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Make it Quick!

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The ID Group and C&D Zodiac Aerospace accept the challenge to produce a full-scale, working model of the new Learjet 85 interior in just 10 weeks, lending a whole new meaning to "rapid prototyping." When Huntington Beach, CA-based design consultancy organization ID Group was approached by C&D Zodiac Aerospace to assist in building a model of the new Learjet 85 interior for the National Business Aviation Association's (NBAA) annual convention, there was one major concern: the full-size, working model must be completed in 10 weeks.

With Lear hoping to showcase the sleek, all-composite interior in a manner highlighting the luxury, comfort and visual appeal of the aircraft, there was no room for mistakes.

Together with C&D Zodiac Aerospace, ID Group began racing the calendar.

Getting Started

Lear provided ID Group with 2D sketches of the fuselage and the plane interior that they had been developing. ID Group then generated 3D computer models based on the sketches, and they digitally prototyped the entire interior. Once Lear signed off on the prototype and indicated that the renderings captured the intended design, ID Group and C&D Zodiac began to build.

The intention was to not only complete a model for the show, but also to enable Lear employees to see the interior in 3D, and to ensure that all of the parts are the correct size and shape for the finished product. ID Group created tools for C&D Zodiac to use in forming the composite parts.

"We did the CAD data and we made prototype tools mainly out of high-density foam," explains Jeremy Wilkens, Industrial Designer at ID Group. "We then CNC-ed the tool and send it over to [C&D Zodiac] and they actually pulled vacuum bag composite parts right off of these tools." This process helped to validate the design and engineering work prior to production tooling. Because tooling and parts can cost hundreds of thousands of dollars, it was vital that the tools be designed correctly to avoid costly mistakes during production. ID Group relied on Objet Geometries' Eden500V 3D printing machine to create the parts.

"The Objet sends a 3D CAD file from pretty much any CAD software down to the machine, and the machine actually builds or 'grows' the part off the table," Wilkens says. "It actually layers materials - each layer sticks to the layer below it - until you have a part that's grown off of the table." Essentially, the Objet machine works like an inkjet printer, only instead of printing down a page, it prints perpendicular, depositing a support material and an acrylicbased resin in layers to create a 3D part. The support material is used to create a platform for the part to grow on, and allows for undercuts and hollow shapes. The resin fuses to the layer below it, leaving, in the end, a block-like representation of the desired part.

The support material is then washed away and the hard, plastic part remains.

Running into Challenges

Having to build every component to spec of an aircraft interior in only 10 weeks was difficult. Some of the parts, in particular, presented significant challenges,

given the time frame. One of the key visual elements in the interior is a large PSU panel that sits over the club seating cluster. ID Group had to build the unit in three parts to complete the 50" panel on the machine. First, a master part was made, and then a silicone mold was produced off of that, and finally five or six urethane copies.

"When we were done, we had a higher-temperature material than comes off of the machine normally, and that allowed us to make multiple copies relatively quickly and inexpensively," Wilkens says. "The whole idea of rapid prototyping in general is to prove out problems and solutions as quickly and inexpensively as you can, and this Objet machine certainly helped us to do that."

The biggest challenge overall was the timeframe itself. The Objet machine often was used to prove out small engineering parts before they went to CNC to make sure the geometry was right and the part was functional.ID Group would rapid prototype the part overnight on the machine, then check the fit the next morning. Once the part was validated, it went to C&D Zodiac's machine shop and they cut it to the same specifications as the prototype.

"Instead of having your CNC guys spend a day programming it and another day cutting it, then find out they're all wrong, we can find out if there's a problem sometimes in hours, rather than days," Wilkens notes. "For something that's moving at a 10-week pace, that's a huge savings."

The fact that C&D Zodiac and ID Group were working hand-in-hand helped to make the project possible. Lear had sent some people to work alongside C&D Zodiac and ID Group in Huntington Beach, and all three organizations met nearly every day during the process.

Factors such as budgetary concerns, shrink rates, and integrating data from all three sources had to be considered in addition to the timeframe issue. Compromises had to be made to make it all possible.

The Finished Product

"We were pretty nervous because we had invested a week or two of time in making all of these prototype tools and casting the first set of parts for check-fit, and if it didn't fit, we weren't sure how we would get that week or two of time back," Wilkens admits. "It's the little things like that that are kind of nerve-wracking."

But Wilkens need not have worried, because the program was completed on time, and Learjet's leadership was impressed with the quality of the mock-up and the speed with which it was delivered. Everything from Passenger Service Units (PSUs) to attendant call buttons, to full-size ceiling panels had been reproduced to the utmost detail with the help of the Objet Eden500V.

"Once it got installed in the shop over at C&D Zodiac, that was the first time the Lear executives were able to actually walk into this interior that they've been looking at sketches for years, so it really takes it to the next level," Wilkens recalls. "They had been living with sketches and pictures for so long, that they really thought they had a good feel for what it was going to look and feel like, but once you build it and you actually step into the environment, your whole perception of the design changes quite a bit."

The Learjet 85 interior premiered at the NBAA annual convention and exhibition in Orlando, FL on October 6, 2008.