



PEAK OF FLIGHT

N E W S L E T T E R

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Adding Lights To A Rocket For Night Launches



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Adding Lights To A Rocket For Night Launches

By Annette Sostarich

After attending several night launches, and going through the routine of taping lightsticks to the sides of my rocket, I finally decided to create a purpose-built night bird.

My first night-launch rocket was pretty conventional: I added a clear payload section to one I already had, and just stuck an electronic lightstick into it. That worked very well, but I've always been fascinated by electronic things that blink, and beep, and do interesting stuff....

I had acquired some interesting little circuits that blink LEDs very brightly, while using so little power that they will run for days on a couple of lithium coin cells. Toys, novelties, (eBay!) and retail display devices are good places to look for these circuits. Another plus is because they have a very short flash (that's why they use so little power), they are not too hard on night vision- they flash faster than the eye can adapt. I'm deliberately not getting too specific here, because there is a lot of this sort of stuff out there, and what you can get will probably be different from what I can get.

I wanted to use one of these to put a couple of dozen LEDs on an existing hobby rocket. This technique can also be used in new construction, and will probably result in a sleeker appearance, since it's a lot easier to build things like battery doors into a new rocket. I took the lazy way out and mounted everything on the outside.

This project will require a small amount of electronic knowledge and tools. You will need, at minimum, a pair of needle-nose pliers, wire strippers, a soldering iron and solder.

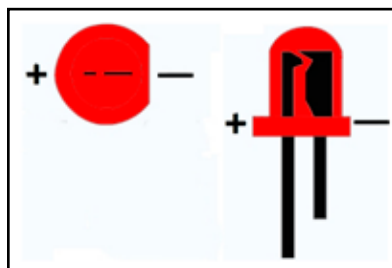
In the article I wrote, called: "*Build a Super Simple Cheap Igniter Tester*" (www.ApogeeRockets.com/Education/Downloads/Newsletter287.pdf), I mentioned good sources for ultra bright LEDs, with eBay being my favorite. You can buy a 10 or 25 pack for only a few dollars. Check the specs on the LEDs. You want a light output of at least several thousand mcd. Most eBay sellers put this spec in their listings. That article also made some recommendations for basic electronic tools and soldering that apply to this project.

The first step, now that you have the LEDs, is to mark

and cut in half lengthwise several pieces of body tube to make side pods. Since this was a small hobby rocket, I used 18mm Estes tubing, and I made 3 pods about half as long as the rocket. The pods need to be large enough in radius to take the LEDs you have chosen. The 18mm tubing can accommodate either 3 or 5mm LEDs, the two most common sizes.

Next, draw a center line on the inside of the tubing. You'll be punching holes and inserting the LEDs from the inside. Make marks where you want the LEDs. I made the pods 7 inches long so I could put in 6 LEDs, spaced 1 inch apart. Using a leather punch or similar, punch the holes for the LEDs. The body of the LED should be a snug fit in the holes.

Identify the short and long leads of the LEDs. The short lead is negative and the long lead is positive. They usually also have a flat spot on the negative side (Drawing 1).



Drawing 1: Identify the negative lead on the LED.

Now you have to decide how you will wire the LEDs. This hinges mostly on whether you will just be powering them with a battery pack or using a flasher circuit of some kind. My flasher circuit has six independent outputs, and I have 3

sets of 6 LEDs each, so I decided to wire them in sets of 3 top and 3 bottom for each pod. My flasher has a common positive for all 6 circuits, so the first thing is to wire all 6 of the positive leads together on each assembly, using (preferably) solid wire, such as "bell wire", available at Radio Shack. Solid wire is better in this application because, being stiff, it will stay where you put it and thus doesn't need to be insulated, I stripped off the insulation of this wire so I could use one continuous length to tie the LEDs together. I then wired the negative leads together on the top 3 and bottom 3 LEDs for each assembly (Photo 1). Cut off the excess LED leads.

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About this Newsletter

Newsletter Staff

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Add LED's To Your Rockets



Photo 1: The LED's, which are positioned in a pod, are wired up in parallel using stiff bell wire.

Now you need to attach leads to these assemblies long enough to go to your battery pack or flashing circuit. I prefer to use "stranded" wire (i.e. multi-strand) rather than solid for this, because it's more flexible. You can see these coming out of the bottom of the pod in Photo 1. Also visible in Photo 1 is the Hot-Melt glue used to "beef up" the LED mounting.

The battery pack and flasher circuitry can be mounted internally if desired, although this will require more work and is best suited to new construction.

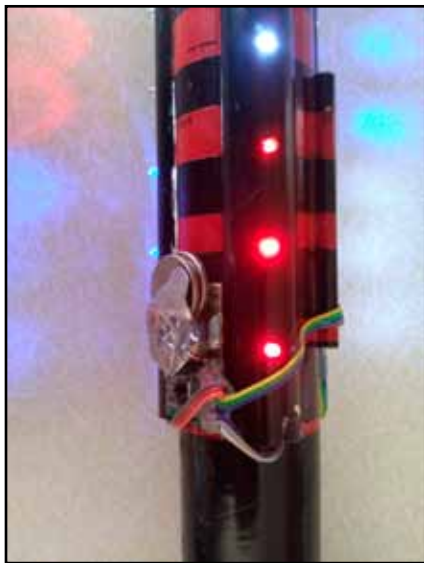


Photo 2: LED's temporarily installed on the rocket.

