SHAPING METAL WITH A FORM block, or hammerform, has been the subject of previous articles in this series, and this month we'll use another variation of this technique to duplicate a flying wire fairing for a 1940 Ryan STM. Fortunately, we have a fairly good original part to use as a pattern for creating the hammerform.

Hammerform Variations
Making a flying wire fairing
RON COVELL

Most hammerforms are flat in the center and you do most of the shaping at the part’s perimeter. This is often called a male hammerform because you shape the metal over the outside edges of the form. It’s easy to make a male hammerform from sheet material like plywood or MDF (medium density fiberboard).

We’ll use the hammerform process to duplicate this flying wire fairing for a Ryan. Straightening the original part using a hammer and dolly, making it suitable for being a master for the hammerform we will create, is the first step.

The chipboard pattern that describes the perimeter of the fairing’s flange should butt against the part’s domed portion. Use this pattern to cut an opening in a piece of MDF, forming the hammerform’s top layer.

Cover all the openings in the fairing with masking tape to prepare it for casting. Use two heavy coats of paste wax as a mold release agent, to keep the plastic auto body filler from sticking to it.

Here we’re mixing paste catalyst into the plastic filler. Note the different size cavities in the MDF forms. This stepped design reduces the amount of filler needed and creates a mechanical interlock between the filler and the form. Glue and screw each MDF layer into place before the plastic filler hardens.
Naturally, not all aircraft parts are flat in the center. Many, like the Ryan’s fairing, are domed, and they call for a female hammerform, and we’ll show how to make one using a combination of MDF and plastic auto body filler.

Straightening and cleaning the original part we will use as the master is the first step. Bob DeVries supplied the Ryan flying wire fairing, but it had some dents and twists, and the opening for the flying wire was torn. We used a hammer and dolly to remove the dents and reshape the metal around the tear as much as possible. Then we lightly sanded the part with 80-grit paper to remove the old paint.

After making a pattern of the part’s

With the last layer of the form attached, use the remainder of the plastic filler to fill the cavity.

After the plastic filler cures, the master part is popped out, leaving a cavity perfectly matching its shape.
Cover all the openings in the fairing with masking tape to prepare it for casting. Use two heavy coats of paste wax as a mold release agent, to keep the plastic auto body filler from sticking to it. Make a clamping ring from another piece of MDF and cut the edge at a 45-degree angle to make it easier to hammer close to the flange area of the fairing.

Cut a blank of .050-inch 3003 H-14 aluminum sheet to size and anneal by carefully heating it with an oxyacetylene torch. Here we’re dusting the blank with a light film of soot with an acetylene-rich flame. This acts as a temperature indicator. Next we’ll heat the part with a neutral flame until the soot film just burns off.

Here’s the completed hammerform complete with the sheet metal under the clamping ring. The 1/8-inch alignment pins keep the parts from shifting during clamping.

Outline where the base flange and domed section meet, we transferred this pattern onto a piece of 3/4-inch MDF large enough to leave a generous flat area next to the cutout. The dome shape is about 2 1/8 inches high, so we used three thicknesses of MDF to create the body of the hammerform, stepping the openings in the second and third to reduce the amount of plastic filler required.

We create the shaped section of the hammerform by casting plastic auto body filler against the master, with the MDF acting as a form to surround and support the plastic filler. The MDF also becomes the portion of the hammerform that holds the flange flat around the perimeter of the part as we form the domed center.

Plastic auto body filler is designed to stick to metal, so we must use a mold release agent to keep it from bonding permanently to our master. We used two heavy applications of paste wax, although other mold release agents such as polyvinyl acetate (PVA) work well.
To create the hammerform, we clamped the master part into place in the opening of the first layer of MDF and mixed a generous amount of plastic filler. To give more working time, so we could cast all three layers of the form with one batch of filler, we used a light amount of catalyst. This required a bit of coordination because we had to apply a layer of wood glue to each MDF layer in addition to troweling in enough plastic filler for each layer. We used drywall screws to apply the clamping for each glued layer of MDF. It took about five minutes to fill, glue, and screw all three layers, and a "hot" batch of plastic filler would have gelled in that time.

