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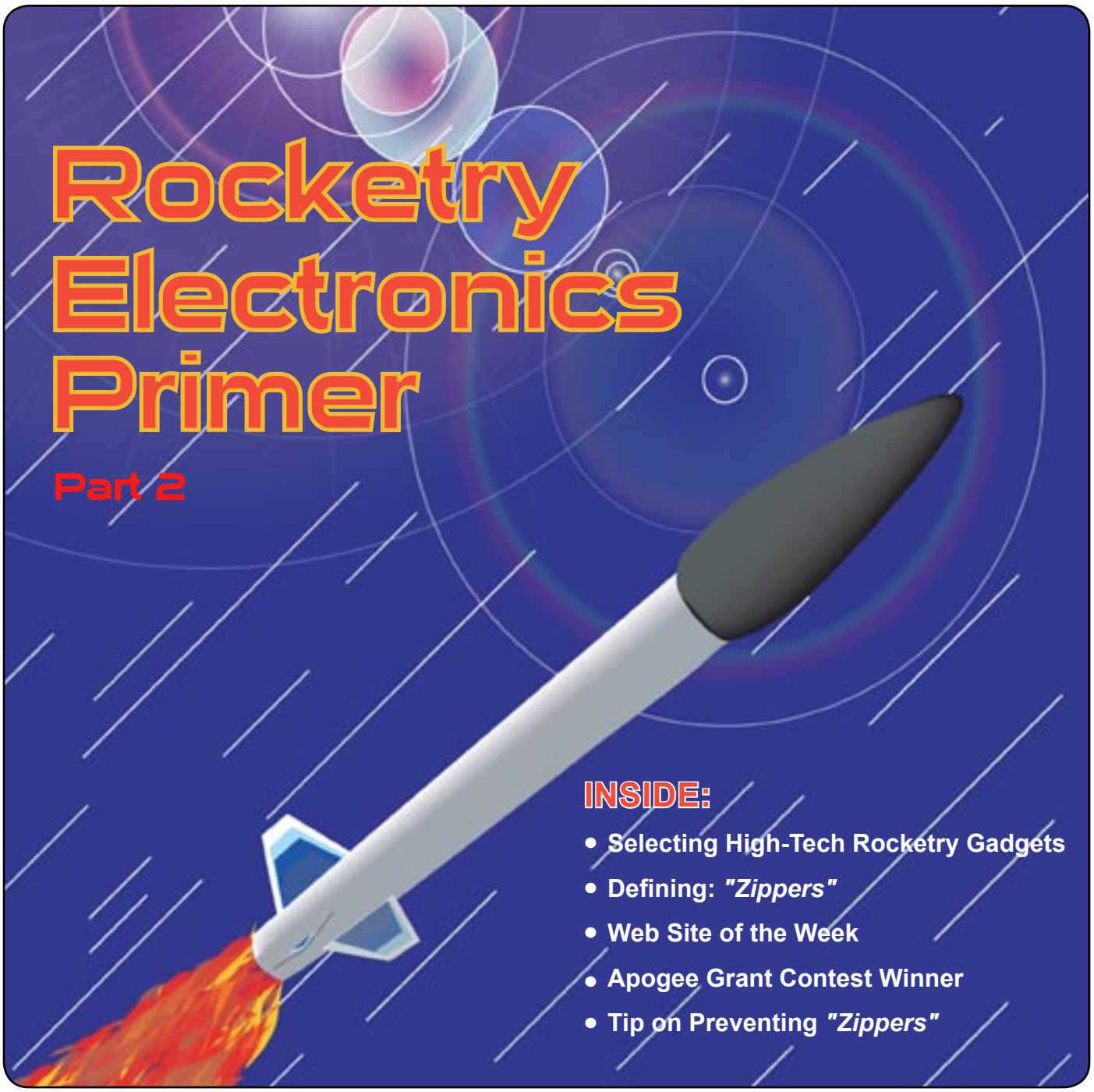
APOGEE PEAK OF FLIGHT NEWSLETTER



Rocketry Electronics Primer

Part 2

INSIDE:

- Selecting High-Tech Rocketry Gadgets
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Rocketry Electronics Primer - Part 2

by John Manfredo

Most of this article comes from John Walquist's "Rocketry Electronics 101" (used with author's permission). The full article is available through ROC's website at http://www.rocstock.org/wizards/rocket.electronics101.pdf

Which is the best choice for you in rocketry electronics devices?

