PAINTLESS VIPER

M - POWERED

by Jason Ware

The completed paintless Viper against a stellar backdrop.

Missiles are boring! Oh sure, an M-powered rocket with a single body tube and three fins makes an impressive display of fire and smoke upon lift off, but what could be more exciting than to see an M-powered SPACESHIP! That is exactly what Dave Schaefer, Dallas Area Rocket Society member, and I have done.

The story starts on a 104 degree day near Argonia, Kansas, site of LDRS 2003. My friend Kyle of Addison Software watched several very large (and 'dangerous') rockets lift off and said "Jason, why don't you build one of those, I'll pay for it." Thus began a yearlong project. The only problem with Kyle's idea is that I am not Level Three certified. This is where Dave Schaefer comes in. Dave had com-

peted his Level Three certification in 2001 with a half-scale Nike Smoke, a missile. I asked Dave if he would be willing to oversee the project and he was thrilled with the idea.

The first step of the project was to decide what to build. I had recently completed and successfully flown a 4x scale up of an Estes Battlestar Galactica Colonial Viper. What a great rocket to scale up to 7.5x! One unique thing about the rocket is that it is essentially "paintless." As part of my home astrophotography business I have a 42" HP Designjet 6 color photo printer. The 4x Viper was finished out entirely using "body wraps" printed from the original Estes decals after enhancement in Adobe Photoshop. I used Kodak 10 mil photo paper and 30-minute epoxy, which provided a finish so smooth that I did not even have to fill the tube spirals in the airframe! So, could the same technique work on a Level Three rocket weighing over 60 pounds? The answer is: yes!

Planning the Viper

Another nice thing about a large printer is the ability to make full-scale drawings of large rockets. After drawing the design in Photoshop, I printed out an 8-foot-long, 4-foot-wide drawing on regular paper. This allowed Dave and I to think over the design and make decisions such as motor mount, centering rings, bulkhead, and electronics placement the old fashion way, with tape measure and pencil rather than CRT and mouse. After much analysis we decided to have the rocket separate in the middle and bring it down with two separate chutes. This also provided a good way to divide the work. I would work on the rear section containing the motor mount, fins, cockpit, and pilot. Dave would work on the front section containing the recovery section and electronics.

Dave and Jason pose with the completed Viper.

The Viper roars skyward on an M1400.

