Renovating the ABS/ASF A36

Part 7: Upgrading the Seats

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Photo 1

If you were to ask people what they like most about owning a Beech airplane, the answers would include build quality, performance, aesthetic excellence, avionics, cabin space, visibility, etc. It's very rare to hear an owner say *seat comfort*. Yet if you think about it, the seat is your physical connection with your airplane. The quality and comfort of the seat can create a love or hate experience when flying in your airplane.

Our aircraft seats perform some interrelated safety functions. First and foremost, they hold us securely in place. Imagine a defective seat latch that lets go, allowing the seat to slip all the way aft just as you are rotating on takeoff. A serious pitch up and stall event could very likely occur. We always very carefully check seat tracking and latching mechanisms when doing an interior. Another issue is crashworthiness and passenger restraint. In most Beech piston airplanes built after 1960, the seat belts are mounted to the tracking seat frames. The security and condition of the seat feet, rails, and belt attachments, as well as the structural integrity of the seat frame itself, are all critical to hold the occupant securely in the seat, particularly in an accident.

Photo 2

A third safety-related function is long-term comfort. Physical fatigue has long been a concern of aviation safety experts. A tired pilot can be a mistake-prone pilot. A poorly designed seat that does not properly and comfortably support its occupant can contribute to pilot fatigue over a three- or four-hour flight. It's not how much foam is in a seat cushion; rather, it is the foam's shape, dimension, and density. A properly designed and fabricated seat supports the skeletal structure of its occupant, compared to a poorly designed seat that requires a person to use his or her muscles to temporarily stay in a position that feels comfortable. After three or four hours of shifting positions, different muscle groups become fatigued and the seat can become quite uncomfortable. This discomfort can contribute to fatigue – and pilot mistakes.

The airlines and the military have made concerted efforts to study and mitigate this part of the pilot fatigue issue. As a result of their research, they now install crew seats with adjustable lumbar and leg supports to help improve comfort for their flight crews.

We think it is important to bring this human factors technology to the light aircraft market. As we are designing a new interior with our customers, we have them sit in a Bonanza fuselage that permanently resides in our front office **(photo 1)**. We take specific measurements to ensure we build a seat that maximizes the individual pilot's comfort level. First, we establish that the seat base height is correct. This will ensure optimum view over the glareshield while allowing for as much head room as possible. We then focus on determining accurate thickness, contour, and location of lumbar support for the customer's lower back, thigh support for their legs, and a thorax contour for their upper back. We also install half-teardrop shapes of high-density foam to the outer edges of the seat back, adding support in the area of the kidneys and to the outer edges of the seat bases, creating a concave seating surface **(photo 2)**. This gives an occupant the comforting sensation of sitting *in* the seat rather than *on* it. Sculpting also adds to the aesthetic appeal of the finished seat. Finally, we measure the customer's relationship to the armrest to create an ergonomically correct seating station. All of

this data is recorded for us to follow when the pilot and copilot seats are fabricated.

All other seats will be built to what is known, in ergonomic circles, as the *standard measure of man*. Currently, that is a person who is five feet, eleven inches tall and weighs 190 pounds. Using "standard measure of man" data to build the remaining cabin seats will comfortably accommodate 90 percent of the current population. Since he will not be the only pilot of the ABS Air Safety Foundation A36, ABS/ASF Executive Director Tom Turner asked us to stick closer to "standard measure" for the pilot's seat as well.

When the seats come into the upholstery lab, they are completely stripped down to the bare frames. A technician with an airframe mechanic certificate places the assembled, stripped seat frames on a bench-mounted set of Beech seat rails and checks the frames for deformations, corrosion, or cracks **(photo 3)**. Every tracking roller, latch mechanism component, and seat reclining system is thoroughly inspected for condition and function. Any problems are photographed and recorded in a discrepancy/defect report. This information is sent to the customer for approval prior to being repaired.

Photo 3

Once the seat frames have been inspected and repaired, they are turned over to our foam builder. Don begins by installing new seat sling reinforcements fabricated from two lengths of tightly bonded and clamped seat belt webbing. He then bonds a drum-tight, high-tensile strength Dacron® canvas sling that replaces the old stretched and sagging factory sling **(photo 4)**. Unlike the original, this two-component sling system will never sag; the double sling is your insurance! The ergonomically designed foam will always remain in its proper location, retaining the correct geometry for the life of the new interior.

Photo 4

With the new slings installed on the seat frames, Don analyzes the seat foam design data that was recorded when the customer was measured in the mock-up seat. Using this information, Don then builds the new seat cushions using multi-density, flame retardant urethane foam.

