Some of the most frequent modeling questions I get are about resin casting. There are lots of products available to the hobby caster today, and there are several ways to achieve similar results. My purpose here is to explain the process I use, as it works for me.

Basically, I start with a pattern (or “master”) that I’ve made, usually from styrene, and I make a mold of it. I can then pour urethane resin into this mold, let it cure, and I have an exact duplicate of the pattern I started with.

Molds are made from a silicone-based material, commonly called RTV (room-temperature vulcanizing) rubber. It comes in two parts: the silicone material itself and a catalyst to make it cure. When the two parts are properly mixed, a chemical reaction occurs and what was a gooey liquid becomes a rubbery solid.
RTV is an interesting substance. When initially mixed, it has a consistency like honey, and will stick to everything. Once cured, though, it peels off almost anything. It will, however, stick to itself.

Urethane resin, on the other hand, is a natural adhesive. It will try to stick to pretty much anything except RTV. It can’t adhere to polypropylene either, but more on that later.

I use Smooth-on’s MoldMax 30 RTV and Alumilite’s “Regular” resin almost exclusively. I’ve developed a process around these two products that works well for me, and I don’t like to stray from it.

I highly recommend buying both products directly from the manufacturer. Both materials have about a six-month shelf life. If you don’t get them direct, you really don’t know how old the product is. Both companies have good web sites, and they’re both set up for on-line sales.

Making a mold

Your master should be completed before you even start to think about mixing RTV. Molds can get pretty complicated. What I’m going to cover in this first article is a one piece, open-face mold. This is the simplest kind, and I prefer to use it wherever I can.

First, you’ll need to glue the master, which must have a flat back side, to a flat surface. Thick styrene (.080”) or Plexiglas works well as a backing. Take care to make sure the master is glued well around all its edges. An advantage to Plexiglas is that you can see from the back what’s glued and what isn’t. RTV doesn’t flow very fast, but it will creep into every nook and cranny. If it creeps under your master, you’ll have a hard time getting good castings later.

Once the master has been mounted to a flat backing, you’ll need to build a mold box around it (photo 1). I like to use styrene, attached with hot glue. Some people use Lego blocks. Whatever you use, you’ll more than likely have to rip part of it off to demold your master, so only attach it well enough to hold in the RTV.

Your mold should be at least 1/4” thick around the edges, and at least 1/4” deeper than your master. But don’t make it more than 1/2” wider than the pattern in any dimension. The mold needs to be flexible enough that you can peel it away from your finished castings. And besides, you don’t want to use any more RTV than you have to in the first place.

Mixing tools

Mixing RTV and resin requires a couple of special tools, as well as some common things you probably already have around the house. The more common things are disposable cups, a large measuring cup, and bamboo mixing sticks (photo 2).

Resin and small amounts of RTV can be mixed with the bamboo skewers. For larger quantities of RTV, you’ll need something sturdier to mix with. I have a small stainless-steel spatula (also in photo 2) that I like to use. I picked it up at a GATS show a few years ago.
get these from Alumilite or Micro-Mark, or maybe even your dentist, if you’re on good terms.

It’s a good idea to keep your RTV-mixing tools separate from your resin-mixing tools. I also find it’s best to use only disposable tools for resin.

Scales
The first specialized tool that you absolutely must have is a reasonably accurate set of scales. Mine are accurate to +/- 0.005 oz. I find that this good enough for the Smooth-on RTV.

You’ll first need to measure out as much uncured RTV as you think you’ll need. I like to use my polypropylene measuring cup for this. Put the empty cup on the scale, zero out the scale, then pour out some RTV; this is just a guess. When you think you have enough, make a note of how much is in the cup.

Now measure out the catalyst. This is the part you need to be precise about. Since the MoldMax RTV is a 10:1 mix ratio, this is easy enough to do. Just move your decimal point one place to the left. For example, if you measured out 5.000 oz. of RTV, you’ll need 0.500 oz. of catalyst.

It’s important that you get this part right. If you use too little catalyst, your master will be permanently covered with goo; too much, and the RTV rubber might start to cure before you can completely pour your mold.

It’s good practice to use a separate cup to measure the catalyst. Sure, you could zero out the scale on the RTV you just measured and measure the catalyst right on top of it, but why risk wasting material?

Vacuum chamber
I wouldn’t say you absolutely have to have this next tool, but if you want consistent castings that are exact duplicates of your masters, take the plunge and get a vacuum chamber. The reason is that, when mixing the RTV, you’re bound to mix in a few bubbles. If one of these bubbles settles next to the master, when you make a casting, it will have a “wart” there. To get the bubbles out of the RTV before it cures, it needs to be “degassed.” This is where the vacuum chamber comes in. By exposing the RTV to a vacuum, the bubbles will expand and rise to the surface, where they’ll pop on their own before you pour the mold.

