MAKING A NOSE BOWL
PART II

BY RON COVELL

In the last installment of this series (see *Sport Aviation* August 1999), we looked at the beginning of a fairly complex project, forming a new nose bowl for a 1928 Curtiss Robin, using only basic hand tools. In that article, we created a wooden buck to define the contours of the nose bowl, and shaped the first piece of metal to fit the buck. Now we're ready to continue with the process.

Using a flexible paper material called 'chip board,' we'll make a pattern for the next piece to fit the buck. The first metal piece we made fit the top and front of the buck, so we'll make the upper side pieces next. When shaping metal with hand tools, it is generally easiest to design your panels so the welded seams are in the areas of greatest curvature. Most often this will mean the central area of each panel will have the lowest crown, making it easier to shape by hand.

The chip board pattern is made about 1/2″ oversize, so after the part is shaped there will still be enough metal to slightly overlap the first piece. The same pattern can be used for both sides of the nose bowl, since it is symmetrical. When the pattern is finished, it is transferred onto a sheet of 3003 H-14 aluminum, .050″ thick, and two parts are cut out.

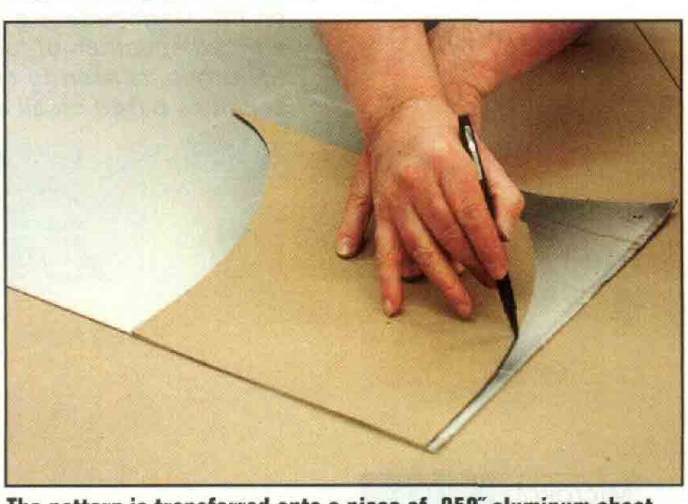
The aluminum we've chosen, a manganese alloy in the half-hard condition, is a little too stiff to easily shape with a mallet and sandbag. To ease the shaping process, we'll anneal the metal before working it. A very light coating of soot from a pure acetylene flame is applied to the parts, then a neutral flame is used to gently heat the panels until the soot film just burns off. The panels are allowed to cool naturally, which leaves them in the fully annealed or dead soft condition.

The part is rough-shaped by working with a mallet and sandbag. We're using a urethane headed mallet here, and working into a 12″ diameter bag filled with coarse sand. The hammering pattern starts in the center of the panel, and then spirals out toward the edges. It is important to leave a border untouched about one inch wide around all the edges. Hammering in this zone would stretch the metal, and be counter-productive to our goal of achieving a domed shape.

The fit of the panel is constantly checked against the buck, and typically several repetitions of hammering and adjusting are required to get a good fit. Once the center of the panel has the right contour, a hand-operated shrinking machine is used on the edges to help pull them down, since these areas have a higher-crown shape than the center.

When the overall shape is fairly well established with the mallet, sandbag and shrinker, the next step is to smooth out all the lumps these tools leave. The process we use is called planishing, which means to make smooth by hammering. We've chosen a dolly with a low-crown face, and propped it on a sandbag so it's supported in a working position. We'll use a slap hammer that has a large, low-crown face to do the hammering. The entire surface of the panel is worked between the hammer and dolly, and then the fit is re-checked against the buck. Typically a little adjusting will be required at this point. Sometimes just twisting the edges of the panel with your hands is sufficient, but other times you'll find some additional work is required with a mallet and sandbag or shrinker to get a good fit on the buck. The more experience you have doing this work, the more streamlined the process gets. A beginner generally goes through many repetitions of reshaping, tweaking and adjusting, and a seasoned professional might go through only one or two.

We're using chip board as a material to make the pattern for the upper side portion of the nose bowl, allowing a 1/2″ overlap.



The pattern is transferred onto a piece of .050″ aluminum sheet with a felt tip marker.

