

INTERIORS

THE INSIDE STORY PART IV

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If you were with me last month, you know the design is finalized, the punch list is completed and the materials are selected. The next step may not be as visually exciting, but is definitely one of the most important design steps we take to develop an optimum interior.

Ergonomics

Since you physically relate to your airplane through the seat you sit in, making the flight station as ergonomically comfortable and functional as possible is extremely important. It's time now to take the numerous ergonomic measurements to ensure the best fit possible between the airplane and its users.

Fortunately for me, my first job after college was working in the medical training film department at the University of Cincinnati Medical College. One project we did there involved making cinemascope X-rays (X-ray movies) of people walking, sitting and standing, allowing us to see how the body structure articulates in different positions and doing various tasks. One of the many things I noticed about a person sitting in a straight back chair with no lumbar support was that their vertebrae became misaligned in their attempts to get comfortable.

Some of this orthopedic information I picked up has really paid off in my aviation career. When you become uncomfortable and begin to squirm in your airplane seat, you are subconsciously changing from one muscle group to the next until all of your muscles are tired.

In a nutshell, if your skeletal structure is held in its proper position by the

seat you are sitting in, your muscles won't have to work to hold you in that position. Obviously then, the design of a seat and foam shape is critical to comfort. And pilot comfort is a major factor in fatigue control and flight safety. Remember, the hard part of flying usually comes last. You want to avoid being tired or in pain when you're shooting that tedious approach.

Fitting a seat to a person can be done in one of two ways. If the person is of normal stature (5' 2" to 6'1") and has no physical anomalies such as fused vertebrae or scoliosis, we can use the standard-measure-of-man seat that is in the Beech cabin mock-up we keep in our office, and which many of you have probably seen in my booth at conventions.

With the customer sitting in that seat, we add (if necessary) additional foam shapes in various places, making slight adjustments until the customer is comfortable. Multiple dimensions and measurements are taken to complete this full ergonomic study of the person in the airplane. The seat, armrest and glareshield are all factors.

It sounds like a daunting and complex task, but it is actually quite intuitive and simple. The process really just involves cutting to fit and adjusting for comfort. The goal is for the customer to be comfortable with the shape of the seat and the position of the armrest, and be able to see without difficulty over the glareshield as well as see and reach all instrumentation and controls.

A word about the "standard measure of man." Periodically, an ergonomic study of the US population is taken and the resulting data analyzed to establish the physical dimensions of the average American. This standard measure allows manufacturers of automobiles, furniture and other commodities to build production items that fit 90 percent of the people who are likely to buy them. At my shop, we most often custom-build the pilot seat for the owner-pilot, and fabricate the remaining cabin seats to the standard measure of man.

If a person is taller than 6'1" or has



Fitting a customer to his partially foamed seat.

a special medical condition, we ask them to allow additional time for us to re-sling their seat and build the foam before they leave. While the customer is sitting in his airplane, we then cut our foam and install lumbar, thorax and thigh supports as the customer gives us progressive feedback. We continue until we are assured by the customer of correct geometry and approval.

What a benefit that all of this takes place before we actually cut or sew any upholstery. For those customers with back issues, we've even made use of a lateral X-ray as an aid in coming up with a correct and comfortable seat build.

Due to the fact that most Beech seats are mounted directly to the spar and for all practical purposes don't have a height adjustment, a very tall person may require a quite radical approach to the seat build. We're not miracle workers, but a surprising amount of adjustment and/or modification can be done to the seat bases, seat backs, foam build, armrests and even headliners to squeeze every inch out of these cabins. We'll cover this in more detail later.

Taking inventory

With that behind us, it's time to focus on the airplane itself. The first thing we do is taxi it to the avionics

shop on our field for an assessment of current conditions with radios, vacuum system, alternator, lighting, etc. Think of everything that will be affected by building, unhooking and moving things around. One loose wire or clamp and something won't be working at the end of the job. Everything is rechecked when the interior is completed, helping ensure a trouble-free delivery.

The point is, even if you're doing your interior yourself, it makes sense to check all of this at the onset of the project. You have an ideal time to troubleshoot and repair a problem when the interior is opened up, and imagine how you'll feel if you finish your beautiful new interior only to discover a problem that requires removal of newly installed components.

Organization

Interior renovation is usually a four-to-seven-week process, and things can get confusing and items can become lost if you're not well organized. Our first step is to secure the aircraft's documents, flight manual and logbooks. Then we box, tag and safely store any personal items the customer may have left. If you are taking your airplane to a professional shop to have a new interior installed, it's best to remove your personal items and keep them safely at home—peace of mind for you and less trouble for the interior shop.

