Renovation:

Interior Paint
The Devil Is In The Details

By Dennis Wolter

I'm certain that at least one time in our lives each of us has decided to cut a corner somewhere. A typical example is when you decide against painting the ceiling, only to find out that once the walls are freshly painted that formerly OK-looking ceiling now looks terrible! Where the renovation of your airplane's interior is concerned, it is important to address every aspect of the complete job. Leave one part unfinished and it is sure to stick out like a sore thumb.

L to R: acryli-clean, strong soap, aluma-prep, alodine, chromate, grey primer, finish paint & flattener (stacked) and thinner.

How many times have you seen a nice paint job with a badly repaired old wingtip, or a well done interior with doorjambs that are either poorly painted or not painted at all. One of my pet peeves is the airplane with a new grey interior, new grey metal instrument panel, exterior paint in complementary colors and, POW!, right there front and center is the old 1970's Cessna orange-brown instrument sub panel with its stick-on labels and cracks. Ouch.

In this article we are going to discuss all aspects of Cessna interior component painting. If ever there was a place where attention to detail pays off this is it. Since door seals are so much a part of this process, we will deviate a little into door seal world. (And just to let you know, if you can get a Cardinal door to close and seal properly, you can probably deal successfully with all other Cessna door seals.)

The paint work in Cessna cabins involves understanding how to prep and paint three very different materials: aluminum, steel and plastic. All three can be finish coated with acrylic lacquer (more on that later). However, the preparation and priming of these three materials is very different.

ALUMINUM. Aluminum requires the most precise preparation of the three, so let's tackle that process first. Before getting into painting aluminum, we should first understand its basic properties. One of the reasons aluminum is an ideal material for aircraft construction is the fact that it doesn't rust. Basically, aluminum is a self-oxidizing alloy. This means that the chemical make-up of this material is such that when aluminum is exposed to oxygen, a thin invisible coat of oxidation is formed that protects the surface of the metal. That's the good news. The bad news is that if you choose to paint aluminum, the surface layer of protective oxide inhibits most primers from bonding well. To facilitate good primer adhesion to aluminum, two chemical applications must be made before the primer is applied.

As with all bonding processes, cleanliness is essential. We first clean the surface with lacquer thinner or PPG acryli-clean to remove any oil or other contaminants. We then brush on PPG DX 533 aluma-prep cleaner and allow it to sit for two minutes. The purpose of using this strong chemistry is to clean, stabilize, and open the molecules of the aluminum surface. We then thoroughly rinse off the DX 533 with lots of hot water; this step is absolutely essential. DX 533 is an acid that can cause corrosion if not thoroughly rinsed.

The second step is to apply an adhesion promoting alodine conversion coating. We use PPG DX 503. The purpose of this aluminum conditioner is to apply a microscopic gold colored coating that is a very effective corrosion inhibitor and adhesion promoter. This will help facilitate a good bond between the treated aluminum surface and the primer. Again, thorough rinsing is a must. Alodine, if left behind, will also cause corrosion. Whatever you do, read the spec sheets on this stuff and handle and dispose of it properly.

All three food groups here! – old bad paint, old glue & seal residue, and dirt.

The next step is to apply a zinc chromate primer. We like

Bad filler in the door jambs.

A stainless steel rotary brush at work.

self-etching DuPont 215S chromate. This product really bonds to an alodined surface. Here's a great timesaving trick: have a can or paint gun of gray sandable lacquer primer at the ready when the self-etching chromate is being sprayed on. While the chromate is still wet, spray on a thin coat of gray primer. This process eliminates having to sand the zinc chromate when it's dry. A very good bond is established between the chromate and the gray primer with this wet overspray method. Allow the chromate and primer to dry for at least eight hours. Lightly sand it with Scotchbrite and the top coating can then be applied.