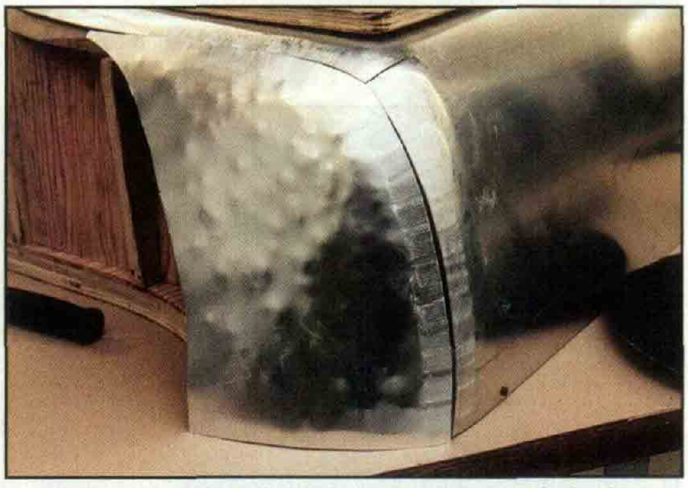
The lower side pieces are the next to be formed. We'll make a pattern on one side of the buck using chip board, transfer it onto an aluminum sheet, and cut the pieces out. Since this panel does not have a compound curve in the center, it doesn't require annealing. We simply form the contour in the panel by freehand bending against the workbench. Once the center of the panel matches the contour of the buck, all that is left is shaping the edges. We're using a homemade post dolly for this operation. The post dolly is clamped to the edge of our workbench, and the edge of the panel is curled over using a slap hammer. This part of the process goes very quickly, and after a couple of checks against the buck and a little 'tune-up' work, these panels are properly shaped.

The last major piece to shape is the lower center panel. This is the most difficult panel, since it has a medium-crown shape over most of its surface, and it's a fairly large part to shape by hand. Again, a pattern is made form chip board, allowing at least a 1/2" margin around the edges, and a piece is cut from aluminum sheet to match the pattern. We'll anneal the whole part, since every square inch needs shaping. Once cooled, the panel is bent by hand to take on the profile of the

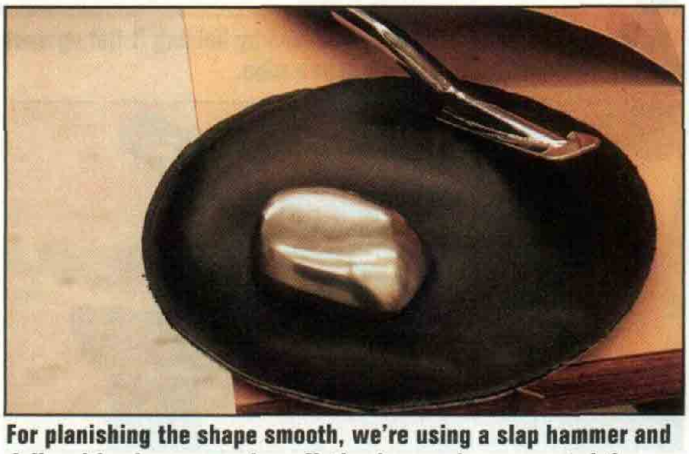
After the panel is cut out, it is annealed with an oxy-acetylene torch.

The rough shaping is done with a mallet and sandbag.

With the middle of the panel rough-shaped, the edges are drawn down with a hand-operated shrinking machine.



The rough-shaped panel is test-fitted against the buck.

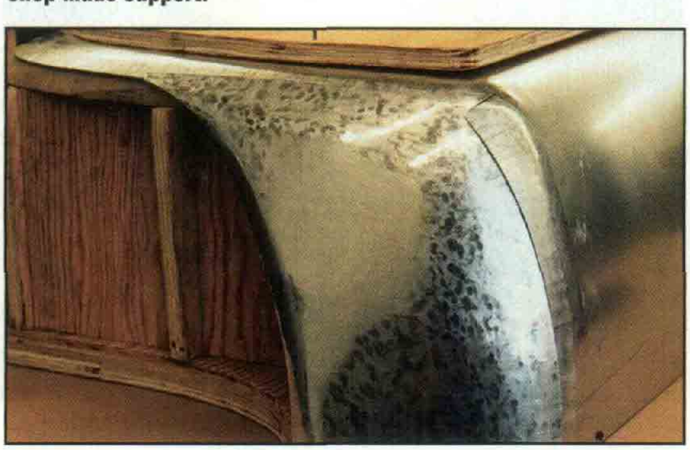


For planishing the shape smooth, we're using a slap hammer and dolly with a low crown face. Notice how we've supported the dolly with a sandbag, so we have a free hand to hold the panel.

