Construction

West Systems 105/206 epoxy will be used in all cloth composite and construction areas.

Airframe

I began with the basic airframe of the RDS Hercules rocket and modified it for repeated heavy use.

The airframe uses three 7.5" dia. sections of 48" long cardboard tubing. To each of these sections I will laminate on three layers of 6oz. fiberglass cloth and one layer of 5oz. satin fiberglass cloth.

Lower section

This is the section where the motor mount and fins will attach to the rocket airframe. Slots are cut in the tubing to allow the fins to run from the motor tube through the airframe. All four fins will be reinforced on the exterior of the airframe tubing with epoxy fillets and fiberglass cloth. Three centering rings will be used to epoxy and attached the motor mount to the interior of the airframe tubing. At the top of this airframe section one of the couplers will be epoxied in to allow connection to the middle section. The interior of the coupler will be reinforced with Kevlar/carbon cloth the help prevent the airframe from folding.

Middle section

This section will house the electronics and ejection charges. To attach to the lower section, the middle section will slip fit over the fixed coupler in the lower section and be affixed with four 10-24 nuts and bolts. A plywood and fiberglass structure will be constructed to hold the electronics and a door will cut in the tubing to allow access from outside the rocket. All areas around the cut door will be reinforced with fiberglass. Six ¼" holes will be drilled in the airframe to allow for pressure equalization. The airframe bulkhead will be epoxied inside the second coupler and reinforced with fiberglass. The coupler will then be epoxied into the top of the middle section to allow connection to the upper section of the airframe.

Upper Section

This section will house the parachute and shock chord. To attach to the middle section, the upper section will slip fit over the fixed coupler in the middle section and be affixed with four 10-24 nuts and bolts. The upper rim of this airframe section will be reinforced with a layer of 2.3oz. unidirectional carbon cloth from the outside to help prevent the tubing from zippering. Four ¼" holes will be drilled in the airframe to allow for pressure equalization.

Nosecone

I will be using a standard 7.5" fiberglass gel-coat nosecone. The nosecone bulkhead will be epoxied to the inside of the nosecone and reinforced with fiberglass. The nosecone has a built in coupler and will slip fit into the top of the upper airframe section. This is the point where the rocket will separate and deploy the parachute.

Fins

They are the standard fins from the RDS Hercules kit. I will be reinforcing them by vacuum bagging them with one layer of Kevlar cloth and two layers of fiberglass cloth.

Motor Mount

The motor mount is a 98mm heavy-duty cardboard tube supplied with the RDS Hercules kit. I will fray approximately 18” of the strap nylon and epoxy it along the side of the motor mount. This will allow for a strong connection between the rocket and the parachute. Three 3/8” Baltic birch centering rings will be epoxied to the motor mount with fillets. The fins will then be epoxied along their root edge to the motor tube with epoxy fillets and then fiberglass reinforced. This entire assembly can then be inserted into the lower airframe section and epoxied in place.

Recovery

I’ll begin by describing the recovery harness starting with the rear of the rocket and moving forward. 18"-24" of frayed nylon strap will be epoxied to the side of the MM tube as well as the centering rings that the strap passes under. From there the strap will pass up through the center of the airframe tubing to the lower side of the airframe bulkhead in the coupler between the upper and middle airframe sections. The strap will attach to the bulkhead by means of a quick link and U-bolt. On the other side (upper) of the bulkhead 15' of 5/8" tubular kevlar will be attach by means of another quick link and U-bolt. (See the airframe bulkhead picture to see how the U-bolts attach to the bulkhead) Sewn to the other end of the tubular kevlar will be ~40' of the strap nylon. Then on the other end of the strap nylon will be a quick link that will attach to the U-bolt in the nosecone bulkhead. The Rocketman R18C parachute will attach to the recovery system approximately 35' from the airframe bulkhead along the kevlar and nylon chord.

The ejection charges for the parachute will be located in the airframe bulkhead. I will do a lot of ground testing to verify that I can get the parachute out of the rocket, thanks!

To protect the parachute from the ejection gases I will install a Nomex heat shield between the parachute and ejection charges and well as fireproof biodegradable wadding.

The airframe bulkhead is design to take most/all of the forces from the parachute slowing the rocket, but in the event of a ballistic recovery and the bulkhead cracks or pulls out I wanted a second hard attachment point. That is why I added the section of nylon between the MM and the airframe bulkhead. This provides positive retention of the MM and motor casing. It may not be a lot but it could save the rocket and a lot of digging. I'd hope that the forces of deploying the parachute would not be sufficient enough to break the bulkhead and the cardboard of the MM.

Electronics

An Emmanuel Avionics Accelerometer and a Missile Works RRC unit will be used to deploy the main parachute at apogee. I am using redundant systems to help prevent any recovery failures and each recovery controller itself has two redundant apogee deployment switches. Most failures that I have seen are because no parachute was ever ejected. Both ejection systems will be set to fire at apogee. Each system will have its own 5 gram ejection charge and two electric matches. I will be able to access the electronics from a door in the side of the rocket and be able to power them on and arm them on the stand.

Motor

I plan to use an Aerotech M1939W reload with a Dr. Rocket 98/10240 motor casing. To retain the motor I will use two Giant Leap Rocketry motor holders (stainless steal clamps bolted to the rear centering)

Launch Lugs

Two ¾" X 6" copper launch lugs will be used along the side of the rocket. These will be epoxied in place and then reinforced with epoxy fillets. For the actual launch I ended up bolting rail guides into each copper launch lug and launching from a 20ft rail.