

# FLOUR POTS

CAMERON JUE WINTER 2012





LIP MOLDED INTO SILICONE  
HELPS CAPTURE THE LID

INJECTION MOLDED SKELETON  
PROVIDES RIGIDITY AND  
SPIFFY COLORS

## FLOUR POTS

- COMBINATION PREP BOWLS FOR "MISE EN PLACE" COOKING DOUBLE AS STORAGE CONTAINERS
- USED FOR HERBS, SPICES, CHOPPED INGREDIENTS, ETC.
- HANDY TO HAVE LOTS OF THEM, PERHAPS IN A FEW DIFFERENT SIZES

FOOD-GRADE SILICONE  
OVERMOLD

SNAP  
FEATURE

## SKETCHING IT OUT

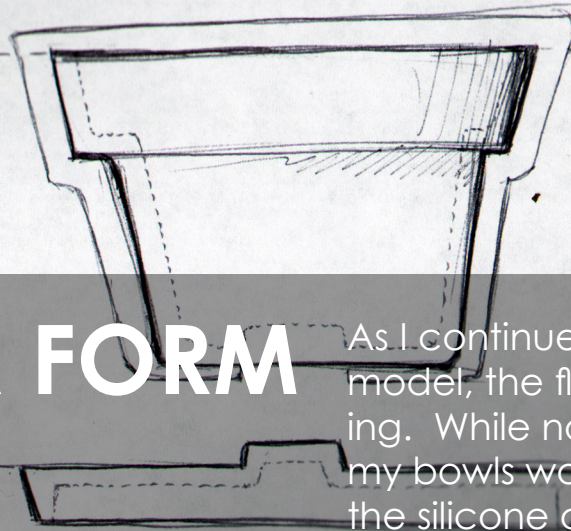
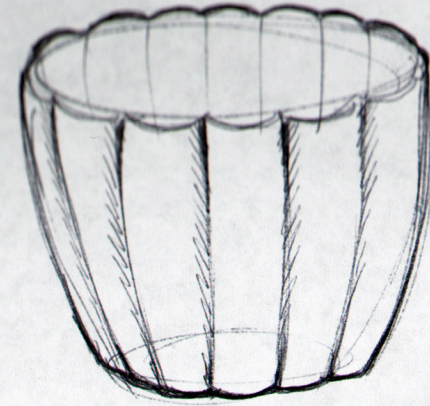
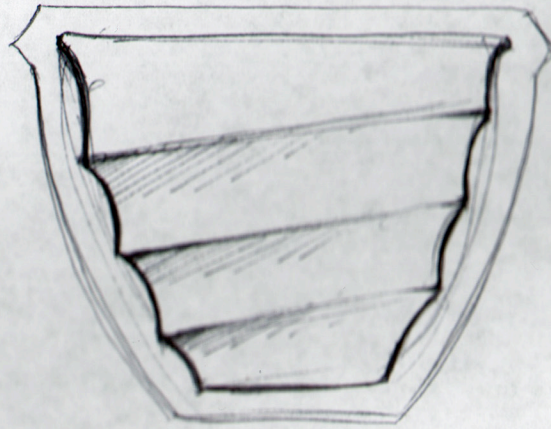
All three of my original concepts involved cooking, but the prep bowls benefited most from injection molding (in terms of multiples), which was the process I knew I wanted to pursue. In their original incarnation, they included a lid, as well as a skeleton that could deform to create a spout.

SLITS BETWEEN PLASTIC "PETALS"  
ALLOW ENOUGH FLEXIBILITY FOR  
PINCHING AND POURING

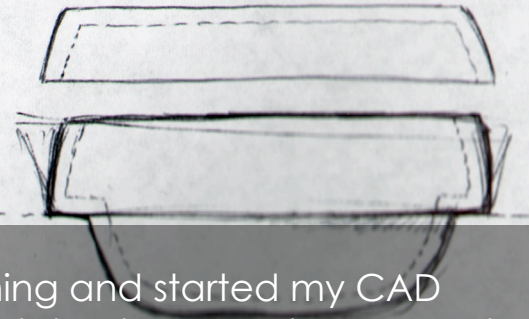
INJECTION MOLDED LID MIMIC  
SHAPE ONTO THE BOTTOM  
(HARDER TO LOSE, PLUS  
MORE STABLE)

"SNAP" FEATURE HELPS  
WITH THE  
FLOATING  
CASTING PROB.  
(PROTRUDES)





PART



## FINDING A FORM

As I continued sketching and started my CAD model, the flexible skeleton became less appealing. While novel, it meant that the functionality of my bowls would be completely dependent upon the silicone overmold. With little experience with the processes, this seemed like a risky move.

