Painting

Glossary...

- **CFM** *-- Cubic Feet per Minute. A measure of air flow.*

- **HVLP** *-- High Volume, Low Pressure. The way of the future that a lot of guys have already gone to.*
- **PSI** *-- Pounds per Square Inch. The unit of measure for air pressure.*
- **PSPC** *-- Primer/Sealer/Paint/Clear. A shorthand way to refer to the primary products you will be shooting out of your gun*
- **VOC** *-- Volatile Organic Compound. You know, the bad stuff that goes up into the air we breathe*

Paint Gun Adjustment

A simple formula to remember:

- orange peel is fluid adjustment and
- run control is an air pressure adjustment.
- If you're getting a few runs try upping the air pressure 5-10 pounds.

Intro

HVLP and low-VOC products are the way the industry is going so I will be referring to them in this discussion on painting and paint guns. Also, some areas of the country are "VOC Regulated" and **require** the use of HVLP for automotive painting. So if you aren't HVLP yet, you will be sooner or later. The good news in this article, though, is most basic issues dealing with HVLP can be applied to conventional guns -- atomization is atomization. The HVLP just arrives at it differently.

The object of the spray gun is to break up the primer/sealer/paint/clear (I will call this "PSPC" from here out) into small particles and lay them in neat little rows on the panel being PSPCed. So the whole outcome rests on how well the gun is doing this. Picture the droplets of PSPC coming out of the fluid tip of the gun and then the air "slapping" them into smaller droplets.

You have two things that help you with this process: air and solvent. Solvent can mean something that is already in the PSPC from the manufacturer or something the manufacturer has told you to add to it. By the way, you should always mix in proper ratios as instructed in the tech sheet. The thinner (less viscosity) you get the PSPC or the more air you have at the fluid tip of the gun the more it will break up the PSPC. The target for you is getting the perfect balance needed. Too much solvent and the PSPC will have no body, fill, durability, etc. Too much air and you blow the PSPC everywhere but the car, poor adhesion, excessive texture, etc.

So, the answer is **proper air supply** and **gun** (and fluid tip) **choice**, and how you **adjust** it.

With today's high-solids, low-VOC products there is less solvent. And with HVLP guns there is less air at the cap to break up the PSPC. Thus, proper air supply and gun setup is more important than ever.

First things first -- Air Supply

Air supply, aside from being a popular Top 40 group from the '70's *(Editor's note: now heard in nursing homes and elevators all over America ;))* is a complete subject by itself. Let's assume you have a **sufficient supply of dry air** and move on. What's sufficient? Check your gun -- If you have a gun that requires 15 CFM you will need a compressor and plumbing that will produce that at a very minimum. There are HVLP guns that need as little as 7.5 CFM so you can get good results even from a smaller compressor. Remember, that's 15 CFM at the **GUN**. If your compressor puts out 15 CFM, but then you use a lot of narrow pipe to get to the gun, you may be choking off some of the CFM. So check your gun and make sure your compressor and set up can supply it properly. Or check your compressor and get a gun that will work with it. How do you dry the air? Again, there are many ways to get there from here and we'd best leave that to a Tech Tip just on air system set up.

Gun Set Up

An HVLP gun requires more VOLUME of air to operate (the V in HVLP) than older gun types. Perhaps you notice your HVLP gun is adjusted at the same PSI as an old conventional gun -- around 50 PSI at the gun (many HVLP guns are set at much lower though) so where is the "Low" in PSI they are talking about? It is at the actual air cap where the air and paint come out. An HVLP gun has only 10 PSI at the cap while a conventional has upwards of 50! This 10 PSI at the cap is something you have no way to measure. "AT THE CAP" means at the fluid/air cap where the paint sprays out. It takes a special air cap with a gauge on it. This "test cap" is used by paint reps, air quality control agents but only a few painters. I have never seen one in a body shop. I say this because the instructions that come with many HVLP guns tell you to "adjust to 10 PSI at the cap" all the while they give you no way of measuring the cap pressure. There is usually a "MAX PRESSURE" stamped on the gun or in the instructions. This "max pressure" is the maximum pressure you can set the gun pressure and still keep the cap pressure at the 10 lbs max at the cap the law allows (in most VOC regulated areas where HVLP is required). So the VOLUME of air (CFM, Cubic Feet per Minute) is the key to proper atomization with an HVLP.

So atomization is the key, but why? Why can't you just lay it out wet and let it "flow,", as an old painter will say. Picture a jar full of bb's that represent small, atomized droplets of PSPC. The gaps in between the bb's is solvent. Now picture a jar filled with marbles representing large, poorly atomized droplets of PSPC. The gaps in between are, you guessed it, **solvent**.

If you apply your PSPC in large, poorly atomized droplets, what you will have is a film full of solvent. This can and will cause slow curing, shrinkage and dieback (the loss of gloss in the hours and days after application).

