

Plastic Repair



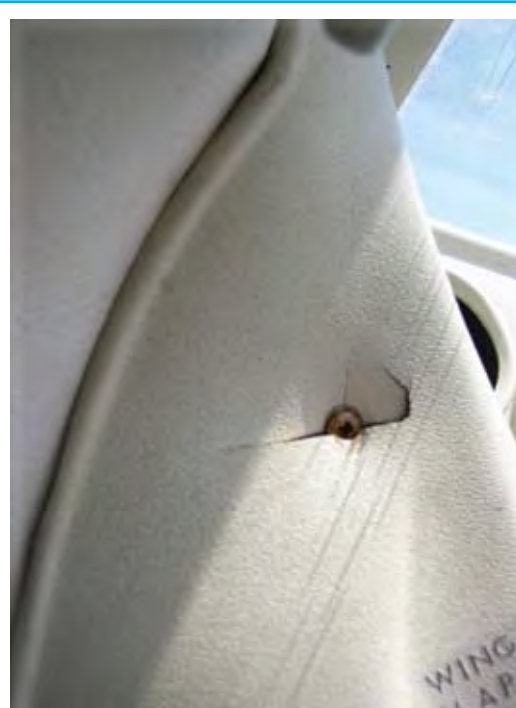
By Dennis Wolter

Well, here we are, eleven interior articles completed and I've failed to thoroughly cover one of the most troubling parts of renovating your interior. Without even mentioning the subject, many of you Cessna owners may be able to guess what it is. I'm alluding to that wonderful plastic trim – don't we just love it.

In previous articles, I did discuss some of the repair techniques involved. However, this is such a tedious and extensive endeavor that I feel an in-depth exposé may be in order.

As I started outlining an article of this scope, I felt a little like the dog who caught the car, quickly realizing I had a lot on my hands. It became obvious to me that the best way to cover this material would be to do three separate articles. This introduction article will be to educate you regarding the material, its properties, and why and how Cessna used it to fabricate their interior trim parts. In the second article, we will cover the many ways to reform, repair, reinforce and reinstall your existing plastic components. Finally, in the third article, we will show you the techniques we use to trim, fit, finish, placard and install new parts. Yes, even new stuff needs to be reinforced prior to installation in an effort to prevent the failures we've seen in those factory-installed components.

To fully understand how to deal with plastic trim it's important to get to know a little about the material itself. In the complex world of plastics, the Lustran material used to fabricate these Cessna cabin trim components is not known for strength and durability. So why did Cessna choose this product? The answer, as in so many things in aviation, is shrouded in compromise. Challenged by relatively low production numbers and the necessity to keep weight to



Typical condition of original ABS .065" plastic.

a minimum, Lustran was the best choice.

In a perfect world, these trim components would be fabricated using aluminum, fiberglass, carbon fiber, or injection molded ABS. However, fiberglass and carbon fiber processes are too labor-intensive to produce and require more expensive tooling. Injection molding, as used in the automotive industry, is heavier, requires extremely expensive tooling and is only cost effective if the production numbers are measured in the tens of thousands. Hydro forming, stamping, or draw forming these shapes out of aluminum is nearly impossible to do. So vacuum-formed Lustran ended up being the method of choice. Affordable tooling costs, ease of forming, low material cost, acceptable durability, light in weight, all combine to make this imperfect material the way to go.

Cessna, Beech and Piper each chose to use a type of non-thermal setting plastic that, when heated to approximately 275°F, can be vacuum-formed into almost any needed shape. Vacuum forming is a very simple means of forming plastic. All one needs is a mold, usually made of wood. Small holes are drilled from the inside corners of the mold's top surface through to the flat base of the mold. The mold is then placed

on a flat table with a manifold that is connected to a vacuum chamber. The perimeter of the mold is sealed where it meets the surface of the vacuum chamber table. The plastic is secured to a metal frame above the mold and heated to 275° F. Once soft, the plastic is dropped onto the mold and a valve is opened that creates a partial vacuum between the hole-impregnated wood mold and the hot rubbery plastic. And zammo!, when cool you have a vacuum formed part. Additionally, this non-thermal setting plastic is material



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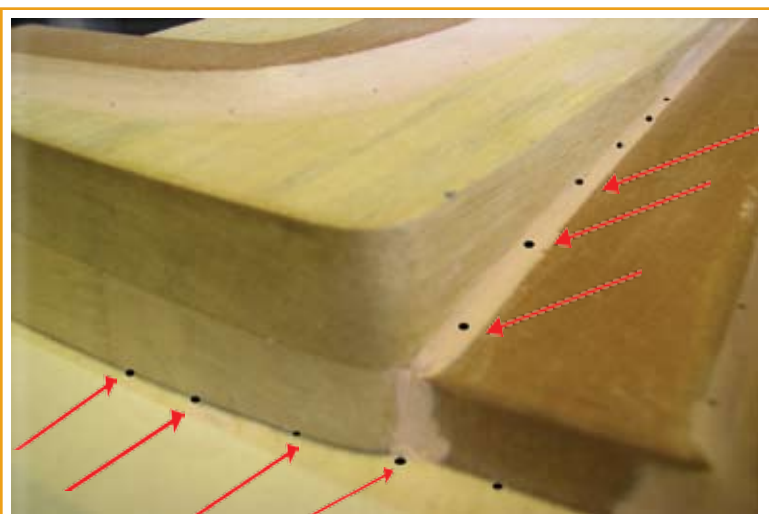