In the last issue of *Peak of Flight*, we discussed the different options available for electronic components in your rocket. In this issue I will talk about the different brands of altimeters, timers, and accelerometers that are available so that you can make an educated decision on which device suits your needs best. My intension is to be impartial and simply give you the information you need to make the choice yourself. The units listed are not all-inclusive, but represent much of the more popular brands available to the consumer.

Figure 1

Peak Reporting Altimeters

Altimeters have come a long way in the last years of this hobby. There is a type available for you that includes just about anything that you want it to do. If you just want a basic peak reporting altimeter, Perfectflite carries the Alt15K (seen in figure 1), which is a tiny altimeter with audible peak reporting and full flight data download capability. It is very small in size (fits

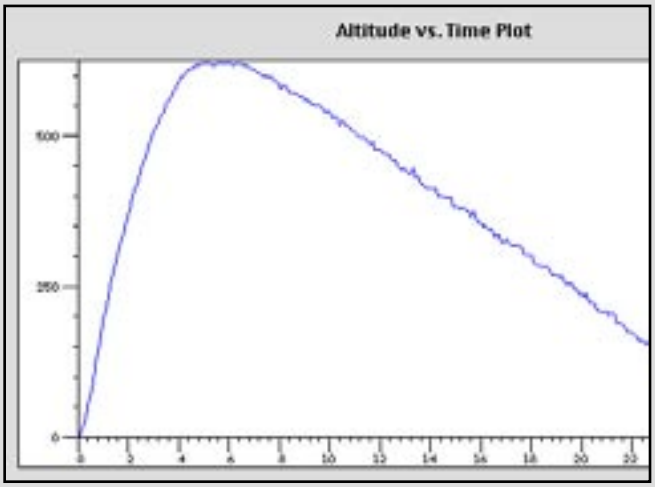

Figure 2

in 18mm BT20, weighs 0.5 oz. with battery)! It will run somewhere between $70 - $80.00. This unit is available from us here at Apogee at http://www.apogeerockets.com/Altimeter.asp. For a nominal but additional fee, you can purchase the computer software and cable. This will provide you with graphs such as the one in figure 2 and run on PC or Mac.

Figure 3

Another small unit that records peak altitude only is the PICO altimeter as seen in figure 3. Touted as the smallest altimeter in the world, it is .6in x .3in, lightweight .8 grams (without battery), and fits in a 10 mm body tube (that's smaller than a dime!). It is seen in figure 3 and is priced around $40.00. Of course, this unit comes without a power source, so you must provide that yourself in the form of a 3V lithium battery.

Adept Rocketry carries the ALT1R and the ALT2R. These record high-resolution altitude data throughout an entire flight. Dump data to a personal computer with included Dumping and Plotting Software. Data may be

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About this Newsletter
You can subscribe "FREE" to receive this e-zine at the Apogee Components web site (www.ApogeeRockets.com), or by sending an e-mail to: ezine@apogeerockets.com with "SUBSCRIBE" as the subject line of the message.

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studied for altitude vs. time, velocity, acceleration and deceleration, parachute descent rate, and so on (The ALT1R Recording Altimeter measures and records with a resolution of five feet. The ALT2R is a metric Recording Altimeter that measures and records with a resolution of one-tenth of one meter, or about 4 inches).

Transolve Electronics makes the P7 Altimeter. The P7 is a peak reading, apogee firing only altimeter that fits in 18mm tubes. The status, continuity state, and altitude data is reported via a LED. It fires apogee, low

Figure 4

current electric matches by one 12V battery, which is supplied. There is also a new 'Colorado' version where the launch site elevation is set to 5,000'. This helps to deal with our state being at such a high altitude to begin with. Some units that are sold or have been sold in the past have to be calibrated specially for Colorado. See figure 4 for a picture of this unit. This is a good in-between unit (i.e. - unit that just peak reports compared to one that has deployment capabilities) that has single deployment capability in addition to peak reporting. You might want to use this unit if you are flying low altitude rockets and want to get used to using electronics for deployment rather than motor - based ejection charges.

Dual Deployment Altimeters

Let's say that you've decided to step up what you want to achieve with your electronics. Dual deployment allows the user to pop out a small drogue parachute at apogee so that you don't have the drift that is associated with motor - based ejection. Then the larger main 'chute comes out at a predetermined altitude, much lower so that the rocket lands safely on the ground.

