

INTERIORS

THE INSIDE STORY

PART VI

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Let's begin where we left off last month. With all the structural, mechanical and foam work completed, it's time to start sewing the seats. But before we turn on the sewing machine, I'd like to make a few relevant points.

By now it should be obvious that renovating an airplane interior, like any complex task, requires different skills in different fields—some creative, some purely technical. In this business, tenacity, time, proper tools and good workspace can be the most important elements.

Of all the various tasks involved in aircraft interiors, definitely the most skill-demanding is the sewing of the seats. Next time you're at Oshkosh admiring homebuilt airplanes, check out the interiors. You will see some beautiful metal work, painting, instrument panels and side panels, only to be disappointed by poorly sewn and ill-fitting seats.

The do-it-yourselfer should not expect total success on the first try. This sewing process can be a difficult skill to master. Be prepared for some rework, but if you stick with it, you'll be amazed at how much you can accomplish.

In this installment, I'm going to show you the techniques AirMod uses to create ergonomically correct, aesthetically appealing and durable seats. Some of the steps we incorporate could be left out and the seat will still look darn good at delivery. But over time you can end up with premature failure.

If you are doing this work yourself, stick with it and try to follow all the steps. I'll give some tricks as we go to help you attain good results. At this time I'd like to re-stress how important it is

to use an *industrial* sewing machine. As I stated in previous articles, the proper sewing machine is key to success.

It's important first to buy enough material for the entire job, including some allowance for a mistake or two. You should have enough left over for future repairs (maybe a yard each of fabric or vinyl and a half-hide of leather). Aviation-approved materials are constantly changing and can become discontinued even before your project is completed.

If you're a novice, it's a good idea—material costs being what they are—to buy a yard of non-aircraft scrap vinyl or cloth for practicing difficult stitching or fitting before you use the more expensive treated aircraft materials. A penny spent can be a dollar saved.

We usually buy about five 40-50 square foot hides of leather for a four-place Bonanza interior, obviously more for a six-place airplane. This allows for an 8-10 percent loss for cutting out leather defects and the half-hide left-over allowance.

If the interior is to be done in a combination of fabric and vinyl, we will probably order six yards of cloth and eight yards of vinyl. (These quantities can change, depending on the seat design and respective usage of fabric vs. vinyl.) Barring any major mistakes, you should end up with enough extra material for future needs. Some patterned materials may require additional yardage to allow for proper pattern alignment.

While we are on the subject of materials, we usually buy somewhere between a 12x6 or 12x8 piece of carpet and three or four yards of headliner material.

PATTERNS

The first step in seat sewing is to lay out the materials. The ladies in our sewing room like to make a set of patterns to help them organize layout and cutting. This reduces material loss and mistakes.

Heavy paper or thin cardboard patterns are laid out and trimmed to meet



Fabricating patterns of the many seat panels.



Laying out the patterns on the finish material before cutting.



Using staples to hold the various pieces together makes sewing a lot easier.

the various contours of the seat shapes. Then the patterns are placed on the raw material in such a way as to most efficiently use the material and/or work around leather defects.

These patterns are cut to the exact shape of the section of the seat they are to fit plus 1/4" seam allowance. This small overhang past the stitch line is necessary for the material to properly pass through the sewing machine head during the stitching process and also to give the component strength once it's sewn. If you sew too close to the edge of the material, the cloth will unravel and vinyl or leather will tear loose at the stitch. We also double-stitch the seams, and over the past 30 years have not experienced a seam failure with this technique.

It's a good idea for someone sewing for the first time to allow as much as $\frac{3}{8}$ " for a selvage edge. More seam allowance means more control of the stitch.

Also for the first-timer, there is another advantage to having a slightly more generous seam allowance: You can actually staple the seam to help hold the several layers of material together during the sewing process. It takes a little more time, but it sure makes it easier. Don't forget to pull out the staples after the seam is completed. They will surely work their way to the surface if you leave them in—ouch!

SEAMS

Before moving on, I want to discuss the three most common types of seams used to sew seats. How the seams are made not only affects how the seat will look, but also how long it will last. If the folded edge of material and thread are exposed to sunlight and wear, the durability of the seam is affected. So here's the good and bad of the seam game.

SINGLE STITCH

This is the easiest and fastest seam used. One simply brings both materials together under the needle. No cording, no double-stitching. It's fast and provides a clean seam, with moderate exposure of the folded material edge and stitching to sunlight and abrasion.



Single-stitch pleat.

TOP OR FRENCH STITCHING

This method involves first making a plain stitch as described in the previous paragraph, then folding the selvage or cut edge back on itself and carefully top-stitching the material on both sides and parallel to the single stitch seam.

We apply a reinforcing tape on the



Top or "French" stitching.

back side, spanning both sides of the cut edge to add extra strength to the seam. This gives a very nice-looking finished appearance to the seam, but it is the least durable way to sew a seat. All of the French-stitched thread and the folded edge of the material are fully exposed to sunlight and abrasion.

