

Headliners



By Dennis Wolter

How often does anyone look up at a headliner and say, “Man, that’s a really cool headliner.” In 34 years of being in this business, I’ve never seen a customer do that at delivery. Between all of the whiz-bang radios, beautifully sculpted seats, and the latest multi-function screens, headliners don’t get much respect! That is, until one is poorly crafted and installed. Only then will this normally innocuous interior component stick out like a sore thumb and be noticed.

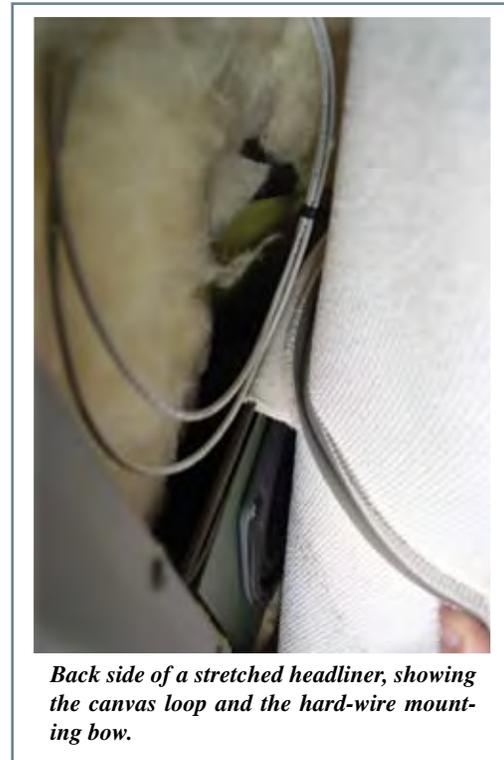


Bow-mounted, sewn and stretched headliner used from 1946 to 1986.

From 1946 through today, Cessna has used only three types of headliners in all of their single and twin engine airplanes. The first type is stretched fabric or vinyl, mounted on 5/32” tempered rod bows. These were common to 1946 through mid-1970s singles and all early twins (Cessna actually stuck with a sewn, bow-mounted stretched headliner for all of the 210s). Later twins used a Galietti extruded aluminum mounting rail system.

Later 172s, 182s, and 206s have a plastic headliner that was initially molded using a non-thermal setting self-skinning urethane foam that was semi-rigid and had a foam backing that did attenuate some sound. These headliners were actually part of the soundproofing system.

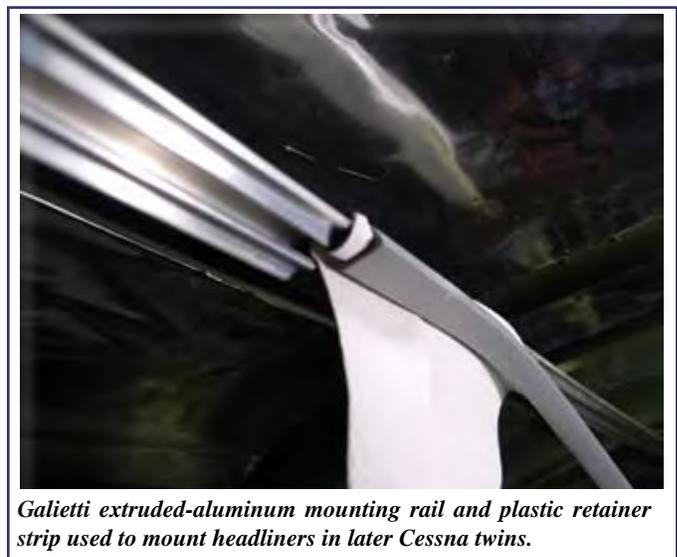
By the late 1970’s Cessna changed to a hard, thin, non-thermal setting kydex plastic for their molded headliners (that same material used to mold their famous window frames). It’s important to mention here that the term “non-thermal setting” means that the material will become soft and flexible when reheated. Unfortunately, summertime cabin temperatures are often high enough for the plastic to become soft, causing it to expand and begin to change shape over time. This thermal movement results in cracks, warping and sagging. Adding to the problem is the fact that, as this plastic ages, the plasticizing



Back side of a stretched headliner, showing the canvas loop and the hard-wire mounting bow.

chemicals gas out and in the end the components become quite brittle and fragile.

