The Airplane Plastics Company

If It Can Be Formed, They Form It

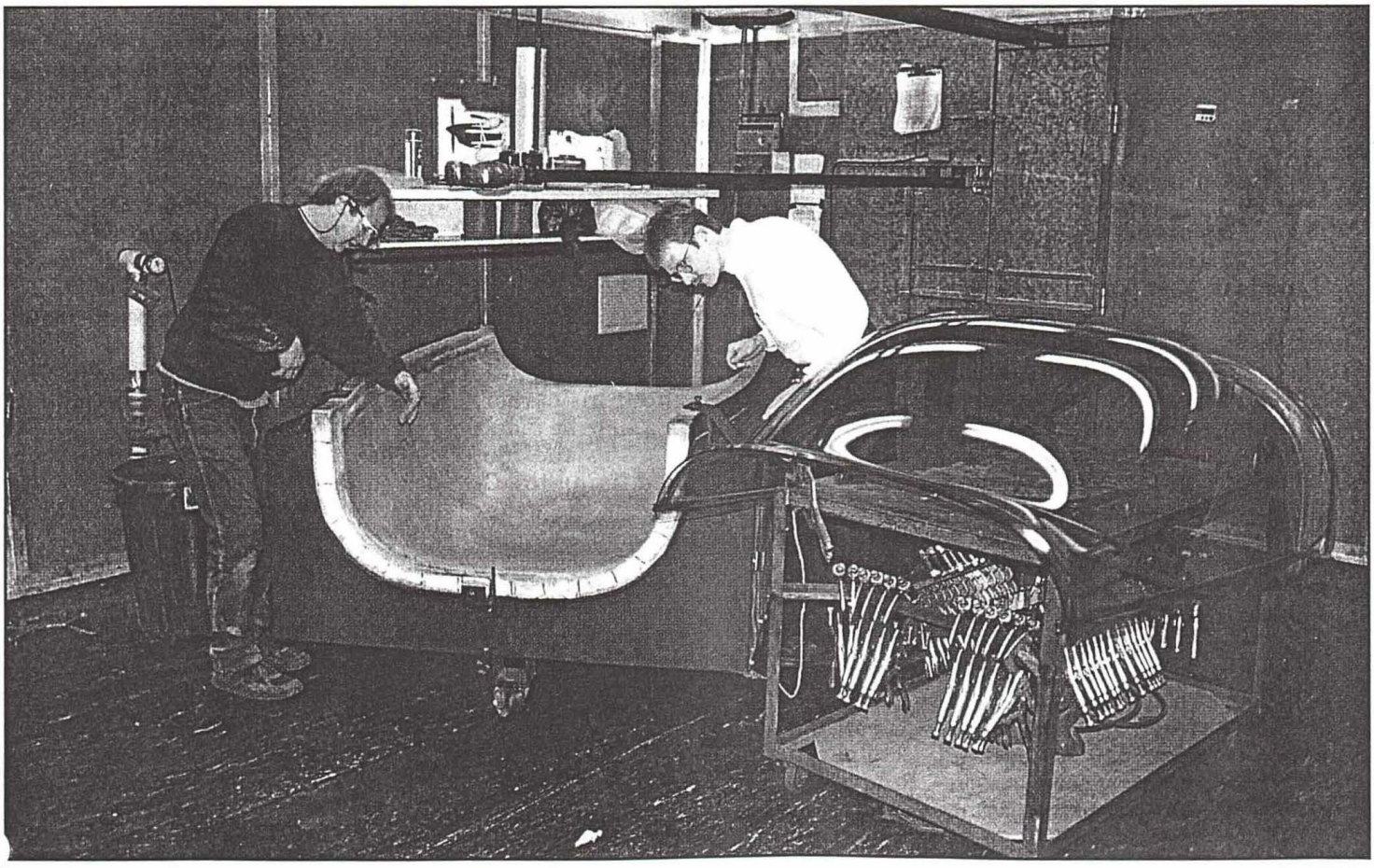
Article and Photos
By Budd Davisson

It sounds like a cliché, but Fox Lite Manufacturing actually did start in a garage. Well, that's not exactly true; it was a small horse barn. The sprawling facility housing Walt Hoy's business and his 65 employees a few miles east of Wright-Patterson Air Force Base in Dayton, OH can trace its roots back to a barn and the fact that no one made a two-place bubble canopy for an Acroduster Too.