It's important here to discuss an alternative to using multi-density urethane foam. If the airplane is in a rental or flight school environment where measuring the main pilot is not an option, building the new seat to the standard measure of man

Photo 5

specs using thermal elastic foam may be the best option. Confor® foam (formerly known as Temperfoam) responds to weight and body heat, and conforms to the size and shape of the seat's occupant. It is heavier and may be less durable over the long haul than urethane foam. However, it presents a viable option to the one-size-fits-all challenge. One distinct advantage of Confor® foam is that it is capable of absorbing a tremendous amount of impact shock, resisting rapid compression as pressure is exerted on it. This can potentially reduce back injuries in an accident where there is a hard downward impact. Since the seats in most

Beech airplanes are mounted directly to the wing spar, with no energy-absorbing seat frame to collapse under an occupant, installing this type of foam can represent a potential safety enhancement. This is just my intuitive theory; I have no empirical data to verify my supposition. But anything that can reduce "G" loads on the body has to be a step in the right direction, and Tom Turner chose to install Confor® foam (the pink and blue sections) for the two front seats in the ABS Air Safety Foundation Bonanza **(photo 5)**. With the seats slung and foamed, we do a final cleanup and painting of the frames.

Next it's on to the sewing lab, where Melanie and Sandy work their magic. Referencing the design drawing that Tom and I put together, the seat finish covers are patterned using the newly shaped foam seat as a guide. The seats are vinyl and fabric instead of the more common leather, for long-term use and also to keep the Foundation's costs lower. All of the individual upholstery pieces are cut, backed with ½-inch, medium-density, flame retardant foam and a thin but strong backing fabric. These materials help create a wrinkle-free and elegant appearance to the finished seat. The next step is to sew the seat panels together using the most durable stitching techniques to ensure long-term durability and appearance of the new seats.

Because this interior is being installed in a working airplane, Tom made good choices from a durability standpoint when it came to sewing options for the seats. We used a corded edge seam as opposed to a top-stitched or French stitched seam. A corded seam protects the stitching and the edges of the finish materials from sunlight and wear. Unlike a French stitched seam, cording is renewable. If it would happen to become worn, the cording can be carefully removed and replaced with new. When an unprotected and exposed edge of a French stitched seam becomes worn, the only fix is to replace the finish material. I personally like the more elegant appearance of a top-stitched seam, but I chose to use corded seams in my own airplane. It looks good

