Apogee Components

PEAK OF FLIGHT

NEWSLETTER

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Make Luminescent Rockets for Night Launches

Cover Photo: Apogee's Research Express rocket kit. Get your own at: https://www.apogeerockets.com//Rocket_Kits/Skill_Level_1_Kits/Research_Express

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Make Luminescent Rockets for Night Launches

By Connor McGrath

Many people enjoy flying night rockets. I mean what's not to love? There are sparks, lights and a lot of noise! Although all of the fun comes with its complications. A couple of the downsides to building and flying "night" rockets are that they usually involve complicated wiring and programming of LED lights, and they require expensive fiberglass airframes in order for the lights to be seen. Well what if there was a very simple way to ditch the complicated wiring of the LED lights and save on the cost of the fiberglass airframes? It gets even better because both of these setbacks can be resolved in a couple of simple steps that will make an amazing, one of a kind rocket that has never been seen before!

When someone is thinking about a night rocket, one of the first things that comes to their mind is, what they are going to use to make the rocket glow and how they are going to power and control it. Night rockets tend to use some sort of light to make the rocket glow. They then need a control board to control the lights and a power source, usually some sort of battery. Adding all of these additional items to the rocket can start to take a toll on the weight side of things and really make them hard to fly on smaller engines. What if there was a way to avoid adding all of the lights, batteries and control boards to the rocket so that you could make and fly night rockets on 18mm motors and up? With the simple knowledge of laminating fiberglass you can!

What you need:

- ☐ Fiberglass fabric (3oz-6oz depending on the size rocket you are making)
- ☐ Laminating epoxy
- ☐ Nitrile gloves
- ☐ Single use brushes (size depends on project. Can be gotten at any hardware store for around $1)
- ☐ Mandrel (Anything with the OD of the ID of the tube you want to make. Can be as simple as a dowel rod or any type of round pipe)
- ☐ Mylar/Duralar/Polyester film
- ☐ Peel Ply (Optional)
- ☐ Strontium aluminate (glow-in-the-dark powder of any color). I got mine at: www.technoglowproducts.com
- ☐ Sandpaper 400-150 grit

Photo 1: The materials and tools needed for making glow-in-the-dark rockets.

- ☐ Respirator (with organic particle filters)

NOTE: The laminating epoxy must not be UV resistant. Otherwise the Strontium aluminate will not be able to absorb the light and glow.

The Science behind it:

Strontium aluminate is a solid odorless and non-flammable chemical, in this case a very fine powder. When activated it acts as a photoluminescent phosphor with long

Photo 2: The powder in daylight (left), and in the dark when it begins to glow (right).

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persistence of phosphorescence. In simpler terms, when exposed to a light source (usually UV light from the sun), the powder will glow whatever color it has been given. Depending on how long the strontium aluminate is allowed to "charge," it can last for hours, much longer than any lights powered by a battery that can fit in the rocket. The best part is that it's non-toxic and safe to use around children! Strontium aluminate is used in anything and everything that glows in the dark so I figured why not use it in a rocket! In Photo 2 you can see what the strontium aluminate looks like in the light and how it glows in the dark!

What we are going to do is mix the strontium aluminate powder into our epoxy before we begin laminating the tubes. Additionally, the same process can be used to create a fiberglass panel for the fins. After the epoxy cures and the tube has cured, the strontium aluminate will be throughout the entire body tube or fins, giving the tube/fins the ability to glow in the dark! As stated above you must use an epoxy without UV resistance or the tube will not be able to glow to its full potential. You should also have a basic understanding of laminating fiberglass/Carbon fiber tubes and plate. For more in-depth information and a tutorial for rolling carbon fiber/fiberglass airframes refer to Apogee *Peak-of-Flight Newsletters* #370 and #371 (www.apogeerockets.com/education/downloads/Newsletter370.pdf and www.apogeerockets.com/education/downloads/Newsletter371.pdf) before attempting this project.

