellow—a chrome yellow will prevent a proper match, due to the red inherent in the yellow.

Painting The Model: Assuming that we have mixed the required colours, and have a supply of Part A for each colour in the model, let's proceed to painting. We are going to use the example of the Me 109 to show the order of procedure.

One basic tenet that holds true in any paint job is that lighter colours are applied first. This being so. spray the underside and fuselage sides with #76.

Next, apply the #75 (the lighter of the two upper surface colours) over the top of the wings and stabilizer. Also apply #75 along the upper "spine" of the fuselage. All divisions between the lower #76 and upper #75 should be a fairly "hard" (but not masked) line.

Now the fuselage sides are faintly mottled, here and there, with #75 over the #76. Choke the spray gun delivery down until a soft effect is obtained . .. we don't want "blobs" Do the fin and rudder in a similar manner.

When the #75 is satisfactory, proceed to the darker #74 upper colour. Do the wings first. Following the plans carefully, "draw" the outlines of the #74 areas with the spray gun. Fill in the #74 areas between the lines with paint Here again, although we don't want a firm line such as masking would give, neither do we want a merge from the one colour to the other. The correct effect is obtained by aiming for the "hardest" division possible with a spray gun.

Do the stab next, then the #75 areas of the fuselage spine, and finally a light mottle on the sides among the #75 mottles already there. To get the idea of the shape and size of realistic mottling, copy a photograph of a full-size 109.

Once the model is painted to this point, *lightly* sand it with wet 600 paper, using plenty of water. This will remove the tiny "spikes" of dry paint or any powdery areas. Do the wings and stabs in a chordwise direction, and the fuselage up and down.

Markings: There are basically two methods of applying markings: they can be painted right onto the model, or they can be decals We could further subdivide the decals and say that there are two kinds: the traditional "water-slide" variety, and the vinyl or mylar stick-on type.

This is. of course, purely a personal opinion, but we feel the stick-on decal is fine only on a ready-to-fly .049 toy-store Park Flyer model. It has no place on a good scale model . . . a vinyl decal will seriously damage the appearance, no matter how good the rest of the model may be.

The ordinary water-slide decal (a vanishing breed) is okay for most purposes, and has the great

virtue of being quick. There are a couple of things to watch out for with decals:

A). Sometimes they are printed "out of register" (one of the colours are misplaced in relation to another.) This is un-correctable usually, and the sheet must be discarded.

B). It is possible that our final' clear coat may react with the decal. causing it to wrinkle, craze or blister.

But assuming we don't have either of these problems, a water-slide decal will be fine. They need care in application. Here arc a few hints:

1). Soak the decal briefly in water. It probably will curl up. *Don't* attempt to straighten it out: you'll crack the decal. It will flatten out by itself as the water impregnates the paper more fully.
2). Moisten the area on the model where the decal will go. Slide the decal into place and adjust position.

3). Squeegee out all trapped water using a piece of wetted soft balsa. Sponge clean and dry.
4). Allow *at least* 24 hours for complete drying before over spraying with paint.

One very good system (we provide this in our kits) is to use plain-colour water-slide decal paper. This has the great advantage of flexibility . . . you can cut the markings you want for your chosen version, and not have to settle for the identical markings that every other buyer of that kit received. A secondary benefit of this idea is that there is no clear carrier-coat that must be trimmed away.

We saved painted markings till last because this we feel, is the best method of all. Certainly, it is the chosen method of the experts. There are two excellent reasons for suffering the extra work and time taken to paint the markings on. First, paint follows any shape, compound curve, goes over rivets, etc.— decals can be a nuisance here. Second, the markings can be weathered along with the rest of the model. You can't do *that* with decals!

Earlier, we mentioned a product called "Liquid Masking Film." . The use of this material will give you the cleanest, most precise markings possible. Perhaps the best recommendation we can give to L.M.F. is to say that this is what we use on our own models.

If you have stayed with this rather lengthy story this far, relief is in sight! Our last chapter deals with that most mysterious and baffling of all arts . . . weathering.