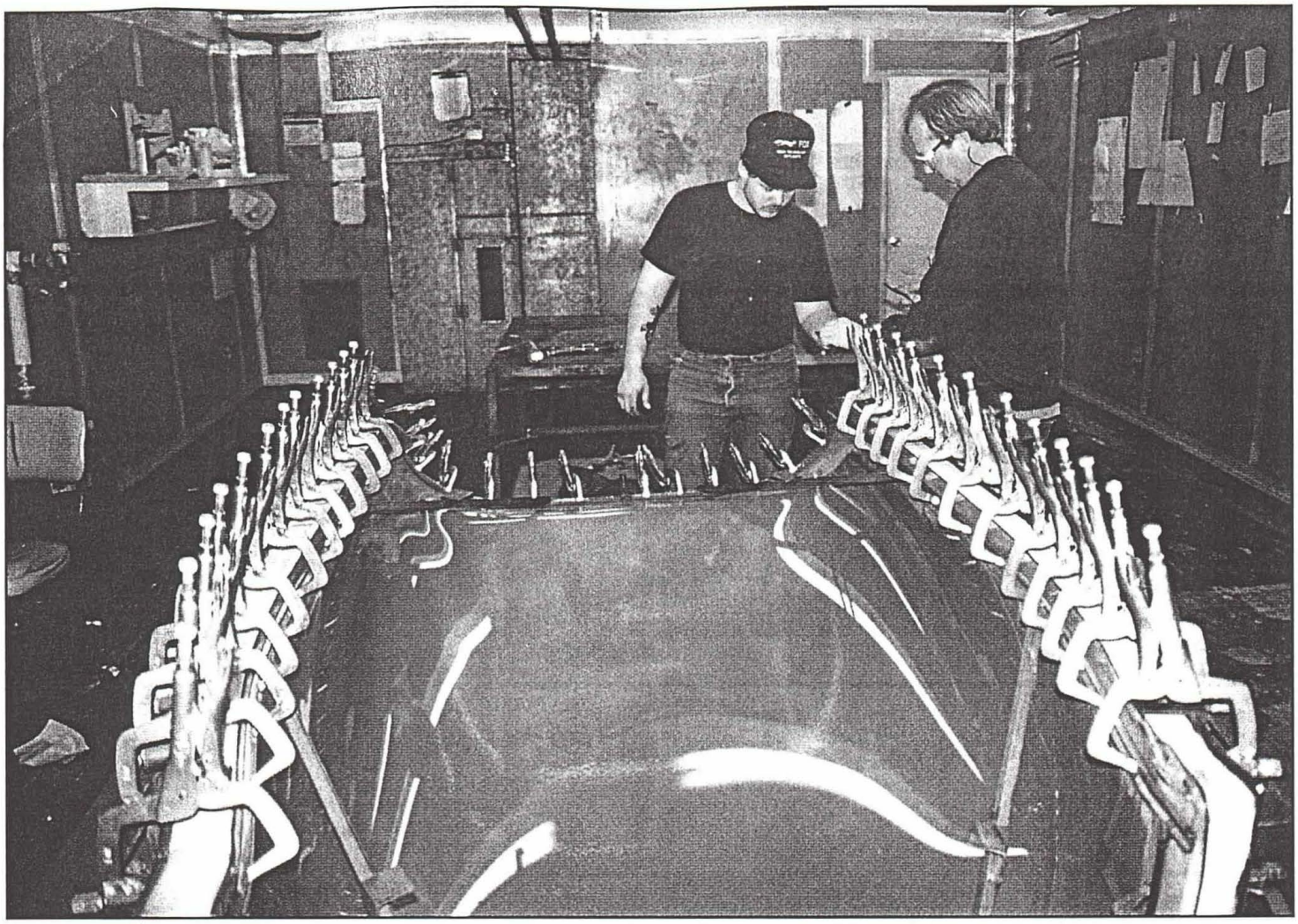
Walt Hoy has a way of looking around, seeing a product that isn't being made or seeing a better way of making an existing one. Then he jumps in and starts doing it. His personal inertia is practically zero. He's always ready to start rolling and his son Doug is there to keep the production line going.