Alumilite and other manufacturers sell ready-made vacuum chambers. I made my own (photo 3). This isn’t hard to do. I bought a 6”-diameter PVC coupling from Lowes for the body of it. For the bottom, I used a piece of 3/8”-thick steel plate. (They were throwing these out at work, so it was a freebie.) You need to be able to see into the chamber while you’re using it, so for the top, I used 1/2” Lexan I ordered through a local glass shop.

I have to point out a safety concern here: do not use Plexiglas! Plexiglas will shatter if it fails. Insist on polycarbonate, like Lexan.

To make the chamber air tight, you’ll need gaskets. You can make them out of RTV, or you can buy gasket material and cut it yourself. A cheap source of gasket material I have recently found is silicone baking sheets.

You’ll need a vacuum gauge, too. When I originally built my chamber, I had the
gauge mounted on the side. I found it was easier to read if I moved it to the top. Unfortunately, this is probably not an item the hardware store will have in stock. My local dealer special-ordered one for me, but he’s out of business now. If I had to get another, Harbor Freight or Travers would be the first place I’d try.

I also found that if I just removed the hose after vacuuming, small molds could get blown over. I installed a ball valve to give me a little more control.

When you’re installing threaded components, use Teflon pipe wrap wherever there’s a metal-to-metal joint. If the joint is metal to plastic, use epoxy. All your joints must be absolutely air-tight.

Most RTV manufacturers will tell you that a vacuum pump that can pull 29” of mercury (Hg) is optimal. A pump that powerful can be expensive though. Mine only does about 27” Hg. I find that as long as I’m careful when I pour my molds, that’s good enough. I picked up a used Gast pump (model #SAA-V109-NQ) on eBay a few years ago for about $90. It moves about 3.3 CFM (cubic feet per minute), which gets my chamber to its maximum vacuum in about 30 seconds.

Your vacuum pump’s CFM rating only needs to be just high enough to evacuate the air from the chamber in 30 to 60 seconds. RTV has about a 15 to 20 minute pot life, which means you have that much time from when you mix it until it starts to thicken.

The reason for having a see-through top is so you can tell when the RTV is completely degassed. When the full vacuum is first applied, it will begin to bubble up and rise. It will double or triple in volume until it gives up most of the trapped air, then it will fall. If it rises out of control, you’ll make a mess, and it’s really hard to get RTV out of tubing. So, keep an eye on it until it falls. After it does, let it continue at full vacuum for a couple more minutes, just to be on the safe side.

I just happened to find that a polypropylene measuring cup that holds four cups fits optimally into my chamber. I had to cut the handle off to make it fit, but it lets me degas the maximum amount of RTV my chamber can handle. This is the same cup that I mix the RTV in.

Pouring a mold

When pouring a mold, it’s best to pour into one corner (not directly onto the master), very slowly, in a thin stream. I like to prop my mixing container up on the workbench and set the mold box on the floor. This gives me about 30” of distance between the two. Go slowly to get the thinnest stream possible. This gets out any tiny air bubbles that vacuuming might not have gotten.

I find it usually takes five or ten minutes to pour a mold, so I like to tilt the mixing cup just far enough to get it flowing, then wedge something under it so I don’t have to keep my hands on it all the time. Don’t be lulled into thinking you can just walk away from it though. The RTV will shift and make the container want to roll or slide, or the cat will get into it, or something else will happen...I’m telling you, it’s like Murphy’s Law, so keep an eye on it.

After you’ve finished pouring the mold, set it aside on a level surface and let it cure completely. Photo 4 shows a freshly poured mold.

If you start using the mold too quickly, it’s more likely to tear. Rubber molds have a finite life. Generally, you can plan on getting 30 or 40 castings out of a mold before it begins to degrade. Complex molds with undercuts have a shorter life. I like to pour my molds in the evening and let them cure overnight. When you wake up the next morning, it’s ready and you’ll be like a kid opening Christmas presents.

You may also notice in photo 4 that the RTV forms a meniscus around the edges of the mold box. Since this will become the bottom of the mold, this edge has to be trimmed off to let the mold set perfectly flat. Turn the mold on its side and use an X-acto knife, held at a 45° angle, to do this. Photo 5 shows the bottom of a trimmed mold.

Molds should be dusted with talcum powder before each casting is poured and also before storage. A perfectly bare mold will tend to stick to itself, or other molds. The talc also helps the resin to flow into the mold’s details when casting. Photo 6 shows a finished mold, ready for casting.

Always store your molds sandwiched between stiff plastic. They’re soft enough to deform if any weight is left on them, and if they stay that way too long, they may not flex back.

Next time I’ll show you how to cast a resin part in your new mold.