CORDING

Last, but certainly not least, is the good old corded seam, the most durable way to sew a seat. This method employs the use of cording, made by folding a $\frac{1}{8}$ " wide strip of finish material (usually leather or vinyl) around a $\frac{3}{32}$ " foam cord that is single-stitched to become a flanged cord. This cord is then placed between the two materials.

Once sewn together, the cord provides complete protection of the stitching and the folded edge of the material, elim-



Cording being made.



Finished "corded" seam.

inating exposure to sunlight and abrasion. If after a long period of time the cording begins to show signs of wear, the seam can be carefully cut open and the damaged cording replaced with new.

Once the edges are worn on a seat with straight stitching or French stitching, the entire panel of material must be replaced. The material will have worn through at the edge, or the thread will have failed. Restitching will only make unsightly new holes right over the old ones, a real compromise.

Thread

A word about thread. Upholstery thread is available in four types: cotton, nylon, polyester and Dacron. Without question, the most durable and strongest is Dacron, with polyester finishing in a strong second place. If you are considering top-stitching, use Dacron or polyester. The other two will more quickly fade and degrade in sunlight.

Backing

By now you've noticed that every seat section has backing foam and backing fabric bonded to it before being sewn together. These backing materials perform three functions:

1. They help to eliminate wrinkles, and one of the hardest things to achieve in seat upholstery is a sculpted seat shape with no wrinkles.
2. The light density foam imparts a softer more plush feel to the seat surface.
3. These materials provide a smooth look, adding just enough dimension and an extra measure of fullness when the finished cover is mounted on the seat.

PLEATING

Now that we know how to stitch the seats together, let's talk about pleating. Pleating refers to the process of sewing a nonstructural, decorative stitch for the purpose of adding design detail to an otherwise plain panel.

There are two basic ways this type of stitching is done. The first and most common is to simply top-stitch through

the finish material, foam and backing fabric, resulting in the thread showing on the surface of the finished pleated component. The beauty of this method is that it allows total freedom of stitch pattern and provides a nice relief and appearance.

The second method of pattern-stitching is the folded-pleat method. First, a single top-stitch is sewn as just described. We fold the material together on the line of the top-stitch, finished sides facing each other. We then run a second parallel line of stitching on the back side of the material about $\frac{3}{16}$ " from the folded edge.

When unfolded and viewed from



Top-stitch pleating with cording on a side panel.



Folded pleats on a seating surface.



Canvas loop, rod and rigging twine.

the finished side of the material, the pleat looks as though two separate pieces were sewn together, giving a more defined design line in the upholstered panel. Not only does the pleat look better, but the thread is hidden between the two joined materials and therefore protected from sunlight and wear, enhancing durability.

We typically use this folded-pleat method on seats. The material thickness created by the folding process makes for an awkward appearance when the pleated panel is bonded to a hard surface such as a side panel. For that reason, we usually use plain, top-stitched pleats for side panels.

The final concept to discuss before the cutting and stitching begins is how to structure and secure the finished cover to the sculpted foamed seat shape.

Seat rigging

Once an ergonomic seat shape is created, we are challenged with the task of applying an aesthetically appealing assembly of soft finished materials to a complex, compound-curve shaped foam form. What this techno-speak means is that the seat isn't flat and we need to devise a way to securely hold the finished cover to the complex seat form.

The best way to do this is to sew canvas loops into a pleat or panel seam that is at a low point in the seat. A stiff steel wire is run through the loop of canvas. Several lengths of Dacron rigging twine are then tied to the wire. These pieces of twine are poked through the foam and seat sling as we pull the sewn cover onto the seat. The strings are then carefully pulled and tied off to the frame, adjusting the pulled-in contours of the finished seat cover as we go. It's much like pulling puppet strings until we create just the right contour and a wrinkle-free sculpted seat.

Of equal importance to the aesthetic beauty of this contoured seat is the structural connection achieved through this rigging system between the upholstered cover and the seat frame. Every time you get out of the seat, it is pulled

back to its designed shape by all of this structural interfacing.

We have tracked countless seats constructed this way that have been in service since the '70s. Thanks to good materials, proper fitting, double stitching and all of this rigging, they still look as good as the day they were first done. Many shops use glue to hold the seat cover in place. It might look good at delivery, but it won't last!

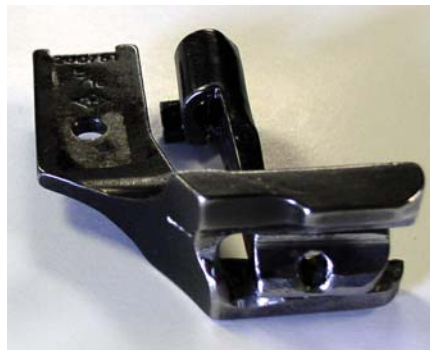
LET'S GET TO SEWING

With all of this theory covered, and all your seat materials cut out and backed with foam and backing fabric, it's time to start sewing it all together. To make things simple, let's assume we are using the corded-seam method.

To properly sew cording, you will need to use a cording foot. It allows the sewing machine to hold the cording and mating materials close to the needle for more precise control of the stitch. Sounds difficult, but practice makes perfect. You will get the hang of it.