So, now that we have learned the need for gun set up, how do we do it? Lets start with the fluid tip choice.

Fluid Tip Choice

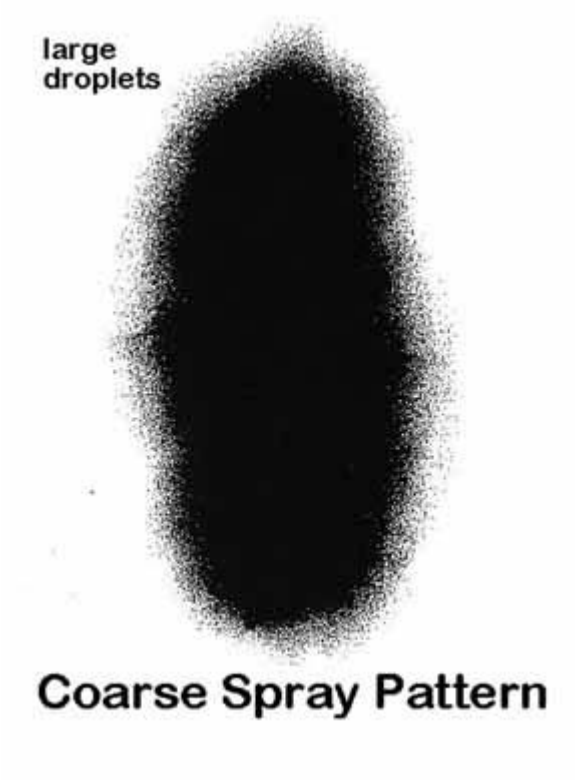
The newer high solids low VOC PSPC products need to be broken up more, so a smaller fluid tip is needed.

Basically you want the smallest fluid tip that will still allow you to PSPC the particular part you are PSPCing, keeping the entire thing wet and in a fair amount of time. In other words, a 1.0 tip would be beautiful for clearing one fender, but would be lousy to paint a complete vehicle. The application would be way too slow and the first panel would be way too flashed by the time you got around back to it. So you need to compromise -- a 1.3 is a great all-around tip, while a 1.5 though getting a little big, can get you by. If you read the tech sheet on the particular product you are shooting, it will have a recommendation for fluid tip size. There are needs for other tips, for instance when shooting polyester primer you may need as big as a 2.3, but for many urethanes and epoxies, or base coats the 1.3 or 1.5 will work great. If you plan on using a pressure pot or paint a bus, all bets are off and we would need to study a little bit more.

As an example of the use of a 1.3 tip, I did a test once that proved the point well. I shot two panels of metal with a medium-solids urethane primer. One was shot with a 1.3 super high-atomizing top of the line topcoat gun. The other was shot with a 1.5 (or a 1.7 I can't remember) "hoser" primer gun. Three coats were applied and after a full cure (the one shot with the larger gun took MUCH longer to flash and cure by the way) the film thickness was measured. The one shot with the 1.3 tip was 2 tenths of a MIL thicker! The larger gun laid out the marble sized droplets full of solvent and when the solvent flashed the film shrank.

This doesn't mean I recommend a 1.3 tip for your primer gun, however. It is only meant to make the subject of atomization easier to understand. **Always refer to the tech sheets of the particular product you are shooting to see what tip you should be using.**

Gun Tuning



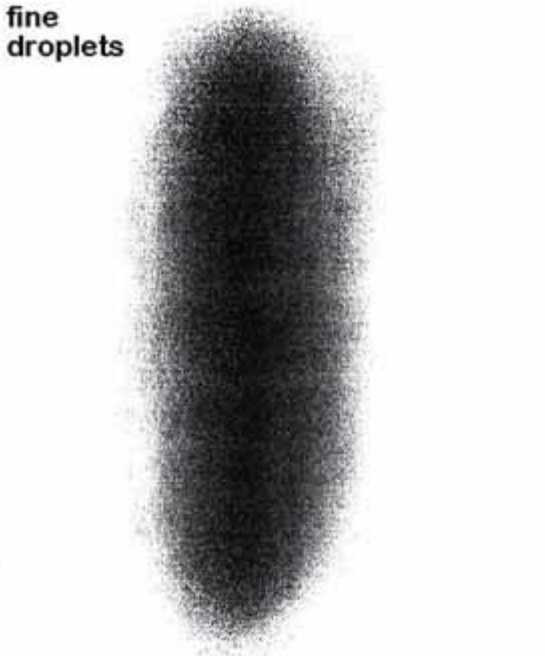
You need to "tune" your gun EVERY TIME you use it just as you would tune a guitar before you perform. This is done with a very basic spray-out pattern test. This very basic test tells you how your gun is atomizing and you adjust it to achieve the best atomization you can.