Weathering- Alright, we've built it. covered it, sanded and sanded and sanded it. We've painted it, and put the markings on. Sure looks like a finished model . . . it isn't. One vital ingredient is missing: one that controls the final effectiveness of the model.

This ingredient is "character." If we forget this, our nice models will always be just that—nice models: nothing more. We must somehow capture the dignity of this machine. Sounds a bit romantic? Well, perhaps it is. But if we can at least be *aware* of this mysterious something that radiates from an airplane, we are on the road to creating a work of art that transcends the model and becomes a true replica. Let's discuss how we might inject this "character" we've spoken about.

An airplane is a tool. It's a tool for doing a specific job. That job may be to carry passengers, or its owner from point A to B—in this case it's a vehicle of transport, like a car. Or the job could be to destroy—to drop bombs, shoot up or shoot down the enemy's tools. Because an airplane is a tool, it is subject to the same treatment as any other tool: a whole lot of abuse, and a whole little of respect. It's called upon to do its designed job (and often more than it was designed for) with unfailing willingness and reliability, coupled with the barest minimum of essential care and maintenance.

Let's itemize some of the effects that this love and attention have on the appearance of an airplane, and also some other inevitable effects that are not man-made. These are, in order of importance:

1 - Colour perspective:

2 - Usage:

3 - Mechanical:

4 -Weather.

Did you notice something unusual about this list? The adding of realistic effects to a model is commonly known as "weathering." Yet, we are asking you to believe that not only is weather just one of four major factors affecting airplanes, but that it's the *least* in importance! How come? Let's take each item singly and the answer will be revealed.

Colour Perspective: Stand by a tree. We can see that the bark is brown and the leaves are green, basically, but there are many shades of each. Now move away 100 yards and look again. Right away, the varied shades have disappeared, and the trunk is plain brown, while the leaves are overall green.

Move another quarter-mile, and we see a much more even colour throughout —the brown seems less brown, and the green less green. As a matter of fact, it would be difficult to tell just what colour a tree is at this distance, if we didn't already know from prior experience.

Move away again—now the tree is on the horizon a mile-and-a-half away. The colour of the tree is now a medium gray all over, with no discernible colour distinctions.

This effect is known as colour perspective. It happens because the air we look through is neither as clean nor as transparent as we think. Between our eyes and the tree, (here is airborne dust in untold quantities. That dust is gray, and it acts like a giant diffuser.

What difference does this make to our scale model? Consider this: looking at a 1/8-scale model from 10 feel is the same as looking at the real plane from 80 feet away, right? Wrong! It's wrong because, when we look at the big one. (here is eight times as much atmosphere between our eyes and the real plane, as there is between our eyes and the model. This has the effect of toning-down the colours on the real plane more than those on the model.

We must compensate for this "visual scale distance." We do it by giving the model an even and *very light* spray-coat of medium-gray after the colour-scheme is completed and all markings are on. The coat should cover all surfaces, including the glass areas.

Colour-perspective gets first place on the list because it is the most inevitable. Even a model of a so-called "factory-fresh" and unused airplane is subject to this universal law. (Having mentioned the words "factory-fresh" let's explode another myth. Many times a builder of a glassy scale model will excuse himself by falling back on the old saw that his model represents a "factory-fresh" airplane. So how, one asks, did it get squadron markings and crest, and a victory tally?)

Usage: Chronologically, the next appearance changes to a full-size plane are caused by usage. We can sub-divide this category into these major items:

A) Dirt and grime,

B) Paint chipping and scratches.

C) Oil and fuel stains.

D) Burns, and

E) Damage.

Dirt and grime are best represented by careful and *very soft* sprays of dark charcoal gray on the completed model. Remember that dirt normally follows the line-of-flight. Thus, it will form behind protuberances on the aircraft and diminish as the distance from the protuberance increases. Panels of slightly unequal levels, e.g.. along wing, stab and fuselage sheeting joints, also show the effect to a lesser extent, especially those perpendicular to the line-of-flight.

Simulate paint chipping and scratches with silver paint on a small stiff haired brush that has been

scrubbed on a piece of scrap paper until almost dry. Then jab the brush on the model to leave irregularly-shaped wear marks.

