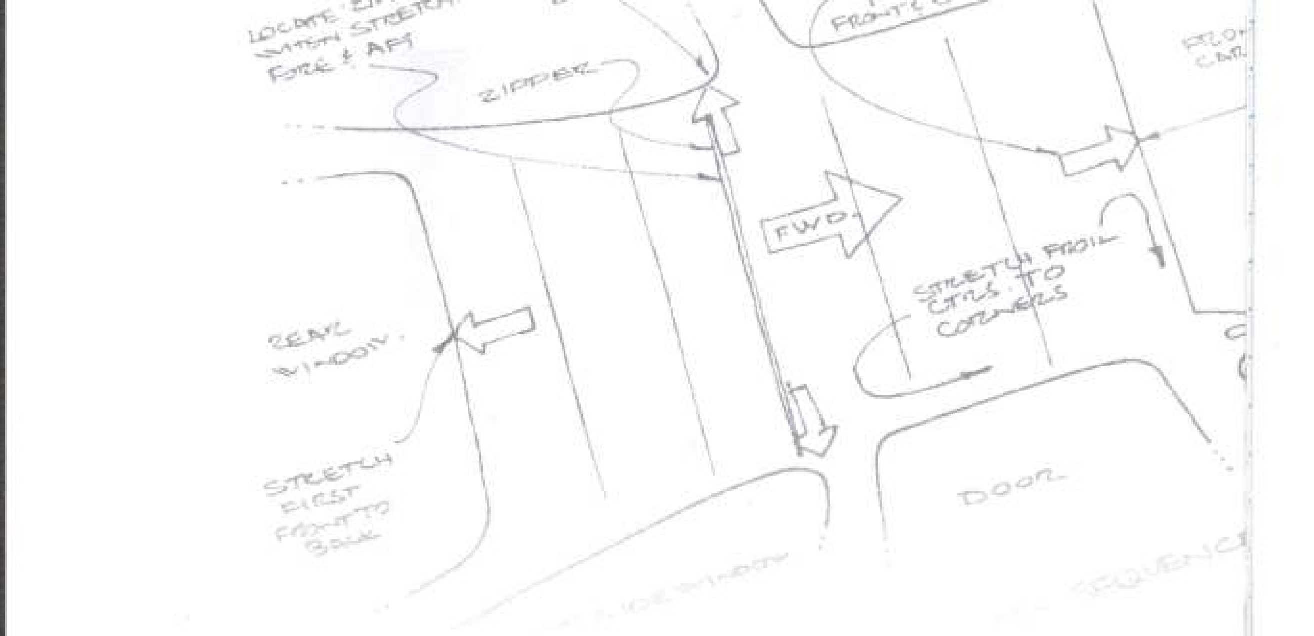
STRETCHED HEADLINERS

Multi-panel sewn headliner secured to the upper cabin structure with tempered rods and clips.



Removing, fabricating, and installing headliners isn't for the faint of heart, but it's a task that savvy do-it-yourselfers can perform with a good step-by-step guide.

By Dennis Wolter

How often does anyone look up at a headliner and say, "Man, that's a really cool headliner!" In 47 years of being in this business, I've rarely heard a customer say that at delivery. Between all the whiz-bang radios, beautifully sculpted seats, and the latest multifunction screens, headliners don't get much respect. That is...until one is poorly crafted and installed. Then, this normally innocuous interior component sticks out like a sore thumb.

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

Later Cessna 172s, 182s, and 206s have a plastic headliner. The first of these used molded, non-thermal-setting, self-skinning urethane foam that was semi-rigid. By the late 1970s, Cessna changed to a hard, thin, non-thermal-setting Kydex plastic for their molded headliners (that same material was used to mold their famous window frames). We will move on to these plastic headliners next month.

Removal of the headliner

Let's get started. As I mentioned, the first headliners Cessna used were the stretched, sewn type. Personally, I think this type of headliner presents some of the most patience-depleting and skill-demanding challenges 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 1970s when I was trying to figure this stuff out. Challenge can 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, you may want to call a company that manufactures and sells interior kits and components. They can provide a new pre-sewn headliner that fits well and looks great.

First steps of removal

To remove these headliners, begin by taking out the sunvisors, the spanwise 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 the soft-edged putty knife to push up and lift the headliner material off those sharp points on the retaining strip. The photo on Page 26 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 tediously removed from the retainer.

A vinyl headliner hanging on a hard steel rod that is secured to the cabin structure.

Fabricating and installing new retaining strips

We've dealt with so many damaged headliners due to the feeble, pointed retaining strips above the cabin doors that we use these retainer strips as a guide to fabricate a much-improved strip assembly. If you have access to a sheet metal bending brake, a plain old pop rivet tool, and a bandsaw, improved retainer strips are quite easy to fabricate.

