

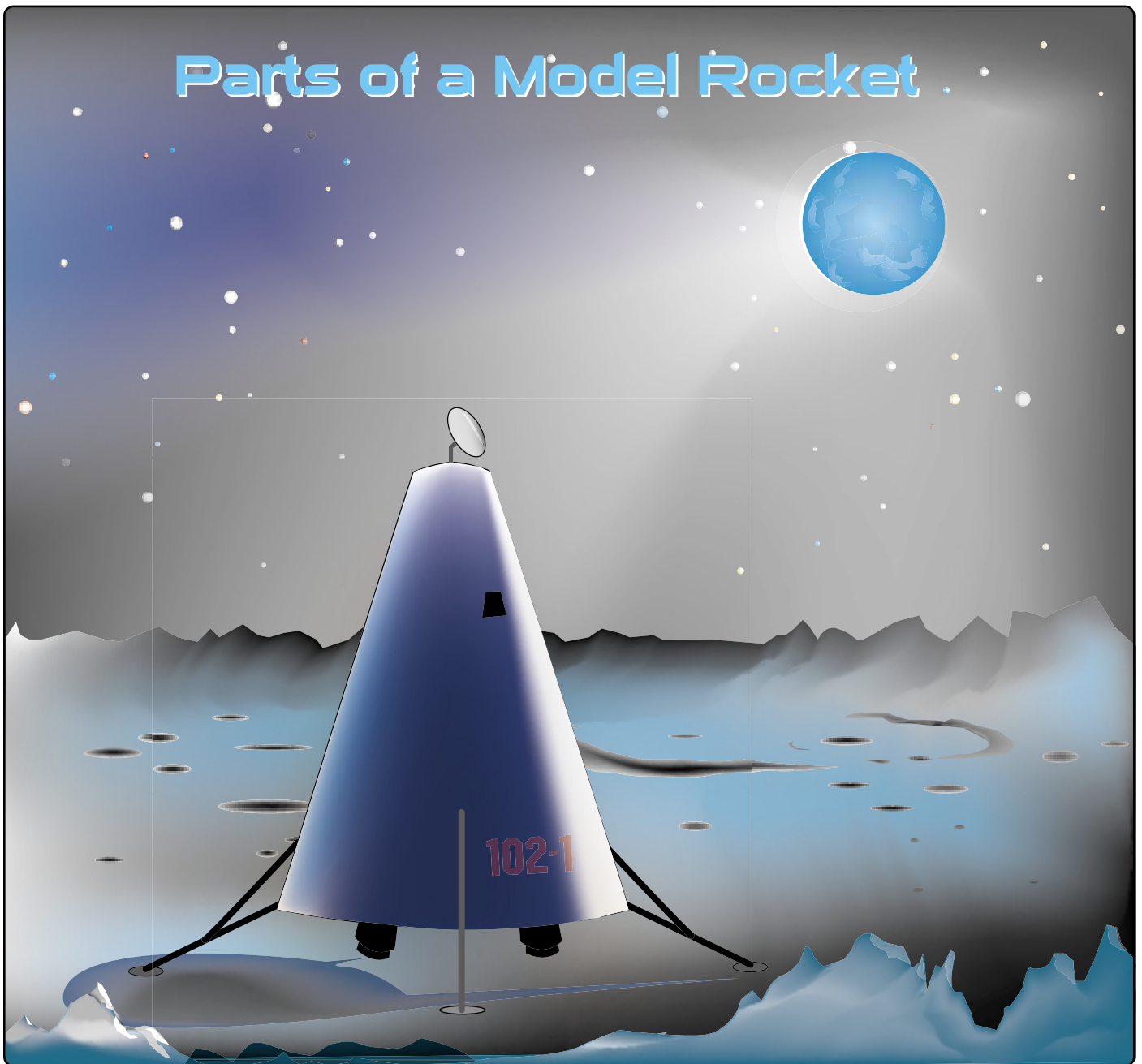
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**APOGEE**

**PEAK OF FLIGHT**

**NEWSLETTER**

## Parts of a Model Rocket



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## Parts Of A Model Rocket

By Tim Van Milligan

When a new modeler gets started in the hobby, they are often overwhelmed by the terminology associated with rocketry. In this article, I will cover the basic names for the parts used so that you can look like an expert when you talk to others about rocketry. I will also try to describe what the purpose of each part, and why it is important to the flight of the model.