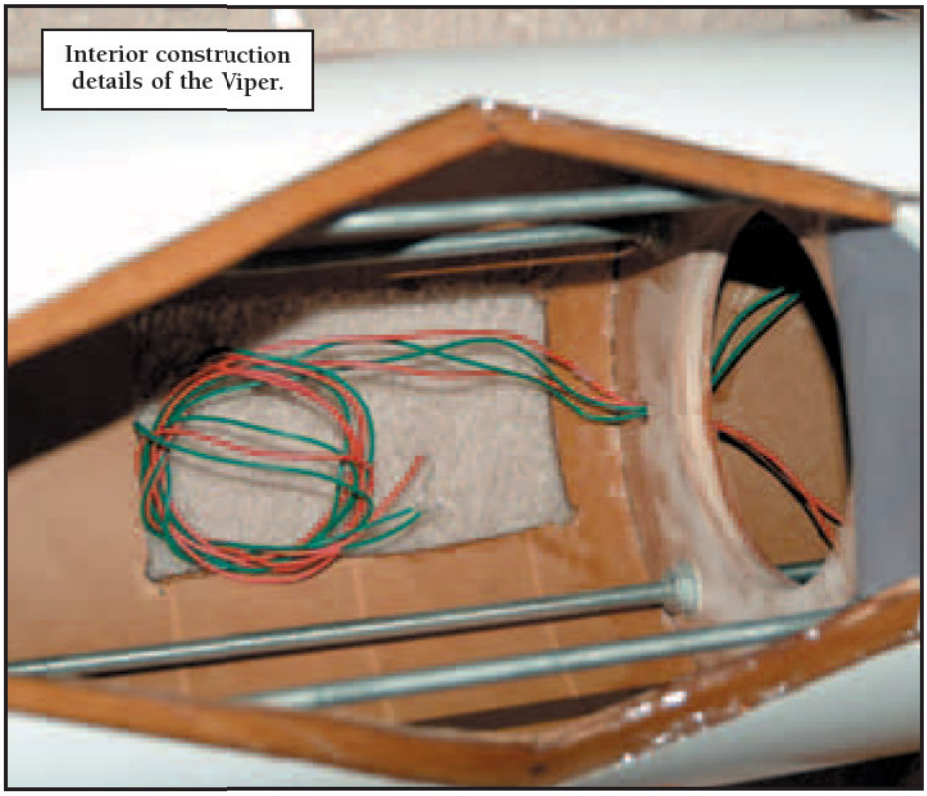
Building the airframe

The first thing I learned about large-scale rocket design is that we need to build everything to a higher standard of structural integrity. One of the best ways to do this is to run 1/4-20 all-thread the length of the airframe, through all the centering rings. Another thing I leaned about building a rocket this large is you need a lot of epoxy and mixing up large quanti-

ties of epoxy results in heat as is cures. This reduces the working time to considerably less than the published time. This proved to be a big problem working with the larger body wraps of the 7.5x model. The solution was simple, I switched to two-hour epoxy which gave plenty of time to mix, apply the mixture, and position the wraps.

One very convenient coincidence in using 7.5" body tube is the dimensions work out to almost exactly 1/4 scale of the original TV Viper. Since pilot figures are available for radio controlled airplanes in 1/4 scale, I decided to add a "Starbuck" to the project. The pilots in the original series wore a highly improbable Egyptian like helmet. This was reproduced using Sculpey oven bake clay. The clear canopy was made by cutting Plexiglas from a clear clipboard to shape.

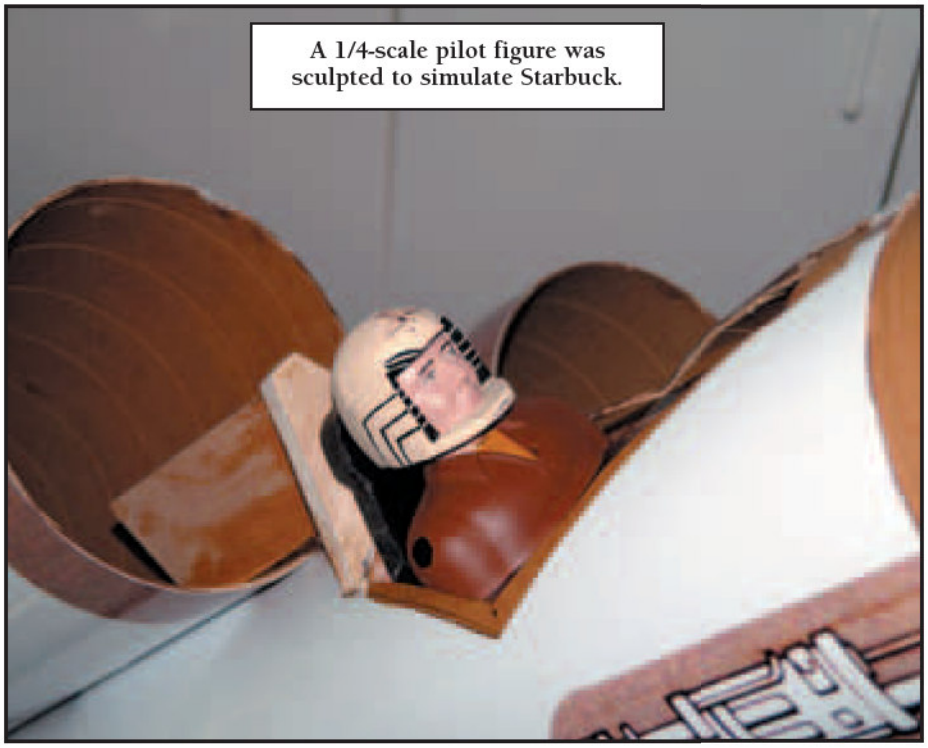
While I was building the lower section Dave went to work on the electronics in the nosecone and the recovery system. Before deciding what size chute to use for the upper section we needed to decide how much nose weight to add. As you might imagine the large fin weight of this project requires quite a bit of nose weight to move the CG forward enough to make it stable. For the 4x version I added enough weight to match the scaled up point of the original Estes kit. This required over two pounds. Had we done the same with the 7.5x we would have added around 8-10 pounds! We felt the Estes model was over stable so we built a D powered version and flew it several times, each time removing nose weight until the instability point was determined. We then duplicated the results by removing the equivalent weight from the 4x model and flying it. From this experimentation we determined we only needed to add around 2.5 pounds, in addition to the electronics, to the large model. This made designing the recovery system much easier. We finalized on a 60" SkyAngle chute for the upper section and a RocketMan R18C for the lower section.