When the layers were screwed together and the plastic filler had set, we unclamped the master part and popped it out of our hammerform. We filled any small pinholes or other imperfections in the hammerform with more plastic filler. After the filler had cured sufficiently, we lightly sanded the entire cavity to make it smooth and uniform.

From another piece of 3/4-inch MDF we made a clamping ring to hold the flange flat on the sheet of aluminum we will be forming. Using a band saw we trimmed the edge of this opening to 45 degrees, which makes it easier to reach the top edges of the hammerform with a mallet. Hammer close to the edge of a square-shouldered clamping ring.

We used .050-inch 3003 H-14 aluminum sheet for this part and annealed it to make shaping it easier. After trimming the aluminum sheet about 1 inch larger than the opening in the hammerform, we dusted it with a light coating of soot, using an acetylene-rich flame and a rosebud tip. Using a neutral flame, we gently heat the metal until the soot coating just barely burns off, leaving the metal "dead soft."

After placing the metal sheet over the hammerform and putting the clamping ring on top of it, we used...
Craft & Technique

After the first round of hammering the basic shape is good, and you remove minor imperfections with further work with the mallet. Use a mallet whose head contour closely matches that of the hammerform.

Remove the part removed from the form after the final shaping with the mallet. The contours are very smooth and uniform, with only a few small blemishes that you can straighten with a hammer and dolly.

Use a 6-Inch disc sander with 80-grit paper to further refine the part’s shape. Sand carefully, and don’t remove any more material thickness than necessary.

Stack the master part on top of the copy and scribe the openings and flange perimeter on the new part. Start the opening for the flying wire by making two 1-inch diameter holes with a step drill.

Remove the bridge between the holes and trim the flange perimeter with hand shears.

Four heavy C-clamps to hold all the parts together. To keep the parts from shifting we drilled 1/8-inch holes through all the parts in two locations and installed alignment pins.

Using a dome-faced plastic mallet we make the first hits around the perimeter of the part, close to the clamping ring. The shaping works best if you use many medium-force taps instead of a few over-powerful blows. We work the metal down around the edge until it touches the hammerform and then move a little more toward the center of the panel. Once we’ve worked to the center of the panel and most of the metal is touching the hammerform’s cavity, we start looking for any areas that aren’t tapped down quite tight.

With patience, anyone can do a good job using this process. The beauty of the female hammerform is that it limits how far the metal can move. If you keep hammering long enough, all the metal will be tight against the cavity’s surface, creating a part that is an accurate copy of its shape. Even if you make dozens (or hundreds) of taps slightly off target, eventually you’ll be able to get a very good fit against the form.

When you get a good fit against the form, remove the part from the form and examine it closely for any imperfections. Usually you can remove any minute deviations in the contour by planishing (smoothing by hammering against a dolly). Sanding is next, to create a surface smooth enough for painting or polishing. We use a 6-inch disc sander with 80-grit paper to smooth the surface, followed by an orbital sander to leave a uniform surface. If you’re going to polish the part, you’d continue sanding in stages up to 600 grit. From this point, it is very easy to bring it up to a mir-
ror finish with a buffing wheel and polishing compound.

To complete the part, put the master part over the newly shaped blank and lay out all the holes and the perimeter of the flange with a scribe. Make the large holes with a Unibit (step) drill and punch the small holes. Trim the edge with hand shears, remove any burrs with a file, and lightly sand the edge with 80-grit paper.

The fruit of our labor, from front to back: our new part, the original part, and our simple but effective hammerform.

Our brand-new part is finished, and the whole process took just one day, with making the form taking the most time. With the hammerform completed, you can shape, smooth, and trip a sheet metal part in about two hours. This is a project a new metalworker can successfully complete, and your friends may be very impressed with the quality of work you can produce using this simple but powerful process!

Ron Covell has been a professional metalworker for over 35 years. You can reach him at 106 Airport Blvd., #201, Freedom, CA 95019; 831/768-0705, or e-mail covell@cruzio.com.