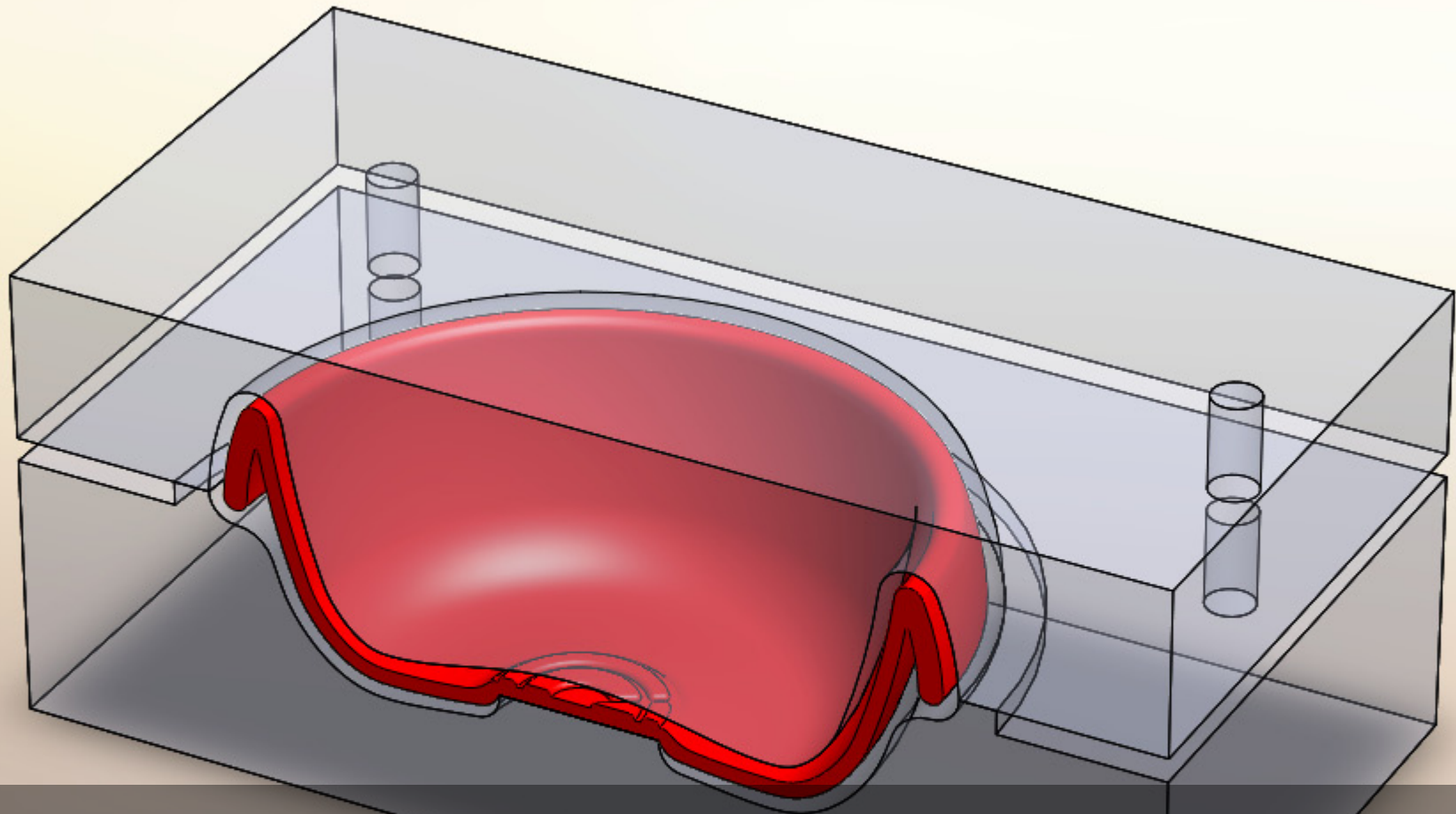




## SIZING PROTOTYPES

Eventually, I settled on a simpler aesthetic inspired by the rolled lip of a flower pot. This form offered surfaces complex enough to be interesting without being visually distracting. The 3D printer allowed me to quickly determine which diameter and depth felt right in my hands.





## THE RIPPLE EFFECT

Due to sprue placement, the diameter I wanted required the largest available insert. On the upside, having so much mold real estate allowed me to shoot two parts at once. However, this meant that the ambiguous shot size became my limiting factor, forcing me to optimize my wall thickness.