Set the fan width as need (you don't want to change it after you have "tuned" the gun). Turn the material knob "out" about 2 ½ turns. This is the "mixture" adjustment, kind of like the idle screw on a carburetor. The farther in it is screwed, the lower the fluid to air ratio is and the smaller the droplets will be. The farther out it is, the higher the fluid to air ratio is and the larger the droplets. Set the air pressure at the inlet to the gun to the manufactures

specs. On an HVLP gun this spec is usually found on the gun and is the maximum PSI it can have while still maintaining the maximum 10 lb at the cap for legal HVLP transfer efficiency (68 %). You are now ready to do a test spray out.

Tape a piece of masking paper on the wall for the test. Hold the gun at a right angle to the wall, just as if you were going to paint the wall. Hold the gun at a spread-out hand's distance (about 8” or 22cm). Pull the trigger to completely open for a split second and then close it. You want an ON-OFF wide-open to completely closed in **ONE** movement. You should have a cigar shaped pattern with complete coverage in the center with fading coverage going away from the full coverage cigar shape in the center. The center should be fully covered without any runs. If you have runs, either you are holding the trigger too long, you are too close or the gun is simply applying too much material. In which case you need to screw in the material knob or turn the air pressure down. But most likely if you have turned the material knob out the 2 ½ turns and the air is set at the factory specs, you are just too close or holding the trigger open too long.

The droplets you see trailing off the center are what you will use to “tune” your gun.



Normal Spray Pattern

Turn in the material knob to make the droplets smaller (and or raise the air pressure). **The balance you need to attain is the smallest droplet size possible before you loose the coverage desired.** In other words if you turn in the material knob too far, not enough material will be coming out to cover the panel! That balance of atomization and enough material coming out is what you are after.

Now, you’ll notice I said, “raise the pressure to the gun.” And earlier I said to set it to "manufactures specs." This can be 25-50 PSI and is measured AT THE GUN. This means at the INLET of the gun, NOT at the cap and NOT at the other end of the hose, but AT THE GUN. If your gun doesn’t have a regulator on it, then install one. This regulator will tell you at all times what the pressure is AT THE GUN, which is what you need to know. Be sure to buy a quality regulator from a paint gun manufacture. Some cheapie regulators are going to rob air volume from your gun because of restrictions within them. This is something most home hobbyist CAN NOT afford due to small compressors. If you don’t have the air volume to atomize your paint, you are NOT going to get satisfactory results.

We are talking a very small adjustment. It is a fine balance in material to air ratio and a little more air than specified is okay. Even if it is an HVLP gun the inlet pressure recommended is to maintain the 10 PSI limit at the cap. Well, about three quarters of the country has no regulations for HVLP use so if you go over the 10 PSI all it will do is atomize the material a little better. You may loose a little of the benefits of HVLP though. But remember you have a lot of control with the material adjustment knob.

After you are happy with the droplet size, ***DON'T TOUCH THE FAN CONTROL***. It will change the PSI at the cap and will change the atomization you worked hard to get.

Do this spray out every time you spray and as material change, temp, and humidity change. Remember, every time is different and even environmental changes within the same paint session will necessitate a new spray-out droplet pattern test. Good luck!

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How To Paint a Pattern Plane With Less Than 4 Ounces of Total Material

Author Unknown

Painting a plane is different than painting something that does not fly. It must be LIGHT. Paint only makes the plane look good and visible, but the additional weight will not help it fly better. When I painted my first pattern plane, a Dick Hansen Excess, I added a full pound of primer and paint. It looked great, but what I did not know at the time is that it could have looked just as good with only four ounces of paint. I later vowed never to add more than four ounces of paint to any pattern plane again, even if appearance suffered. On the next plane, a Hansen Elan, I added just less than two ounces of paint material. I achieved this by not using any primer, and not spraying much paint. The result was a very bright, glossy paint job, without any orange peel, over spray, or other defects. I should mention however that you can see the formers right through the fuselage, and if you hold it up to light, you can see the light through the fuse easily. There's no magic in achieving a light paint job – if you want it light, don't squirt much paint. Making it look good is challenging, and it does require a good paint gun and air supply.

Surface Preparation

Currently I am in the middle of painting a ZN line Alliance. The fuse comes pre-primed with a white gel-coat. At first glance it looks perfect, but if you look closely, you will find mold imperfections, and that glossy surface must be non-glossy before you paint it. I consulted Tony Stillman and Troy Newman on how to proceed. I worked the seam first. The best approach is to just knock down the narrow ridge with 320. Do not be tempted to make the seam perfect at this time. You are going to use your primer/surfacer for that. If you try to completely level the seam first, you will sand through the gel coat, causing more effort (trust me). Next, scratch ALL the shiny area along the seam with a green scotchbrite pad. If you leave shiny areas, you will notice that the primer rubs off instead of sands off. Done properly, you will only have tiny pinholes along the 1mm width of the seam. Fill that with thinned Model Magic, Hobbylite, or Red Devil One Time Spackle, and sand when dry. Use a tack rag to lift the dust from the surface, and then shoot primer along the seam only, about an inch wide. Sand with wet 600, and repeat as necessary until the seam is perfectly smooth and level. Again, take care not to sand through the gel coat.

