Apogee Components

# PEAK OF FLIGHT

NEWSLETTER

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**Cover Photo: Mad Cow Solar Express model rocket kit. Get yours at: www.ApogeeRockets.com/Madcow_Solar_Express.asp**

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# Light Up The Nozzles Of Your Saturn V

Marek Ratajczak - Gibraltar

I've finished my Saturn V 1:70 rocket model by Apogee Components (www.ApogeeRockets.com/Saturn5.asp). It's beautiful, many thanks to the Apogee Components team for their effort to prepare the whole set so professionally.

I'm not going to launch my model, there was another reason to build it. It's a part of my apartment decoration, where in the tall living room (through 2 floors in a duplex apartment) the rocket will be presented against a background of 2.9 x 1.9 m size photo wallpaper that is "Visor shot", one of the most famous images taken on the Moon. Next to the rocket, Buzz Aldrin's "Magnificent Desolation" copy and "Saturn V Flight Manual SA-503" (SA-506 is unfortunately unreachable in the net) will be presented as well. My model can fly, because it was assembled exactly follow Mr. Rocket's video instructions, with as much as possible accuracy. But the main model purpose is presentation, not launch, so I made one important extension to this project.

The thrust structure of stage 1 doesn't fly anyway, so all 5 F1 engines I've equipped with small, however very strong LED lamps (4.5 W each, which is the equivalent of a regular 20 W bulb each, so the equivalent of a total 100 W traditional bulb), powered by a 12V transformer.

Here is presented which kind of LED lamps to use, how to install them inside thrust chambers / nozzle extensions, and how to cool them, because installed power of a total 22.5 W is quite a lot for plastic nozzles.

When the rocket is presented at the height of 2.5 m, strongly luminous engines are spreading the light around the living room, working as a part of whole lighting design, and the Saturn V seems to have cleared the launch tower....

### *What do you need:*

In my rocket I used five "OSRAM" LED bulbs 4.5 W each, presented in the images at the right. You need also some electric cord (e.g. 2 x 0.5 mm2), micro-connectors, thermo-shrinkable tubes, an electrical connector strip, and 240(120) V / 12V transformer. I used a two-section, two-range transformer from an old desk lamp.

The advantage of using this particular type of "OSRAM" PARATHOM MR16 20 – 12V lamp is the specific construction of bulb body. It is already painted in almost the same

color as the nozzles, and is almost the same maximum diameter as the thrust chambers.

We cannot fit the whole bulb deeply in nozzle extension (as shown on the image) because of the external diameter, but it doesn't really deteriorate the appearance of thrust structure.

The biggest advantages of using LED bulbs are that they have very low energy consumption and an extremely

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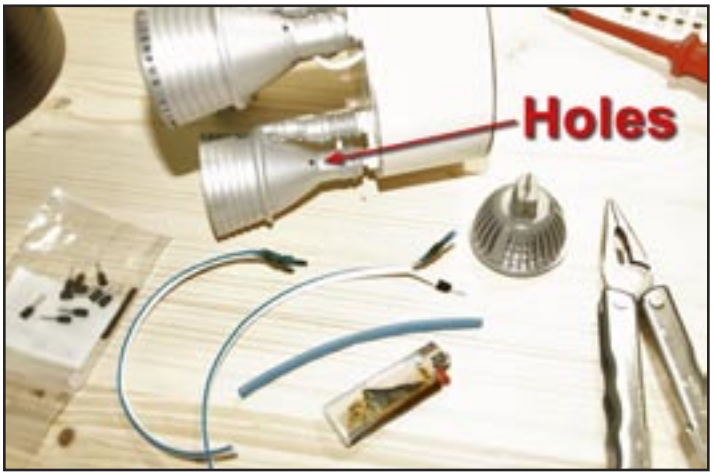
## Light Up The Nozzles of Your Saturn V

long life. Efficient generation of white light doesn't produce a big amount of heat; when lit, they can be kept in the hand. When fully warmed up however, they can burn a bit, so I invented a way to cool down the whole thrust




structure during exhibition.

Lamps are powered by a12V transformer, so the pins are very thin and small. To fit a bulb inside the nozzle

extension, I used very small connectors clasped on the electric cord and pin, protected with thermo-shrinkable tube insulation.