# VERY SOFT TOOLING

I soon realized that I could only learn so much fiddling around in SolidWorks. Transitioning to GibbsCAM brought changes to almost all my radii in the interest of tool selection and minimizing surfacing time. The resulting pair of Modulon inserts in turn gave me a tactile sense of scallop height.





# THE SIMPLEST THINGS

Preparing my stock proved to be more of an endeavor than anticipated. I was determined to achieve perfect 90° corners and tolerances down to  $\pm 0.001$ ", which meant lots of time with a machinist's square and micrometer. In retrospect, this was likely overkill given the level of fit required.





## EVER SO SHINY

On the other hand, my arguably obsessive attention to detail paid dividends when it came time to start machining aluminum. Within a reasonable amount of time, I was able to achieve a surface finish that exceeded my expectations. One side of the mold down!





## PERKS OF PATIENCE

The core side yielded a new set of challenges in that it required a very long, small tool to reach into the recessed feature. Even with the tool extender, I was within 0.050" of hitting the wall. The thin tool also meant tons of chatter, which in turn meant drastically reduced feed and spindle speeds.





# MAKING THEM MINE

Part of the reason I began my process with such unconventional designs was that I felt compelled to make a prep bowl that I couldn't just go out and buy in a store. Although simplicity won out in the end, I was still able to add a personal touch to the bottom of my bowls in the form of a logo.



The image shows two orange injection molded parts on a metal surface. The top part is a large, shallow bowl-like shape with a small, irregular hole on its inner surface. The bottom part is a smaller, more complex shape with multiple lobes. The background is a metallic surface with some circular patterns and two screws visible.

# TRIAL AND ERROR

In stark contrast to chip load calculations and the precision of the CNC mills, operating the injection molding machine proved to be a highly empirical process. Even after trying everything we could think of, my parts continued to trap an air bubble (which resulted in features like the hole above).





# THE GRAVEYARD

After hours of experimentation across multiple plastics and myriad settings, we succeeded in getting my molds to fill (albeit with a small blemish from the air bubble). This process also marked one of the first times I felt genuinely bad about the amount of landfill I was generating for a project.





## MOLDS: ROUND 2

With my injection-molded parts in hand, I was able to measure the shrinkage and finalize my design for the silicone overmold. The acrylic was a breeze to machine and gave me a glimpse of what the aluminum mold would have been like had I designed around a larger ball end mill.





## THE SECOND 'SHOT'

The part of my silicone molding I was most worried about—proper alignment—ended up not being an issue at all due to the silicone's viscosity. It did, however, take several attempts to figure out the proper flow path for a complete fill and, most importantly, how to remove the part afterward.





## BUT WHICH TO USE?

Even without the silicone molding defects shown here, I found myself preferring the look and feel of the uncoated polypropylene. They felt less bulky and the smooth surface worked much better for most ingredients (especially powdery ones) than the sticky silicone.











## ELEGANT FORM, LESS ELEGANT MACHINING.

I quickly learned that my relatively simple form was less simple to machine, largely due to the folded-over lip (which, interestingly enough, was mostly to maintain uniform wall thickness). I now have a much greater appreciation for the design trade-offs involved with making things at scale.

## MAKE IT AS PRECISE AS IT NEEDS TO BE.

In retrospect, I didn't need to machine my inserts to such high tolerances across every dimension. In fact, the sprue hole that I reamed to the 'perfect' 1.000" was too small for the actual sprue. On the other hand, taking great care in my operations also produced a beautiful surface finish.