For the remainder of the fuse I decided to scratch it lightly with 320 (600 wet probably would be a better choice), apply a coat of K-36 primer to the entire fuse, and then wet sand all of primer off with 600. The reason for primer this time around is because the white gel coat is so thin that it is easy sand through exposing the fiber underneath and creating pinholes or potholes. As Troy pointed out to me, there are areas of gaps between the fiber and gel-coat that will be exposed if you over-sand. The primer is used as a visual indicator to know when to stop sanding. As soon as the primer is gone, stop sanding.

You have an option to leave the seam the way it is, or shoot a coat of single-stage white over the primer. Shooting a light, inch wide coat of white will cover the dark gray primer, which will enable you to use less paint overall. An added benefit is that the paint will show you whether you did a good job of prepping the seam. If you spray white over the seam, let it dry completely, and then wet sand very lightly with 600. What you want is a prepped fuse that is all one-color, void of any dark primer blotches, and void of all other defects (pinholes, mould imperfections, polished areas, scratches, etc.). This concludes the surface prep of the fuse. Your fuse and belly

pan now should not weigh more than when you started, and it may weigh slightly less. If you made a mistake and sanded through the gelcoat, then fill as necessary with light filler, sand level, shoot the area with single stage white paint, and then wet sand lightly with 600 to remove the gloss and overspray. Take your time, and make sure you are happy with the surface. Any imperfections that you ignore will be highlighted when you shoot your color.

Safety First

Modern polyurethane two-part paints can be extremely hazardous if breathed and can also be harmful through excessive exposure to skin. I did a little Internet research on the subject of protection from isocyanates, however I barely scratched the surface. Isocyanate compounds are used in the hardeners of polyurethane two-part paints, and this is the stuff that can cause serious health effects. Most sources advise to use an air-supplied mask instead of a carbon filter cartridge mask. Also, latex gloves are known to be completely ineffective against isocyanates, so purchase a heavy duty neoprene rubber glove or a nitrile glove. Before painting, please ensure your shop is well ventilated and that your lungs, eyes, and skin are completely isolated from paint fumes and contact.

Paint – Single-stage Versus Two-stage

I don't have the knowledge or space necessary to discuss the many varieties of paints and characteristics of each, so I will narrow the discussion to polyurethane automotive finishes because that is what most builders use to paint their pattern planes. Polyurethane has all of the qualities that we desire: it is light, easy to apply, durable, glossy. It covers well, sticks really well to epoxy fuselages, and it is easy to sand and fix mistakes.

The one main choice that you must make is whether you will use a single-stage or two-stage (base coat/clear coat) paint. With single stage, the clear part is pre-mixed in with the color, and it dries glossy. Two-stage paints require a clear coat that is applied after the base color coats are sprayed. There are several advantages to both types, and either can be used to achieve a light and beautiful finish. The first stage of a two-stage paint is a color base coat, which dries fast; this means that paint sags and runs are easier to avoid, and easier to fix as well. You can mask over a color coat usually within an hour, allowing multiple colors to be applied in a day. Any dust or insects that get caught in the color coats can quickly and easily be sanded away before the clear coat is applied. Another big advantage to a two-stage paint is the deep shine that can be achieved once the clear coat is applied. Several coats of clear may be applied for greater gloss, however the more you spray the more it weighs.

The biggest disadvantage of a two-stage paint is the potential for fuel to ruin the finish. I have seen beautiful paint jobs turned into a mess when fuel penetrates the color coats. When this happens, the paint wrinkles and dissolves immediately. This can occur if the clear coat is scratched or if even tiny areas are not sealed with the clear coat. For example, the finish on the belly pan of a friend's plane was ruined because of a single pin hole that exposed the color coat to fuel. The pan was sufficiently protected on the outside, but not from the inside. Because single stage paints have the clear component mixed together with the color, protection against fuel is assured even if you scratch it. The disadvantage of a single stage is that drying time is much longer, and it may not be as easy to achieve a world class finish. I know two professional auto painters who say they would never use a single stage because two stage-paints are easier to work with, provide a deeper shine, and because the base coats dry so rapidly. However I have

always used a single stage paint because 1) it has increased durability that is built-in, 2) Radio South sells it in small affordable quantities, in colors that match monocote, and 3) because even though the results may not be as nice as a two-stage paint, a beautiful finish can still be achieved. If you are painting a Harley Davidson or a Ferrari, then the choice of a two-stage paint is an absolute must, but for pattern planes a single-stage paint is a very reasonable choice.