Take a look at the drawing on the next page. Feel free to print it out as a mini poster to display to your friends. It shows you the basic parts of the rocket. We'll start by describing the external parts first.

### Nose Cone

The nose cone is the forward-most part of the rocket. The purpose of the nose is to reduce the aerodynamic drag on the model.

Most nose cones that you find in rocketry are either made from plastic, or balsa wood. When you first get started in rocketry, you almost always buy a pre-made nose. But it is possible to make your own. You can make them out of paper, like an ice cream cone, or you can carve one out of wood. If you'd like to make your own paper cone, you'll find a simple diagram in the book "Model Rocket Design and Construction." [http://www.apogeerockets.com/design\\_book.asp](http://www.apogeerockets.com/design_book.asp). The problem making a paper cone is the seam. It becomes more difficult when the nose is very long to roll the cone properly.

The alternative is to carve one out of wood or Styrofoam. This isn't as difficult as it sounds. Actually, it is a lot of fun and you can really save a lot of money. You'll find instructions on how to make high quality nose cones in the video book "Making Custom Nose Cones" at: [http://www.ApogeeRockets.com/make\\_nose\\_cones.asp](http://www.ApogeeRockets.com/make_nose_cones.asp).

### Forward Fins

These are fins placed forward of the Center of Gravity (CG). I don't recommend using forward fins, because they are always destabilizing. That means they will make the rocket less stable, and could cause it to do loops when you launch it.

This is very unsafe.

If you are tempted to create a rocket that has forward fins, be sure to run a RockSim simulation to make sure it is still stable prior to launch.

We'll talk more about fins a bit later in this article.

### Airframe Tube

Most people refer to this part as the "body tube." But that is a little bit vague, because paper tubes are used extensively throughout the rocket. By naming it as "Airframe," we know that it is a tube that can be seen from the outside of the rocket. Internal tubes can have different names.

The purpose of the airframe tube is to hold the internal stuff. In other words, it keeps the stuff on the inside from falling out of the rocket. It also separates the drag-reducing nose cone from the fin section. If they are too close (in other words, the rocket is very short), the model could be unstable when you launch it.

The airframe tube is a flight critical item. That means that if it should kink while the rocket is traveling upward, the flight will go berserk and unstable. The result will be a crash. Ouch.

The tube usually made of paper. But some bigger rockets are made from other materials, like fiberglass, or paper that has been soaked in a phenolic resin to make it hard and stiff. But for most rockets, paper is plenty strong. If you are just getting started in rocketry, don't worry that the tube is going to break under flight loads. Paper is actually very durable.

One problem that I see over and over among new modelers is that they attempt to make their rocket too strong. Bullet-proof in fact. But they don't realize that this actually makes for an unsafe condition. The rocket is too heavy because of the extra glue. So when it goes unstable, it can do a lot more damage than a lightweight one.

Always try to build a lightweight rocket! Isn't that what NASA does? Yes. They keep the weight of the rocket low so that it can fly higher into the air, or carry a large payload.

