

# **PEAK<sub>OF</sub> FLIGHT**

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**NEWSLETTER**

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**ROCKETS**

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## Tie-Dye Finish for Rockets

By Josh Frizzell

### Introduction

YouTube is arguably one of the best free repositories of knowledge on Earth (especially if you've discovered the Apogee Components channel). Just by watching YouTube I've learned how to do portrait photography, 3-D CAD drafting, basic computer coding, read music, change a ballast in a fluorescent light fixture, extract a friend's achy tooth in my garage... OK, maybe that last one isn't true, but one can acquire a great deal of skills on YouTube without spending a penny. It's also abhorrently addicting. The shadowy A.I. that lives in the YouTube somehow knows what I want to watch next and continuously suggests documentaries and space news that I can't turn away from. Somehow it knew that I would click on a video about creating awesome swirly multi-colored high-gloss epoxy finishes on stainless steel drink tumblers even though I've never expressed any interest in decorating a tumbler. It's not so much that I wanted to decorate a tumbler, but tumblers and rockets are surprisingly not dissimilar. A tumbler, from a finishing standpoint, is really just a cylinder. A rocket, from a finishing standpoint, is also not much more than a cylinder. I clicked on the swirly tumbler. With some adaptations, the swirly epoxy rocket finish was born. It creates a hard, high-gloss coating and every result is intricate and unique. Each effort leads to dazzling rockets that are literally unlike any other. In this article I'll describe what you'll need to do it, keys to success, and how to adapt the technique to any rocket paint job (swirly or not) for a hard, smooth, high-gloss result.



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FIGURE 1: CUP TURNER FOR EPOXY COATING PROJECTS.

### Setting Up Equipment

In order to achieve the high-gloss swirl epoxy finish, we'll need a way to slowly, continuously rotate the rocket along its longitudinal axis in a horizontal position for several hours. This causes the epoxy coating to constantly self-smooth while it slowly cures. A rotation speed of about 3 to 5 rounds per minute works well. Creating a device to rotate the rocket is not a bad little DIY project in itself, but pre-made cup turners for epoxy resin crafts are readily available (Figure 1). I got one on Ebay for about 20 bucks, which included a simple wooden stand, electric motor with on/off switch, and a 1/2" diameter PVC pipe and foam ball for holding the work piece. Other online sources such as Amazon or craft suppliers could be fruitful.

To affix the rocket to the PVC pipe, I glued a small wooden dowel into a yellow thrust ring pusher tube that comes with many low-power kits (don't throw it away! See



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**FIGURE 2: HOLDER TO AFFIX THE ROCKET TO THE CUP TURNER.**

paper or Teflon tape so that the fit is very snugly and there should be multiple layers so the assembly can later be pulled apart after the epoxy cures (Figure 3). Then I used cable ties to secure the dowel to the PVC rotating shaft on the turner (Figure 4).

That method works well for small, low-power rockets, but for larger mid- to high-power rockets you'll want to support the rocket at both ends. To achieve this I built a

Figure 2). An appropriately-sized coupler tube would also work. The coating epoxy will invariably work its way between any unsealed gaps. In order to prevent the pusher tube from being permanently (and I mean PERMANENTLY) fused to the body tube, I wrap wax paper or Teflon tape around the pusher tube before inserting it into the rocket. There should be enough wax



**FIGURE 3: WAX PAPER OR TEFLON TAPE HELPS PREVENT COATING EPOXY FROM WORKING ITS WAY BETWEEN PARTS THAT NEED TO BE SEPARATED AFTER THE EPOXY CURES.**



**FIGURE 4: SUGGESTED METHOD FOR AFFIXING A MID-POWER ROCKET TO THE CUP TURNER USING CABLE TIES.**

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support stand from PVC that loosely fits inside the rocket's motor mount.  $\frac{3}{4}$ " PVC fits well in a 29mm mount and 1" PVC fits well in a 38mm mount. The loose fit allows the rocket to freely rotate around the PVC support shaft (Figure 5). On the other end I tightly wrapped bubble wrap around the PVC rotating shaft on the cup turner, secured tightly with cable ties, and snugly friction fit it into the rocket's body tube (Figure 6). The cup turner motor can then rotate the rocket freely while supported at both ends.

You'll want to protect your work surface as the inks involved in this technique will permanently stain nearly anything they come in contact with. I use a flattened cardboard

box large enough to cover the space under the cup turner and rocket with room to spare. Other solutions such as sheet plastic could also work.