Using the original retainer strip as a pattern, fabricate new aluminum replicas of the base metal using 0.032-inch 2024T-3 aircraft aluminum and the soon-to-be-not-pointed piece using 0.025-inch 2024T-3 aluminum.

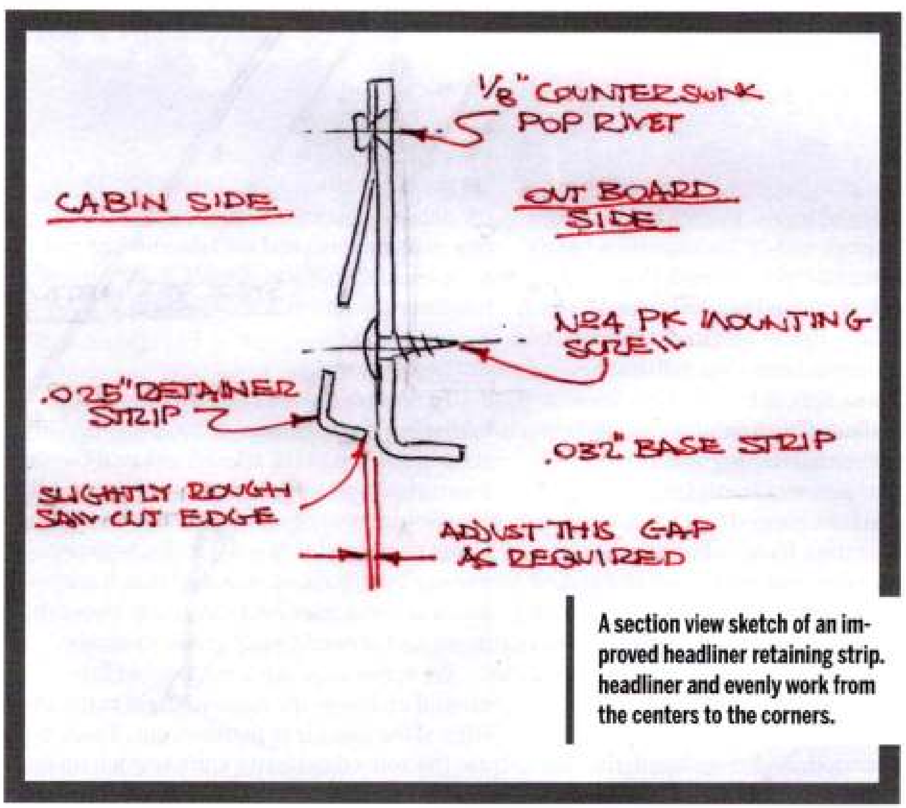
Next, using a bending brake, form an approximately 1/4-inch, 90-degree angle along the edges of both new strips. Then, bend a second slight angle in the 0.025-inch retainer strip replicating the exact geometry of the original piece. Cut the 1/4-inch, 90-degree flange of the 0.025-inch formed retainer strip down to 3/16 of an inch using a bandsaw. It's important to leave the slightly rough edge created by the bandsaw blade uncleaned. The roughness of this edge will help to hold the headliner material in the retainer strip.

The next step involves riveting the rough-edge-formed 0.025-inch strip to the single-bend 0.032-inch base strip using 1/8-inch countersunk pop rivets with the factory head on the outboard side of the trim strip assembly.

The final step in this process is to exactly replicate the mounting holes that allow for installing the new retainer assembly to the upper door frame with No. 4 PK sheet metal screws.

Once the new retainer assembly is installed above the cabin door, it may be necessary to slightly increase the gap at the bottom of the retainer to allow for the new headliner to be tucked into the retainer assembly.

The beauty of these field-fabricated retainer strips is that they will securely hold the edge of the headliner material in place without damaging the material during future removal and reinstallation of the headliner.



A section view sketch of an improved headliner retaining strip. headliner and evenly work from the centers to the corners.

Spar carry-through maintenance

With all sides of the headliner material removed from the old retaining strips, peel the forward glued edge loose from the front spar carry-through. Be sure to remove all the old glue from the spar carry-through and check for corrosion that may have developed under the glue—here's your chance!

Thoroughly clean off any corrosion that is found and spray the spar carry-through with a coat of real zinc chromate available in convenient spray cans from aircraft supply houses. If any corrosion found on the spar carry-through will not clean up with the use of a Scotchbrite pad, it's time to involve your maintenance technician for an inspection of the damage. *(Cessna 210 owners should check with their A&P for compliance with AD 2020-03-16. —Ed.)*

Final removal steps

Starting at the front and working aft, remove the No. 4 PK screws that secure the headliner clips holding the bows to the cabin top. Finally, lift the bows out of their retaining cup holes at the outer edges of the headliner. The headliner can now be removed from the airplane. Once the headliner is completely removed, you should absolutely have your maintenance technician inspect the cabin top area for such things as corrosion, bad cables, and old hoses.