Before we begin you will need to cut the appropriate weight and length of fiberglass fabric you will need for the size tube you desire to make, as well as the correct length of Peel Ply if being used. The mandrel must also be wrapped with mylar so that the tube can be removed easily. Refer to *Peak-of-Flight Newsletters* #370 and #371 for assistance in doing so. Make sure that you have protected all surfaces that you do not wish to get epoxy on and have paper towels handy. Now let's begin.

Body Tube:

NOTE: The amount of strontium aluminate you use will vary on the size and amount of epoxy you need. For the tube in this tutorial I used 16 grams of strontium aluminate for 140 grams of epoxy. More or less of the powder can be used. The tube will be able to glow brighter and longer with the more strontium aluminate you use. However, don't use so much that the fiberglass can no longer be wet out. I will be rolling a 54mm tube with 5 wraps of fiberglass.

Step 1: Mix your laminating epoxy according to the instructions. After the epoxy has been thoroughly mixed, begin to add the strontium aluminate powder. Again, I used 16g for every 140g of epoxy and obtained a moderate amount of glow. Make sure that the powder is mixed in with all of the epoxy and that all clumps of the powder are broken up before beginning the next step.

Tip: Break up any clumps in the powder before mixing into the epoxy. I found that a small sifter worked great for removing all the clumps from the powder. Mix the powder

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Photo 3: This is what the Epoxy should look like after the strontium aluminate has been thoroughly mixed in. It takes a little bit of effort to completely mix the powder in as it has a larger density than the epoxy.

in gradually to avoid it from clumping together.

Step 2: Begin laminating your tube as you normally would, making sure to wet out every surface of the fiberglass. Apply the Peel Ply if being used and clean up any epoxy that may have been spilled during the layup. Follow the epoxy's instructions and allow the epoxy to cure for the designated amount of time.

Step 3: After the tube has been allowed to fully cure, remove it from the mandrel and continue to remove the mylar and Peel Ply. Cut the tube to its desired dimensions for your project.

Step 4: For final preparations, sand the tube with 150 grit sandpaper until it is smooth and then use some 200-400 grit sandpaper to make the tube completely smooth.

You are now done making your airframe!

Photo 4: The tube with Peel Ply after being laminated. It will sit and cure overnight before being removed from the mandrel.

Photo 5: Sample of the tube after it was taken off the mandrel (top). The tube is shown in the dark (bottom). It is much brighter in person.