PLASTIC. The second material we must deal with is that lovely plastic trim. If the plastic is unpainted, the trick is to thoroughly clean the surface with a strong detergent, let it dry, and then wipe the piece down with lacquer thinner and a lint-free rag. This strong solvent wash will soften the surface to help the lacquer-based finish thoroughly bond to the material, making it unnecessary to use any primers on this previously unpainted plastic. Only strong solvent based paints such as lacquer and SEM color coat will bond well to this interior plastic trim. Enamels and urethanes will not melt into the surface the way lacquer and SEM products will. If the plastic component has been previously painted with enamel or urethane paint, the only fix is to sand off the old paint and start over, or apply an interim barrier primer (more on that later).

STEEL. The third material used in Cessna interiors is steel.

Temporary location of the 2" door seal sections.

Using a 3 x 5 index card to check the fit of a seal.

Most of the early seat frames were fabricated using 4130 chromoly steel. Once disassembled and cleaned with steel brushes and a solvent such as acryli-clean, the seat frames are sanded and re-cleaned with acryli-clean. Any bare spots can be primed with a lacquer based red oxide primer. We like Seymour 98-26 red oxide; it bonds well, dries quickly, and allows for good topcoat adhesion – what could be better!

Some of you are probably wondering why I'm so into lacquer. Why not use enamel or urethane, or even powder coat the metal pieces? Before I continue to tout the virtues of lacquer, I'll let you know the drawbacks of using alternative finishes.

I don't think enamels are the best choice for interior painting because they take much longer to dry, create a major overspray problem, are difficult to repair, and require a higher concentration of flattening base in order to dry to a nice semi-gloss or eggshell finish. The flattening base I just mentioned is basically a little solvent mixed with very fine talcum powder that, when mixed with glossy paint, will dull the finish to a non-reflective surface. The bad news is that the more flattening base that is added to the paint, the softer the paint will be when it dries.

Regarding urethane finishes, they are quite durable. But they too require a long curing time, create an overspray problem and are very difficult to repair. The real bad news is that urethane paints are chemically cured by adding activators. This chemistry is very unhealthy, and stringent safety precau-

tions need to be taken to protect people and the environment from exposure to this stuff. Use of these products requires full body protection and a full environmentally controlled spray booth. That means the entire airplane would have to be masked and put into a spray booth – very expensive.

Last but not least is powder coating. The only material that can be safely powder coated is steel. Most of the modern Cessna seats are fabricated from a high alloy aluminum that could possibly be damaged by the high temperatures required to bake powder coating onto a metal surface. Even though the powder coater may be very good at what he does, it's not worth the risk of gambling on just how hot they got the metal during this process. Another problem would be finding a powder coater with an oven big enough to bake the powder coat on your doorjambs.

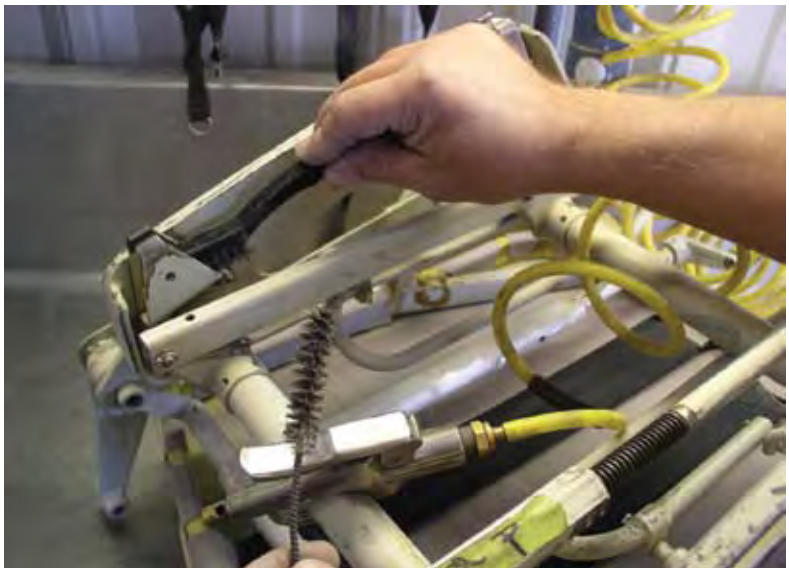
When it's all said and done, we plan to stick with lacquer. It's durable, is very easy to spray, creates very little overspray, dries quickly, and is easy to spot repair. I can't tell you how many times we've been in the final stages of completing an interior, the customer is due to arrive in less than an hour, and we notice a scratch on their newly lacquer-painted panel. All we have to do is feather sand the scratch, spray on new lacquer with an air brush, and voila!, no evidence of damage. I love it.