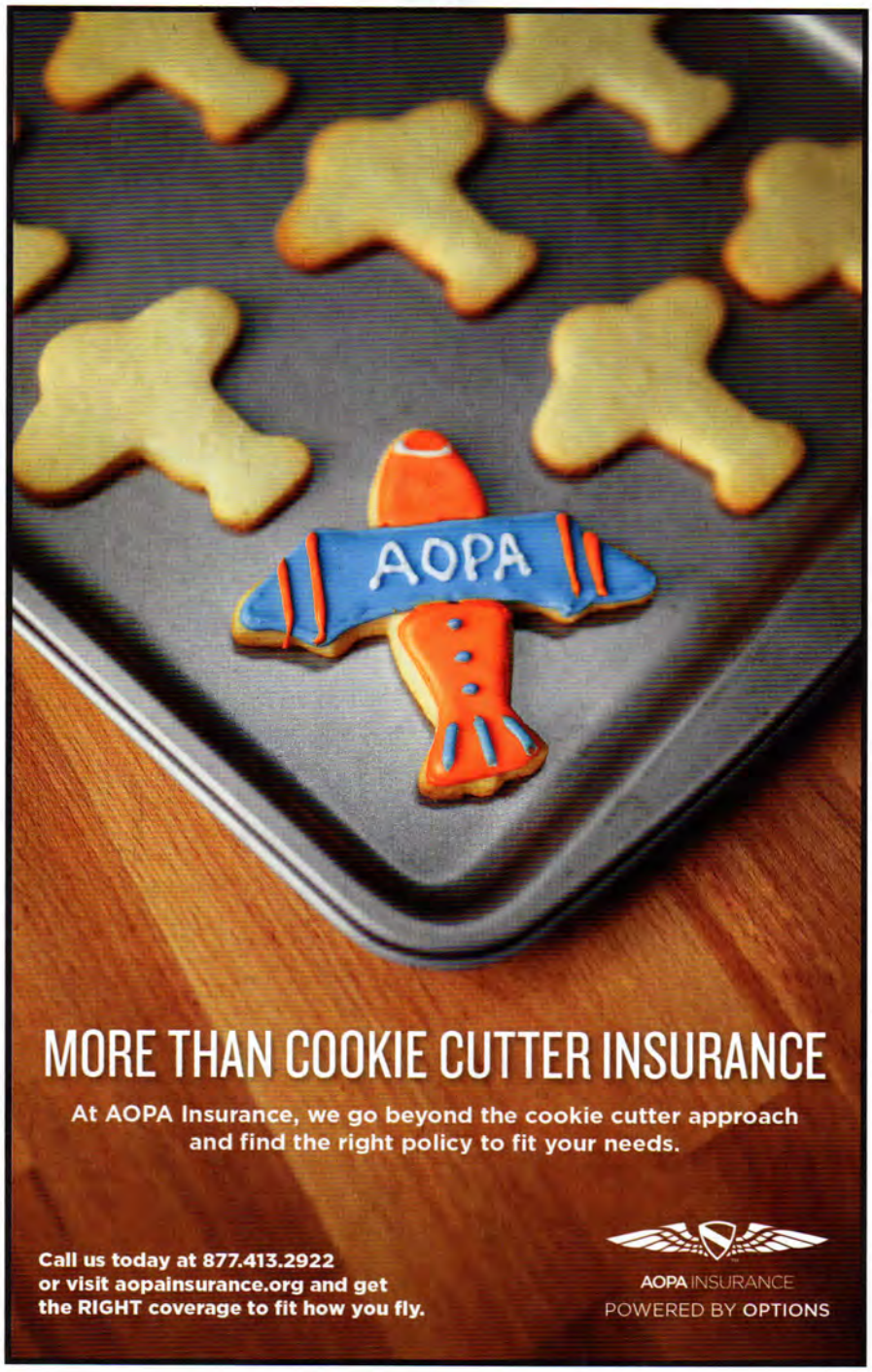

Photo 6

when it is on display at aviation events, and it can withstand rough treatment of loading camping gear and an occasional antique motorcycle into my aircraft. That said, with proper care, French stitched seats will hold up well in most private use environments. I advise our customers to choose the stitching style that most appeals to them aesthetically.

So the sewing begins **(photo 6)**. Each seam is double stitched to ensure that no seam will ever fail **(photo 7)**. Loops of canvas, steel rods, and rigging twine are built into seams that are located in low points of the seat bases and backs **(photo 8)**. The rigging twine is pulled through the seat foam and sling, and then attached to the rack at the base of the seat back. This hidden rigging establishes a structural connection between the finish upholstery cover and the seat frame, creating a very sculpted look to the seat that will not sag or develop unsightly wrinkles in the future.

Tom chose to have the Beechcraft logo embroidered into the headrest **(photo 9)**, tastefully picking up the color of the red cording in the side panels, and subtly helping to coordinate the design of the interior with the A36's stunning new paint job.

Once the finish covers are sewn and trimmed, they are then mounted on the foamed seat frames. New tracking rollers are installed and adjusted as necessary **(photo 10)**. As we said earlier, it's critically important to check the tracking and latching of these seats. Any difficulty is a serious concern that should be addressed immediately.

Photo 7

Next month, we will take a look at preparation of and improvements in the cabin prior to the installation of new insulation, interior trim painting, and door and window seals. Until then, fly comfortably and safely!

Photo 8

Photo 9

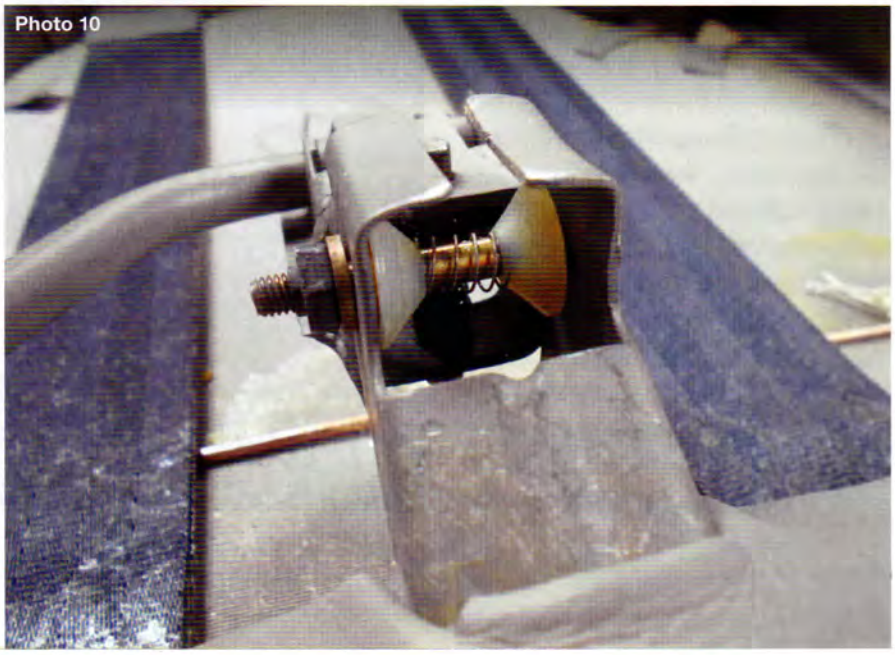
Photo 10