Paint Tools

One of the best tools which happens to be fairly inexpensive is good lighting. Without excellent light conditions, you will not be able to see how much or how little paint is appled. Even the best spray equipment, paint, and skill will be of no use unless you can see and control what you are doing. The exact amount of paint that is applied is critical and will determine the outcome of the finish. Fluorescent light fixtures and bulbs are relatively inexpensive; several should be hung from the ceiling and perhaps some should be mounted lower to project light from the side. An alternative is to paint outdoors. Natural light is sufficient, however the environment outdoors is often too dusty for painting purposes.

The next tool you must have is an air compressor. I have a 30 gallon compressor that outputs 4 horse power, 11 CFM, and that is sufficient for my spray gun and air brush. An inline water trap between the compressor and the spray gun is the next item that you should have. There are many, however the transparent, cheap disposable type that changes color when saturated is completely useless. Don't waste your money on those. Instead, buy a real water trap from your automotive paint supplier. The one I use is model number M-60, manufactured by Motor Guard Corporation.

The paint professionals I know swear by Sata paint guns. The model I use is a Sata minijet 2 HVLP 1.1 mm spray gun. It's intended to be used as a touch up gun for automotive repair, which is just about perfect for pattern plane size jobs. The Sata can atomize paint about as well as an air brush, but it also allows you to spray much higher volume than an airbrush. It is very frugal on paint consumption because overspray is minimal, yet because it atomizes the paint into such tiny particles, the paint will flow with very little paint applied. This results in a great finish that is also light. I don't have any interest in endorsing Sata, but I am very happy with mine.

I use a Badger 150 airbrush for tiny jobs such as highlighting canopy edges. This inexpensive tool can also be used for elaborate airbrush art, or for touching up tiny mistakes and hanger rash. You can get by without one, but every now and then I find a good use for mine. Paint can be controlled extremely well with it, and overspray is almost nonexistent. It's also fun to use.

Those are the big ticket items, however you still need some miscellaneous items before you start spraying. One, Four and eight ounce mixing cups with graduations and ratio marks are handy. Popsicle sticks are good for stiring. You should have a dozen or so disposable paper paint filters to filter paint that fills the spray gun cup. For masking, I use 3M/Scotch 471 blue vinyl tape because it can make curves or straight lines, and it produces a razor sharp fine line. Regular masking tape is useful for securing masking paper, which is used to mask large areas. You need a gallon of inexpensive lacquer thinner for cleanup, a quart of surface cleaner/degreaser, paint, paint thinner and paint hardener that is specifically designed for your choice of paint and the weather conditions of your area. Along with paint, you should purchase sufficient clear and clear hardener if you are using a two-stage paint. You may color sand a single stage paint and

apply a final clear coat, however this is optional – an option which adds unnecessary weight. Last but not least, you need a tack rag to lift dust from the surface of your fuselage just before spraying. I once forgot to use a tack rag before spraying, and the result was a dusty mess. I use the inexpensive white cheesecloth variety. All of these miscellaneous items should be available at your automotive paint supplier.

To summarize thus far, I have described how to prepare a composite fuselage for painting. This procedure left little or no primer on the surface, and thus no extra weight. This method works well with either pre-primed in the mold or epoxy gelcoated fuselages. The paint and paint tools I have described will help you sort out what you need. Additionally I have specified the type of spray gun I think is necessary to achieve a light and very nice finish. Next month I will describe the masking and painting process.

Keeping It Light

The best way to keep the paint weight low is to avoid spraying a lot of paint. It sounds simple, and in fact it is not very hard, but there are several factors that can contribute to making your paint application too heavy. The most significant way I have found to keep the paint volume down while still achieving a beautiful finish is to reduce the paint considerably more than what the manufacturer recommends. The more the paint is reduced, the easier and quicker the atomized paint particles will flow into one continuous film of paint. Once the paint starts to flow, you stop spraying. This is a point worth emphasizing. Getting the paint to flow is the name of the game. If you spray too little or improperly, the paint will not flow, and the result will be either a dull, chalky finish, or a bumpy orange peel finish. Too much paint will be heavy, lumpy, and runny. If there is insufficient reducer in the paint, then it will require more paint particles to make the paint flow, and thus more weight – much more weight indeed. You might ask, is it possible to over-reduce paint? Of course the answer is yes, and if you over reduce the paint, the coverage will be poor. Still, I tend to prefer adding more reducer and extra coats of paint as necessary for coverage. So the basic strategy for minimizing the amount of paint that is applied is to reduce it sufficiently so that it flows easily.

The next question to answer is how much reducer is required? The answer (as usual) is that it depends. It depends on the ambient temperature, and the type of paint product you are using. For the PPG Concept also known as Flying Colors which Radio South sells, I have found that 2:2:1 **paint:reducer:hardener** is a good starting point. I believe the manufacture calls for 4:1:1 mixture, which I think would be insufficiently reduced for any condition. I have even used 2:3:1, and still did not feel the paint was over reduced. Because paint viscosity is affected by temperature, I tend to add more reducer as the temperature drops. But again, 2:2:1 for PPG concept has served me well. It took me a couple of tries to determine this on my own, and a lot of wet sanding and starting over after some ugly, lumpy coats of paint on prior projects. Mixing your paint properly is necessary to achieve a light and beautiful finish, but it in no way assures it. So I will talk about that next.