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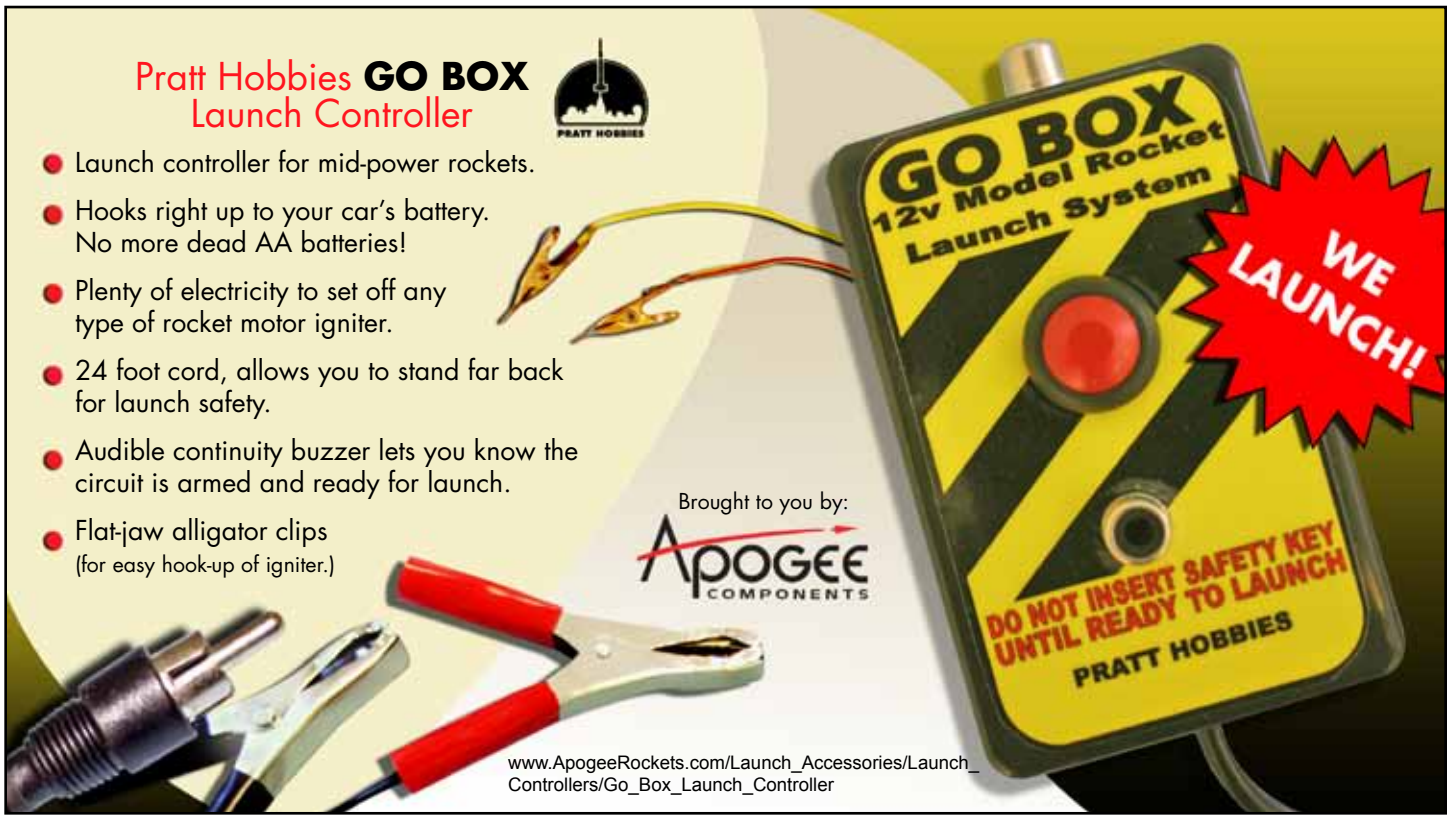

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Fins:

We will need to make a fiberglass plate for our fins. It is very simple to do so and they will look amazing when done. Keep in mind the colors you want your rocket to glow. You can use different color glow powder in order to have the airframe, fins, fillets and nosecone be a different color! Different materials can be used for the fins, however they will not glow as if you made your own fiberglass panel.

Step 1: First you will need to cut the proper amount of fiberglass "sheets" to obtain the thickness of fin you desire. Keep in mind the size of the panel you will need to fit all of your fins on.

Step 2: Cut a sheet of mylar larger than the overall size of your desired panel. Mix your epoxy with the the same 1:8 strontium aluminate to epoxy ratio as we used for rolling the airframe. Begin to laminate the fiberglass sheets onto the mylar rotating the direction of the weave after each layer. Alternate the weave will allow for a stronger less flexible panel.

Step 3: After all of the fiberglass sheets have been laminated apply another layer of mylar on top of the last layer of fiberglass. The mylar will give you a perfectly smooth surface on the finished panel. Place the panel inbetween two smooth flat surfaces and allow the epoxy to cure for its designated amount of time.

Note: Additional weight can be applied onto the panel in order to squeeze out any extra epoxy. However, this is not necessary but will result in a lighter panel. The weight can be anything from a couple of textbooks to a vacuum bagging system.

Step 4: Remove the mylar from the panel. It should be perfectly smooth and flat. Continue to mark out your fin pattern and cut them out. Because the glow powder is within the entire fiberglass structure, the fins can be rounded or beveled and still glow just fine. Of course you can also just leave them square.