One such unit is the G-Wiz altimeter. Pyro output 1 has a jumper select between launch detect (for clusters) and burnout detect (for staging). Pyro output 2 fires at apogee detect for the drogue parachute. Pyro output 3 fires at a fixed, low altitude, jumper selected between 400 feet or 800 feet. Acceleration and Barometric data sampled and recorded 16 times per second along with all detected events. Enough memory on board for up to 4 min of flight. It comes with a standard serial port connector and the graphing software provided works on PC and Mac computers..

Figure 5

As seen in figure 6, the Perfectflite miniAlt/WD logging dual event altimeter. It works to 25,000 feet MSL and audibly reports peak altitude after flight. This unit stores over 5 minutes of flight data at 20 samples per second for later download to PC, Mac, or PDA. It deploys both drogue and main chutes with audible igniter continuity check. The main chute deployment altitude is adjustable from 300 feet to 1,700 feet in 200 foot increments.

Figure 6

This little but powerful unit measures just 3.0"L 0.9"W * 0.7"H, fits in 24mm tube, and weighs only 0.7 oz.

Many rocketeers depend on a tried and true unit from Missileworks called the RRC2. You can see a picture of this in figure 7 on page 6. This unit is rugged and will read from 0 - 25000 feet MSL in altitude. There are two independent recovery stages. Event 1 fires at apogee (default) and event 2 fires at 1000'/800'/500'/300' AGL. Event 2 can also fire 1 second after apogee.

One of the features that many rocketeers prefer is the super positive on board 9V battery retention hardware. This unit is engineered for a perfect fit into a

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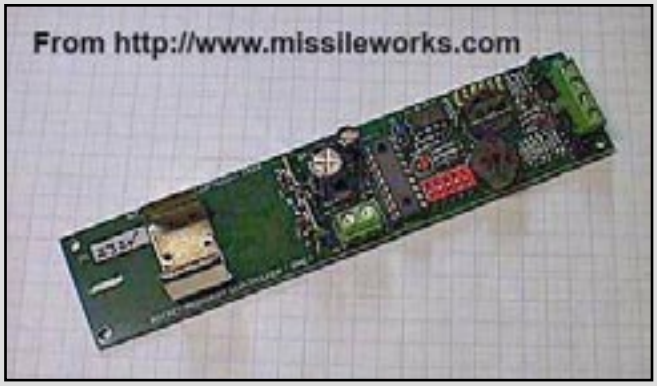
38mm coupler tube. It has a weight of 1.76 oz (50 gm) without a battery and 3.38 oz with a battery (96 gm) typical. This altimeter sells for about $90.00.



Timers

If you are in the market for a timer, there are many available, but I will focus on three. The first is the Perfectflite miniTimer 3. As seen in figure 8, this timer features an easy to set delay time, which is field adjustable from 0.6 seconds to over 60 seconds in 0.1 second steps. The beeper provides audible igniter continuity check, powerup reporting of current delay time setting, and post-flight siren to aid in rocket location.

The high accuracy digital time setting is retained in EEPROM (electrically erasable programmable read-only memory) even with power removed. It uses secure screw-down terminal blocks for battery and igniter. The optional on-board G switch can be seen in the lower right corner of figure 8. This automatic trigger sense configuration (normally open/normally closed) allows use with G-switch, break-wire, pull-pin, etc. The trigger condition must be met for 0.5 second in order to start timing cycle in order to avoid false liftoff triggering.

It measures just 1.5”L x 0.9”W x 0.5”H, fits in 24 mm tube, and weighs 0.24 oz. This unit can be used for ignition of sustainer motors in multistage rockets and ignition of auxiliary motors in airstarts. It can also be used for accurately-timed deployment of recovery devices in lieu of the sometimes variable delay times associated with the motor’s built-in delay grain.

The next timer is the Adept Dual (Two-Event) Staging/Deployment Timer as seen in figure 9. This timer is capable of supplying very high current to igniters or deployment charges. It arms at the first instant of liftoff, and each output fires individually after predetermined periods of time. It can be used for staging multi-stage rockets, air starting motors, or for controlling parachute deployment at a given time(s) after liftoff. This timer may be used for multi-event deployment (Dual Deployment) due to it having two programmable events instead of one.

Last, but not least, is the Xavien XSSET-1, which stands for "Xavien Single Stage Event Timer". This timer is cool because it is a G-switch - activated, single channel event timer. The XSSET-1 is small, lightweight and versatile. It was designed for staging or ejecting recovery devices. It has two modes of operation; “TMR” (TIMER mode) and “BOS (BURN-OUT SENSE mode). In BOS mode the unit begins countdown after the rockets motor burns out. In TMR mode the unit begins countdown when the unit is first launched.

