

## Casting detail parts from polyurethane

by Paul Kohlmann

Photos by the author

**B**uilding and covering a balsa airframe is an achievement, but just a little more work can bring your project to the next level. This is particularly true of scale subjects, which are almost certain to need some exhaust stacks, a scoop or two, and a pilot to truly look the part. Detail parts can also be added to your ARF to set it apart from the rest of the crowd.

Many detail parts can be made from a bit of balsa, foam, and some odds and ends, but complex parts, such as pilots or sets of identical parts like exhaust stacks, could use a better solution. I've been experimenting with silicone molds and polyurethane casting resin and have found these to be handy materials.



Scale models look much better when their cockpits are appropriately populated.

### The Project

The last several articles in the construction series have focused on the Miles M.20. For this installment, the project at hand is a 32-inch Kawasaki Ki-61 Tony Japanese fighter from Manzano Laser Works. The kit as I designed it looks nice with only the vacuum-formed spinner, supercharger scoop, and canopy, but as with all scale subjects, there's always more that can be done to make it better.

### Engine Details

For starters, a Ki-61 needs some exhaust detail. As the only Japanese frontline fighter

to be powered by an inline engine, the Ki-61 needed a set of Daimler-Benz-style exhaust stacks. Each of the two stacks is composed of six identical exhaust stubs. Although these could be carved from balsa, sealed, and sanded, I was able to whip out a perfectly matching set from polyurethane in less than 30 minutes.

A single exhaust stub was carved from balsa. This was the master. The next step was to roll a chunk of modeling clay into a flattened slab. The master stub was pressed into the clay slab to make molds of the six stubs that comprise a single exhaust stack.

This is where the polyurethane resin comes in. Available from plastic supply stores such as Tap Plastics, the two-part resin is mixed 50:50 into a syrupy

A single exhaust stub was made from scrap balsa and stamped into a slab of modeling clay.



amber liquid. After it is fully blended, the resin is poured into a mold where it solidifies into a pale yellow plastic within a couple of minutes.

The six identical exhaust stubs were peeled out of the clay and then pressed into a second slab of clay in a row. The heat shields that frame the exhaust stack were created by pressing bits of balsa strip into the clay. More balsa strips were used to create a frame to hold in the resin. When the stubs and shields were carefully removed from the clay, the new mold was ready to be filled with resin.

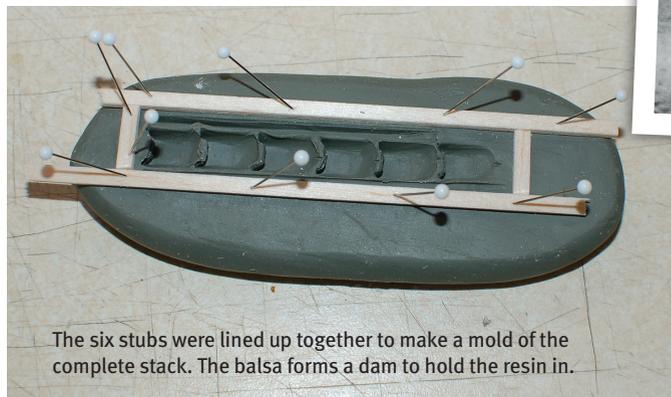
Five minutes after filling the mold, the resin was fully cured and the clay was carefully peeled away from the stacks. The heat shields were trimmed to make a left and a right, but they are otherwise identical.

The cured polyurethane is a tough plastic that is easily sanded and takes paint well. Many other items such as scoops, vents, and even radial engines can be cast this way.

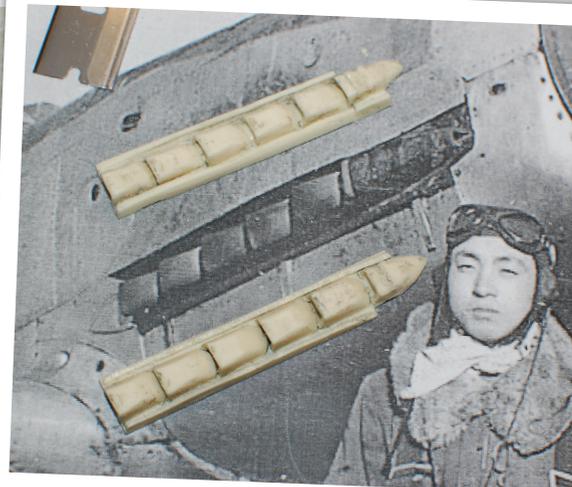
### Make Your Own Pilot

Models don't look right flying around with nobody under the canopy. There are a few vendors out there that make ready-made pilots, but it can be tough to find one that is the right size and appearance. When you

Three cloned stubs are on standby while three more are beginning to cure.



The six stubs were lined up together to make a mold of the complete stack. The balsa forms a dam to hold the resin in.



The matched set of stubs was ready for paint in less than 30 minutes, start to finish. They weigh a couple of grams combined.

cast your own, you can make sure that the fit and the details are perfect for your project.

I'm no artist, but I've found that sculpting a pilot from clay is easier than

I would have thought. It turns out that the secret is largely perseverance.