Sanding old paint that is in good condition and well bonded.

One final note on materials. Some of you may be faced with painting interior components that have been previously painted with rattle can enamel. Most professional finishes such as lacquer primer and paint will cause the old enamel paint to wrinkle and separate from the component's surface. Here's a trick. If the existing enamel is well-bonded and in good condition, a water-based barrier primer can be applied that will prevent wrinkling and lifting as well as offer a good sandable primer surface. The product we use is DuPont 210S gray waterborne primer surfacer. We have employed this method many times with great results. It definitely beats stripping or sanding the old paint off.

With all that technical mumbo jumbo covered, let's get started on cleaning, prepping, and priming the airframe, seats, and interior components.

The first step is cleaning. We begin by masking all the doors and doorjambs. The big issue here is the quality of the masking tape. We prefer 3M products for this. Cheap tape just doesn't cut it. The adhesives used on cheap masking tape will not hold up through the scrub-



Super cleaning of the seat frames with stainless brushes, solvent and compressed air.

bing and sanding required to prep these components. The first step is cleaning everything to be painted with acrylic-clean oil and tar remover. Pour lots of solution into a one gallon pan and rinse your cleaning rags and brushes frequently. The idea is to remove all of the oil, grease and silicon from the doors, doorjambs, seat frames, and plastic components. We use small stainless steel toothbrush-size brushes and rifle barrel cleaning brushes to get into all the nooks and crannies found in seat frames and door latches.

Being focused on renovating the total cabin, we always pull up the floor inspection panels and clean the greasy mess we often find below the floors. We do this last, since the prep solvent we used to clean other components can be reused to clean those extra dirty floors; it's good enough for use in this area. Never waste anything!

Sometimes we run into an airplane where the interior trim components, seat frames, doors and doorjambs have been painted with two or even three different paints, all of which are ugly and peeling. The only fix here is to remove the whole mess and start over. Since we can't use paint strippers on the doors and jambs we will use soft stainless steel rotary wire brushes to sand and clean in such extreme cases. The seats will be bead

Sanding old paint on a seat frame

Sandblasting off multiple layers of questionable paint.

blasted to remove the old paint.

The message here is that you must thoroughly clean everything. Any dirt or grease that's left behind will come back to haunt you. All you need is to be spraying primer or paint and suddenly some oil film begins to migrate out from a lap joint, causing your new finish to fisheye. Or after a month or two the new finish begins to lift off due to poor bonding caused by an oil film leaching out from between metal and the chromate primer.

Here's an eye-opening situation. Two or three times a year we are cleaning a thick grease and dirt mess out of a belly and we uncover missing rivet heads that were so corroded they popped off under stress. These failed rivets often look good from the outside. There is a Cardinal RG in our hangar right now with this problem. For this very reason, part 43 in the FARs states that an airplane is to be cleaned as part of a 100-hour or annual inspection. How can you inspect an aircraft's structure if it is covered with years of dirt? There's nothing better than clean living, and that goes for your airplane, too! Especially your airplane.

Here's a little side note. We normally remove door seals in order to prep and paint the doors. If the old glue is too thick to be removed with solvent only, do not start by cleaning the doors with the acryli-clean. You need to remove the old thick glue first before any glue-softening solvent is applied that will turn that thick glue into a gooey mess.

Once the doors are antiseptically cleaned and alodined, we like to mask the area where the new door seals will be bonded to the doors. The idea here is to bond the new seal to alodined aluminum rather than painted aluminum. The bond is much stronger if glued to alodined aluminum.