Before I put bulbs inside the nozzle extensions, I made some small holes in the thrust chamber to enable some hot air circulation within the chamber. 3 – 4 holes, 3.5-4 mm indiameter, are not really visible, especially from a distance, and not visible at all when lighting, so they don't worsen the general look.

One cord end, connected to the bulb, comes outside the engine through the small hole in the thrust chamber (drilled from the less visible side of each engine), and goes into the thrust structure box through the hole next to the en-

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gine mounting point. When you paint the cord a silver color,

it's almost invisible. All bulbs must be connected in parallel. Because my transformer is divided into 2 sections of 20 W each, I made 2 separate circuits, 2 bulbs and 3 bulbs. All is connected together with power cord inside the thrust structure box with use of an electrical connector strip, and fixed with hot-melt adhesive (hot glue).

### *All assembled. Just needs some paint...*

Lighting my rocket after a couple of minutes I realized the heat coming from bulbs is bigger than I expected. In theory I could decrease voltage on the transformer, or use a dimmer. The only problem is, this kind of LED lamp (as many others) is not suitable for use with dimmers. Even using dimmers, LEDs are lighting quite strong. Decreasing

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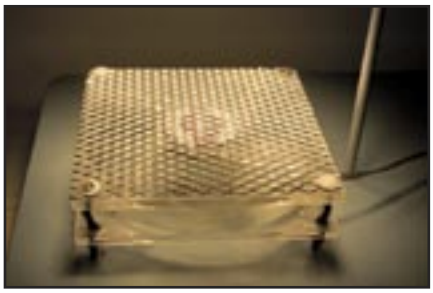

outgoing voltage on the transformer helps a bit, but primarily I had decided to get strong light to simulate rocket's lift off. Finally the solution came from "computer technology". On the stage, 12 cm under the rocket's engines, I put a typical (however, quiet) 12 cm dimension computer fan, powered with the same 12V transformer, using one of my lamp circuits. When I switch on the lights, the fan also starts to spin.

A typical computer box fax is covered by an aluminium net, to protect the propeller but mainly to improve the general look. Anyway, my rocket will be presented on the height of 2,5 m, so the fan won't be visible at all. To eliminate any vibrations which could be spread by the fan to the whole rocket stand, for fan mounting I used rubber pins, commonly used in computers. Rubber pins inserted into corner holes in the fan frame will settle in holes drilled in the rocket stage. No fixing is necessary. One day when I decide to launch my rocket, I can just simply lift up the fan and take it away to not destroy it by exhaust gases.

The last image was taken to present the general view of the rocket with stand. The final look will be improved by turning the stand to hide the rod.

Despite the OSRAM described LED lamps as "Not suitable for use with dimmers", I use a dimmer. A modern dimmer switch based on triac, "chops up" the sine wave. It automatically shuts the light bulb circuit off every time the current reverses direction -- that is, whenever there is zero voltage running through the circuit. This happens twice per cycle, 100 or 120 times a second. It turns the light circuit back on when the voltage climbs back up to a certain level. This "turn-on value" is based on the position of the dimmer switch's knob. If the dimmer is turned to a brighter setting, it will switch on very quickly after cutting off. The circuit is turned on for most of the cycle, so it supplies more energy per second to the light bulb. If the dimmer is set for lower light, it will wait until later in the cycle to turn back on.

A traditional bulb changes brightness when dimming. LED lamps are different. They start to pulse with the same intense light. And as long you use LED for illumination, it's not a welcome effect, but using as F1 engine "fuel", it will bring you more fun, I guarantee that...

# Why Competition Rocketry Stinks

Tim Van Milligan

Actually, it doesn't. But I wanted a controversial title that would draw attention and make you want to read more. I apologize for the trickery... In this article, I'll give you some insight as to what competition rocketry is all about, and my opinions on what can make programs like competition rocketry grow in numbers.

### *Competition is Intense*

A few days after NARAM was over and I was back in my office, a customer walked in and said "Tim, I don't know how you can stand competition. I saw what was going on at the competition range at NARAM, and it was too intense for me."