Making the Choice

Now that you have many options laid out before you, how do you decide between them? There are many considerations that you have to take into account.

Number 1 : What do you need it for?

Are you mainly interested in finding out how high your rocket flew? If this is the case, then you can stick with a basic peak reporting unit.

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Do you want to launch a high - altitude rocket and don't want to lose it or walk miles to recover it? If so, then choose an altimeter that has dual - deployment capability. I would say that for most flights with parachute recovery that are expected to go over 3000 feet AGL, you should go with dual - deployment. Streamer recovery is another matter, since the rocket will most likely be smaller and not drift. An example of this is the Apogee Aspire (http://www.apogeerockets.com/aspire_rocket.asp), which was designed for mile - high flights on the Apogee F10-8.

Maybe your interest is in staging and you want to make sure that the sustainer motor lights at the right time. You will need a timer for this and possibly a dual - deploy unit as well to keep it from drifting.

Number 2 : How much do you have to spend?

A lot of times, it comes down to this question. Sure, it would be nice to have that real cool, expensive altimeter, but you'd have to go into debt trying to finance it! Seriously, this is one of those areas in which you will have to weigh the cost versus the functions of the device. Keep in mind that as with most things, you get what you pay for. This is not to say that the smaller, more inexpensive units are not really good, but the more expensive ones are that much better.

As John Walquist says in his article, "The cost of an altimeter is very dependent on what a manufacturer thinks his unit is worth to those of us who are buying these toys – in their defense, it does cost money to design, troubleshoot and market a product and the manufacturers are entitled to a fair return on their investment of time and labor, Right? That's Capitalism at work!" How very true, John.

In the end, it comes down to these two factors; the device's intended use and what you have to spend as far as which one you should choose to buy. Take your time and choose wisely! I hope that you are armed a bit better now for when you decide to go electronic.

About the Author

John Manfredo is the Education Coordinator and Newsletter Editor at Apogee Components. He is Level 1 High-Power Certified and has been building and flying rockets since the early 1970's. He enjoys passing his love of rocketry down to his kids.

Question & Answer

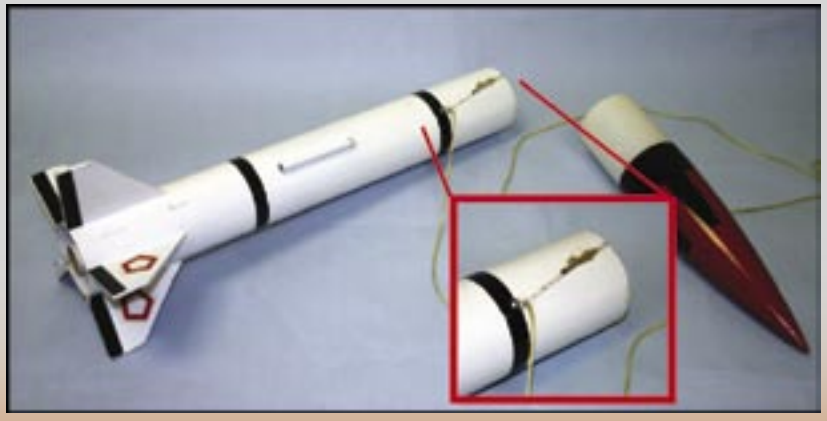
Our question this issue comes from Dave & Bonnie Miller, who say, "We ordered your Mylar streamers for our daughter's science project. Tech Pub #4 mentions attaching a string off-center to the streamer. Do you have any suggestions on what type of string to use and how to attach it to the streamer?"

Mr. Rocket answers, "You might take a hole punch and put a hole near one corner of the streamer. Then take a notebook paper hole reinforcement ring, and put it around the hold to give the streamer strength. After that, tie the string through the hole. You can also tape the string to the streamer. That is what I normally do. I run the string parallel to the end of the streamer so there is a lot of gripping area, and I put a knot at the end of the string so it won't easily pull through the tape."

DEFINING MOMENTS

A ***Zipper*** occurs when a rocket is traveling at too high of a velocity when deployment of the recovery takes place.

As seen in the photo on the right, when I flew my Dynastar Sky Torpedo (http://www.apogeerockets.com/Sky-Torpedo.asp), I chose a motor that had too short of a delay for my launch conditions. I thought I had it pegged, but I should have run a simulation in Rocksim (http://www.apogeerockets.com/rocksim.asp). It would have saved me from the dreadful *zipper*!