Defects

I hate paint defects, however the bottom line is that I would rather have a light finish with defects, than a perfect finish that is heavy. Still, it is possible to have a great finish that is light, and that what we are trying to accomplish. There are many different paint defects, but the ones that I will discuss are over spray, orange peel, and runs or sags. Over spray occurs when the

paint dries mostly before it hits the surface. In this case, the surface appears dull and it may feel dusty. This can also occur when too little paint is applied, such that the paint does not flow. This condition is rarely a problem unless you just cannot see what you are doing or if you forget to mask off an area that should not receive paint. The next defect, orange peel, is the defect that I struggle with the most. Evidently, so do many car manufactures. I often check the car in front of me as I pull up to a stoplight. It is a rare paint job that does not have an ugly orange peel finish. The surface may have a good gloss, but it is bumpy like the peel of an orange. Improper spraying technique or under reduced paint are likely contributors to orange peel. Other causes are a paint gun that does not atomize the paint well, or an improperly adjusted gun (too little or too much pressure, or too wide a spray pattern). Spraying too much paint in your quest to avoid orange peel can cause the paint to run or sag. Even if the paint does not run, you may be spraying too much paint. Paint will flow downward due to gravity, and if you get a thick, abrupt ridge on your masking tape edge, then you are spraying too much paint.

Masking

Speaking of masking, I stumbled upon a simple technique for making straight lines with masking tape. Over Christmas, my wife bought several spools of that ¼ inch ribbon that is used for wrapping gifts. I used it to help me find straight lines on the fuse. I secured one end with masking tape, and then pulled it tight along the centerline of the airplane, and then secured that end. Once this reference ribbon was in place, other ribbons can be positioned above or below it. It then becomes very easy to find a straight masking line along the fuse.

Once you have decided on your paint pattern, plan how you intend to mask and the order of colors that you will spray. There is a decision of whether or not you will spray a base color and then shoot the other colors on top. For example, if your plane is mostly yellow or white, then you may wish to spray the entire fuselage in yellow or white first, let that dry, and then spray the other colors on top. I have done it both ways, but I prefer not to spray a base color because it increases weight unnecessarily, and I feel it adds more work. When you spray a base color, you must sand the surface of the base (with 600 wet) before you apply a second color on top. If you do not dull the surface sufficiently, the trim colors will not stick well. Another reason that I don't like to spray the entire fuse one color is because the amount of surface area is more difficult to cover with my spray gun, and the likelihood of defects increases.

Painting

I hesitate to discuss spraying technique in further detail mainly because it is a lengthy topic and because I am not an expert on the subject. I have gained my knowledge by speaking with friends in the professional auto painting business, other modelers, and by reading on the subject. However, even reading and speaking with professionals is no substitute for experience with your painting equipment and developing your own techniques. Since I have had success with keeping the paint light, I'll mention a few final pointers that work for me.

Because I spray such a thin film of paint, I decide up front not to color sand, and not to spray a final clear coat. This is a personal choice that I make to ensure a light paint job and because I think it looks good enough without extra clear coat and extra effort. If I were painting a collectable auto or a Harley Davidson, then I would use a two-stage paint, color sand, apply multiple coats of clear, and then rub out the clear to perfection. But I draw the line on what airplanes and collectible cars should look like. PPG concept will color sand quite nicely with

wet sandpaper, but if you decide to do it be careful not to sand through the paint. With only three ounces of paint on a large pattern plane, I would be worried about sanding through the paint.

I find that the setting for my Sata Minijet that works best is very low volume and a narrow spray pattern, at 30 PSI. With this setting it atomizes the paint as well an airbrush, but with more volume. It is really a nice tool. When you are ready to paint the fuse, mix about two to four ounces of total material (paint + reducer + hardener) depending on how much surface you need to cover. For a belly pan for example, I usually mix about one ounce total, and end up spraying about ½ - ¾ ounce. If my spray gun is set to too high a volume however, one ounce can disappear in seconds, which means that I have added too much weight and wasted paint. It is surprising how far a little paint can go with the right spray gun and the right setting.

Before masking and before spraying, ensure that your surface is free of dirt, grease, and dust. I use a cleaner/degreaser (available from an auto paint supplier) to wipe down the fuse with a dust free cloth to remove oily fingerprint residues. Just before spraying, I make a final pass with a tack rag.