In this shot, you'll see that about 1/4 of the panel is planished. This took about one minute.

The panel is test-fitted to the buck to test its shape as the planishing progresses.

This is a shop-made post dolly, created by welding a dolly onto a shop made support.



You can see how well the contours of the panels match each other.

After a few adjustments, it fits the buck very well.

The planishing nears completion. It took about five minutes to planish this panel smooth.

We're using the post dolly and slap hammer to round over the edges of the panel.

The lower side piece is shaped freehand by holding it flat against the workbench, and gently lifting one edge.

The edge of this panel is rounded over using the slap hammer and post dolly.

Another test fitting on the buck, paying attention to how the contours of the panels match.

Using chip board to make a pattern for the bottom piece. Note the use of push pins to anchor the board to the buck.

buck. Next, the shrinker is used on the edges to start pulling them down. If you look closely at the photos, you'll see that the shrinking process alone has put the majority of the shape in this panel, before any hammering was done!

Once the edges are shaped, the center portion of the panel needs to be bulged out, and this is done with the mallet and sandbag. Several test-fittings and minor readjustments are required to get the contour just right. The next step is planishing, to smooth out all the bumps left by the mallet. It takes an experienced person about 20 minutes to planish a panel this size by hand. Using a pneumatic planishing hammer or an English Wheel would certainly speed this part of the process, but our goal in this article is to show how you can make seemingly complicated panels using only hand tools!

With all the panels shaped to match the buck, the next step is to scribe and trim the mating edges, and then weld them together. For convenience, we're using a TIG machine for the tack welding, but it could be oxy-fuel tack welded as well. The advantages of the TIG process are that it can be done right on the buck, it's fast, and there is no flux to mix or clean up. If you choose to do the tacking with oxy-fuel, after the panels are fitted to the buck and the edges trimmed, you'll need to put witness marks along the seam at convenient intervals. Next, the panels will be clamped together off the buck, making sure the witness marks are aligned and the tack welds can be made without danger of charring the buck.

Tack welds are placed along the seams 3/4" to 1" apart. If you are oxy-fuel tack welding, be sure to wash the flux off thoroughly at this point. Next, the joint and the tack welds are worked carefully with a hammer and dolly to ensure the edges fit flush, and to close any gaps between the panels as tightly as possible. Once the seams are properly aligned, they are finish welded. We chose to oxy-acetylene weld these seams, since this is the equipment readers are most likely to have, and it leaves a very strong, yet very workable weld. Oxy-hydrogen or TIG welding would also be good processes to use.

A special flux is needed for gas welding aluminum. It comes as a powder, and is mixed with water (or alcohol) to form a thin paste. (Note: Sometimes trace amounts of impurities are found in water, and this can greatly diminish the effectiveness of the flux. If you are having problems with your welding, try using distilled water for the flux.) Mix only as much flux as you plan to use that day, to ensure it stays fresh.

The paste is brushed onto the seam, both inside and out, using a small acid brush. Aluminum oxidizes very quickly at elevated temperatures, and the flux is necessary to exclude atmospheric oxygen from the weld area, so

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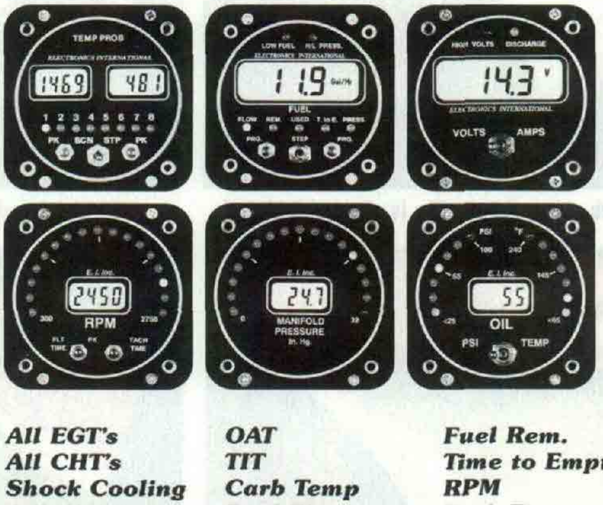