Thinking about it, he was right. Competition rocketry is as intense as you'll see anywhere on the rocket range. But what did he mean when he said it was intense? Having participated in competition rocketry, I'll try to explain what it means.

Competition rocketry is a lot like golf, but with a time limit. While you compete against others to see who can put up the best flight, in reality, you are really competing against yourself. It is a way to gauge how good of a modeler you really are.

For example, a parachute duration rocket seems pretty simple, right? There isn't too much technology that you can invent (or some other person can invent) that is going to provide a serious advantage. It is like "which golf club is better?" One may be made out of titanium, but how much of a real advantage is that? Which would you rather have, the titanium golf club, or the hitting skills of someone like Tiger Woods?

It is the same in competition rocketry. There is a tiny amount of "technology" that can give you an advantage over your competitors, but the real edge is given to the person with the better building and flying skills.

So in competition rocketry, it comes down to personal achievement. Are you putting together your best rocket? And are you using your best flying skills?

For the most part, if this was all that competition rocketry was, I think there would be more participation amongst modelers. But there is the "Time Limit."

The time limit comes about because you have to fly a certain number of rockets during the contest. And the contest has a beginning and an end. Usually, you have one day to make all your flights. That makes sense, doesn't it?

The problem people run into is that they get a really good flight and the model drifts forever! Now you have to chase down your rocket, so you have to build that time into your schedule too, along with flying your other rockets. Plus you have to put in volunteer time to run the range too. You might be a timer, a tracker, a range safety officer, etc. Everyone has to put time in to make the contest run smoothly

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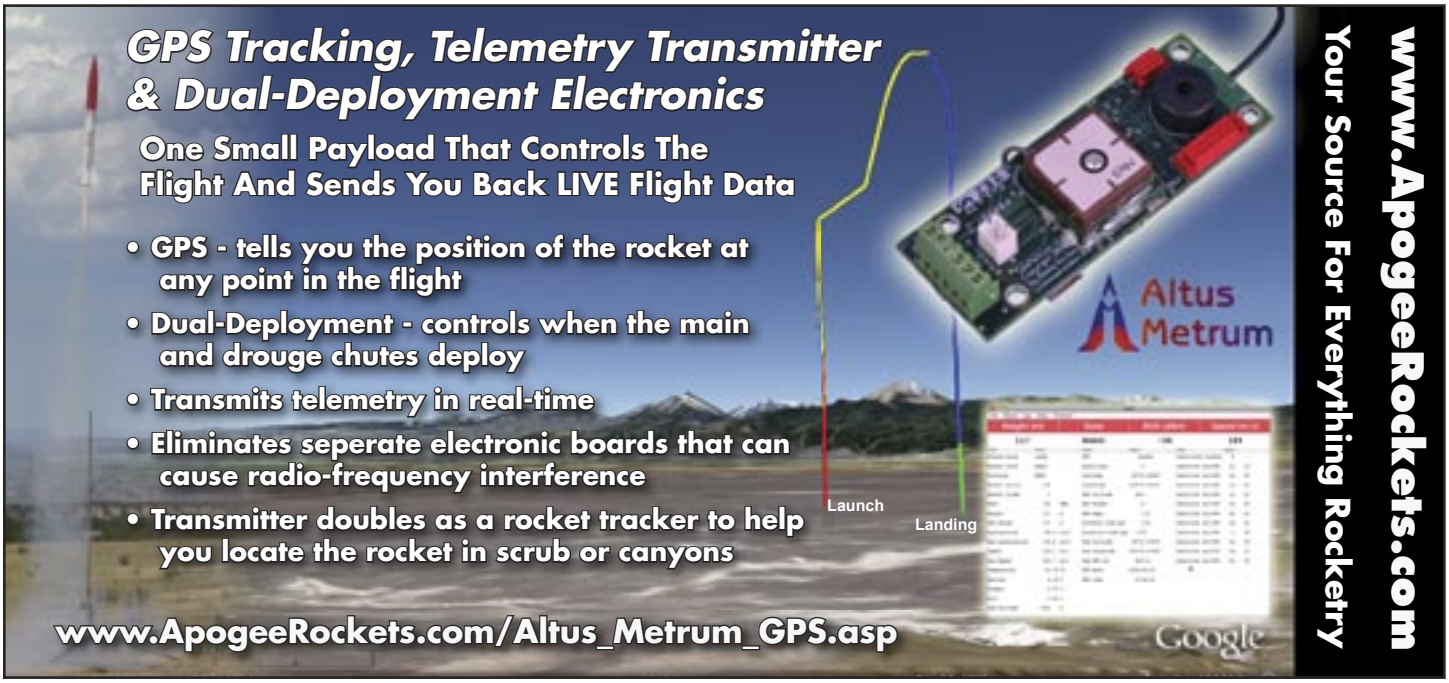