Not to worry. Thanks to the fact that the headliner plastic is non-thermal setting and solvent-sensitive, it can be re-formed and repaired. Additionally, there are things we can do to prevent these problems from recurring. In this article we will work our way through not just how to repair and re-place these headliners, but actually substantially improve them, making them be more durable, better looking, more maintenance-friendly and



Galietti extruded-aluminum mounting rail and plastic retainer strip used to mount headliners in later Cessna twins.



Molded plastic headliner in a 1978 R182.



Heat-induced sagging in a 1981 182.

easier to install and remove. Not a bad deal!

So, let's get started. The oldest system used is the stretched sewn type of headliner. Personally, I think these stretched headliners present some of the most patience-depleting and skill-demanding challenges found in aircraft interior renovation work. But don't let that statement scare you do-it-yourselfers. It's my intent to walk you through all the procedures and tricks of this game. I wish someone had done that for me back in the early 70's when I was trying to figure this stuff out for the first time. Challenge can often be a good teacher, and necessity is definitely the mother of invention.

Before getting into the process of fabricating and installing

one of these stretched headliners, I want to stress how important it is to keep the old headliner as a pattern. If you don't have the pattern the best thing to do is call Airtex (215-295-4115) and order a new pre-sewn headliner. Airtex is a quality company that manufactures and sells interior kits. Their headliners fit well and look great. If you have any problems they are very helpful with installation pointers.

To remove these headliners, begin by removing the sun visors, the span wise trim strip at the top of the windshield and the two windshield post covers. In later airplanes, the plastic window trim must also be removed. Using a rounded thin putty knife, begin removing the headliner material that is tucked

into a pointed-edge retaining strip above the doors and around the aft cabin windows. We sometimes use a bent awl to fish around up inside the retainer strip to get the edge of the headliner material out. Then we use a soft edge putty knife to push up and lift the headliner material off of those sharp points on the retaining strip. The photo shows it all. Hopefully the headliner has enough surplus material to allow us to grab the selvage edge, helping to eliminate damage as the headliner is removed from the tedious retainer.

We have dealt with so many damaged headliners due to the pointed retaining strips that we send those feeble retainers to the scrap aluminum bin and fabricate much improved smooth replacements; they hold the material edges quite well and make the headliner very easy to install and remove. And "easy" translates to less potential for damage.

With all sides of the headliner material removed from the retaining strips, peel the forward glued edge loose from the front spar carry through. Remove all of the old glue from the spar carry through and check for corrosion under the glue

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Using a rounded thin putty knife to remove a stretched headliner from the pointed retainer strip - be very careful.

– here’s your chance! Next, starting at the front, remove the #4 PK screws that secure the headliner bows to the cabin top. Finally, lift the bows out of their retaining cup holes at the outer edges of the headliner. The headliner is now ready to be removed from the airplane.

Here’s how to properly cut, sew and install a stretched headliner using the old headliner as a pattern. The first step is to locate a fore-to-aft longitudinal center line on the old headliner and mark it at each seam. Then remove the tempered steel bows and number them from front to back (numbered masking tape tabs work great). We always thoroughly clean off any rust we find with a wire brush and spray the bows with a good steel metal primer.

Now mark each headliner panel with a number from front to back. Include a forward pointing arrow; this will eliminate a sewing error later. Failure to take these steps will drive you nuts at installation time. Now cut the seams open with a sharp razor blade, being very careful not to cut the headliner material. The mission here is to have an accurate set of well-marked patterns for creating the new headliner.

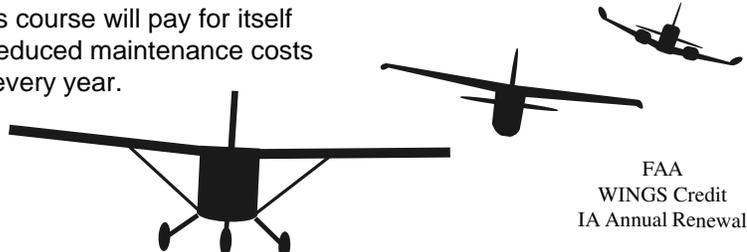
A note on the proper way to mark on these upholstery materials: Use only chalk markers. Do not use indelible markers, ballpoint pens, pencils or wax-type markers. Trust me, the above-mentioned markers will eventually bleed through any type of upholstery material. A word to the wise!