For those attempting to do the sewing yourself, I suggest you practice with the surplus material you bought. Fabricate some cording and sew together a sample that replicates the actual assembly you will have in your final pieces. This will allow you to develop the skill needed to properly sew together the various components without risking the expensive aircraft materials.

With your practice panels finished to your liking, I would next sew the cover for a small, easy-to-sew component in the airplane like a baggage door cover. If you make a mistake, you won't



Cording foot.

be damaging much of your expensive material. Also, flat surfaced panels are easier to deal with, and you'll feel more confident when you take on the challenge of the seats.

After sewing a couple of smaller side panel pieces, it's time to get the hang of sewing a cover for a compound shaped seat. Again, small steps first. I would start with an armrest or a headrest which, if you screw up, you won't be ruining that much material.

With a headrest patterned, cut and backed with foam and fabric, lay out the facing and side panels. Index and mark with chalk exactly how they are oriented to the shape of the foam. If cording is being used, first sew the cord to the side panel.

Next, use the indexing marks to properly align the side panel to the face panel and staple the two together. Now it's time to carefully run a stitch close against the cording (remember the cording foot). Use only pencils or chalk to mark your materials. Pens and markers can bleed through.

With the headrest or armrest sewn, remove the staples and turn it right side out and pull it over the foamed shape. If it's too loose, either cut it down and re-sew it or add foam to the piece being upholstered. Never stuff loose filler material between the cover upholstery and the foam. It will shift around over time and the entire piece will look bad.

Sewing upholstery is a skilled endeavor, the full explanation of which goes far beyond the scope of this article. However, if you adhere to the basic concepts presented here and use the old upholstery as a technical guide, you can do it. Your existing upholstery can be a great tool. Study how the stitches were made and the components were assembled. It's how I taught myself to sew 30-some years ago.

I know you think I've told you how to build a watch when all you wanted to know was the time. Remember, I'm trying to write this stuff for readers doing an interior on all levels. For those who have no intention of ever sewing a

stitch, you will be relieved to know that sewing school is almost over and we will shortly see how to assemble and mount a seat.

Sewing a seat starts with assembling the face panels. Pleated sections are done first, and mating panels are sewn together with a structural pull loop sewn in where needed. Then the adjoining side sections are sewn in place.

Next, the cording is attached and the vertical side panel is sewn on.

Finally, each seam is flipped over and sewn from the opposite side, creating the double-stitch mentioned earlier—good insurance. The staples are removed and the retaining rods and rigging twine are installed. The finished cover is now ready to be mounted on the foamed seat.

Mounting on foamed seat

With the seat cover inside out, poke the rigging twine through the foam and



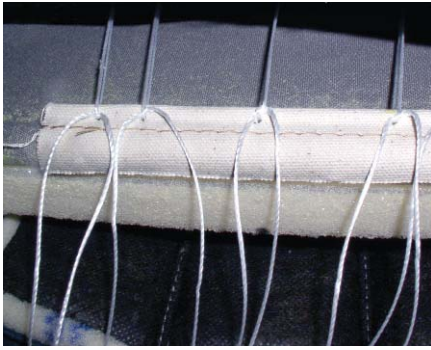
Seat face panels sewn together.



Vertical side section of the seat being sewn on using a cording foot. Note the double stitching.



With rigging loosely in place, the seat cover is now ready to turn right side out and pull over the foamed frame.



The rigging twine secured to the seat frame.

seat sling. Then lightly tie the lines to the rack that is secured to the seat frame. The cover is then turned right side out and pulled over the foamed seat frame.

Start pulling the rigging twine until you get the precise seat contour you desire. Secure the rigging, stand back and take pride in a job well done. Well, almost done. There is one other seat detail to discuss.

It is very important to physically secure the upper corners of the seat back map case to the seat frame. This will prevent the elastic seam and/or heavy objects in the map case from deforming the edge of the seat back. (How many times have you seen this in the field?)

Often a seat frame is either too small or the wrong shape to properly accommodate this needed fastener. In this case, we rivet a mounting tab of .050-inch aluminum to establish a good attachment for the map case. Trust me, a map case cannot be properly secured by thread alone.

While all of the above seat activity was going on in our sewing room, the technicians in the hangar were quite busy preparing and modifying the side panels for their run through the sewing process.

Sounds to me like a good topic for next month. See you all then – and fly safely!

Dennis Wolter is an A&P, IA and a 3,000-hour instrument pilot who started Air Mod in 1973 to bring innovative design and high-quality renovations to the general aviation market. Dennis, his wife Cynthia and 10 dedicated employees complete about 40 renovations each year at their facility on the east side of Cincinnati. Dennis has a degree in industrial design from the University of Cincinnati.



Improperly secured map case, pulling at the sides of the seat.



Properly secured upper map case (corner).



Map case securing tab ready to be riveted to the seat frame.



Here's the proof in the pudding! I know it's a lowly Cessna seat, but thanks to the good materials and techniques described in this article, this seat is now 12 years old and has seen about 800 hours of service. Not a wrinkle, torn seam or sag to be seen.