Those tasks out of the way, we move on to parts and components. The system that works best for us involves the use of various sizes of plastic storage bins and tubs. One will be marked for and contain all headliner components, one for side panel parts, one for floor parts and so on. We often put intricate and small subassembly parts in labeled zipper bags before putting in the appropriate tub. And we are sure we have a place set aside for large and delicate pieces, such as plastic trim components. (Take this from a guy who once accidentally stepped on a \$400 window frame! Live and learn.)

We always keep a disposable cam-

era at each project location to record progress as we go. This camera is ultimately given to the customer. Memory being what it is, we also take digital photos of how things are originally installed that might be helpful to us weeks later during reassembly. The digital camera is also a great communication tool to show an out-of-town customer an unexpected problem or condition.

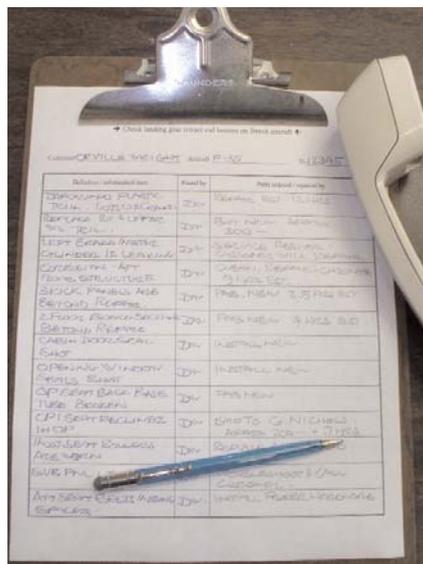
As components are being removed from the airplane, each is evaluated for needed repairs or replacement. With the airplane completely stripped out, every component, structural member and visible system can be checked, and required action outlined accordingly.

We obviously have our own in-house forms for this purpose, but if you're doing the work yourself you'll have to come up with some method to keep the project organized. (It's easy to overlook something in the course of a lengthy project).

Our formal teardown report contains a record of the discrepancy in question as well as a customer's response when we call back to get either approval for the repair or a request to defer the work.

Look over the list of items we typically encounter during the course of a thorough interior renovation.

Also included with this article are photos of some of these problems.



Discrepancy list with customer's response.

Space for photos is limited, so you'll just have to imagine what some of the stuff looks like. And yes, it's true—we really do see all of this!

TYPICAL ITEMS FOUND IN AN INTERIOR RENOVATION PROJECT

SEATS

- Cracked or broken frames
- Worn tracking rollers
- Worn or inoperative seat reclining mechanisms
- Worn seat tracks
- Missing or incorrect seat stops
- Improper seat belt attachments
- Frayed or deteriorated seat belts and shoulder harnesses

SIDE PANELS

- Torn or deformed side panel backing
- Crushed or torn composite side panels
- Damaged aluminum mounting rails
- Damaged armrests and mountings
- Old unused wiring not removed

FLOORS

- No spar crack checks
- Damaged or deteriorated floorboards
- Incorrect hardware
- Dirty bellies
- Oil-soaked wood floorboards
- Neglected components under the floorboards (cables, hoses, etc.)
- Missing or torn landing gear retract rod boots
- Torn, deformed or missing spar covers
- Collapsed heat ducts and plenums
- Corroded floor structural components

CABIN TRIM

- Deformed, brittle or cracked plastic trim
- Deformed or cracked glareshields
- Poorly fitting components

HEADLINER

- Torn metal backing panels
- Failing air outlet nozzles
- Defective cabin lighting components
- Improperly installed antennas and wiring
- Damaged air ducting

WINDOWS AND DOORS

- Leaking windows
- Improper seals
- Poorly installed seals
- Misadjusted windlace cords
- Out-of-adjustment or worn door latches
- Worn or damaged hinges and stops
- Years of door seal glue build-up
- Improper paint on doors and jambs
- Damaged or bent doors

Corrosion

The big item not included in the list on the previous page is corrosion damage. I hate the fact that we in the interior business now find ourselves in the corrosion-removal and prevention business. The major reason for this is neglect. There are a lot of maintenance people out there who are simply not pulling out the interior components for proper inspection, cleaning and lubrication of everything that is unseen.

Almost every pre-1975 Beech airplane we have worked on lately has



Broken seatback frame.