Using a small bent awl to pull the selvage edge of the headliner material out of the pointed retainer rail.

Before proceeding with the process, we should also discuss the various flame-retardant materials available for headliner fabrication. The key word here is “flame-retardant”, considering all the fuel and electrical lines that run behind your headliner. Safety is very important. Look for materials that pass FAR 25.853a. Lots of commercial fabrics and vinyls meet this requirement; check the spec sheets. Remember, your IA knows the rules and will require proof of FAR compliance at your next annual. Never use material that was flame-treated as an after market application. This type of treatment can cause serious corrosion.

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Choose the right material. As with many areas of aircraft renovation, this can involve compromise. Hanging a headliner with no wrinkles is easiest to do if it is a stretchy material. That usually means fabric of some kind. Well, cloth is not as durable nor is it as easy to clean as vinyl, but vinyl is not as stretchy as cloth. Wool fabric will shrink a bit with the application of steam vapor, so any wrinkles in a wool headliner can be steamed out with a steamer. Sounds great at this point, but wool ages poorly and is very susceptible to dirt and water spots, ouch! Nylon and dacron fab-

rics are quite durable, but they are relatively inflexible and once tightly stretched will sag if exposed to high humidity. So what looks good in winter will look like an old army pup tent on a humid summer day.

All things considered, we strongly prefer a good upholstery grade of aircraft vinyl for a durable, cleanable, soil-resistant and with some work you can end up with a wrinkle free stretched headliner. Never fabricate a headliner out of leather. Leather just shrinks too much as it ages. Take it from someone who's made this mistake!

Whether you choose vinyl or fabric, it's important to properly work with the bias in the material. In plain English, this means that all materials will stretch more in one direction than the other. Since wrinkle elimination is a major concern when installing a stretched headliner, you need to use the inherent bias of the material's stretch to your advantage. We have found it's best to have the most stretch running fore and aft. To identify which direction of the raw material stretches the most, simply pull the material both ways, check the results and mark it on the back side with a chalk marker. In some cases you may have to use more yardage in order to have the stretch work to your advantage. Don't skimp on the material – a wrinkle-free headliner is worth it.

Finally, it's time to begin fabricat-

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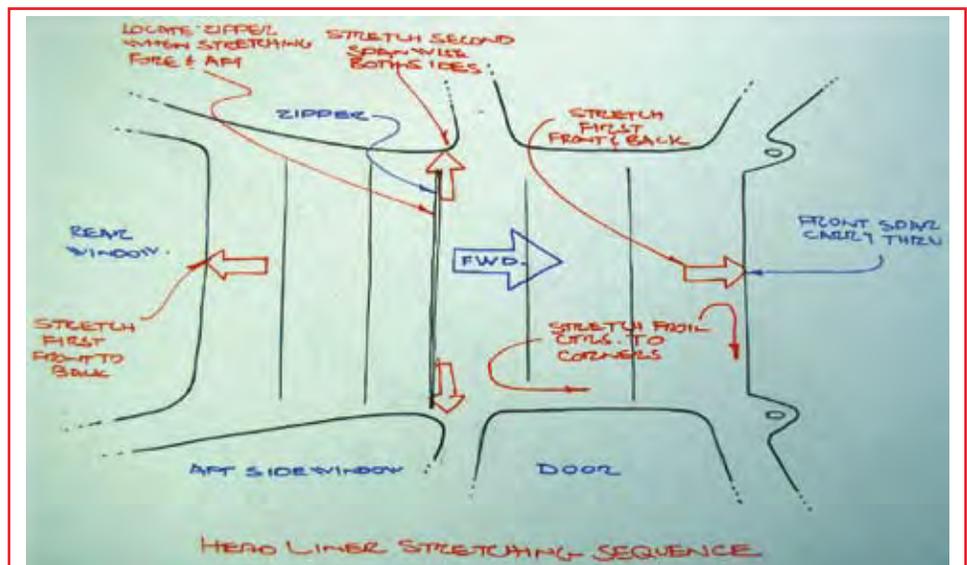
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Sketch of headliner stretching sequence.