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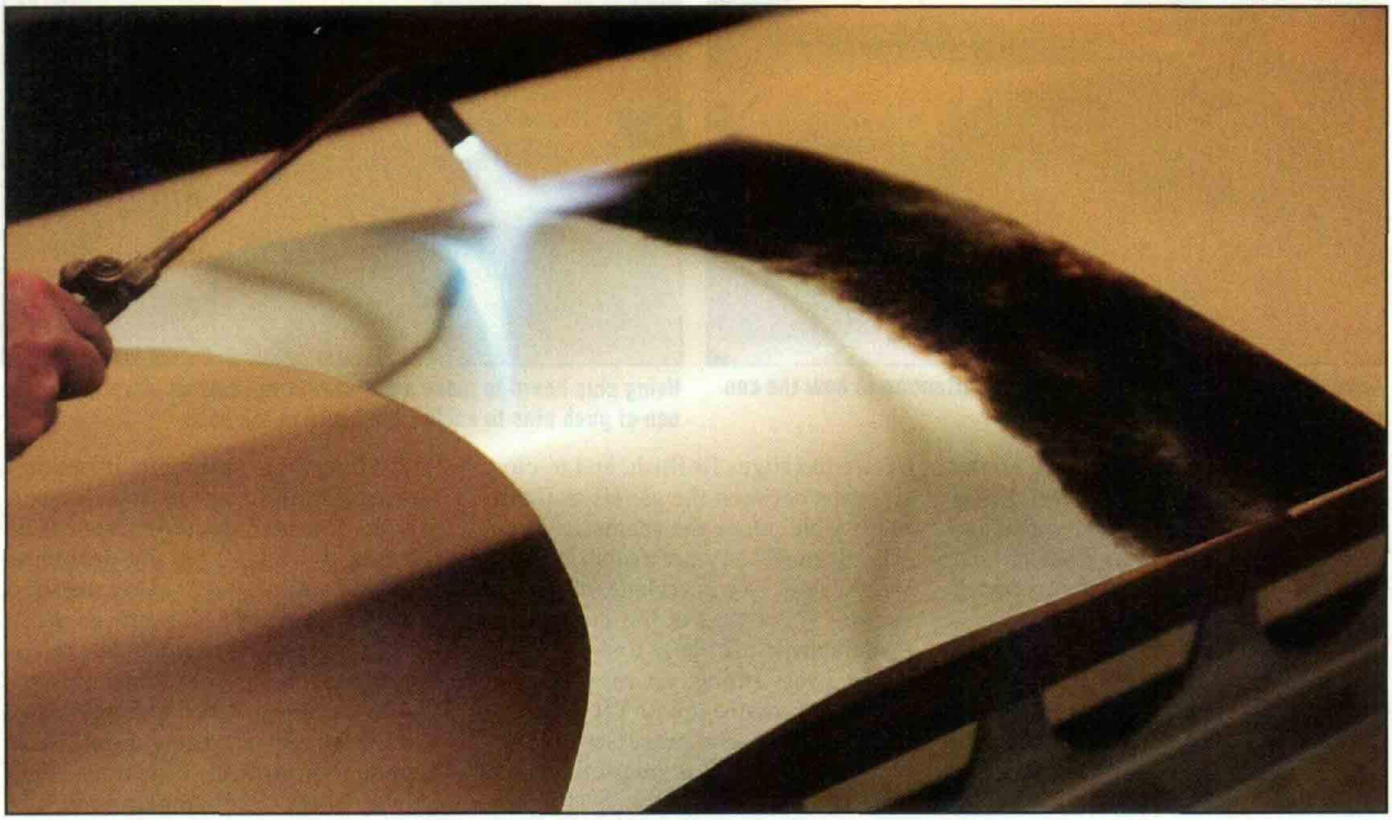
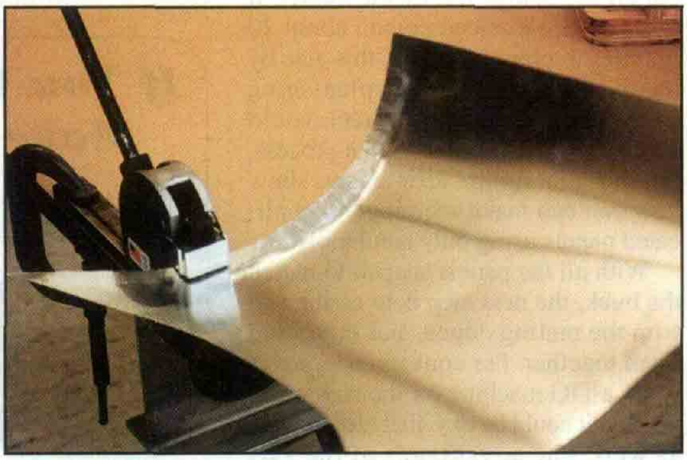

The entire panel is annealed to make it easier to shape.