Finished armrest (left), wood mold (center), and untrimmed formed armrests (right).

that, once formed, can be reheated and reformed. This means that after the part is installed in your airplane, the Lustran plastic remains thermally active, becoming soft and expanding with summer temperatures, and conversely, becoming more rigid and shrinking slightly when exposed to the cold temperatures of winter. These changes can create stress in the plastic that can eventually lead to cracking.

As if thermal activity isn't bad enough, old mister sun gets into the act. The plasticizing chemistry that keeps this plastic flexible is degraded by intense ultraviolet sunlight as well as time. Being exposed to so much intense sunlight at the windows' edges, this stuff was in trouble from the start.

about plastic than I will ever know. I won't bore you with the chemical analysis information he covered with me, but I will discuss just what we need to know to effectively deal with this material. Cessna molded the original plastic trim from an early generation ABS plastic of approximately 60 thousandths of an inch (.060") thickness. Vantage Plane Plastics molds their parts using a much improved later generation Lustran containing a higher content of more stable rubber to enhance flexibility and durability by reducing sunlight degradation. Also, Plane Plastics uses .090" material for added strength. Some complex shaped components that require a deep draw are molded using .115" material. This extra thickness will increase strength



Close-up shot of a wood mold; note the small holes at the inside corners

For some professional input on this material, I called Dale Logdson at Vantage Plane Plastics. Being a plastics engineer, he has probably forgotten more

of the part where the material is pulled into a deep recession in the mold. Think of the aft corners in the center pedestal fuel valve area. The plastic can become



High impact corner of a Cessna armrest is reinforced with bondo.

quite thin as it stretches into this deep recession. When installed, this area is in a high impact location, making strength even more critical. The .115" material is a real benefit in this application.

Here's a neat and easy trick. Before installing a new (or used) pedestal, sand the inside surface of the vulnerable corners and fill them with automotive bondo. This is a great strength enhancement in this location. It's all about the details! As we progress through the plastic articles, I will show you several tricks that will make this plastic way better than the original stuff.

Lustran plastic is solvent sensitive, so chemicals such as lacquer thinner and methylethylketone (MEK) will dissolve it. This means that lacquer paints and SEM sprays will thoroughly bond to this plastic with proper preparation, allowing for strong repairs and durable finishing. Since this non-thermal setting plastic can be reheated and re-formed, we can correct misshapen old parts and reshape ill-fitting new ones (more on this later).

Bonding to this solvent sensitive Lustran is easily done using PVC plumbers cement, cyanide acrylate adhesives such as polyfix, or grinding some material into a fine powder and mixing it with MEK to create a color-matched paste. The paste bonds well and makes a great small hole filler. A bit of advice: never use polyester or epoxy resins as they do not dissolve into this solvent sensitive material and may not establish as strong a bond as the previously mentioned

products.

The first step in the plastic renovation process is to organize the original parts into different categories based on condition. 1) re-usable as removed, 2) easily repaired components, 3) parts salvageable with some effort, and 4) unsalvageable parts.

Reusable parts are those that, once removed and assessed, require no re-

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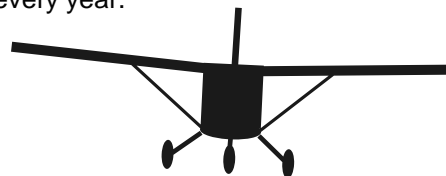
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forming or repair. That doesn't mean that some reinforcement and additional bracketing may be required to ensure proper fit and maximum durability. We like to make things better whenever we can!

Easily repaired parts are a no-brainer. One or two simple repairs, maybe a lit-

tle reinforcement and these still-flexible components are ready to be refinished and re-installed.

Salvageable parts are those that are not overly brittle, have a manageable amount of needed repairs, are unavailable or very expensive new and, once repaired, are installed in a place that is

somewhat protected. Overhead panels and aft side window frames come to mind as being in this category.