While we're on the subject of seals, I'm going to explain how to locate the new seal so it will actually seal your door. In dealing with airplane door seals, we must come to grips with an unpleasant reality: these things are a joke! Because of high production, Detroit can dedicate a lot of design and engineering into the door seals they install on automobiles. I don't think the aircraft manufacturers gave door seals a thought until they had the airplanes on the line and realized that they had to do something. Often that "something" involved a trip to the building supply store to find a solution (Home Depot here we

come). I'm being cynical here, but we are basically dealing with door seals that leave a lot of room for improvement.

The biggest challenge we have installing seals is the result of the fact that these doors and doorjambs are handmade and hand-fit; they are not precision structures that are all the same. The doors do not have consistent clearances at all points when they're closed. So here's a very worthwhile procedure that will go a long way to ensure the best fit possible between the door seal and the doorjamb.

The mission here is a test fitting of the new seal. We cut what we call "sacrificial seal" into 2" sections. Using rubber cement, we temporarily glue the 2" sections to the door approximately four inches apart. We then close the door and look to see how the seal sections compress against the doorjamb. We also use a 3" x 5" index card to feel for seal closure from outside of the closed door. The intention here is to locate the seal so it seals properly against the doorjamb but is not so tight that door closure will be difficult. You may be surprised to find that just arbitrarily gluing the seal into the corner of the door will not result in a good seal at all points. Once all the seal sections are located, we connect all the seal section positions with a light pencil line. We now have a perfect masking roadmap for a ¾" wide strip of masking tape that, when removed after painting, leaves a perfectly located, alodined aluminum footprint for our new seal to be bonded to. I will never guarantee a customer that we can make his or her airplane watertight. However, techniques such as this will do a lot to make it as good as it can be.

Moving back to paint preparation, we find three distinct areas when dealing with painting Cessna interior-related components: doors and jambs, seats, and plastic trim pieces.

Let's tackle doors and doorjambs first. Once the airplane has been masked and cleaned around the doors and jambs we remove the old seals. Then we either use solvent or a rotary stainless steel brush to remove the old glue. We then take a 1" wide paint brush and clean down into the door latches and receivers with solvent. Don't forget to lubricate these mechanisms after the doors and jambs

Wiping unpainted plastic with surface-softening lacquer thinner.

are painted.

If the existing paint is in good condition and well bonded to the metal, we will use 180 and 400 grit wet / dry sandpaper to feather sand all rough and chipped areas. We follow up this step with another wipe down with fresh acryli-clean. Now we apply the aluma-prep wash and alodine to bare aluminum spots as previously mentioned. It's very important to keep these chemicals from getting inside the doors and down into the airframe. Did I mention that thorough hot water rinsing is a must?

When all is dry it's time to apply the self etching 215S chromate and a light sandable primer to all the bare aluminum spots. Then we hold a bright light close to the surface in order to see any areas that may need a coat or two of sandable primer and surface sanding. This will fill in any irregularities. Once all the rough spots are fill primed and feather sanded, we apply a full coat of gray sandable primer. One more visual check with a bright light and our surface prep is complete.

Ready for paint, the surface should be very smooth and consistent. Any anomalies will stick out like a sore thumb once the final coats of paint are applied. We finish up by sanding all the prepared surfaces with red Scotchbrite and blowing everything clean with an air nozzle. If you have any apprehensions about all of this, check with a friend who works in an automotive body shop or who messes with restoring old cars or motorcycles. They've probably learned some of these lessons the hard way.

Once repaired, prepped, primed and masked, the actual paint spraying takes only 20 minutes or so.

Air oil separator in an air line. Drain it frequently.

Now that the doors and jambs are ready to paint, let's move on to seats. Prepping seats for paint is tedious to say the least. The big deal here is cleaning and sanding all the intricate nooks and crannies that are inherent to these parts. Once the seats have been totally disassembled, inspected and repaired, start with brushes and acryli-clean or mineral spirits and clean the years of collected and dried lubricants found on the actuating mechanism, stop linkage pivot points, and rollers. Here's where the stainless steel toothbrushes and rifle barrel cleaning brushes are quite handy.