The first fitting on the buck, after the profile is shaped by hand.


Using a hand shrinking machine to pull the edges down.


Test-fitting on the buck again. Notice how much shape has been put into the panel just by using the shrinker!


The center portion of the panel is bulged slightly with a mallet and sandbag.

Test fitting on the buck again. Notice the use of C clamps to help hold the panel tightly against the stations of the buck.

We're ready to planish the panel smooth. Notice how the panel is clamped to the corner of the workbench, freeing up our hands to use the slap hammer and dolly.

the molten puddle doesn't skin over with a film of aluminum oxide. Always remember that this flux contains fluorides, and should be considered a toxic material. Be sure to wash your hands after using the flux, and be especially sure to not smoke or eat with a residue of it on your hands. The fumes given off by the flux when it's heated are also harmful, so be sure to work in an area with proper ventilation, and don't weld in a position where the rising heat of the welding flame carries the flux fumes into your nose.

A special lens is required for gas welding aluminum, since the flux gives off a very bright yellow-orange glare that is nearly impossible to see through with a standard lens. The age-old cobalt blue welding lenses are no longer available (they are not OSHA approved), so the excellent TM 2000 lens made by Kent White (TM Technologies, North San Juan, CA) is the only way to go.

1100 (pure aluminum) welding rod is preferred for non-structural aluminum components like this nose bowl. It has nearly the same tensile strength as the 3003 alloy aluminum we're using, yet the weld bead is soft and workable. This will be a real advantage when it's time to planish the weld smooth. Generally, it is wise to choose a welding rod diameter that matches the thickness of the sheet metal you are welding. In this case, we're using 1/16" welding rod since it is difficult to find aluminum welding rod .050" diameter.

We're using a Victor aircraft torch with a 0 size tip. Although the welding process will require some practice to master, it's really no more difficult than gas welding steel. People often melt a lot of holes in the metal as they are learning to control the heat and

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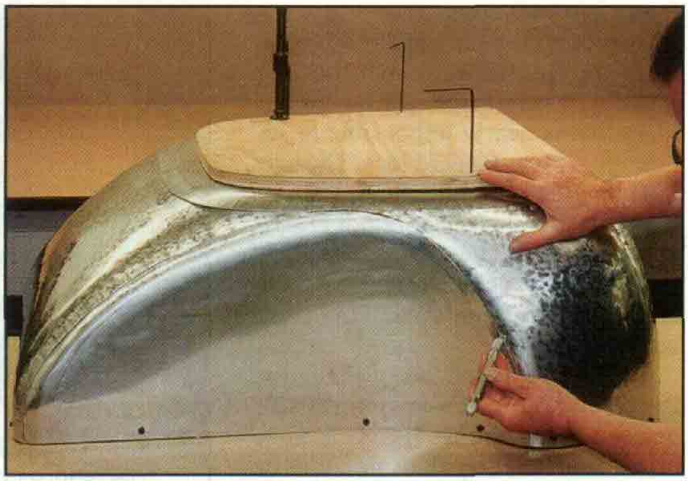
Here you can see the relative smoothness of the planished area compared to the rough-shaped areas.

With this panel completely planished, you can see how well it matches the contour of the buck, and how smoothly it blends in with the other panels.



Scribing the edge of one panel onto another for trimming.

We're using a TIG welder to tack weld the panels together.