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Add this all up. If you're getting good at putting up rockets high into the air, and keeping them up for a long time, you eventually come to the conclusion that the time-clock is your real enemy.

This is what makes competition rocketeers so intense.

### *Fighting the Time-Clock*

They are very busy fighting the clock. Because of that, they don't have much extra time during the day to dawdle and jabber-jaw with fellow rocketeers (as fun as that might be). Success in rocketry is a matter of paying attention to the small details. In "competition rocketry" it is even more important, because you're pushing the envelope quite a bit more. For example, you might be stuffing a bigger chute into a rocket than you normally would, just to keep it in the air for a longer time period. And in order for it to deploy properly, you'll need to pay more attention to how it is folded and inserted into the rocket. If you do it haphazardly, it will get stuck in the tube and the flight will be a wasted effort.

If you see a competitor on the range, more than likely, they have their head down over their prep table trying to put their rocket together for that next perfect flight. They know that a small distraction can cause them to miss something important, like securing the motor properly in the rocket, or not inserting the recovery device so that it comes out easily and quickly during the flight.

For that reason, competition rocketry is highly intense.

Normally, the people that fly competition rocketry are just as easy-going as the next rocketeer you may meet at the range. But when you catch them trying to get everything right so that the next flight they make is not wasted, they can get a bit edgy and seem standoffish. Again, they are trying to minimize distractions so that they don't screw up. After the competition is over, they'll go back to being the nice people that you may have remembered earlier.

To sum it up, it is the "time limit" that makes competition rocketry so intense. If it wasn't for that, and the repercussions that occur because of it, I believe that more people would give it a try.

### *How HPR Certification Is Like Competition*

I say this, because in a way, getting a high-power certification has several elements in it that are similar to competition rocketry, and the number of people that are going after that L1 cert continues to grow all the time. For example, to get a L1 cert, it will challenge both your building and flying skills, because you can't cut too many corners or you'll fail at it. But the big difference is that there is no time limit. You proceed at your own pace, and make the flight when you're ready to do it.

I suspect that if you added a time limit to it, or said that if you failed on your first attempt that you had to wait at least 6-months before making another attempt; it would be just as intense as preparing for a competition. If that was the case, I know that I'd be a lot more focused when I went

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## Why Competition Rocketry Stinks

after my L1 certification.

When people say to me that they think competition is fun but too intense, I know now that it is really the time-limit factor that they are objecting to.

Take away the time-limit factor, and you have something like the long-running NARTREK program (www.NAR.org/NARTREK/) or a high-power certification program. I really like the concept of the NARTREK program, which challenges you to build a variety of rocket types, although I think that it stops too soon for adult modelers. Just building and flying a scratch built model is enough to top out for the NARTREK "gold" achievement award. But for the long-time participant in rocketry, scratch-building a rocket is pretty trivial.

For adult modelers, I think there is room for some type of additional achievement program that pushes modelers to do greater things. I could see something that might be a cross-breed between the High-Power certification and the NARTREK program. It could be as simple a thing as "the mile high club" where the object is to use a rocket to go over 5,280 feet, or the "Supersonic club" where you have to successfully put a model past Mach 1.

Of course, the success of any type of program like this is conditional on one thing. If you don't have this one thing, the program will be doomed to failure. What is this one thing?

It is the same thing that would bring more people into competition rocketry.

### *How To Get More People Into Competition*

I see that many people try to make competition more fun by eliminating the part that is "challenging", like pushing your building skills to the limit. They do this by having what they call "fun events," which could be things like having everyone build a specific rocket kit, and use the stock recovery device. They think that by doing this, they'll increase the number of people that give competition a try.