When the rocket is on its ascent, the recovery device needs to be deployed when the model is moving as slow as possible. This may be just before or just after the point of apogee. If the motor delay after burnout is too long, then deployment will occur when then rocket is on its way down. Conversely, if the delay is too short (which is my case), then the model will be moving at a high rate of speed when deployment occurs. This is the more common way that a *zipper* happens in flight.

Web Sites Worth Visiting

The website to turn your browser to for this issue is Sean Rose's "Cycline3" at http://www.cycline3.com/rockets/index3.html. I discovered this site back in 2002 when I read about it in this newsletter, way before I started working here. Back then, just about the only thing on the site was the "$10 Rail Pad". That's what I was after at the time. Since then, he has added a bit more and it is worthy of another look.

As I mentioned before, the homemade rail launcher is cool. I made one after finding this site years back. You can see one in the picture. There is also a rod pad in construction detail. One of the nostalgic things to see are the pictures from Sean's childhood, including his dad, who was his inspiration to get into rocketry. Check this site out; I'm sure you'll be glad you did!

Homemade rail launcher

The criteria that is used to select the websites for publication here is that they need to be rocketry - related, plus educational or "how-to" in nature. There are over 10,000 readers of this e-zine, so if you have a website that you'd like to send some traffic toward, or if you know of a neat site that other rocketeers would benefit from seeing, please send it to me at: johnm@apogeerockets.com (hint: to increase you odds of making it to the "site of the week, "have a link back to the Apogee website...We need publicity too.)

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TIP OF THE FIN

The tip for this issue is on how to keep tube zippering from occurring. It comes to us from Michael Pontikos.

Michael says, "Use masking tape on the shock cord to prevent zippering. Place the tape one centimeter below the edge of the BT and one centimeter above it. Then, wrap the tape around ten times. The tape will make the pressure have a larger surface area and won't zipper the BT."

As a "thank you" to Michael for this tip, he will receive a 58" Dynastar nylon parachute! If you have a tip that you think would be good to share with other rocketeers, please send it to johnm@apogeerockets.com. If we use it in this newsletter, you will receive one of these beautiful parachutes as well! Go to http://www.apogeerockets.com/parachutes.asp to see these for yourself.

L-R: **Daniel** *(Production temp.)*, **Dave** *(Graphic Design)*, **Carla** *(Graphic Design intern)*, **Brenda** *(Customer Care)*, **Michelle** *(Shipping/Office Manager.)*, **Tim** *(Owner/Rocket Scientist)*, **John** *(Education Coordinator/Newsletter Editor)*, Front: **Pluto**, *the rocket wonder dog*

Apogee Rocketry Grant Winner

It is with great pleasure that we announce the winner of the First Annual Apogee Rocketry Grant Contest! We had a great response for this contest the first year out. Choosing the recipient was difficult, as there were so many wonderful entries. The winner of the $300.00 award goes to Neil Brown of the Lower Hudson Valley Challenger Center in Suffern, NY. They may use this award to go toward any Apogee products of their choosing.

In the selection of this recipient, we looked at the rules that were laid out and chose the one group that most embodied the Mission Statement of Apogee Components, Inc. This statement, in brief, says that "we want to immerse in a rewarding experience any person wanting to further their growth in rocketry by providing entertaining and educational products that teach and show how safe and fun the hobby can be." In short, he plans to use the money to purchase products that the Challenger Center can use to further education and experiences with rocketry not only in the Center itself, but Neil also has plans to form a new local National Association of Rocketry (NAR) club that will meet the needs of the community.

There are plans to obtain multiple copies of Rocksim for the Challenger Center in addition to establishing an educational library that will carry all of Apogee's written materials and educational CD ROMs. They would also like to obtain Apogee supplies to allow up to 12 of their middle school students compete in next year's TARC contest. The Challenger Center has over 11,000 students, 1,000 scouts, and 2000 kids who attend birthday parties pass through each year. Since Neil is on the board of directors, he hopes that he might be able to help the 50 other Challenger Centers around the country to become interested in our educational products as well.

As far as the NAR club goes, the emphasis will be heavily weighted toward parents and children working together in order to pass along this hobby to the next generation. They plan on holding rocketry classes of different levels, which will realistically impact almost 300 people in the beginners class alone. They could then offer advanced classes for high power rocketry as well. **Congratulations Neil!**