Unsalvageable parts are those that are so deformed or full of cracks that the time commitment to reform and repair them far exceeds the cost of replacement, or the part is so brittle that once repaired, its failure in the future is likely. Think of a forward door post cover that is often pulled on as people get in or out of the airplane. If not in good condition, one good pull and the part cracks again. Additionally, consider the fact that any part located in a susceptible area (high sunlight or high impact) such as near a windshield, window or door jamb, has always been and will continue to be exposed to ultraviolet light or physical damage. Take the plunge and buy a new part. A properly fit, reinforced, finished and installed component will last a long time and look great.

One final note on dealing with unusable, unsalvageable parts. What if a replacement part is simply not available from Cessna, salvage yards, or after market sources? In this case, we will go to great lengths to reform, repair, reinforce and re-use a part. Sometimes you have no choice. An alternate solution we've found is to send the repaired part to a company such as Vantage Plane Plastics and have them use that part as a pattern to manufacture a new component. This approach may not always be practical. Plane Plastics is obviously a business in need of paying attention to the bottom line. If there is little demand in the field for a particular part, it may not make good business sense to tool up for something which will never be profitable.

Aircraft age is also an issue. Older airplanes exist in smaller numbers and are generally less valuable. This means lower market demand for their parts (basic economics!). Unfortunately for many of us, the older the airplane, the more likely it is that a part you need will be difficult to find. So don't discard even what appears to be an unusable part until all of your options have been explored. You may be forced to don the repairman's hat.

I would be remiss if I didn't touch on another related subject when it comes to dealing with Cessna plastic. I've taken some heat over the years with regard to

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this subject, but I want everyone to be aware that I, and my dedicated technicians at Air Mod, have experienced a great deal of frustration and invested a tremendous amount of effort in dealing with the disparity of fit and quality when it comes to certain Cessna models. Can anyone say “Cardinal”? We (and many other interior shops) have struggled with plastic trim issues in these airplanes for years. Here’s one of general aviation’s best-looking, well-constructed, efficient, user-friendly airplanes, that cost the folks at Cessna a lot more to build. So much so that (I’m guessing here) by the time they got to the end of the project and finally focused on the interior, time was running short and they rushed the interior design to get the airplane to market.

Cessna made several design changes over the years, which means that what fits in one Cardinal won’t necessarily match up to the same part in a Cardinal built in a different year. This drove both Cessna and the after-market plastic manufacturers crazy. The net result of this lack of standardization is that not every part for a specific year Cardinal is always available so, even if most of your plastic trim is reusable, one or two pieces in that set may be extinct. The solution is to either make extreme repairs on a few old parts or buy a whole new set of interior trim plastic.

Between relatively low production numbers, high manufacturing costs, and several incomplete plastic re-design efforts, these airplanes never reached a high level of quality interior fit and finish that we see in the more numerous 172s, 182s, and 206s.

Thankfully, Cardinal owners are so passionate about their airplanes that the fleet is alive and well. In fact, due to this enthusiasm, Plane Plastics is re-tooling their molds to come up with a precise-fitting complete plastic trim set for the Cardinals. Finally, you will be able to buy new plastic made of a much better grade of Lustran that will actually fit. Once properly installed and finished, these plastic trim components will look great and finally be more durable. Cessna 210 owners also face some of these same issues with the center console and aft baggage compartment trim. The message here is that some specific Cessna models

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present additional challenges that can affect your plastic renovation plan.

There is one more point that I would like to mention in this introduction and planning article. Back in 1973, when my hair was still dark and I started Air Mod, a lot of parts weren't available for the early 60's airplanes we were then renovating. I decided to cover some of the unattractive plastic trim pieces (mostly window frames) with any approved aircraft material I could find. I tried fabric, vinyl, and leather. By the early 1980's, we were starting to see failures with this covering process. The first to fail were the pieces we covered with cloth. Sunlight and plexiglas window cleaners turned some of these fabrics almost to powder. The vinyl-covered pieces began to crack, fade and have seam failures. The leather-covered components began to show evidence of distortion when the leather shrunk as it dried out, an unavoidable occurrence with leather. Fortunately by this time Cessna, Piper, and Kinzie (now Vantage Plane Plastics), were all beginning to supply new parts to replace those deteriorated ones.

This experience made me a believer that the best way to extend the life of plastic trim components is not to cover them, but to paint them with a durable ultraviolet-tolerant finish. At Air Mod, we wipe down the part with lacquer thinner and then spray it with acrylic lacquer. Acrylic lacquer reflects ultraviolet light, keeping that damaging sunlight from getting directly into the plastic. I repaired, reinforced and refinished the light grey upper painted plastic in my 172M in 1981. The airplane was stored outside in southern Ohio until 1994, when there was finally room for it in Air Mod's new hangar. You have to look hard to find a crack after 26 years. Not a bad deal!

Now that you know a little more about your cabin plastic, you may not think it's such bad stuff after all. Armed with this information, you should be better able to plan the renovation or upgrade of your plastic trim components. With that thought in mind, we'll move into the shop next month and get started. Until then, fly safe.

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