We often clean the same area several times and blow out the tight spots with compressed air and an air nozzle. Compressed air is a tremendous help in getting dirt out of tough spots. The existing finish on some seats is in such rough shape that we de-grease the seats with solvent and take them straight to the bead blasting cabinet. Be sure to clean any left over blasting medium out of the reclining mechanisms. After a final wipe down with acryli-clean, we mask chrome knobs, jack screws, and other parts, then we alodine and prime the frames. Steel seat frames are prepped the same way as aluminum frames with the exception that all priming is done with the red oxide ferrous metal primer. Don't forget the wet primer blending mentioned earlier. That's about it for seat prep.

The final group of components to prep are those lovely plastic pieces. This was thoroughly covered in previous articles. The only review item I'm going to mention is the lacquer thinner wipe down. Some important details come to mind here. First, use a clean, lint-free white cotton rag. Second, rinse it frequently in the pan of clean thinner, and as soon as the thinner flashes off, paint the part while the plastic surface is tacky.

Now it's time to discuss paint applications. We strongly prefer spraying these paints with a siphon type of paint gun. I'm referring to the old-fashioned type of gun that has the paint supply cup below the spray head. This type of gun will use more paint, however, due to its higher pressure, it will do a better job of atomizing lacquer paints, making for a finer finish. The other advantage of a siphon type gun is that it will spray paint at almost any angle. Think of all the different places you must spray when shooting the doors and jambs. HVLP guns are gravity feed and will not easily spray overhead surfaces.

Considering the shape and sizes of these components, we prefer to use an inexpensive touch-up gun, approximately $30. This handy gun will get into tight spots and can put out enough of a spray pattern to cover even the larger trim pieces. I would suggest that a first-timer practice painting on some old parts to get the hang of it. Spray painting is best learned by doing. So just do it. Here's something worth knowing. Paint the difficult places on the part first, then spray the big, easy to get to areas second. This will go a long to help you avoid having bare spots in the difficult to reach contours.

If ever you are going to break the big 'man' rule, and actually read the instructions first, this is the time to do it. All these finishing products come with spec sheets that cover it all: how to thin the paint, how much flattening base to use, drying times, temperature and humidity considerations, spraying pressures, and, most importantly, environmental and safety considerations. Stick with the directions and you'll have better success.

I'm going to close this article with a list of pitfalls. These are the most common problems new technicians have had here at Air Mod as they learn to paint these components.

FISH EYE: This is paint spreading

because of contaminants left on the prepared surface. Usually old silicon or oil residue is the culprit. The fix is to thoroughly remove the paint from the defective area with a solvent rag. Let the area thoroughly dry, and sand, prime, and try again.

ORANGE PEEL: This is a textured surface caused by not properly thinning the paint, spraying at too high an air pressure, or spraying from too great a distance between the gun's nozzle and the surface being painted.

TEMPERATURE: Most paints must be sprayed at between 60-80°F. Spraying at too high a temperature can cause orange peeling; spraying at too low a temperature can cause the paint to chill, resulting in slow-drying runs and moisture build-up. The paint will not properly dry, and the finish will unfortunately remain soft.

HUMIDITY: Most paints are best sprayed at 50% humidity. Too much humidity and the paint picks up and retains moisture as mentioned above. Too little humidity and the paint dries too quickly. The spec sheets will have information as to how to use additive chemistry, such as retardants and thinners to help those who must shoot in less than ideal conditions. I personally think the best plan is to wait for a better day. (Did I mention reading the spec sheets?)

WATER (OR OIL) IN THE AIR LINE: All air compressors build moisture as the air is compressed. This moisture collects in the air tanks and hoses. If an air dryer, such as an air moisture separator is not used, these small droplets of water will spray out of the paint nozzle and cause fish eye blemishes. The fix is to frequently bleed the air tank and the air oil separator. Some compressors are the old piston types that, like an engine, have a crank case with oil in it. Since the piston rings can't totally seal the oil as the piston moves through its stroke, oil gets into the compressed air causing the same problems as water does. The fix is the same: bleed the system.

So, have fun. I really do enjoy painting. What a difference it can make. Remember, the devil is in the details. 'Til next time, fly safe.