The half-tube pods are finished off with paper half-nose cones, painted, and super-glued to the rocket body 120 degrees apart, with the connecting wires extending from the bottoms. The flasher module is mounted 180 degrees from the launch lug with hot-melt glue. The wires are trimmed to length, connected,

and secured to the rocket body with hot-melt glue (Photos 2 and 3).

If you are just using a battery pack to power your LEDs, a lithium "coin cell" battery can power 2 or 3 LEDs without needing a series resistor. For more elaborate systems, you can use either 2 or 3 AA or AAA batteries.

If you're going this route, you need to use a little bit of

math to ensure the LEDs get the right amount of power: subtract 1.7 Volts (the LED's Forward Voltage) from the battery voltage (each AA or AAA battery is 1.5 Volts), then divide the resulting number by .020 (the LED's Maximum Current, in Amps). The number you wind up with is the size, in Ohms, of the resistor you need to have in series with the LED. For example, a standard LED with a 2 AA battery pack would be $3 - 1.7 = 1.3 / .020 = 65$ Ohms. You can get appropriate resistors at Radio Shack, from eBay or a number of online retailers.

This works for standard LEDs, otherwise (especially with blue and white LEDs), you need to find the Forward Voltage and the Maximum Current in the LED's spec sheet. The resistor needs to be "in series" with the LED. It doesn't matter which side of the LED you connect the resistor to,



Photo 3 LED's temporarily installed on the rocket.

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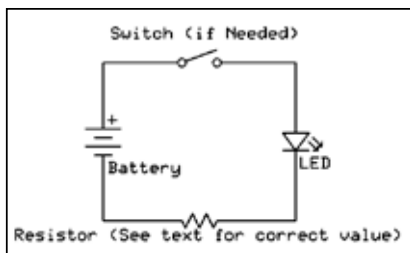
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Add LED's To Your Rockets



Drawing 2: Identify the negative lead on the LED.

as long as the circuit goes from the battery, to the switch (if used) to the resistor, to the LED, and back to the battery (Drawing 2 shows a schematic representation of this).

Photo 4 shows the finished product. You can see how bright the LEDs are. Be sure that your lighting system does not mess up the CG or aerodynamics of your rocket to the point of being unsafe. It will be heavier, so know what the new weight and balance numbers are and don't fly with minimal engines. According to Rocksim, the pods on my rocket must act as inefficient fins, as they moved the CP forward enough to need some nose weight. It flew very well at my last night launch and was quite visible... Now if I could just keep it off the roofs of RVs...

Is Night Launching Legal?

A word about the legalities of night launching in the United States of America: According to Federal Aviation Regulations (FAR's), small model rocket night launches



do *not* require a waiver from the FAA, but larger rockets do.

Small model rockets (under 1500 grams), are called Class 1 rockets under the definition of FAR § 101.23 (<http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&rgn=div5&view=text&node=14:2.0.1.3.15&idno=14>). Basically, if you follow the NAR safety code, you'll be in compliance with the federal regulations. See: www.nar.org/NARmrsc.html

Anything over 1500 grams, and you are now operating a Class 2 rocket, and it does require a waiver from the FAA (see FAR § 101.25).

Complete instructions for obtaining a waiver can be found at the NAR's website (www.nar.org/)

Photo 4: The completed rocket with the LED's installed.

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Add LED's To Your Rockets

[cabinet/waiverinst.html](#)), but here's the short answer: you need to obtain an *Application for Waiver or Authorization*, FAA Form 7711-2. You will have to file your application with one of the FAA's regional offices no later than 45 days before the proposed launch.

According to FARs, the information on the waiver application shall include for each type of Class 2 rocket expected to be flown:

1. Estimated number of rockets,
2. Type of propulsion (liquid or solid), fuel(s) and oxidizer(s),
3. Description of the launcher(s) planned to be used, including any airborne platform(s),
4. Description of recovery system,
5. Highest altitude, above ground level, expected to be reached,
6. Launch site latitude, longitude, and elevation, and
7. Any additional safety procedures that will be followed.

Applications must be filled in triplicate, signed, and be accompanied by 7.5 series topographic quadrangle map(s) published by the USGS of the proposed operating areas. These need to be printed out and marked up with depictions of your flight line, launch control point, safety dispatch, and fire control equipment (fire extinguisher normally).

Note: This is the same type of waiver used for any other high-power launch, including dates and times of the planned flights. If you fly with a club you have the advan-

tage of the club officers doing all that paperwork for you. Besides, it's always more fun launching with others.

About the Author

Ever since she can remember, Annette Sostarich has been fascinated with two subjects - electronics and aviation. From watching planes take off as a kid on Saturday mornings to over 450 parachute jumps, designing and building numerous kites, volunteer work at Tucson, Arizona's Pima Air & Space Museum in their restoration hangar, and now designing unusual rockets, there have been a lot of adventures.

Her electronics background began with picking up a soldering iron by the wrong end at the age of 12, and has

since been parlayed into a part-time computer repair business. She is just beginning to apply electronics to rocketry with subcompact video cameras as payloads. She met her husband of 28 years while skydiving, and they jumped into their own wedding. Her husband is an aircraft mechanic who is currently building an airplane in their garage.





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