Hoy was a career Air Force pilot and engineer whose last tour was at Wright-Patterson AFB, home of some of the Air Force's research projects. One of them brought Hoy into contact with a combination of people and materials that would later help form the basis for his business.

The project was an RPV named XBQM106 (they dubbed it "Killer Fox") which looked a lot like a big model airplane because that's exactly



Jeff Rogers and Doug Hoy inspect the mold prior to pulling a RV-6 canopy. The mold has holes in the bottom for vacuum which helps pull the warm Plexiglas™ all the way in.



A partially formed canopy blank is clamped into the mold using a steel frame which sets the edge shape.

what it was . . . a 10 foot, zero-length rail launched RC model powered by a 10 hp McCulloch 101. But this was a model with teeth. It was designed to loiter over enemy airspace seeking targets and then dive directly into them at 200 mph.

It is the way it sought out the targets that made it unique.

Hoy and his project team members came up with an ingenious radar seeking device that utilized four automotive radar detectors to home on a radar signal. They also came up with a listening device that would let the model recognize the acoustical signature of specific types of mechanized armor and go after that as well.

Since the bird was mostly composite, it had practically no radar image and could buzz around in enemy airspace for hours, waiting for someone to turn on a radar unit or a tank to rumble through its territory. Then it stuck its nose down and let its 50 pound payload do its job.

The entire airplane and all its internals were extremely simple and reliable but had one fatal bureaucratic flaw: the unit was inexpensive to build ($5,000 plus electronics) and operate. As if that wasn't enough, it wasn't terribly glamorous looking either. It just did the job. So it was canceled.

But, the project had its technological fall-outs and Walt Hoy and sport aviation became the beneficiaries.

Among other benefits, Walt became knowledgeable in both composites and plastic forming. He also became good friends with the owner/president of Fox Industries which made the extremely popular radar detector. Both were to work to his benefit in the future.

When Walt retired as a Major in 1978, he continued doing what he had done his entire life - playing with little airplanes. Throughout his career, there had never been a time he didn't own at least one little airplane. So, when he was finished flying the C-130s, C-123s or any of the other aircraft or helicopters he flew in his job, he always had something small to play with. Usually that kind of play meant restoring or building.

The project right after his retirement was an Acroduster Too and he decided the Ohio weather dictated a canopy. He didn't want the winter to shut down his flying fun. However, no one made a two-place bubble that would fit the little biplane. So, in typical homebuilder fashion, he began expanding his knowledge of acrylics and built his own bubble.

It is unknown whether Hoy knew he had an entrepreneurial bent while he was in the service, but it certainly surfaced as soon as he was out.

Looking around, after blowing his Acroduster canopy, he realized he must not be the only guy having troubles finding the right bubble canopy. At that time a lot of Sonerais were being built, so he designed and blew a canopy for Monnett's little speedster and ran a small ad.

A week after the ad came out he was in the canopy business and it has never slacked off.

Then one day he was sitting in his den gazing up at the skylight that had never actually stopped leaking. It had always been an aggravation and he told himself, "I can make a better skylight than that." So he did.

Using foam and aluminum for a base, he blew his own skylight and installed it.

He had remained good friends with his Fox radar detector buddy who looked at the skylight and was impressed. He had built up a number of companies from the radar detector business and to make a very long story

business building skylights with the canopy business integrated into the production plan. Eventually Walt bought the company which is now known as Fox Lite, with the canopy division working under the name of The Airplane Plastics Company.