I start with a tack coat that just dusts the surface so that following coats have something to hold onto. I don't let that dry very long, maybe three to five minutes before following the next coat. In the coat following the tack coat, I do not try to achieve complete coverage. My experience is that I risk causing a sag if I to try to achieve complete coverage, although it can be done (On my Elan for instance, I actually quit after the first coat. The coverage was so poor that you could see the formers through the fuse, but it still looks good and I used less than two ounces of paint total). I give the first coat about 5 to 10 minutes before I start with the second and final coat. On this coat, I try to achieve sufficient coverage, but I still have not sprayed a lot of material. If things go well, the surface will have no noticeable defects, and when it dries a day later, somebody may ask you if it is still wet. When my wife or daughter ask that question, I know I did well.

That covers the basics. The fourth and final article will be a short one on how I feathered and painted the clear canopy of the Alliance.

I do not care much for clear canopies on pattern planes. They are heavier, scratch easily, require more work, require tinting if you want to see your plane well, and by the way, who really needs to see inside of the canopy? I personally wish pattern kit designers/manufacturers would stop making clear canopies or at least offer a fiberglass or carbon option. But some people really like clear canopies, and I must admit, when I see a nice paint job with a clear canopy where there is no distinction between the fuselage and the canopy, it looks quite nice. That is what this short how-to article is about.

Step one, before you attach the canopy; drill a 1/16-inch breather hole somewhere between the canopy floor and where it attaches to the sides of the fuse. Without this hole, the canopy will collapse under vacuum during cold weather, and become inflated during warm weather. Next, paint the floor of your cockpit. Trim your clear canopy, and trial fit. Take your time and ensure that the canopy does not extend beyond the groove in the fuse, because when fastened, it must be level with the fuse. I use canopy glue – either RC-56 or Pacer 560 very sparingly where the canopy mates with the fuse. This stuff has always worked well for me, and I have never had a

canopy come loose. Once the canopy is glued in place, hold it in place with masking tape. If there are any edges of the canopy that are not lying flat, fix this problem now.

In this procedure, you are going to paint part of the canopy, so that there is no visible distinction between the fuse and the canopy. But before this happens, there is a whole lot of filling, sanding, and preparation that must be done. On the Alliance, I ran blue fine line masking tape around the bottom edge of the canopy, leaving approximately ½ inch where the canopy edge will receive paint. This was just above the cockpit floor, which covers up some of the dried glue beads. You can expose more of less of the canopy surface for paint depending upon your preference. Next, mask off the fuse, exposing only the adjacent ¼ inch of fuse below the canopy edge (see photo). This isolates the region that needs to be filled, sanded, and blended into the fuse.

Next, you need to apply filler in the gap between the fuse and the canopy. I used epoxy and micro balloons, because I was uncertain whether Model Magic ™ or Red Devil One Time ™ would crack (but in hind site, I don't think it would). Epoxy is horrible stuff to sand however, and I wished I had used filler that was easier to sand. Anyway, fill and sand that gap until everything is level and looking good, being careful not to sand deep into the fuselage. The edge of the canopy that is to be painted must be sanded so that the paint sticks, however be very careful not to sand into the masking tape. If you do, it will fray the edge and look lousy when you lift the tape after it is painted. You may now remove the lower band of masking tape on the fuse, but do not remove the band that is around the canopy. The tape on the canopy stays for the duration until painted

Finally, spot prime the area with your favorite primer. This will fill sanding scratches and expose any imperfections. Wet sand with 600-grit, and repeat priming/sanding until the canopy is perfectly feathered into the fuse. Avoid build-up of primer on the edge where the canopy is masked, otherwise when you lift the tape it will look poor, and you may not be able to pull the tape off cleanly.

That's all there is too it. You can now paint the fuse as you normally would. There is more effort in filling and feathering the canopy into the fuse, but I think that the results are well worth it.

That concludes this four-part article on painting. I hope that your next project goes well, and that you are successful at keeping it light.

Author unknown

Continued on next page

Air pressure adviser

Coarse surface finishes

Orange peel, color matching problems and mottling.

Reason:
Insufficient atomization pressure

- ***Cause of problem:***
- Compressor too small or too many users; air line diameters too small.
- *Remedies:*
- - Replace compressor
- - Reduce number of users
- - Install larger compensation container for bigger reserve
- Too many leaks in the air line
- ***Cause of problem:***
- Worn-out compressed air lines and hoses, etc.
- *Remedies:*
- - Repair leaks
- - Disconnect leaking users
- - Replace defective pipes
- Air flow of follow-up devices such as refrigerant dryer or filter is too low
- ***Cause of problem:***
- Wrong calculation of performance data; wrong consumption data
- *Remedies:*
- - Adapt performance data of follow-up devices to compressor or user
- Compressed air line diameter too small; air line too long
- ***Cause of problem:***
- Compressed air line has wrong dimensions
- *Remedies:*
- - Replace compressed air line; increase diameter
- Formula: The greater the length of a compressed air line, the larger its diameter must be.
- Diameter of compressed air hose too small
- ***Cause of problem:***
- Wrong choice of hose diameter; too many hose pieces coupled together; too many diameter reductions
- *Remedies:*
- - Use compressed air hoses with a minimum diameter of 9 mm
- - No coupling of hoses together; always use a hose having the correct length.
- Diameter of compressed air couplings or hose fittings too small
- ***Cause of problem:***
- Compressed air couplings or hose fittings with too small a diameter lead to a large pressure drop
- *Remedies:*
- - Use couplings with a free diameter of minimum 5.5 mm
- - Use hose fittings with a minimum diameter of 5.5 mm
- Air passages for air distribution to the nozzle dirty or clogged
- ***Cause of problem:***
- Insufficient cleaning
- *Remedies:*
- - Clean gun and check air cap pressure
- - Replace gun
- Air cap damaged or clogged
- ***Cause of problem:***
- Mechanical damage, insufficient cleaning