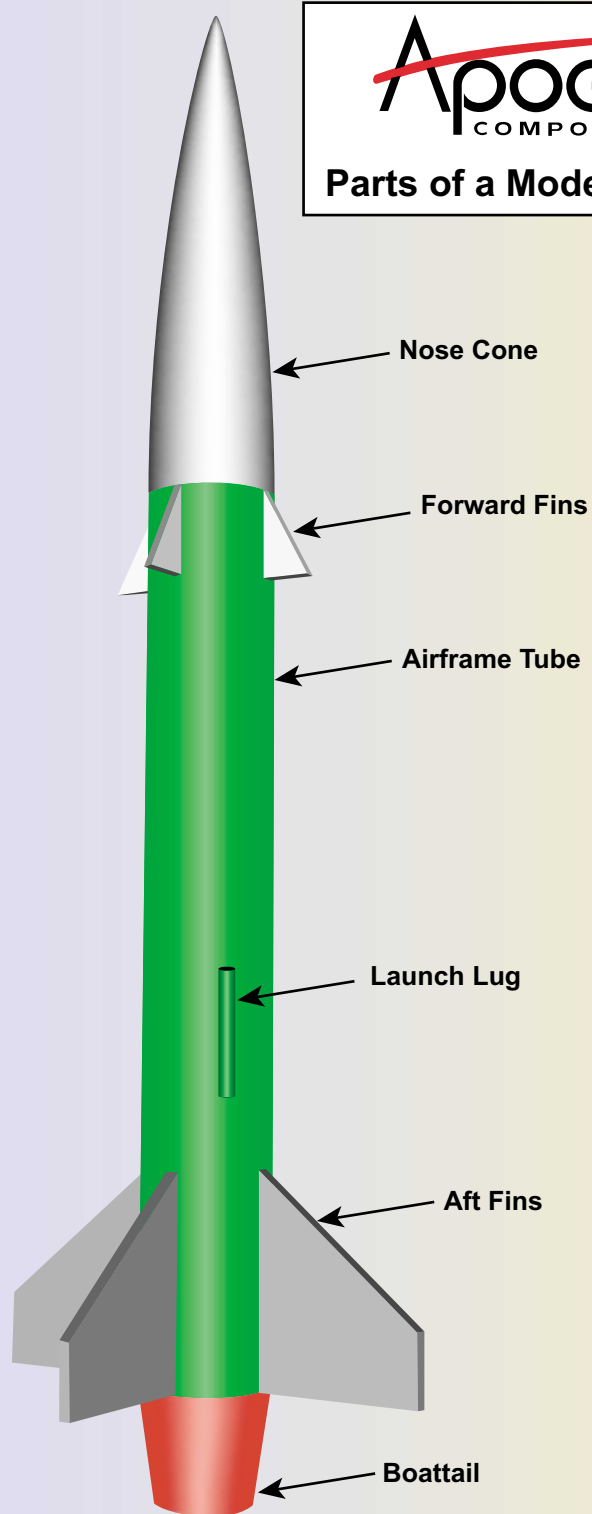
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### About this Newsletter

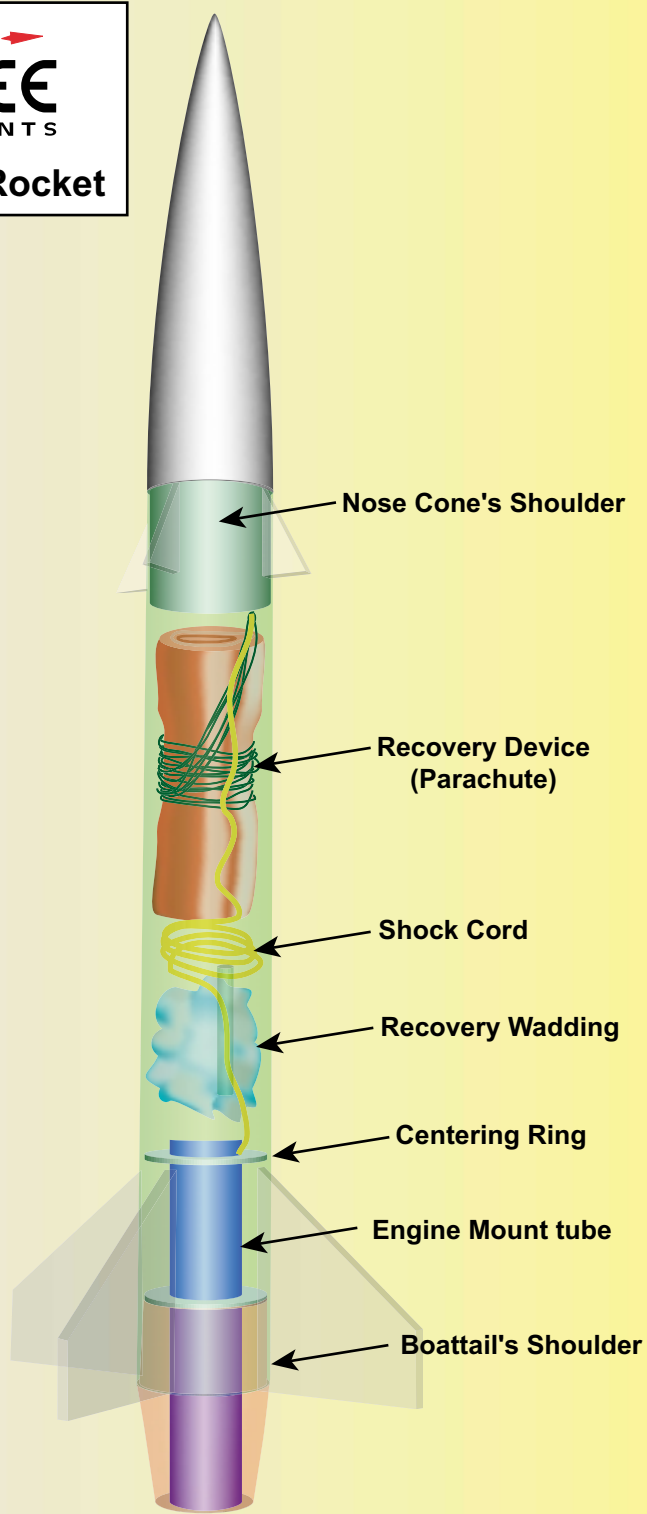
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**Parts of a Model Rocket**



