Building Rockets for Safety

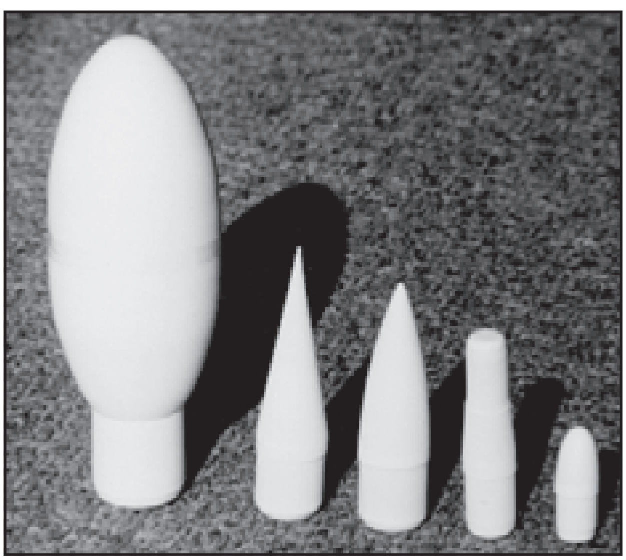
If Your Rockets Are Built To Survive A Ballistic Crash, It May Be Time To Rethink Your Design Philosophy For Safety.

By Tim Van Milligan

Over the past five or six years, I've noticed a disturbing trend among rocket builders. It seems to be popular to build rockets to survive ballistic crashes. While this sounds like something great, the result of these types of ruggedly built rockets is that they forsake safety.

What does this mean? One important thing that contributed to the excellent safety record established during the 1960's and 70's was that models were designed out of lightweight materials. More importantly, they were made out of "frangible" materials. That is, they could crumple in on themselves if they were to strike an object.

This ability to be frangible is important. Think of an automobile for an example. Since the 1950's, all cars have been built with a "crumple zone" at the front and rear of the vehicle. This crumple zone is designed to absorb the impact energy of a crash. It transfers the energy by deforming the materials; keeping it away from the occupants inside the car, nor the object which the car strikes.



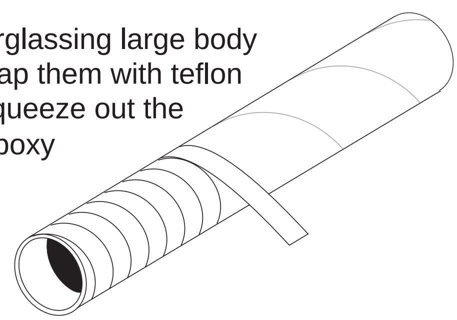
Lightweight vacuum formed cones are good to use when designing for safety.

Our rockets are missing this important crumple zone. There is no way to dissipate the energy of a crash. The sturdily built rocket survives, but whatever it hits — like a building, car, or "person" — receives all the damage. I worry that someone is going to get really hurt by one of these indestructible rockets.

It this concerns you too, what should you do?

First, stay away from thick-walled tubes; and those made from exotic materials like high-impact strength plastics and phenolics. What are good are thin-walled tubes made out of paper. Also, the safer nose cones are the light-weight balsa varieties, or thin-walled vacuum form plastic ones. Nose cones that have a blunt nose shape are also safer than ones with a pointy shape.

For bigger rockets, I still like the thin-wall paper tubes, which can be strengthened just enough fiberglass to give sufficient rigidity. Use epoxy sparingly. Epoxy doesn't add strength; only weight. I highly recommend the vacuum bagging technique to squeeze out excess epoxy resin from fiberglass cloths.

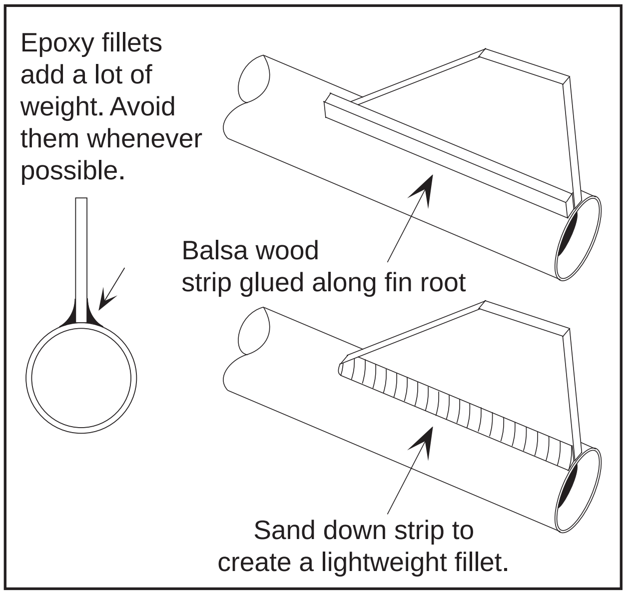


After fiberglassing large body tubes, wrap them with teflon tape to squeeze out the excess epoxy resin.