Extra span wise full-width zipper allows access to the oxygen bottles.

ing the new headliner. The first step is to lay out the old pattern pieces on the new material, keeping every section oriented properly so the stretch bias is running forward and aft. It helps to lay heavy weights on the pattern pieces as you trace the shape of each section onto the new material. Hand tools work great! Don't forget to mark the center lines and panel numbers with chalk on each section.

Here's a technique worth knowing. We like to cut each headliner panel slightly undersized by about a 1/8" at each seam. When sewn with a normal seam allowance, the new headliner is slightly shorter in length than the old one. The idea here is to have a headliner that is dimensionally snug enough to require a little more stretch at installation time, this helps to eliminate the tendency for wrinkling. We add about two inches of width on each panel for a little extra insurance.

Never sew a headliner with linen or cotton thread. Use only durable dacron thread. This will prevent seam failures in the future caused by rotting thread. Be sure also to buy durlon zippers with dacron taping. Brass zippers with cotton taping will corrode and jam, and the tape can begin to fail in as little as five years. Finally, use dacron canvas to fabricate the bow loops. It's all about durability.

The sewing techniques originally used by Cessna to assemble the headliner and its zippers and bows should be duplicated when fabricating the new headliner. We staple the panels and canvas bow loops together with a hand-held stapler to keep everything in register and

to eliminate slippage during the sewing process (don't forget to remove the staples!). I would suggest that you first timers take some pictures for reference before disassembling the headliner. We still do this at Air Mod if it's a type that we don't see very often. The pictures can be very helpful later.

Before hanging the headliner, install all of the mounting screws and bolts necessary to install interior trim components, lights, air vents and shoulder harnesses. Once the headliner is mounted and stretched, these mounting points will stick out enough to help you locate and install those other components. We definitely don't want to cut a hole in the wrong place.

Now for the fun part. With the cabin top cleaned, chromated and reinsulated, and the fuel and electrical components inspected and repaired (as described in previous articles), the next step is to hang and stretch the headliner. Begin by reinstalling the headliner retaining bows in their respective canvas loops on the new headliner. Next, starting at the back and

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moving forward, locate a one inch slit in the canvas bow loops where the rod mounting tabs are located, and hang the headliner a bow at a time.

Next it's time to heat-stretch and trim the headliner. Heat is important if you are installing a vinyl headliner. Even in summer, we use two electric cube heaters and close the cabin doors to get the vinyl up to about 120°F. This will help make the vinyl flexible. To aid in wrinkle removal, we also carefully use a heat gun to spot heat the vinyl in trouble areas.

With the headliner hanging by its bows, pull it snugly and attach the center forward edge of the headliner to the center of the front spar carry-through and to the center of the upper aft window structure. Then start just behind the upper trailing edge of the cabin doors and pull the headliner span wise until it is taut, and secure it to the attachment structure. The sketch I've drawn gives you a little "roadmap" of how this is done. You must properly locate the main span wise inspection zipper very precisely so that the upholstered aluminum zipper trim cover when installed will completely hide the zipper. In extreme cases, we will sometimes modify the zipper cover mounting tabs to reposition the cover. Next begin stretching and securing the edge of the headliner material at the center points, progressively working toward the corners. You can work a wrinkle to a corner where it can be pulled out. On the other hand, if you mistakenly start at the corners and work the wrinkles to the center, there is no place for the surplus

material to go. Big problem.

In earlier Cessnas that have the direct reading fuel gauges in the wing roots, it's important to properly locate the cone shaped fuel gauge reliefs at the time you are positioning the zipper. A word to the wise here: don't trim any surplus headliner material until the entire thing is hanging wrinkle-free, and all locations for zippers, reading light mountings, air vents and any protruding components that may be poking from behind the headliner are checked and dealt with. If you don't like what you see, remove the headliner to trim and re-sew a panel that doesn't fit properly. This is a game where tenacity and patience definitely pays off.