**External Parts**



**Internal Parts**

## Parts Of A Rocket

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### Launch Lug

The launch lug is that little paper tube attached to the side of the model. The purpose of this tube is to hold the rocket on the launch pad while it is building up speed. You see, our rockets can't be steered, so they need guidance when you launch them so that they go in the direction you want. The rocket needs to reach about 30-40 miles/hour before it leaves the launch pad. That is when the fins on the back of the rocket start providing a restoring force to keep the rocket heading in the right direction.

It is the launch lug keeps the rocket going in the correct direction until the fins begin to become effective.

The reason the launch lugs are paper is so you can glue them to the side of the rocket. Plastic straws don't work well, because glue doesn't stick to them.

### Aft Fins

As mentioned above, the purpose of the fins is to provide the restoring force necessary to keep the rocket heading in the

right direction. Without aft fins, the rocket will go unstable.

Fins can be made out of a variety of materials. The most common is lightweight balsa wood. The reason is that it can be shaped easily to create a good airfoil, and it can be easily glued and painted. You can find out more information about making fins and attaching them securely to the rocket in the book *Model Rocket Design and Construction*. [http://www.ApogeeRockets.com/design\\_book.asp](http://www.ApogeeRockets.com/design_book.asp).

The size of the fins depends on the size and shape of the rocket. I always recommend using a rocket design program, like the RockSim software to determine if your fins are adequate size. The RockSim software is unique, in that it will allow you to create any size or shape fin you want. So there is no excuse for making an unstable rocket.

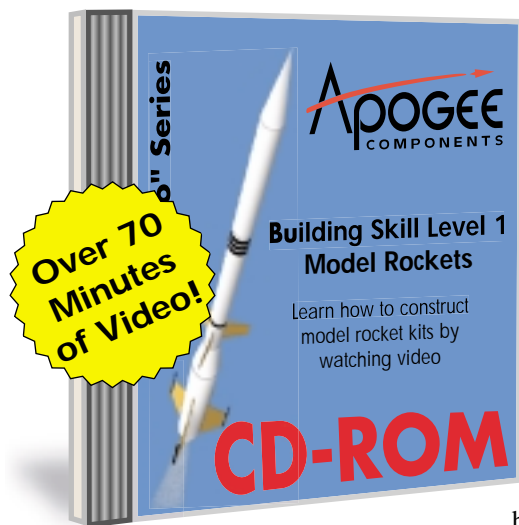
### Boattail

Boattail is a drag reducing part on the back of the rocket. It helps direct airflow around the base of the rocket. In effect, it keeps the flow smooth, which reduces the aerodynamic drag and allows the rocket to fly higher into the air.

It isn't necessary to have a boattail on your rocket. Most models don't have one. But they can help to make your rocket

Continued on page 5

## How To Make Better Looking Rockets: Discover The Secret Techniques Used By Master Craftsmen



*"The use of videos imbedded into the text made the lessons easy and fun to read. Even my girls could understand!"* -- Craig Christenson

**Note:** The CD-ROM is not a DVD disk. It is an ordinary computer CD-ROM. It works on both Macintosh and Windows computers. Requires Adobe Acrobat Reader, which can be downloaded free from the Adobe website.