Preparing your new headliner

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 at each seam. Then, remove the tempered steel bows and number them from front to back (numbered pieces of 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 metal primer.

Galietti aluminum extruded rail and a plastic retaining strip that secures the long, full-cabin-length headliner panels.

Marking

Using sharp colored chalk, mark each headliner panel with a number from front to back. Include a forward-pointing arrow and centerline mark; this will eliminate a sewing error later. Failure to take these steps will drive you nuts at installation time when you attempt to install an incorrectly sewn headliner.

Now, cut the seams open with a sharp razor blade, being careful not to cut the old 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 upholstery materials: Use only colored chalk. 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. This is a word to the wise.

Material choices

Before proceeding with the process, we should discuss the various flame-retardant materials available for headliner fabrication. Considering all the fuel and electrical lines that run behind your headliner, the key words here are "flame-retardant." 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 aftermarket application. This type of treatment can cause serious corrosion later.

Make sure to 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 the material is stretchy. That usually means fabric of some kind.

That said, fabric is not as durable nor is it as easy to clean as vinyl; but vinyl is not as stretchy as fabric. Wool fabric will shrink a bit with the application of steam vapor, so most wrinkles in a wool headliner can be eliminated with a steamer.

Nylon and Dacron fabrics 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 could end up looking like an old army pup tent on a humid

Pointed headliner retaining strip that holds the headliner above the doors in airframes with a soft headliner.

summer day.

All things considered, we strongly prefer a good upholstery grade of flameproof aircraft vinyl for a durable, cleanable, soil-resistant and, with some work, 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 preferred direction 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.

Fabrication

Finally, it's time to begin fabricating the new headliner. 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 on the new material. Don't forget to mark the center lines and panel numbers with chalk on each section of new material.


Using a small bent pick to begin pulling the headliner material out of the pointed retainer strip.

Here's a technique worth knowing. We like to cut each headliner panel slightly undersized by about 1/4 of an inch 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 will help to eliminate the tendency for wrinkling. We do cut the various headliner panels about 1 1/2 inch wider than the original pattern. This extra width will come in handy when securing the headliner along the sides of the cabin; more on this later.

Sewing

Never sew a headliner with linen or cotton thread. Use only durable Dacron thread to prevent future seam failures due to rotting thread. Be sure also to buy Durlon zippers with Dacron taping. Brass zippers with cotton taping will corrode and jam, and the cotton tape can begin to fail in as little as five years. Finally, use Dacron polyester or nylon 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 handheld stapler to keep everything in register and to eliminate slippage during the sewing process. Don't forget to remove the staples when you're done!

I would suggest that first-timers take some pictures for reference before disassembling the headliner. We still do this at Air Mod when we are fabricating a type of headliner that we don't see very often. Pictures can be very helpful later.

Hanging and stretching the headliner

Before hanging the headliner, install all the mounting screws and bolts necessary to install interior trim components, lights, air vents, shoulder harnesses, etc. Once the headliner is mounted and stretched, these mounting points will stick out enough to help you accurately locate and install those components. We 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, the next step is to hang and stretch the headliner.

Begin by reinstalling the headliner retaining bows in their respective

Pulling the surplus headliner material out of the pointed retainer strip while using a rounded-off, thin putty knife to lift the headliner material off the retainer strip sharp points.

canvas loops on the new headliner. Next, starting at the back and moving forward, locate a 1-inch slit in the canvas bow loops where the rod mounting tabs are located, and hang the headliner one bow at a time.