For airplanes equipped with oxygen systems, two additional considerations come into play. First, check the entire system for function and leaks while the headliner is removed. Second, add two extra full width zippers immediately below the cabin top-mounted oxygen bottles to allow for future removal of the bottles without having to disturb the headliner installation. Your mechanic will thank you for this change. See, even a headliner can be modified to make maintenance faster and easier. We're always thinking ahead.

Now that we've taken care of stretched headliners, let's move on to those pesky molded types. Being that Cessna molded these from two different materials, we will discuss each group separately. The first material being a self-skinning semi-ridged molded foam type and the second being one made of 1/16 inch hard



Using a wood form and heat guns to re-form a sagging plastic headliner.



Aluminum bonded to the back side of a molded headliner. This one will never sag again!

molded kydex plastic.

The earlier molded urethane foam jobs present some distinct problems. The first is shrinkage seen as gapping at seams as the headliner pulls away from the window and windshield trim. Very little can be done for this, other than grafting additional material recovered from a donor headliner. This material has been out of production since 1980, so previously used material is all that is available. The grafting process is the same as that used to repair the kydex window frames. Due to the visibility of a grafted seam, you must cover the repaired headliner with very stretchy double-woven fabric. This process looks great and actually enhances sound attenuation by converting a previously reflective surface to a sound absorbing one.

The second problem with these molded headliners is sagging and deformation. The first step in correcting this problem is to carefully heat the deformed area with heat guns to re-form the material back to its designed shape. We apply the heat evenly and carefully, mostly to the back foam side of this material. A word of caution, if too much heat is applied in a concentrated area, the finish skin can delaminate from its foam backing and the piece is junk. Always have a means of controlling the shaping of the material once it becomes soft and pliable. We have a wood form in the shape of the original headliner. Wet towels are used to quickly cool the hot plastic as it is held to its designed shape by the wood form. We then bond formed aluminum to the back side of the re-formed shape,

ensuring that the headliner does not re-sag in the future.

The third problem with this soft material is imprinting caused by impact damage or by the edge of a plastic trim component pushing too hard on the finished surface of the headliner. After thoroughly cleaning with lacquer thinner and scuffing with scotchbrite pads, we have had reasonable success filling these impressions with automotive body

fillers. This works well in thin areas of less than one-half inch in width and one-eighth inch in depth.

The final issue with this stuff is splitting, also caused by shrinkage. Here we employ the same repair that we use to repair plastic cabin trim components. Most of the time, if this type of headliner is splitting, I would strongly recommend buying a new one from Vantage Plane Plastics (580-327-1565).

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The newer style hard molded kydex headliners installed in Cessnas from the mid-70's through current production airplanes is re-formed, repaired and reinforced in the same way all Cessna plastic is repaired. When heating this material, especially older brittle pieces,

you will notice a good deal of shrinkage occurring. So if your plastic is brittle, replace it. Even if a successful repair is accomplished, chances are that the part will fail again.

One often asked question we get from Cessna owners is, "How do I clean

the sticky film that is covering my headliner?" This condition is the result of attempting to clean a plastic headliner using those spray-and-wipe kitchen type of cleaners. The sticky stuff is actually plasticizers gassing out of the plastic because those strong cleaning chemicals are beginning to break things down. You can clean off this sticky goo with isopropyl alcohol (aircraft de-icing fluid).

We refinish plastic headliners with automotive acrylic lacquer or SEM vinyl spray. After we thoroughly clean the plastic, we wipe the surface with lacquer thinner to soften it a little so the paint will thoroughly bond – it works great.

One final detail. The later-style hard plastic headliners are not good sound attenuators. If you choose to paint rather than cover your headliner, bond some surplus flame retardant fabric to the back side of the hard headliner. This will dampen the plastic material, giving a more solid feel to the headliner while reducing the cabin sound level.

That's about it for the headliner tricks we use here at Air Mod. I think it's obvious just how much easier the later molded plastic headliners are to install and remove than their stretched counterparts. Personally, I really like the classic look of a stretched headliner. (But no one looks up to notice anyway, remember?) Until next time, fly safe!

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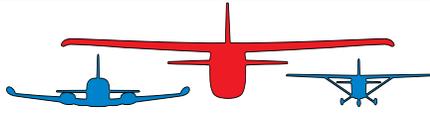


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