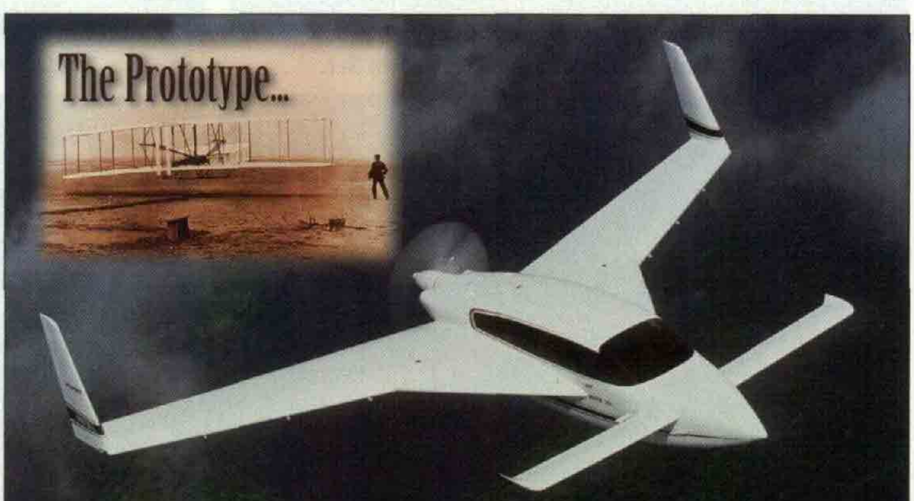
Using a hammer and dolly to work the seam for perfect alignment of the edges.

The paste flux for aluminum gas welding is applied with an acid brush.

speed, but practice makes perfect. The general overview of the process is to form a puddle on the metal, dip the rod in the puddle, draw the rod back slightly, move the torch forward a bit, dip the rod, pull it back, advance the torch, etc. There is a rhythm you develop with this over time, and when mastered, you can make a weld bead that is smooth and consistent on both the inside and outside of the panel. There are some excellent training videos available that clearly demonstrate the aluminum gas welding process.

Welding always causes some distortion, but for this nose bowl, which has the welds placed in the highest-crown areas, the distortion will be very minor. (If you try welding two flat panels together, you'll get an alarming amount of distortion!) For this reason, we were able to make the welds continuously from one end to the other, without needing to skip around from one area to another.

With the welding completed, the flux is washed off using warm water and a cloth or brush. Next, the weld is planished down flat with a hammer and dolly. This improves the strength of the weld, and allows you to smooth out any irregularities in the contours of the metal. Once the weld areas are



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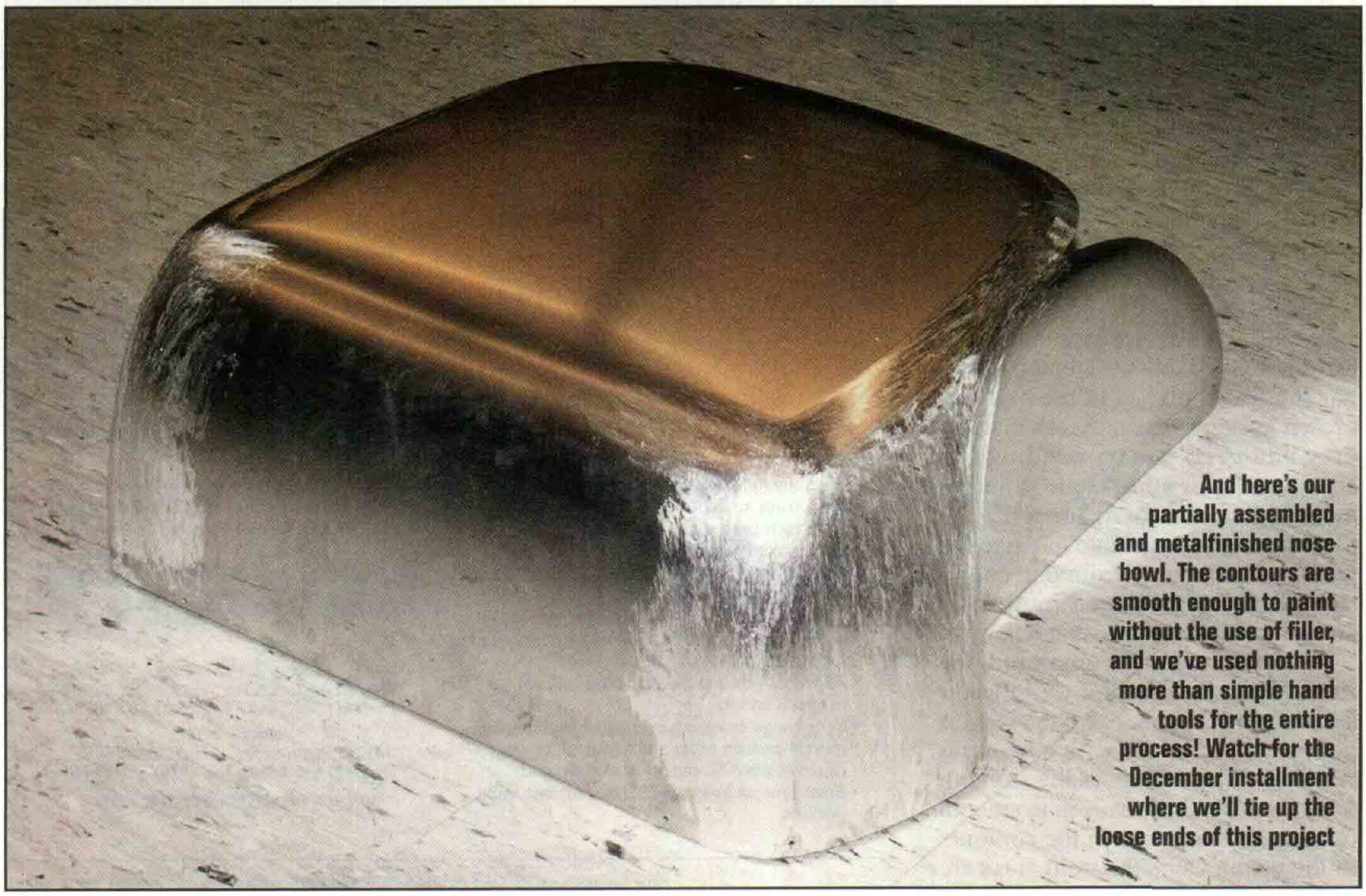
We're welding the seam with an oxy-acetylene torch.