When we arrived it was obvious this was a company in the process of expanding while still trying to keep production from stumbling over itself. Walt Hoy was out of town but Doug took us through the plant. While doing so, he was continually interrupting himself by saying, ". . . and this used to be over there and we're moving this over to this side." The ground next door is in the process of being cleared so the plant can be doubled in size. Things must be looking up in the skylight business.

But skylights are a long way from being their only business. Even as we wound our way through a maze of CNC routers and past a dome forming machine that looked like a carousel from Terminator II, we saw product after product and process after process that could be adapted to making parts for aircraft.

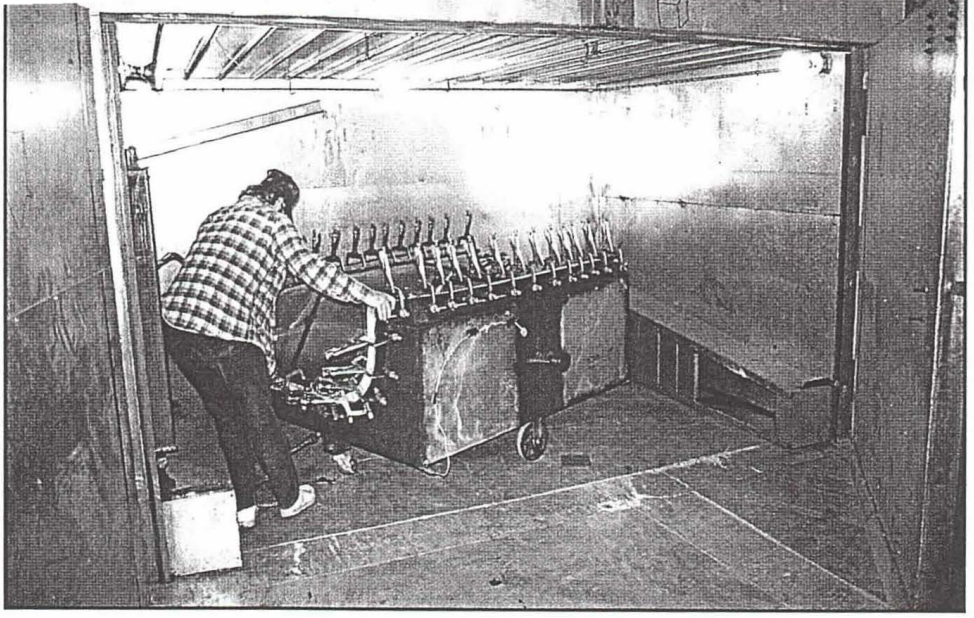
And this isn't lost on the Hoys. They were homebuilders at the beginning and they are homebuilders today. The Lancair IV that's going together in a converted office area mid-factory testifies to that.

Both of the Hoys are engineers, with the elder having an MBA and the younger a masters in engineering. Far beyond that, however, it is obvious they combine an innate understanding of things mechanical and production processes with an entrepreneurial urge. Doug never strayed far from airplanes in his conversation and how they could make this part or that part and how they were gearing up to try a new carbon fiber forming/curing process and how it might be applied to aircraft.

The canopy making operation occupies a sizable back corner of the building with the area dominated by what looks to be galvanized steel garages against several walls. The clear area between is machine shop.

The galvanized steel garages are, in one case, a gigantic oven. The other is a combination clean room and oven. Either is large enough to accept the family sedan should you want it baked or broiled.

The entire area is the domain of The Airplane Plastics Company under the leadership of Jeff Rogers, Mr. Canopy of Fox Lite. Jeff has logged nearly 15 years with the company, every minute of it making canopies, so it is understandable that Doug stands back and lets Jeff do the talking when it comes to canopies.