Photo 6: This is the finished fin plate in the light (left). It was placed under a set of 20 lb. dumbbells. The finished fiberglass panel shown in the dark after being "charged" for 10min. Just like the tube it is much brighter in person!

Step 5: Use any type of clear epoxy for tacking the fins onto the tube. Glow powder can be added here but is not necessary. Now to move on to fillets.

Fillets:

You will need to mark and tape off your fins as you normally would for making the fillets on this rocket. There is nothing special about this step except for the epoxy. Mix the strontium aluminate powder into the epoxy using the 1:8 ratio. Just like with the fins, a different color glow powder can be used for a different colored glow! We are now done with the actual construction of the rocket! Of course, you will need to install a motor mount and shock cord. Just like the fin material, you don't need to mix the glow powder into the epoxy with the fillets but it will take away the cool

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factor of glow in the dark fillets!

Nose Cone:

Well we can't forget about this guy! Unless you're making your own cone as well, you will most likely need to find a way to make it glow. There's always the option to use some sort of light inside of the cone, but that defeats the purpose of this project. I've found the best way to get the rocket to glow is to paint the nose cone whatever color you wish and then mix a small amount of the glow powder into the clear coat so that it will look good during the day and glow at night. The downside to this is that you would need a spray gun to apply the clear coat. Another option is to use a thin layer of laminating epoxy with the glow powder mixed in as the clear coat. Follow the steps below to learn how to do so.

Step 1: Tape off the shoulder of the nose cone so that no epoxy can come in contact with it. Mix up some laminating epoxy with the 1:8 ratio of glow powder. I tried to match the color of the glow powder to the color of my base color but you can do whatever suits you.

Step 2: Begin to apply very thin coats of the epoxy mixture onto the nose cone making sure to cover every surface. Because this is an epoxy and not a paint there is no need for a very thick coat of it.

Step 3: Hang the nose cone upside down and allow the excess epoxy to drip off. If you did a thin enough layer you shouldn't have a lot of excess epoxy. Have a disposable cup such as the one you mixed the epoxy in under the nose cone tip to capture the dripping epoxy.

Step 4: Once the epoxy has cured you should have a smooth finish on your nose cone. Additional layers can be applied if there are any imperfections. To do this, lightly sand the nose cone making sure not to go through to the color coat and start the process over at step 2.

Note: I found that the best base coat for the brightest glow was black. It yielded the best results compared to the orange and blue base coats which I also tried.

You now have a finished one of a kind glow in the dark rocket! You can go out and fly it as is or apply a clear coat over it. Just like the epoxy, make sure that the clear coat doesn't have UV protection or the light will not be able to pass through to energize the strontium aluminate.

The tube can be energized in many ways. Glow powder responds best to light sources rich in UV rays such as sunlight, black lamps and halogen lamps. Tungsten lamps (typical household bulbs) take longer to recharge the pigment because their UV output is low. Fluorescent lamps, which are rich in UV, provide faster excitation when Glow-Powder is placed near them. Sun light will charge the rocket in about 5 minutes / UV light (Black light) - 5 to 10 minutes and Normal light in about 20 to 30 minutes. Sunlight is the best source for charging the products, but