Interior construction details of the Viper.

To trigger the ejection charges Dave chose to use his magnetic apogee detector (MAD) for the primary and Tony Huet's RDAS as a backup. We felt the unusual nose and airframe shape would make it difficult to find a location to mount a barometric altimeter in smooth airflow. The only potential problem with the MAD is that we have heard reports that iron-supported launch rods could generate a magnetic field upon launch causing the ejection charge to fire even before the rocket left the rod. We wanted to test this using a smaller rocket but did not get it done in time for North Texas High Power in August 2004. We opted to use the Dallas Area Rocket Society's aluminum rail, which eliminated the problem.

We decided on a Cesseroni M1400 motor for its kick off the pad and Dave would assemble it. This would end up being, to our knowledge, the first launch of this motor in the US and it performed exceptionally.



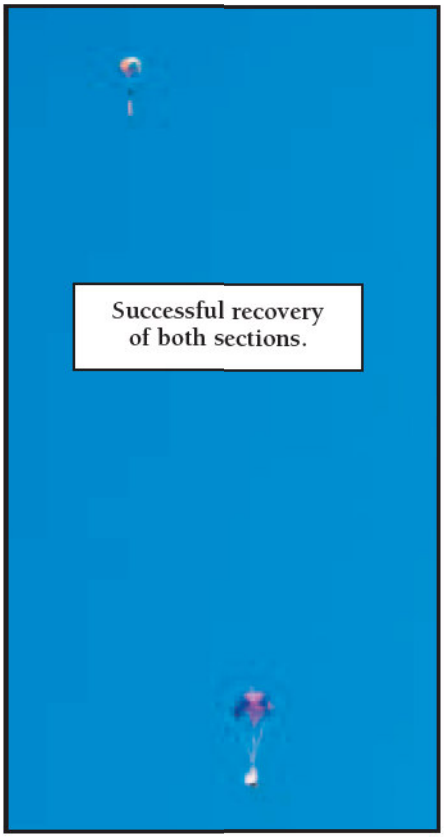
A 1/4-scale pilot figure was sculpted to simulate Starbuck.

Launch day

After several weather delays we had a "go" launch day on August 29, 2004. NTHP was rained out on Saturday and we really didn't think Sunday would be dry enough to fly, however, late Saturday night the DARS website was updated with a

"Sunday is a go" message. We scrambled to get everything together and arrived at the site around 10:00 AM. By that time the wind had picked up considerably out of the north but was predicted to die by 3:00 PM. This gave us plenty of time to pack the chutes, review our checklists, and rehearse the arming of the electronics. Finally around 2:00 PM the wind began to die and we were ready to fly. Everything went pretty much as planned except for one small hitch. The MAD had to be armed on the pad with the rocket vertical. Dave's arming pins are inside the top of the nosecone and we could not reach them. We had no ladder. Luckily we were able to borrow an ATV, used for retrieving rockets. By rolling the ATV up close to the pad and using a borrowed makeup mirror I was able to just reach into the nosecone to arm the electronics and observe the continuity LED.

As we walked back to the range head the wind became almost dead still so the LCO quickly began a 5 second countdown. The most important part of any project is the launch photo and with this quick countdown I almost missed it but fortunately my new digital SLR booted up in time and provided a perfectly timed photo. The photo revealed at launch that dirt clods from the North Texas cornfield had been blasted almost 30 feet in the air from the power of the M1400.



Successful recovery of both sections.

Dave had predicted the rocket would arc over towards the canopy side and indeed it did. Aside from not being a totally vertical flight, the rest was textbook perfect. The ejection charges fired as predicted and both chutes did their job bringing the rocket back softly.

This was a very time consuming project but well worth the effort. There is nothing quite like the feeling of being able to breath again when you see those large chutes open and the rocket begins to drift back to earth.

For more photos as well as a video provided by Tony Huet please see my web site at http://www.galaxyphoto.com/rockets/viper8.html.