Additional considerations

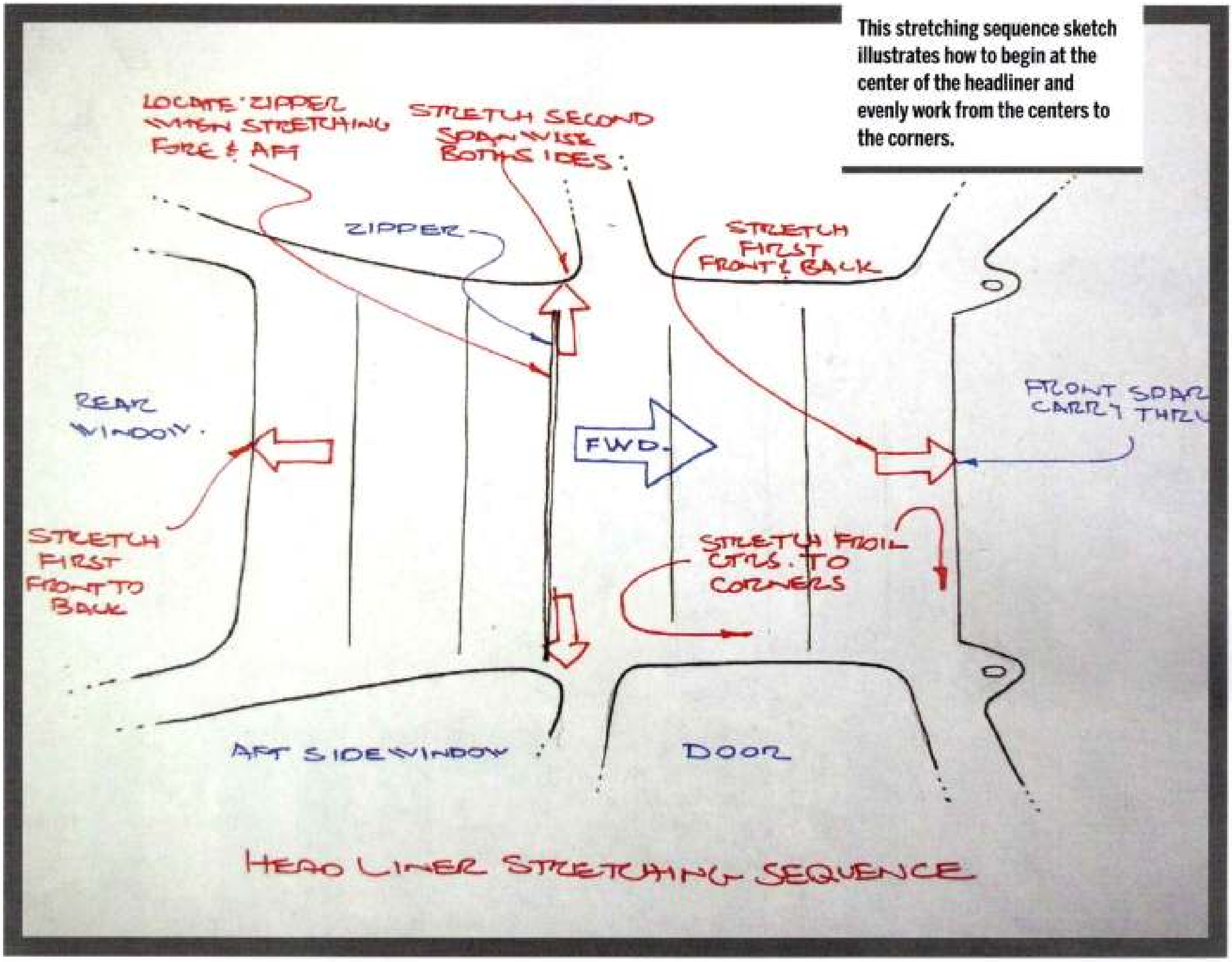
For airplanes equipped with oxygen systems, two considerations come into play. First, check the entire system for function and leaks while the headliner is removed. Second, add two extra full-width zippers immediately below the cabin-top-mounted oxygen bottles to allow for future removal of the bottles without having to disturb the headliner installation.

Your mechanic will thank you for this change. We're always thinking ahead! Even a headliner can be modified to make maintenance faster and easier.

Since strutless Cessna 210 owners are required to have your spar carry-throughs inspected, if you are going to install a new headliner, it's important to install a full-width spanwise zipper located right under the spar carry-through. This handy additional zipper will make future inspections of the spar carry-through a snap.

Stretching

Next, it's time to heat-stretch and trim the headliner. Heat is important if



This stretching sequence sketch illustrates how to begin at the center of the headliner and evenly work from the centers to the corners.

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 now-chromated 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 spanwise until it is taut and secure it to the attachment structure.

The sketch I've drawn (above) gives you a roadmap of how this is done. You must properly locate the main spanwise inspection zipper in the exact place so that the upholstered aluminum zipper cover will completely hide the zipper. In extreme cases, we will sometimes modify the zipper cover mounting tabs to reposition the cover.

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 start at the corners and work the wrinkles to the center, there is no place for surplus material to go at the center point. That's a big problem.

Final trimming

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, you will have to remove the headliner to trim and re-sew a panel that doesn't fit properly. This is a game where tenacity and patience definitely pay off.

Having taken care of stretched headliners, we will move on to those pesky molded types next month. They are molded from two different materials, and we will address each one. Until then, fly safe!

IMPORTANT: This article describes work that may need to be performed/supervised by a certificated aviation maintenance technician. Know your FAR/AIM and check with your mechanic before starting any work.

Industrial designer and aviation enthusiast **DENNIS WOLTER** is well-known for giving countless seminars and contributing his expertise about all phases of aircraft renovation in various publications. Wolter founded AirMod in 1973 in order to offer private aircraft owners the same professional, high-quality work then only offered to corporate jet operators. Send questions or comments to editor@cessnaflyer.org.