These marks most commonly occur at the places where the crew enter the plane and where mechanics perform routine work. Fuel fillers, ammunition bays and inspection hatches gather wear of this kind in an unbelievably short time in use—especially military use. where a proud owner is not around to moan about the smallest ding! Keep the silver where it belongs. We don't want the model to look like some full-size plane that got left out in a sandstorm.

Oil and fuel stains are best applied by rubbing the model at the appropriate places with some staining agent on a soft cheesecloth.

Burns form around and behind exhaust pipes. Soot from the exhaust sometimes marks an aircraft for several feet. Use near-black or fawn. You might want to browse in the model railroad department at the hobby shop. There are commercial stain colours used to weather trains.

Before applying exhaust bums, find out whether marks of this kind are characteristics of the type of plane: Skyraiders always mark. Spitfires seldom do.

This brings up an important point. Study as many photos as possible of your subject. Look "through" the jazzy schemes and study the usage marks, noting which ones seem to occur consistently. Concentrate on these.

Damage, of course can happen anywhere and to any degree. This is impossible to detail. Just use your imagination. But go easy.

Mechanical: Mechanical causes of significant appearance changes can be broken down as:

A) Repairs, or B) Holes.

Repairs to an aircraft typically take the forms of patches on damaged metal or fabric. Very often, patches on metal structure have fresh paint applied, which shows as a sharply contrasting shade of colour, even when the colours are "the same." Patches in fabric may have the same treatment, or can be painted in red primary-dope, which often is left just this way. It was not uncommon to encounter airplanes with dozens of such red patches in war time.

Imagine this situation: Someone decides to add some device or other onto an airplane, and goes ahead and bolts it in place. Later, it is decided to remove the gadget. Do you think that they then

bother to fill in the holes after removing it? No way. Here again, use your imagination—but, once more, don't over-do it.

Weather: So, finally we come to weathering. We say finally, because the other things described previously have a rapid effect on the appearance of an airplane, whereas weathering takes lime. Even then, the effects are subtle, and a good deal of caution is necessary here. The visible effects of weathering are:

A) Fading.

B) Cracking and peeling

C) Rust and other corrosion.

All paints fade, in time. Under certain conditions, such as continued exposure to strong sunlight, noticeable fading can happen in two months.
We simulate fading with a very light coat of pale gray, sprayed from a distance and in merging formation. The upper surface of the wings, stab, and top of the fuselage fade more rapidly than the sides of the fuselage and the fin; while the whole under surface scarcely changes at all.

Cracking and peeling are best done by flaking off the odd area of paint with a knife. Here's another trick: after spraying the colour dope and before it has a chance to cure properly and become fuel proof. rub in some fuel on a rag. The paint will lift and flake off.

Rust is easy. Simply buy a pot of Rust enamel from the hobby shop (sold for model railroad use) and paint it on. Don't use too much—tatty and beaten airplanes may be. but rusty they aren't. The odd spot here and there is all you need.

Tools: Let's finish up with some remarks about the "tools of the trade." Really, apart from masking tape and the usual stuff found in any modeller’s workshop, there is only one tool. This is an airbrush *. . . a really good air brush.* The type of "airbrush" that has a hole which you block with your finger to spray, then release to stop, is fine for plastic models, but it will not do for really intricate detail.

What we need is an airbrush which has a trigger that is controllable by a screw, so that we can adjust the flow for more or less paint. Get the right kind of airbrush and it will serve you well. Such brushes are not cheap—ours cost nearly $100.00 (without the compressor).

The compressor should be fitted with a water trap, or you will be forever blowing out the water

which forms when air is compressed. Usually, high-humidity conditions and/or small nozzle openings aggravate this problem.

As with any new-experience area of modelling, mistakes will be made, and first results are far from good. But persistence will eventually be rewarded.

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[1] (Klass Kote Advisory: Whilst this technique above will work we do not recommend this procedure – it is better to pre mix the paint and catalyst before thinning as per our documentation)

[2] Klass Kote now produce pre mixed Military Colours