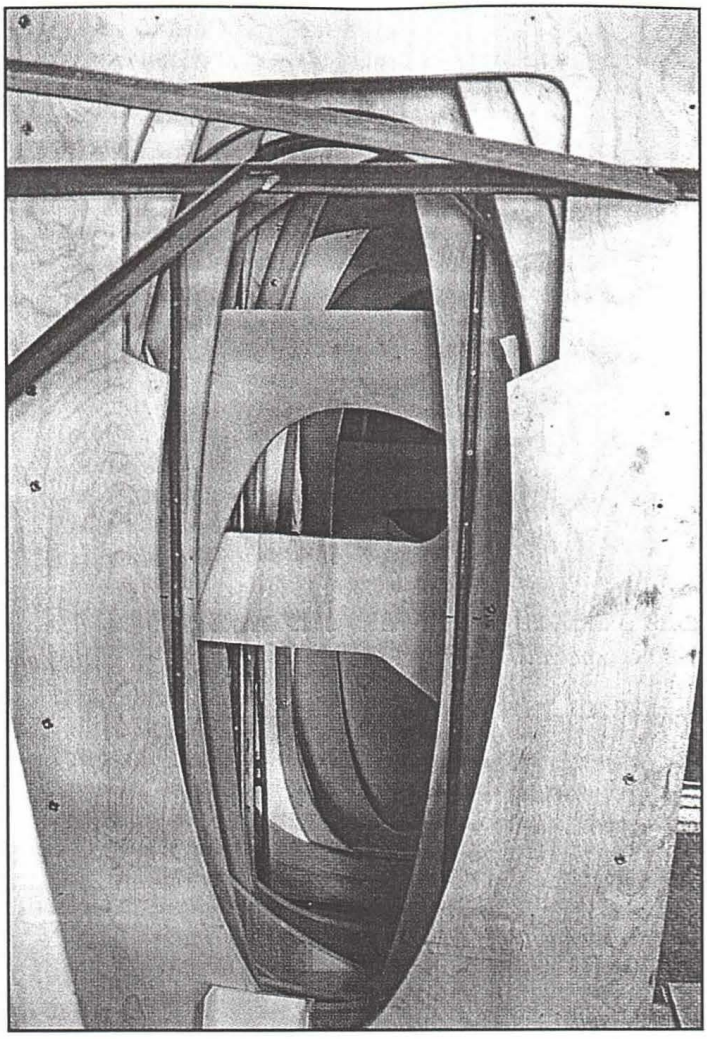
The entire mold is warmed in a specially constructed oven which holds an even temperature at all points within it.

Doug Hoy, left, cut his teeth in the aerospace industry as an engineer before going to work with his father as production manager. Here he and Jeff Rogers inspect a finished RV-6 canopy.

The canopy making process can involve at least four different types of molding, depending very much on how the canopy is to be shaped. The most common is the free-blown variety such as found on Long-EZs. Then there is the draped method in which a sheet is allowed to sag into a mold. This is limited to fairly shallow canopies or those with little or no compound curve to them. Then there is the wrapped variety which is pulled around a mold.

The most common canopy forming system Airplane Plastics uses is that which is used on the RV-6 canopy which, understandably, is also the most popular canopy for them at the moment. Because of the compound curves and the width of the canopy, even when heated it won't flow down into all the required shapes, so it needs a little help in the form of suction in the bottom of the mold. That's the process we saw in action during our visit.

The first step in making any canopy is taking the raw material, cast acrylic sheet 3/16" thick, hanging it from a rack and putting it in the oven. The object is to get the sheet to relax. It is a form of stress relieving and lets any flaws formed in the extrusion process come to the surface. Often, a wave or glitch that was not there when the sheet was received will appear once it is heated and internal stresses removed. If this first step is eliminated that defect could wind up right in the pilot's field of vision. Once the sheet is cooled, the canopy blank is laid out



Stacks of mold boards for a wide variation of aircraft attest to Airplane Plastics' willingness to make a canopy for anything.

so the defect is out of sight at the rear or off the blank. Often, however, the defects require the sheet be trashed. Jeff says they lose at least 5-10% of their raw sheets at that step.