A close-up look at the welded seams. Note the consistency of the weld beads.

Using a hammer and dolly to planish the welds down flat.

This is a "Bullseye Pick," used for gently tapping up the low spots.



And here's our partially assembled and metalfinished nose bowl. The contours are smooth enough to paint without the use of filler, and we've used nothing more than simple hand tools for the entire process! Watch for the December installment where we'll tie up the loose ends of this project planished as smooth as possible, it's time to metalfinish the panels.

Metalfinishing is defined as making the metal smooth by removing some materials. With the thin metals generally used for aircraft construction, you must be very careful not to remove too much material, for fear of diminishing the strength of your part. Metalfinishing allows you to smooth a panel well enough so it can be painted without using filler, and as little as .005" material thickness will be removed if you work carefully.

To metalfinish, a vixen file is carefully drawn over the surface. You're trying not to remove much material here, so just barely kiss the surface with the file. The file only touches the highest points on the surface, so you'll know anything the file doesn't touch is too low. The low spots are gently tapped up from the backside, and the panel is filed again. This process is repeated until the file contacts every point on the surface, and when it does, the panel will magically be very smooth — in most cases ready for paint or polishing. We're using a special tool called a "Bullseye Pick" to do the tapping up of low spots. This makes it easy for even an amateur to have pinpoint accuracy when raising low spots. Our tool has been fitted with a blunt Delrin plastic tip, so it doesn't leave marks on the back side of the metal like the standard pointed steel tip does.

Look for the December installment of this series where we'll add the last panel to the nose bowl, form the louvers, make the openings for the radiator air inlet and propeller shaft, and strengthen the openings with wired edges. ◆

About the Author

Ron Covell has been a professional metalworker for over 35 years. He operates a business named Covell Creative Metalworking, offering a complete line of metalworking tools, books and videotapes, as well as offering a series of metalworking workshops nationwide. You can reach him at 106 Airport Blvd., #201, Freedom, CA 95019, 831/768-0705, or you can send email to covell@cruzio.com

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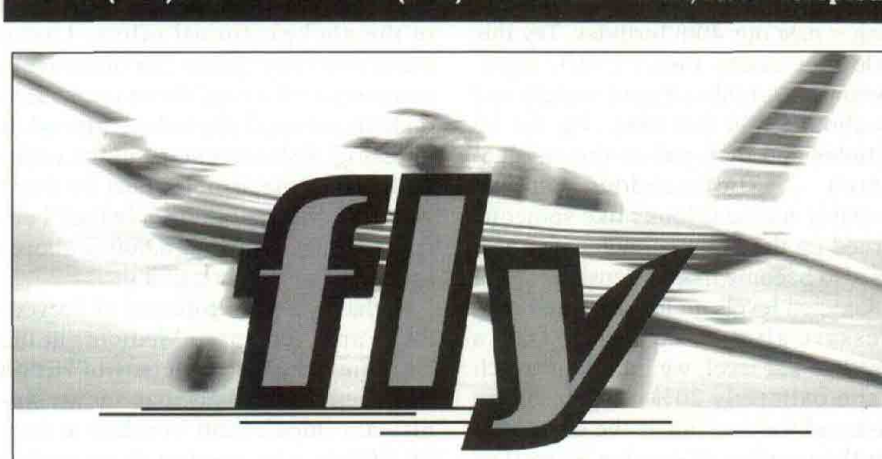