Does that work? Is there any evidence that it has drawn more people into competition rocketry?

My gut feeling is "no." And I've never seen any proof that it does work. I only know that I have never participated in one of those "fun event" type competitions. Why? Because those type of competitions don't push me to become a better modeler. A win in a "fun event" type contest is to me like winning the lottery. They are just about being luckiest.

One thing that hasn't been tried to bring more people into competition is to remove the time limitation. This is

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hard to do, so you'd have to get more creative. Why is this? For one thing, in a formal competition, you have to schedule judges, timers, trackers, and results people. If there was no time limit, then it could become much more difficult to set this up to occur all the time. In addition, it doesn't take into account the weather on the day of the flight, nor the size of the launch range. People in the western United States would have a bit more of an advantage in that type of contest, because the launch ranges are typically larger.

The TARC competition is the closest thing to an event with a very long time limit. It is quite popular, and I do think there are a lot more students and schools that participate in it, just because the deadline is so far out into the future.

However, does the lack of a short time-limit on the event encourage people to come back again and compete in the future? In other words, is there a high turn-over, or do we see the same schools every year? And how important is it really? Could there be other ways of increasing participation in competition that haven't been tried yet?

I'm not so sure removing the time-limit is necessary. One of the things people like about game shows and sporting events on TV is the contestants have to compete against the clock as well as perform a task. Without the deadline, the victory seems a bit more hollow.

### *A Radical Proposal for Increasing Participation*

It isn't really radical… Again, I'm only saying that to increase the readership of this section of this article.

One thing that I have observed that nearly always works in motivating someone to do something is to give them "recognition."

Sounds simple, doesn't it. But it is not used nearly enough. I try to use it as much as possible with my own customers here at Apogee Components, because it does work so well. I've found that customers (you) are more likely to buy from our company if we treat you better than other companies treat you. Is it manipulation on my part? You bet. But are you going to turn me down for treating you with kindness and offering you special recognition? I don't think so.

Recognition is the key ingredient to creating any type of successful rocketry program, or for getting more people interested in "anything."

Say you did something special in your life, such as hiked up all 50+ mountains in Colorado that were higher than 14,000 feet. Woudn't you want something for that achievement? I would.

If the person that meets a challenge is not recognized by receiving some type of special pin, a medallion, or other "portable-but-visible" award, then the program will fail and be a waste of time for the person responsible for running it.

Getting recognition that you can carry around to show others your accomplishment is the key. I think it is the special ingredient that makes the High-Power Certification program so successful. My NAR membership card shows my high-power certification level, and it really makes my 10-year old daughter jealous. That is why it is special to me. It is something that she'll have to wait and achieve on her own.

This past summer at NARAM, there was a special reward for people getting high-power certification. They got a one-of-a-kind medallion. And it was a HUGE success. There were more people that certified at NARAM than at LDRS – just so they could get that special medallion on top of the new membership card that shows their certification level. Recognition is that big of an incentive.

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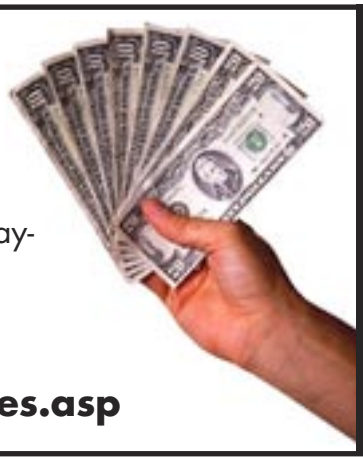

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## Why Competition Rocketry Stinks

***High-Power Level 2 Fliers received special medallions at NARAM-52 to recognize their achievement.***

In competition rocketry, there is a pretty big "recognition factor" that is part of the reward for winning. That's what the award ceremony is all about. I think that plays a pretty big part in why some people enjoy competition. Take away the award ceremony, and it becomes just a contestant's own internal motivation to do better. While that sounds very spiritual, it isn't enough to motivate people to do more and better things.