There are lots of secrets to making good canopies, especially when the definition of the term "good" includes a high quality optical finish. If optics aren't part of the equation, the process becomes much simpler. If the pilot wants a clear, clean view of the world, then Jeff and his guys have to use every trick in their considerably deep bag of tricks. The mold includes most of those secret tricks. It has to be accurate and totally free of defects. Jeff says it can take six to eight weeks of full time work to produce just one mold. The molds themselves are made of aluminum filled epoxy cast into a steel frame with lift points on the sides. Those pivotal lift points are another secret . . . they let Jeff pick the entire mold off the flow and suspend it upside down. Why upside down?

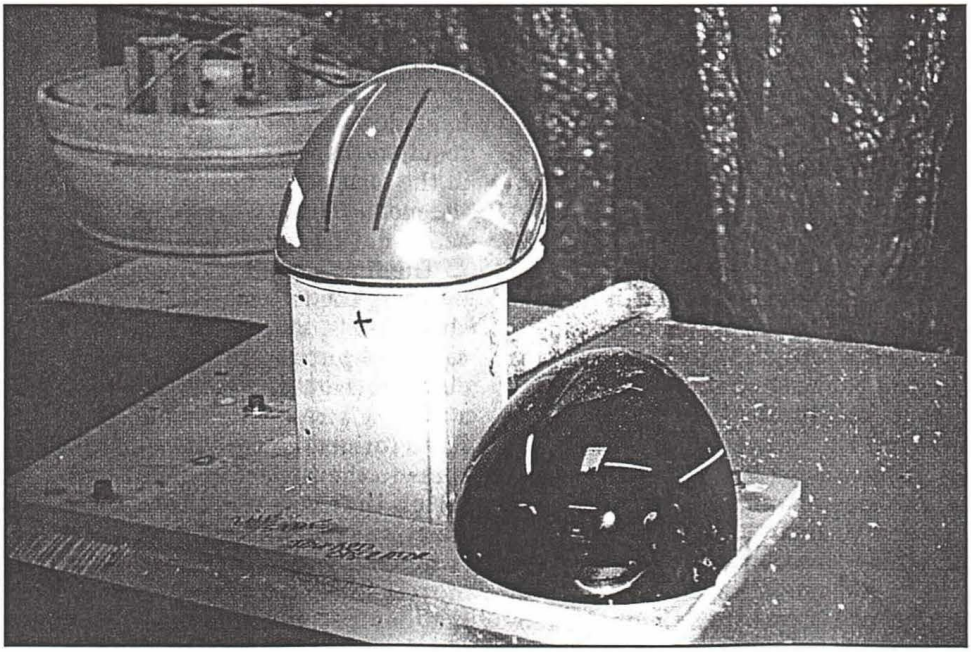
"We've tried everything to keep a mold clean while we're prepping it," he explains. "We finally found the best way was to hang it from the ceiling and prep it upside down. That way nothing falls into it."

They do everything in female molds, rather than pulling them over male plugs. Jeff says pulling them over a plug puts too much pressure on the glass and further imprints any imperfections in the mold or the flannel usually used to cover a plug. Female molds are harder to make and use but give a better optical product.

Normally the RV-6 canopy is molded in two steps. Because they make so many of them, they do the first step, letting the acrylic sag most of the way into the mold, several times a day, making a bunch of pre-prepared, partially molded blanks. These are formed by sagging the material into the mold and then placing a steel frame into position. This frame shapes and clamps the material around the entire perimeter of the mold, forming a seal so the suction drawn through the holes in the top, or bottom, depending on how you look at it, can pull it the rest of the way down.

When a pre-molded blank is dropped into position for the final pull, it is secured by probably 100 modified welding clamps. The mold has already been prepped, which includes cleaning it until practically sterile and pre-heating it. It has also been coated with a layer of Vaseline-looking grease which they refuse to identify. Jeff says that's one of their secrets to maintaining optical clarity and they don't want it leaking out. It looks a lot like the secret stuff the colonel uses when doing his chickens.

Once the blank is in position, the entire unit, mold and blank, are wheeled into the garage sized oven where the entire thing is brought up to temperature. At that point, the vacuum pump pulls just the slightest amount of suction, which draws the



The practice face plates for the shuttle astronaut's helmets come off this mold.