Improper seat belt attachment hardware—correct aircraft structural hardware and spacer shown in upper left circle .



Worn seat rollers.

required 20 to 40 hours of prechromating clean-up. We bill this work at half-shop rate, but it can still total \$600 to \$1,200. With proper maintenance and storage, the problem can be avoided. (For your reference, we did a three-part series on corrosion in the May, June and July 2003 *ABS Magazine* that goes into this subject in great detail.)

With everything removed, disassembled, inspected and written up, it's time to call the customer and convey our findings. Most jobs generate a discrepancy list of 15 to 20 items that can

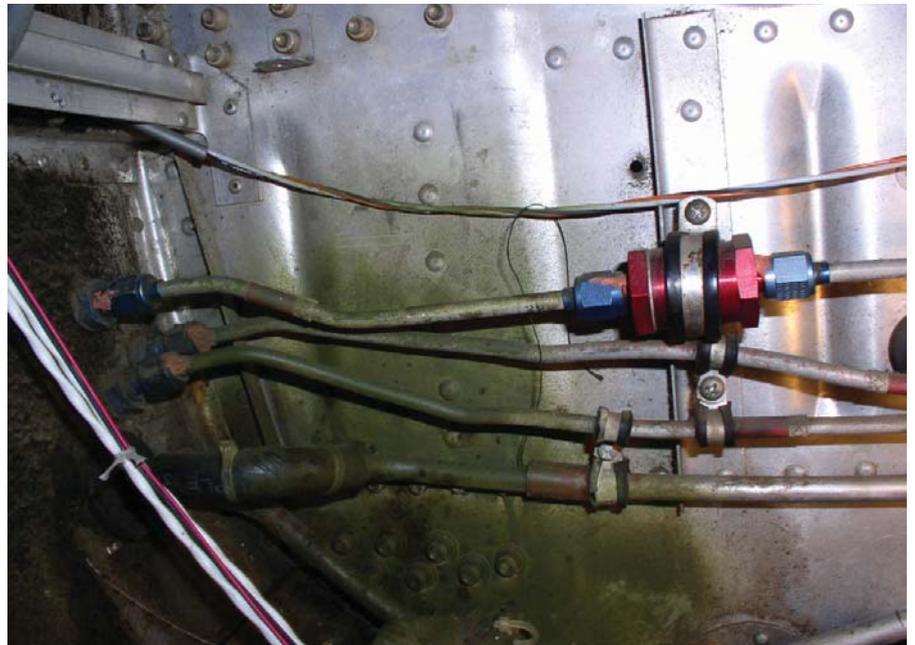
add 10% to 15% over the bid price. Let's say a new interior in a '62 P35 is \$15,000. It's likely there will be \$1,500 to \$2,000 in additional charges for unknown conditions or unpredicted repairs.

Reality check

Considering the age of most of our fleet, it's impossible for any shop to predict the exact cost of a thorough interior renovation. I'm certain you will encounter many policies and pricing structures at the various interior shops



Damaged side panel backing panels.



Even though the spar crack A.D. was signed off in the logbooks there is no evidence of it having been performed because the spar should be cleaned but with some dye penetrant remaining.

out there. We have struggled over the years to come up with a realistic way to be fair in our pricing.

In the early '70s, I included eight hours of repair time in each bid to cover the unknowns I have outlined above. It didn't take very long to realize the fallacy in that concept. There is simply too great a variation in the condition between one equally aged airplane and the next.

I think you should be somewhat leery of any shop that sticks to a fixed price for an interior. If you want the job done properly, that approach simply can't work. Those conditions and discrepancies that cannot be predicted in advance should be handled on a "time & materials" basis.

You're probably beginning to wonder how much more I can expound on interior renovation before I actually get into interior renovation! It should be clear by now that there is so much more involved than just choosing the right piece of fabric and carpet.

This is a multifaceted discipline, and a successful outcome is the result not only of some careful planning, but also an understanding of how many

seemingly unrelated issues are significant factors in the execution of a quality interior. But we won't put off the real work any longer!

In the next installment, we will definitely bring out our tools, scissors and foam knives and dig into the project. Starting with the fabrication and modification of your seats, from repair to build-up to final upholstery, we will

begin to see the evolution of that dream interior in every detail, every step of the way. Until then, fly safe!

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.



Damaged and flammable, oil-soaked floorboards (at bottom) and new composite floorboards (at top).



Heat-damaged plastic windshield trim.



Deteriorated and poorly repaired fresh air ducts.



Corroded floor structure and dirty belly.