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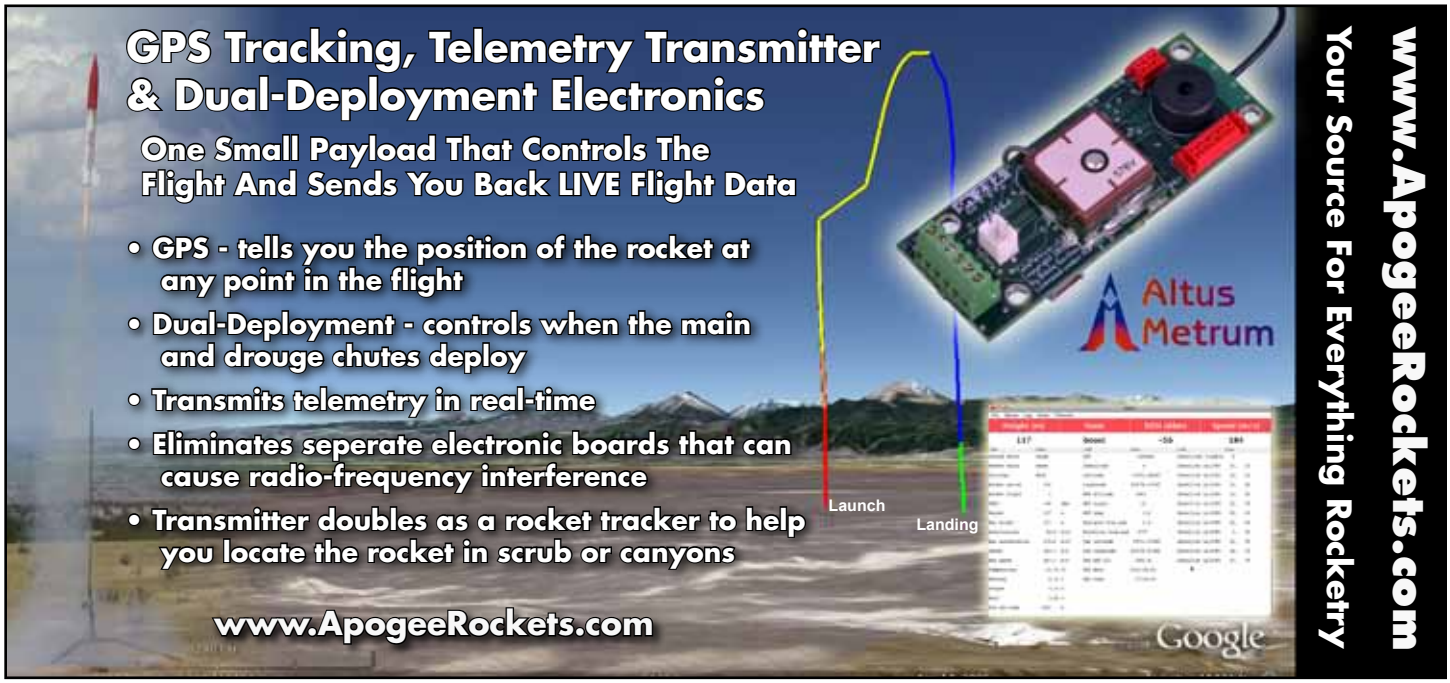
practically any light source will do. Black light is a good provider of UV light.

One thing you may be asking is how long it will last? You can charge the pigment OVER AND OVER indefinitely! The shelf life is about 10 years. Once mixed, the indoor life is 5-7 years and outdoor life is 3-4 years. However, the powder will continue to glow even after its "expiration" date but the intensity of the glow will begin to diminish. Something very important to know is that some glow powders are better than others. Make sure you make your purchase from a reputable seller, as some powders contain lots of fillers and are not pure strontium aluminate; resulting in a powder that does not glow as bright as a "pure" strontium aluminate powder. Another thing to remember is that different color powders have different strength glows. The traditional green color is the brightest of them all. Doing a quick search of a "Glow powder comparison chart" will give you a list of the brightest glow powders in descending order. Even if you don't end up rolling your own tubes and making your own fin plates so that they glow, you can still take away the idea from this article. You can experiment with the powder and see what works and what doesn't. Another way you could attempt to apply this information to one of your rockets is by mixing the glow powder in with your clear coat. You can paint the rocket whatever colors you want and then have it glow a little in the dark. There are a ton of things you can do with strontium aluminate. Just remember to have fun and stay safe!

About the Author:

Connor McGrath is 16 years old and has been involved in rocketry for 7 years. He obtained his NAR JR. L1 almost a year ago. He is also a Tripoli TMP. Connor flies with CTRA-NARCONN in Cobleskill NY. He says that he's launched dozens of L1 range motors from Small H's to Large I's, and enjoys flying anything from high performance minimum diameter rockets to complicated 2 stage rockets.