Jeff Rogers is Mr. Canopy at The Airplane Plastics company and has been making canopies for nearly 15 years.

semi-flowing material gently into the mold. It starts out at 3/16" drawing to perhaps 1/8" at the top.

Jeff says the side-by-side canopies, like the RV-6A, T-18, Mustang II and others, are by far the most difficult. This is because they are not only large, but require a huge amount of time to create tooling because it has to be as close to perfect as possible. Any canopy which can't be blown requires a female mold and all the related complexity.

Blown canopies require much simpler tooling, which usually consists of two base boards, one of which has an opening which simulates the footprint of the canopy and bolts down to the board which accepts the air pressure.

Canopy tooling is stacked everywhere at Airplane Plastics. Easily a dozen huge female molds are stacked up on top of the clean room/oven while bubble canopy form boards for another couple dozen lean against one end. The storage building out back has another cache of tooling interspersed with stacks of canopies held in inventory.

Every possible airplane type imaginable is represented - from RVs to Pitts, Midget Mustangs to Sea Hawks. Two of the more interesting were labeled "Nemesis" and "Voyager." Seems like a good place for a slogan, ". . . goin' far and fast behind Fox Lite glass."

We also found the tooling for the helmet face plates the space shuttle astronauts use in training. Originally those were costing the taxpayers a, shall we say, "unreasonable" amount of money although not quite as much as the often mentioned toilet seats. Apparently there were some EAAers on the shuttle engineering team who pointed out that there were better sources for this type of material. The Hoys have been turning them out ever since at a third the original acquisition cost.

The Fox Lite/Airplane Plastics operation has a bunch of intriguing aspects, not the least of which is their willingness and ability to crank out a canopy and formed parts one at a time. It's not necessary for you to want a dozen. One will do. Need a lid for your brand new, never before seen, four-place, aerobatic, jet-powered gyrocopter? Give them a call.

To crank out custom canopies they need as much information as possible, the minimum being an accurately scaled three-view drawing. It might even be a good idea to ship them the coaming or frame, if that's possible. That way there's a guaranteed fit.

To answer your next question: We thought the costs were quite in line.

We saw a lot of really neat stuff while poking around at Fox Lite, but the one thing that kept coming back to us was the obvious innovation and flexibility demonstrated in so many areas. If it can be formed, they can and will make it. That makes for all sorts of aviation oriented possibilities.

They work in a wide variety of materials including ABS, polystyrene, acrylics and polycarbonates. It is this last, polycarbonate, also known as Lexan™, that has some interesting possibilities and characteristics. It is the same stuff safety glasses are made of because it is practically unbreakable. Unfortunately, it also scratches quite easily, even if cleaned by a rag, and can't be polished as acrylics can. It is also attacked by aromatic hydrocarbons, which includes gasoline. That's one reason it's seldom used for canopies or windshields on the civilian market. That and the fact the material itself is twice as expensive as normal acrylics (Plexiglas™).

There are ways around that which include laminating a layer of acrylic on top of the polycarbonate or coating it with one of the newer space-age hard coatings. This is the way it is used on new Corvettes.

Airplane Plastics is so committed to the concept of tougher canopies and other products that they are now in the process of finishing up the installation of their own polycarbonate production center. This would allow them to produce sheets as long as necessary and they could co-extrude it with acrylic, if desired. This is the way F-16 canopies are made.

A polycarbonate canopy would be nearly bird-proof, something to think about when whistling around at 200 mph plus.

When walking through the plant, it would be easy to mistake the company for a skylight operation that makes canopies on the side. Don't believe it. The Hoys, both younger and elder, are first, last and always homebuilders. It appears they feel as if they are canopy builders who happen to make a bunch of skylights.

Either way, it is exciting to see a company with so much enthusiasm and innovation and know that is all directed towards sport aviation. They are a positive asset for our industry and everyone should have their phone number stuck to the shop wall.

Sooner or later we'll all need their help.

The Airplane Plastics Company is located at 8300 Dayton Rd., Fairborn, OH 45324, 1-800/233-3699, Fax 513/864-7010. ◆