**Do you want to "really" know how to build better looking rockets?** Would you like stronger rockets? Do you want your rockets to fly higher? Are you pressed for time and looking for ways to build rockets faster? If you answered 'yes' to any of these questions, please read on.

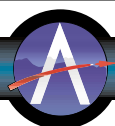
### No More Confusion - Your Brain "Gets" This Material Instantly

If you wanted to learn piano, karate, or even business, calculus, or computer programming -- wouldn't you find it easier to learn in a classroom, with a teacher, than at home with a book? Go ahead and try explaining how to tie your shoe to someone without actually showing them. Do you see my point?

It's the same with building and flying model rockets. When you see a master craftsman assemble a rocket right before your eyes, the techniques and procedures crystallize in your brain. This really is the closest thing to having me in your workshop sitting right next to you at your workbench.

Once you watch a video you just pause it and then you go do exactly what you saw me do. If you have a question, just hit "rewind" and instantly access the information you need. You can go at your own pace (fast or slow) because all the information is right at your fingertips. You'll find this video-book indispensable for all your rocket project, both easy and complex. Go to the Apogee web site, and order you copy today! For just \$12.95, you won't find any better rocket education. ([www.ApogeeRockets.com/skill\\_level\\_1\\_video.asp](http://www.ApogeeRockets.com/skill_level_1_video.asp))

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## Parts Of A Rocket

Continued from page 4

sleeker, and to fly higher into the air.

When a boattail is located in another position on the rocket, it is usually given another name. When it is further forward on the rocket, it is called a reducer. When it is turned around, so that the smaller diameter is toward the front of the rocket, it is called a transition section or sometimes a shoulder.

The easiest way to make a boattail is to take a nose cone, and cut off the tip with a saw. When you do it this way, you can have curved shapes, just like a nose cone. You can also make boattail and transition sections from paper sheet. Instructions for doing this are in the book: *Model Rocket Design and Construction*.

### Internal Parts

If you again take a look at the diagram, we'll now talk about the parts inside the rocket. Let's look at the top, and work downward.

At the bottom of the nose cone, is a cylindrical section. This is called the nose cone's shoulder. It is actually a part of the nose cone, even though it is listed inside the rocket as a separate item.

The purpose of the nose cone shoulder is to hold the nose cone on top of the rocket. The nose cone is NOT glued on the rocket. It gets blown off when the rocket engine's ejection charge fires. When it comes off, everything inside the rocket, like the parachute and shock cord come out too.

The shoulder section usually has some sort of attachment point for the recovery device and the shock cord. That way, it doesn't get lost on the way down during the recovery phase of the flight. On nose cones made out of plastic, the attachment point is already molded into the part. On nose cones made of wood, a metal screw eye is inserted and glued into the base of the nose cone. Then the parachute and shock cord are tied to this.

### Recovery Device

In most rockets, the recovery device is either a parachute or a streamer. The purpose of the recovery device is to slow the descent of the rocket, so it lands on the ground softly and can be flown again.

A parachute is used on heavier rockets, or when you want it to come down the slowest; for example, when you have a delicate payload that needs to land softly.

A streamer is usually used for rockets that are lightweight, or that fly so high that they might drift long distances. The streamer works just like a parachute (it creates drag to slow it

down), but it descends a bit faster.

Selecting a parachute or streamer can be done using the RockSim software. It will calculate the descent speed of either type of recovery device, so you can see how far away the model will land. You can even use the FREE demo version of the software if you aren't ready to buy the full version yet. <http://www.ApogeeRockets.com/rocksim.asp>

Once you have designed your recovery device, the next thing you'll need to do is assemble it. For instructions on how to do that, and to attach it to your rocket, see the book: *Model Rocket Design and Construction*.