I think that is the real reason the "fun competitions" are not ever going to drive new people to get involved with competition. The awards ceremony is not for a real accomplishment, it is more like the ceremony for a lottery winner. The guy that got the winning ticket feels good, but the people that lost feel no pain because they really didn't do much to control the outcome. "Yea… whatever."

If you want to drive more people into competition rocketry, the answer isn't to make the events easier to participate in. The answer is to make the recognition more significant just for participating.

Greater recognition isn't the same thing as making the prize bigger.

There might be a significant cost difference between a 6 inch tall trophy and a 17 inch trophy. But the trophy size alone probably won't affect the number of people that come out to compete.

However, if you gave the winner absolutely nothing, except that you did hire a bunch of attractive models to stand next to the winner of the contest and give them hugs and kisses during the awards ceremony, now we're talking something completely different. I would bet that it would bring out additional contestants in droves. Recognition like that is more powerful than money or other trinkets.

Maybe we need some sort of "rocketry ambassador" position for the winner of a big contest. Sort of like how Miss America travels around the country after the event, or how the winner of the National Spelling Bee goes on all the TV talk-shows. We may not be big enough yet to support this position, but I think it should be our goal.

### *Rocketry Is All About Recognition*

Is this overly simplistic? Is that what rocketry all about, recognition?

Most people take up rocketry as a "hobby," which is an

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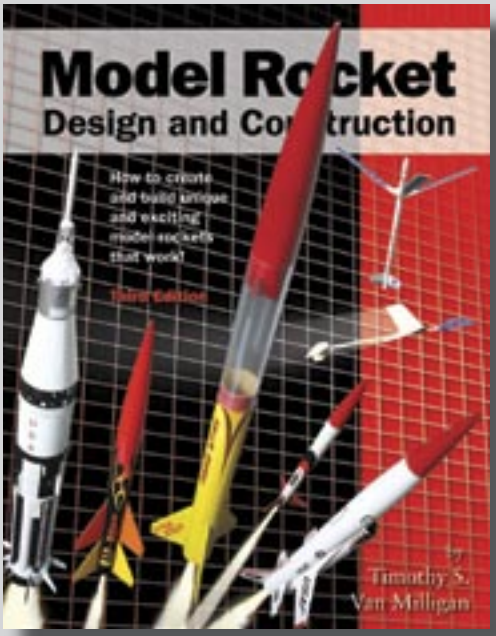


## Model Rocket Design and Construction

*By Timothy S. Van Milligan*

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activity that is suppose to relax you between the stressful times in your life. But one of the reasons I believe that they stay in the hobby long-term is for the recognition it brings them. For example, doesn't it warm your heart when you hear someone start a sentence with the phrase: "It doesn't take a rocket scientist to…"? The connotation of this phrase is that rocket scientists (like YOU), are exceptionally intelligent and smart.

That type of recognition we get may be a major reason why we stay in the hobby, even though we may/may not have any formal engineering training.

The more we can do to recognize achievements of others, the bigger the hobby will grow! Competition is just another way to earn recognition, just like HPR certification or setting an altitude record.

### *Additional Resources:*

Why people like rocketry – without using the words "it's fun" or "it's cool:" www.ApogeeRockets.com/education/downloads/Newsletter85.pdf.

Building Your Rocket Club During a Recession Part 1: www.ApogeeRockets.com/education/downloads/Newsletter212.pdf.

Building Your Rocket Club During a Recession Part 2: www.ApogeeRockets.com/education/downloads/Newsletter213.pdf.

### *About The Author:*

Tim Van Milligan (a.k.a. "Mr. Rocket") is a real rocket scientist who likes helping out other rocketeers. Before he started writing articles and books about rocketry, he worked on the Delta II rocket that launched satellites into orbit. He has a B.S. in Aeronautical Engineering from Embry-Riddle Aeronautical University in Daytona Beach, Florida, and has worked toward a M.S. in Space Technology from the Florida Institute of Technology in Melbourne, Florida. Currently, he 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 a FREE e-zine newsletter about model rockets. You can subscribe to the e-zine at the Apogee Components web site or by sending an e-mail to: ezine@apogeerockets.com with "SUBSCRIBE" as the subject line of the message.