

## *Composite Repairs Figure Highly in Future Maintenance*

By AIRM Staff

Rivets are so passé. The era of composites has truly overtaken the general aviation industry, with great designs like the Cirrus SR20/SR22. In use on military and large commercial airplanes for decades, these composite designs are proving that they will be an increasingly common sight at airfields nationwide.

For airplane owners, the increased initial cost of purchasing a newer composite airplane should correspond over the lifetime with lower costs to repair and maintain the airplane's structure.

Composite construction, where the airframe is built primarily with durable, pre-impregnated fiberglass that forms the bread in a sandwich around a porous foam core, results in a strong structure that adds minimal weight. Additionally, composite construction allows for reduced drag from surface area and seams, according to manufacturers like Cirrus Design, which is the world's second largest manufacturer of single-engine, piston-powered aircraft.

Cirrus has spent the last three and a half years training more than 100 technicians in its repair techniques for the composite airframe on the SR20/SR22.

"We have been setting up [a network of] 130 authorized Cirrus service centers worldwide," said Corrie Volinkaty, technical instructor for field services at Cirrus.

The strategy, he explains, has been to space these centers geographically so that each center can count on enough repair business to make it financially viable to maintain its A&P mechanics' expertise on the Cirrus airplane.

Corporate Flight Management, a FBO operation in Smyrna, Tenn., has actively gone after composite business, not the least of which is due to its operation as a service center for Cirrus and another composite aircraft, Diamond's Katana.

"I've sent two guys to take the training course at Cirrus and another guy to school at Diamond. The courses are two weeks in length and then you get on the job training by working with another qualified worker," said Leon Custers, vice president of maintenance for Corporate Flight Management (CFM).

Custers adds that after a couple of months of that on-the-job experience, depending on the volume of work, he lets the technician begin to work on his own with the composite repairs.

In theory, composite aircraft require less repairs from low-speed, low-energy impacts, such as bird strikes, than a comparable impact on an aluminum aircraft, according to Cirrus' Volinkaty.

“If the two planes, one aluminum and one composite, were traveling at the same altitude and speed then the aluminum will suffer extensive deformation, whereas the composite will bounce back. It takes a much more severe impact to composite to cause comparable damage,” Volinkaty explains.

Custers estimates that minor dings and small holes in a composite aircraft would cost about \$1,500 to \$2,000 and be finished in about five days. For example, a major collision, which was caused by an aircraft coming off a towbar and running into the towing vehicle, generated a \$35,000 repair bill just for the composite work and it took about 2 months to repair the cosmetic and structural damage.

These costs haven’t translated into cheaper insurance costs for composite airplane owners however, in fact, Cirrus had to practically twist the arm of at least one underwriter to cover its aircraft.

“We had one underwriter, who shall remain nameless, tell us they didn’t want to insure ‘disposable’ aircraft, as the conventional wisdom was that composite aircraft would not be worth repairing after an accident,” said Bill King, vice president of business and administration for Cirrus. “So we offered to take a pickup truck with a 2x4 strapped on either side and drive it between two airplanes, one aluminum and one composite, and then challenged them to see which was cheaper to repair.”

Perhaps it would have been instructive, however the underwriters never took them up on the offer, but they did begin writing coverage for the composite aircraft.

It’s worth noting that the SR20/SR22, which both sport a parachute recovery system, has had seven deployments thus far and all but one of those aircraft were repaired to airworthiness again.

The largely determinate factor in negating any insurance savings from lower repair costs is that hull rates are so much higher on the newer composite aircraft than on comparable aluminum aircraft, according to King. The longevity of certain aircraft, such as a Cessna 182 or Piper Warrior, also means that salvage parts are readily available, often at a much lower price.

For a prospective buyer of a used composite aircraft, Custers notes that proper repairs are nearly invisible to even the trained eye and are just as strong as the original structure. CFM, a FAR 145 certified repair station, operates under stringent guidelines as dictated by the FAA. These include detailed calibration regimen for its tools and an exhaustive documentation practice.

Telling if the work was done properly can easily be accomplished by checking the contours and paint, as well as, performing a “tap test” to see if any delamination is occurring under the repaired section, he said. The aircraft’s log book and the repair documentation is also useful in confirming a repair was successful.

“We’ve started taking digital pictures of everything that we do as part of a repair and as we take the aircraft apart. The biggest reason is liability, since ‘saying’ what you’ve done is not as strong as being able to ‘show’ what you did should it ever go to court,” Custers said.

These pictures also serve the manufacturer, who is often consulted directly during repairs. “Digital repairs are definitely speeding up the process,” Volinkaty explains.

Any repair to the aircraft is done in conjunction with the manufacturer, whether through standardized repair procedures or crafting a unique repair deviation in consultation with the aircraft’s engineers. Thus by viewing pictures of the aircraft with appropriate reference markings made by the technician on site, the engineers are able to create a custom repair scheme for that particular damage without having to see the aircraft in person.

### **Cooking up composites**

The repair techniques for composites are more like following a cooking recipe than hammering on sheet metal. The process involves layering resin-impregnated material and then heating it to a certain temperature for a specified length of time.

The technician lays the ply down and then uses a heat lamp or heat gun in conjunction with a digital thermometer to reach 185 degrees, plus or minus 10 degrees, for the 10 hours needed to cure the patch. Since curing time is cumulative, a repair can be made during operating hours or as the technician is available to monitor the process.

In actual man-hours, composite repairs are faster, but, because of the curing process, actual total time to complete a repair is about the same or a little longer than with sheet metal, according to Custers.

### **Manuals are expensive**

The costs associated with maintaining an aviation repair shop are tremendous, despite increases in technology to make the process easier. This is likely going to squeeze the smaller shops into specializing in particular aircraft or out of business all together.

“Two things that have become very expensive in this industry are tools and technical publications,” Custers said. “I probably spend easily \$45,000 a year in technical documentation for repairs, inspection criteria, teardown procedures and troubleshooting guidelines.”

For example, he points out that it costs him \$15,000 for Jetstream manuals and he can spread that cost out over roughly 30 big jobs on that aircraft in a year. A smaller repair station would have the same costs in manuals, but may only see one or two such jobs in a year.

“In the mom & pop world, I believe it will become more difficult for those smaller shops to remain competitive,” Custers adds. CFM also has a high-speed Internet

connection to its hangar, three computers on the shop floor for reference and a wireless network for mobile workstations and laptops.

A shortage of qualified technicians is also something that hits shops both large and small.

Custer admits he is trying to fill four full-time positions. "I'm having a very hard time right now."

The problem, he expects, is only worse for smaller repair stations.

One insurance factor that is driving changes in the repair industry is the ability of a FAR certified repair station to sign off on repairs as an entity rather than by individual.

"A single A&P mechanic in a small shop has to put his personal name on everything he does as an individual. He's personally liable, whereas here ... the company is liable as an organization," Custers said, though noting that in the case of gross negligence, a FAR 145 station would certainly seek to hold that employee liable for that action. →