### Shock Cord

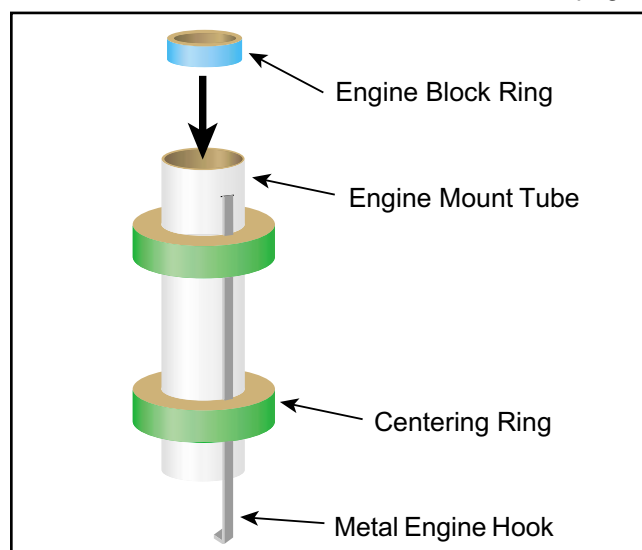
The purpose of the shock cord is to keep the entire rocket together during the descent phase. Otherwise, you'd need to put a recovery device on both the nose, and the main body of the rocket. And you'll have to recover both parts after it lands so you can fly it again.

I personally prefer Kevlar® as the material for the shock cord. It is pretty much indestructible. Everything else in the rocket is going to break long before it does.

There is a small concern you have to consider when using Kevlar®. It can cut the upper portion of the body tube if the rocket is traveling too fast during deployment. To counteract that, you need to use a longer length of cord; that way, the rocket has a chance to slow down before the Kevlar® can cut into the tube. I recommend making the cord three times the length of the rocket.

For more information about attaching the shock cord to the rocket, see the book: *Model Rocket Design and Construction*.

Continued on page 6



Components in an engine mount.



## Parts Of A Rocket

Continued from page 4

tion.

### Recovery Wadding

Many newcomers to rocketry think the wadding is plain old toilet paper or tissue. It isn't. It has been treated with a chemical that makes the paper fireproof. Once treated, it doesn't burn. It only smolders and self extinguishes.

The purpose of the wadding is to protect the parachute from getting the full heat of the engine's ejection charge. The hot gases of the ejection charge are more than 1000° F, and can easily melt the plastic or nylon parachute. The wadding insulates the parachute from the heat, so that it functions properly once it is ejected out of the rocket.

Without the wadding, it would be melted into a plastic wad.

To give the parachute more protection, I like to put the shock cord into the rocket first, before installing the parachute. Any extra space between the parachute and the engine is a good thing.

### Engine Mount

The engine mount is an important part of the rocket. Its purpose is to hold the rocket engine firmly in place inside the model, and to align it concentrically with the centerline of the model.

It is usually made up of several components items. These are the engine mount tube, the centering rings, and can also include an engine block and engine hook (not shown in the diagram).

In Peak-of-Flight newsletter #104 (<http://www.ApogeeRockets.com/education/downloads/newsletter104.pdf>), I presented a lot of information on how to design and build your own engine mounts. I would recommend reading that article, as you'll find a lot of good information and illustrations.

### Conclusion

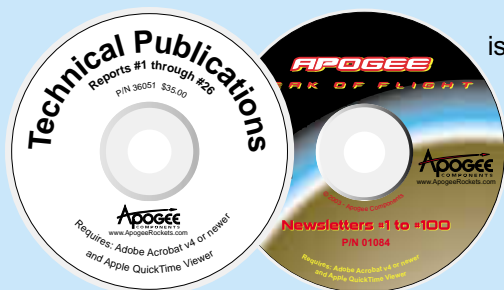
Even though this was a long article, I've attempted to simplify things to make rocketry understandable. Why? When you give me a call on the phone to talk about rockets, we'll both be using the same terminology. We won't have to guess what the other is trying to say.

### About the Author:

Tim Van Milligan is the owner of Apogee Components (<http://www.apogeerockets.com>) and the curator of the rocketry education web site: <http://www.apogeerockets.com/education>. He is also the author of the books: *Model Rocket Design and Construction*, "69 Simple Science Fair Projects with Model Rockets: Aeronautics" and publisher of the FREE e-zine newsletter about model rockets. You can subscribe to the e-zine at the Apogee Components web site, or sending an email to: [ezine@apogeerockets.com](mailto:ezine@apogeerockets.com) with "SUBSCRIBE" as the subject line of the message.

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