If you don't have that, excess epoxy can be squeezed out by using Teflon tape (like used on water pipe threads). Just wrap the tube tightly with the tape, and the epoxy is squeezed out between the wraps. When it hardens, it will leave ridges. But these are easily sanded down.

Similarly, watch that your fin fillets remain low mass. Epoxy fillets really add a lot of weight. Try another technique instead. Balsa strips can be glued along the root edge of the fins, and sanded down like a normal fillet *(see the illustration on the next page)*.

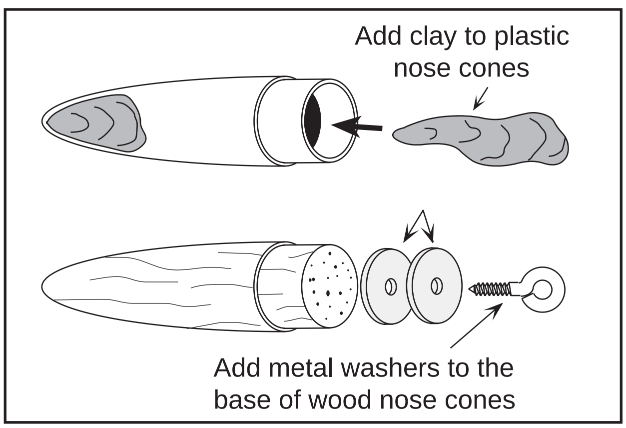
Remember, keep the mass of the rocket as low as



possible. A lightweight rocket doesn't have the damage potential of a heavy one.

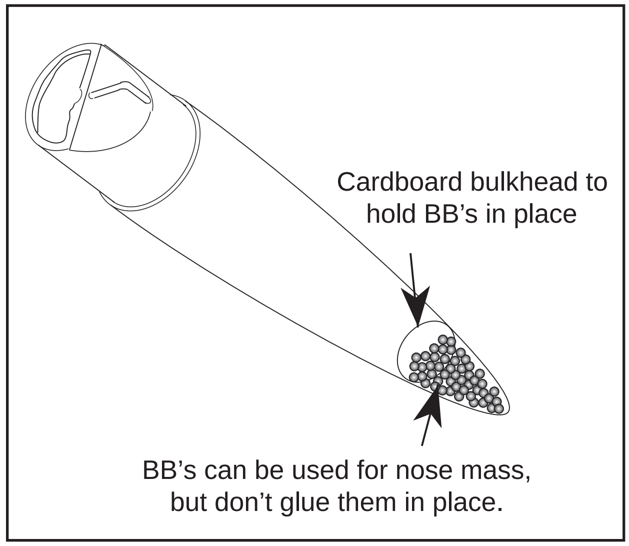
If you must add weight to the rocket (such as getting it up to its optimum mass), try to put it in the payload of the rocket. If there is no payload, use clay or sand in the nose cone. If you have to use metal, try to use washers attached to the base of the shoulder. That allows the forward part of the nose to deform to use up the energy of a crash.

To move the CG forward, use BB's in the nose,



but don't epoxy them in place. Instead, use a cardboard disk behind them as a bulkhead to prevent them from shifting aft. As a last option, use lead shot BB's (not the most environmentally friendly) for maximum CG shift.

In reality, building lightweight frangible rockets will mean that the model will take some pretty seri-



ous damage if it should crash. To avoid this, you'll need to relearn the basic flying skills. They are: choosing the correct motor for your rocket, selecting the proper recovery device, aiming the rocket to match the given wind and recovery area constraints — and most important of all — whether or not to fly the rocket at all on that day (or range). As I've said hundreds of times before, I recommend a software simulation program like RockSim. It will aid you in learning proper launch skills. It is a much inexpensive way, compared to crashing rockets, to learn launch skills.

In conclusion, remember model rocketry mimics real-world aeronautics. In that sense, by building heavy and indestructible rockets, we are getting away from the principles that modelers should be using to guide our endeavors. Please, build lightweight and frangible rockets.