- *Remedies:*
- - Clean air cap
- - Replace air cap, i.e. nozzle set
- Insufficient gun inlet pressure
- ***Cause of problem:***
- Wrong pressure adjustment at the filter; pressure drop inside the hose; wrong coupling dimensions
- *Remedies:*
- - Add a pressure regulation valve with gauge on the gun, to allow pressure reading and adjustment
- - Add a pressure gauge, e.g. spray pressure control kit, to the gun inlet
- - Increase pressure at the filter

Silicone and oil or condensate droplets in the coating, matting, adhesion problems etc.

Reason:
No or insufficient condensate separation in the compressed air

- ***Cause of problem:***
- No filtration
- *Remedies:*
- - Install suitable water separator
- - Install suitable fine filter
- ***Cause of problem:***
- Only water separator available for filtration
- *Remedies:*
- - Add suitable fine filter, e.g. with a filtration degree of 0.01 µm to the water separator
- ***Cause of problem:***
- Not every single gun connection is equipped with a compressed air filter
- *Remedies:*
- - Every single outlet must feature a compressed air filter consisting of water separator and fine filter
- ***Cause of problem:***
- Too high a temperature of the compressed air causes the condensate to be "pulled along"
- *Remedies:*
- - Add cooling device
- - Increase pressure compensation container
- - Compressor is too small and gets hot. Can be seen in permanent compressor run.
  Install additional or larger compressor.
- Condensate amounts are repeatedly pulled along from low spots or similar places;
  filters are mere "aerosol" (droplet) separators and cannot separate water "breakthroughs"
  from the compressed air. Thus, the condensate flows through the filter.
- ***Cause of problem:***
- Main compressed air line exit does not move upward in swanneck shape; condensate runs into exit.
- *Remedies:*
- - Install compressed air line exits upward in swanneck shape
- - Install compressed air lines with a decline of 1 - 2 % and add a condensate discharge at the end,
  complete with "water trap".
- ***Cause of problem:***
- The compressed air line has low spots, i.e. if the line is fed into a second building through the
  ground (earth / hall floor)
- *Remedies:*
- - Remove low spots
- - Install a condensate discharge and collector inside the low spot
- ***Cause of problem:***
- Attention: Hose exits through hose rolls at the main air line, too, lead to low spots
- *Remedies:*
- - Install a water separator before the hose rolling device, to avoid the collection of condensate
  in these low spots

- The water separator does not continuously discharge condensate; filter is overfilled; the condensate is gradually pulled along
- ***Cause of problem:***
- No condensate discharge available
- *Remedies:*
- - Install condensate discharge in the filter
- ***Cause of problem:***
- The filter only features a manual discharge which is not activated frequently enough
- *Remedies:*
- - Install automatic condensate discharge valve in the filter, or ensure that the manual discharge is activated frequently
- ***Cause of problem:***
- Automatic condensate discharge valve does not work properly
- *Remedies:*
- - Replace or repair and examine condensate discharge valve
- Installation of plastic tubings in places exposed to heat
- ***Cause of problem:***
- Due to the high heat expansion of the plastic (approx. 10 % at 20° C), low spots appear between the holding clamps (the line starts to sag)
- *Remedies:*
- - Install galvanized steel pipe
- - Install stainless steel pipe
- - Never use copper, as air and condensate cause corrosion (verdigris may cause color shade changes)

Coarse surface structure during coating

... Color shade changes and / or mottling increases

Reason:
Gun inlet pressure not constant
Cause of problem:
No pressure regulator connected
Remedies:
- Install suitable pressure regulator
Cause of problem:
Pressure regulator does not function or only irregularly
Remedies:
- Repair or replace pressure regulator
Cause of problem:
Filter cartridges are clogged
Remedies:
- Replace or clean filter cartridges
Cause of problem:
Diameter reduction due to teflon tape or rope pieces used for tightening fittings / connections
Remedies:
-Remove teflon tape
- Ensure tight fit by means of sealing rings or liquid sealing agent, i.e. Loctite
- In case a teflon tape is indispensable, apply thoroughly and avoid diameter reductions or loose pieces