I sit down with a bit of clay while a ballgame is on television. After warming the clay slightly in my hands, I gently shape it into a head, neck, and shoulders. Keeping a picture of an appropriate pilot nearby for reference is helpful.

When the proportions look right, this featureless blob is fitted into the cockpit to check the size. If it's off, don't get mad. Just squash it and start over. It's very therapeutic.

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A pencil is a great tool for adding in the features. I'm not qualified to teach sculpting of the human form, but I can say that even a blind pig can find an occasional acorn. I just keep poking away with that pencil until I've got the hint of a nose and eyebrows that look believable. Then I work in some cheekbones and some eyes. Add in



Aim low to get started—a simple bust with the right proportions is a victory. Having a reference photo nearby helps.



My mini pilot is ready to be cloned.



a mouth and then go over the whole thing again.

If the face takes a turn for the worse, just erase it by smearing the clay features away and start over. That's the secret—just keep plugging away until you sneak up on it. Eyes are the most critical part of our faces, but luckily for us, no self-respecting pilot flies without shades on, but if even “Clay Bans” can't save you, flying goggles and an oxygen mask will improve even the worst attempt!

After you stumble upon a face worth keeping, go ahead and focus on the rest of the bust. Thin strips of clay can be added to create a flight suit collar and chute straps. Flattened balls of

clay can become a headset. Add and subtract clay as needed until you get the look that you want.

Of course, clay is too heavy and delicate to be used in our model. Unlike the clay mold for the exhaust stacks, the clay pilot is only a plug. A negative mold must be made from the plug before it can be reproduced. This is done by encasing the clay pilot in silicone.

Silicone is also available from vendors such as TAP. It comes as a system that includes a base, a catalyst, a thinner, and a thickener. The exact mixing ratios are sensitive, so make sure to closely follow the instructions.

The thinner is useful in making a runny silicone for the first coat of a mold that has fine detail, because it is less likely to include bubbles and voids. To keep it from running right off, I used a barbecue spit motor to slowly turn the clay bust.

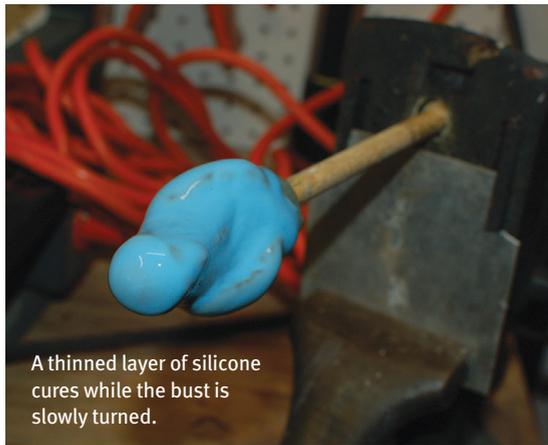
After it was cured, the bust was covered with a second layer of viscous silicone by using the thickener (thixotrope) instead of the thinner. The thickened layer is tough and holds its shape much better than the thinned mixture.

After 24 hours, the silicone will be fully cured. It's rubbery, but surprisingly strong—especially if the thixotrope was used. With luck, the mold can be peeled inside out to expel the clay. If that doesn't work, a slit up the back with a sharp blade does the trick. Get your trusty pencil out again and pick out any clay bits that are stuck in the mold.

The silicone mold is now ready to be filled with resin. I like to make one solid copy right off the bat. This gives me a durable master in case a replacement mold is needed, but it is much too heavy for flight duty.

Lightweight copies are made by swirling some resin around the mold and then dumping it out after the resin has partially set. This results in a thin shell that weighs very little.

It takes quite a bit of work to make the first usable pilot, but after that, dozens can be made in just a few minutes apiece. I've had so much fun goofing around with this that I made a Cartoon Scale model of my dog to fly the Extra 260!



A thinned layer of silicone cures while the bust is slowly turned.



Here is the finished mold, along with a solid bust (30 grams), and a hollow one (2 to 6 grams, depending on how long the resin sets before dumping).

### Conclusion

I really enjoy building up a balsa model, but I have to admit that making weird stuff out of clay, silicone, and resin is nearly as much fun. There's no limit to what can be done with these materials.

One side note, though—the unused silicone and polyurethane tend to cure on their own after a while. Keeping them in the refrigerator will significantly extend their shelf life.

### M.20 Update

I have heard from a number of M.20 builders who were unsure of how to find a vendor

to 3-D print the spinner for their projects. One useful resource is MakeXYZ. This is a service that allows users to locate operators of 3-D printers in their area.

Most of these operators are hobbyists, so costs are usually low. The operator whom I found was within walking distance of my house and charged less than \$20 for the spinner and backplate together.

**Next month** we'll whip up some custom waterslide decals. Until then, the sky's the limit! 🛩️

—Paul Kohlmann  
ptkohlmann@aol.com

#### SOURCES:

TAP Plastics  
(800) 246-5055  
www.tapplastics.com

MakeXYZ  
www.makexyz.com

Manzano Laser Works  
(505) 286-2640  
www.manzanolaser.com