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should also allow persons, for a fee, to sell merchandise from a tailgate or trailer adjacent to the Blue Parking Lot. If they come with a trailer that takes up two spaces, they should pay for two spaces. Tom Poberezny stated the Aeromart program was run by the Green Bay Chapter for many years. This year, the West Bend EAA Chapter took over. We wanted to incorporate the new people into it, before we pursue any changes.

Peter Miles from Mukulto, WA, EAA #154377 — Liked the changes that have occurred on the convention grounds, especially the new forum buildings. Mr. Miles stated we need more trash containers in the forum area. The water fountains have not kept up with the changes on the convention grounds, and on a hot convention day it would be nice to have more drinking water available. The price of soft drinks in the concession stands is too high. He paid $3 for a 32-oz drink. This year Mr. Miles decided to get individual day passes instead of the weekly wristband, because he liked to take it off at night. On Sunday, he neglected to bring it with him, so he had to pay an additional $14. He would like to see refunds allowed under these circumstances.

Dennis Agin, EAA #123486 — This is the nicest convention he has been to in years and is having a wonderful time. In the past, he has helped the judges in the contemporary section. This year he worked with the judges in the ultralight section. He addressed an issue regarding aircraft judging. It was suggested that he meet with Bob Warner after the meeting to discuss his questions further.

Stanley Matalon, EAA #245837 — Brought up the number of vehicles on the Convention grounds and whether they are all needed.

Larry Wheelock, EAA#100430 — Mr. Wheelock is very happy and appreciates all the improvements made to the convention. Has been a member since 1975, and first came to Oshkosh in 1978, and has been here most years since then. He always liked to get here early, and camp next to the woods, but now he has been moved back and it spoiled it for him. He expressed his feelings regarding the number of vehicles on the flight line. He has been camping for many years, and in 1998, Waste Management did the best job ever. This year Waste Management was slow in getting the port-o-lets cleaned, and many were padlocked towards the end of convention.

There was no other new business.

ELECTION RESULTS

Tom Poberezny called on Emory Swinney to present the Election results. The vote was as follows:

Class I Director-Three year term

Bill W. Bateman	17
John Beetham	46,537
Mal Gross	46,524
Paul H. Poberezny	46,542
Tom Poberezny	46,541
Alan Ritchie	46,527
Ron Rudolph	10
John Winter	9

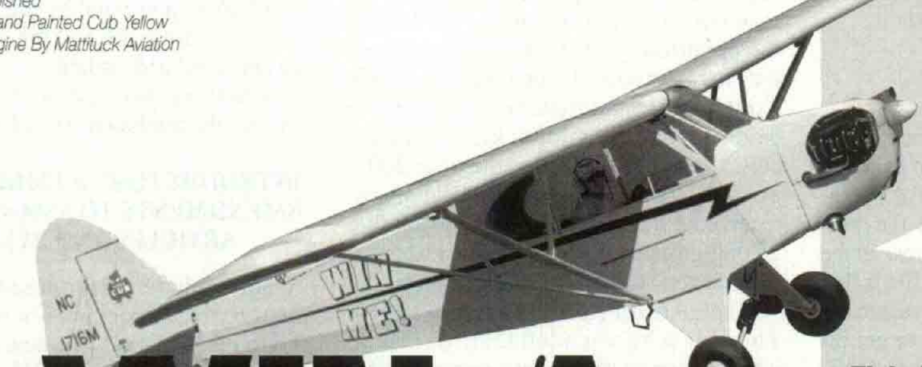
Class IV Director-One year term

Louis J. Andrew, Jr.	6,541

The Class I Directors elected for a three-year term will be John Beetham, Mal Gross, Paul H. Poberezny, Tom Poberezny and Alan Ritchie. The Class IV Director elected for a one year term will be Louis J. Andrew, Jr.

ADJOURNMENT

With no further business the meeting was adjourned.



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