## NO SUBSTITUTE FOR EXPERIMENTATION.

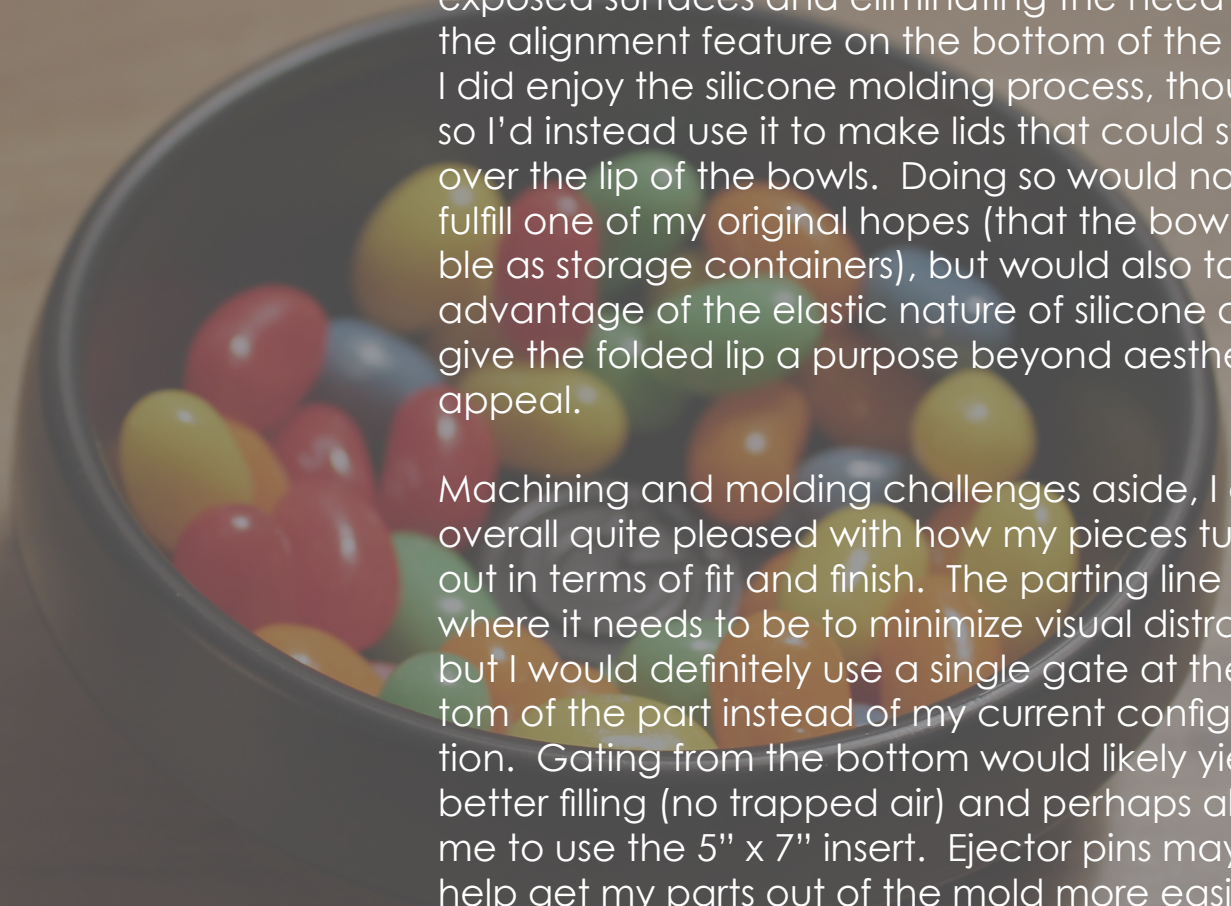
Between the trouble I had with my mold filling and the fact that I actually prefer the bare polypropylene to the silicone, I became very much aware that I couldn't anticipate everything about my project. Precision does not necessarily denote predictability, even with the best laid plans.

## WHAT TO DO WITH MY HANDS?

On a more personal note, I experienced a nagging sense of detachment as I worked on most of my project. After so much non-CNC work, it felt very strange to be so far removed from the material. Frustrating as it was in other ways, the silicone molding was refreshing in this respect.



## TO DO IT ALL AGAIN.

A black bowl filled with colorful jelly beans (red, yellow, green, blue, orange) sits on a wooden surface. The bowl is the central focus of the image, with the text overlaid on the right side.

Knowing what I do now, I'd likely forgo the silicone overmold, instead keeping polypropylene for the exposed surfaces and eliminating the need for the alignment feature on the bottom of the bowls. I did enjoy the silicone molding process, though, so I'd instead use it to make lids that could stretch over the lip of the bowls. Doing so would not only fulfill one of my original hopes (that the bowls double as storage containers), but would also take advantage of the elastic nature of silicone and give the folded lip a purpose beyond aesthetic appeal.

Machining and molding challenges aside, I am overall quite pleased with how my pieces turned out in terms of fit and finish. The parting line is where it needs to be to minimize visual distraction, but I would definitely use a single gate at the bottom of the part instead of my current configuration. Gating from the bottom would likely yield better filling (no trapped air) and perhaps allow me to use the 5" x 7" insert. Ejector pins may also help get my parts out of the mold more easily.

## SPECIAL THANKS

I would like to thank Craig, Tamara, and Jacobi, whose patience and expertise with the injection molding machine kept my parts from being riddled with holes. Once we get the settings dialed in perfectly, let me know if you want a set of bowls!