

Introduction

In selecting a senior project, my highest priorities were that I be able to work with my hands and make something artistic. After some previous work on car bodies in Professor John Morrell's MENG 489 senior design class, working on Yale's SAE Formula Hybrid team to make the race car's body seemed like a great idea. I came into the project knowing the basic steps in the process, but my senior project demanded that I learn the intricacies of every phase, from aerodynamic considerations, to computer-modeling, to fiber-glassing and painting.

It was really a pleasure to be a part of the SAE team, and I am finding that making car bodies is a very enjoyable process that blends many of my engineering and artistic interests.

Finished Product



I sanded, primed, and painted each piece. I reinforced the side panels with aluminum bars for strength and attachment. I made all the attachment tabs for the nose piece. Unfortunately, the Yale SAE team was not ready in time to make it to the SAE competition, but the car (and its body) will still serve as a learning tool and may be raced in the 2010 competition.

Yale

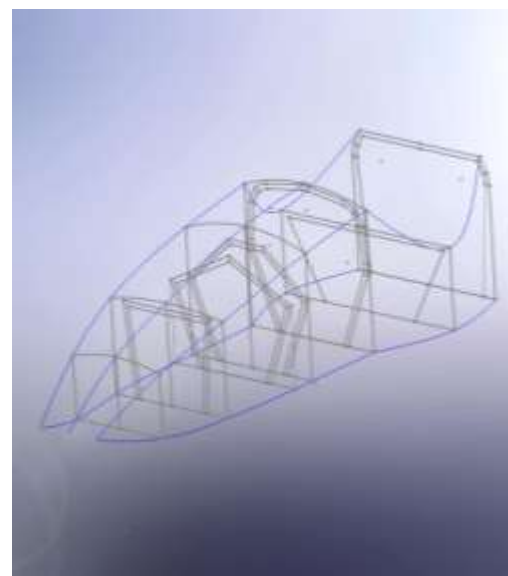
Research done in collaboration with Arthur McClung, John Morrell, Glenn Weston-Murphy, Nick Bernardo, Henry Misas, and Kamil Wasilewski

Foam Mold

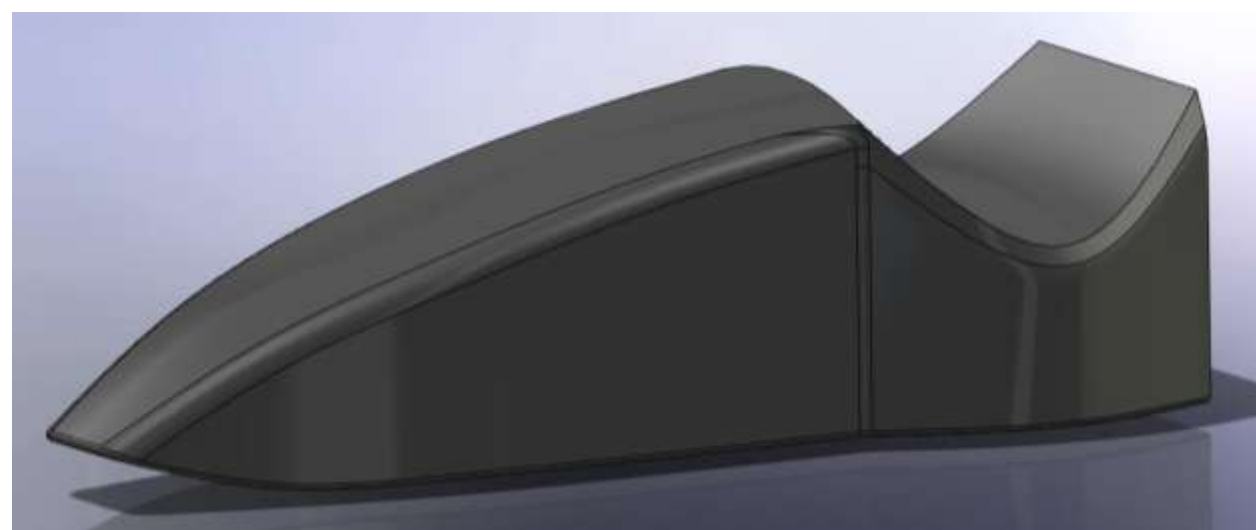


While I was hoping to make the body out of an eco-friendly plastic, I knew that any material I used would be laid on top of a foam mold. In the absence of a CNC mill, I would have to make this foam mold myself by hand. This complicated process involved printing out sectional profiles in 1:1 scale, tracing them onto foot-thick foam blocks, and sculpting the foam down to its correct shape. Making the foam mold accurately was, by far, the most time-consuming part of the project.

Design



With a list of requirements that my body would need to meet, I gathered information on previous designs, read SAE rules, and consulted the car's existing steel frame. From there, I made several sketches before making my own 3D models on SolidWorks. Taking into account aerodynamics, connection points, aesthetics, and ease of building, this design was selected.



Fiberglass Vacuum Bagging



After getting the foam mold looking how I wanted it, I experimented with eco-friendly 3Form plastic, hoping that I could successfully heat-form it to fit the foam mold's exact shape. Unfortunately, I could not get a good finish with plastic, so the next option was fiberglass, the inexpensive substitute for carbon fiber. After ordering all the components, a team of SAE members and I laid four layers of lightweight fiberglass on the mold, coated it with resin, covered it with a plastic bag, and sucked all the air out of the bag so as to get the fiberglass to fit the mold as close as possible. After a few days of letting the resin cure, I cut the body into its correct shape (one large nose piece and two side panels) and detached the body from its mold, a process which took a surprisingly long time.