### Materials

The cornerstone of the technique is coating epoxy. I used Alumilite Amazing Clear Cast (Figure 7) but there are other suitable products from other vendors, in-

cluding some that claim to be volatile organic compound (VOC)-free and would possibly be better for working with kids. The product comes in two parts and is mixed at a 1:1 ratio. It sets fairly slowly which allows time to work and cures to a high-gloss, hard finish.

You'll also need a rocket, assembled except as noted below, adhesives fully cured, primed and painted.



**FIGURE 5: APPARATUS FOR SUPPORTING AND ROTATING A LARGER MID-POWER OR HIGH-POWER ROCKET.**



**FIGURE 6: AFFIXING THE ROCKET BODY TUBE TO THE CUP TURNER USING FRICTION FIT WITH BUBBLE WRAP AND CABLE TIES.**



**FIGURE 7: CASTING EPOXY.**

You can build the rocket as normal but, for reasons I'll detail later, I recommend leaving the shock cord unattached from the nose cone or upper/payload section. If your rocket has a payload bay upper section with a cardboard tube coupler that slips into the lower section, the coating process will be a bit easier if you omit gluing in the coupler until after

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the finish is complete.

The paint coat can be literally any color that strikes your fancy, but should be flat or matte finish. If you've selected a paint color only available in gloss, finish with a matte or flat clear coat. Once the final paint coat is applied is it **IMPERATIVE** that you do not introduce finger oils to the rocket's surface. After the final paint coat is sprayed only handle the rocket wearing gloves and try to handle by placing your fingers inside the end of the body tube and motor mount rather than touching the rocket's painted surface. Any oils will cause the laminating epoxy to pull away from that part of the rocket, resulting in obvious uncoated areas. That effect will occur no matter how much epoxy you try to add, so to reiterate, be absolutely certain not to touch the painted surface with bare fingers. Allow the final coat of paint to cure fully before applying coating epoxy, which usually takes at least a couple of days.

To create the (optional) swirl pattern, the key is alcohol inks. Alcohol inks are available in small dropper bottles for most colors (Figure 8). Craft stores (e.g. Michael's) carry them and they are also available on Ebay, Amazon, etc. I've also gotten white in a larger bottle and applied the ink with small disposable droppers. Multiple colors on a rocket create more detailed swirl patterns.



**FIGURE 8: ALCOHOL INKS.**

You will also need disposable, powder-free gloves to apply and distribute the epoxy as well as a heat gun.

### Application

#### Small, Low Power Rockets

At this point the builder has a decision to make. As mentioned above, the coating epoxy will invariably find its way into any unsealed gaps, including that gap between a nose cone shoulder or coupler and a body tube that it is inserted into. Here are a few suggested methods of addressing this challenge, in order from simplest to most difficult.

The easiest and most reliable way to make sure your nose cone doesn't end up permanently fused to your body tube is to coat the rocket and nose cone separately. One option is to leave the nose cone as a single color (Figure 9). I like silver as a fairly universal color option for nose cones, but any color that strikes you works. Leave the nose cone separate while epoxy coating the rest of the rocket (the reason for leaving the shock cord disconnected in previous steps). Be careful to wipe away epoxy that slops over into

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the inside of the body tube so the nose cone will still fit after the epoxy cures.



**FIGURE 9: SEPARATELY COATED SINGLE COLOR NOSE CONE OPTION.**

Alternatively, one can separately coat the nose cone with epoxy and use alcohol inks to create a swirl pattern to match the rest of the rocket. The swirl patterns will not line up between nose cone and body tube in that scenario but the color scheme would be consistent.

It is possible to achieve swirl patterns that match between the nose cone and body tube, but the method is subject to possibly ending up with a nose cone stuck in place. The method is not recommended for a first attempt at epoxy coating. It is also not recommended for rockets that at ejection separate at a cardboard coupler rather than a plastic nose cone shoulder as is often the case for rockets with relatively long body tubes. If you're adamant on having the swirl patterns on the nose cone line up with those on the body tube, here's what you will end up doing: Before applying epoxy coating, start by measuring the distance between the aft end of the body tube and the point where the nose cone will separate from the body tube (i.e.

the other end of the body tube). This measurement needs to be as accurate and precise as possible. Shoot for the nearest tenth of a millimeter and note the measurement for later. Before applying epoxy, wrap the nose cone shoulder with Teflon tape all the way up to the top of the nose cone shoulder. There should be enough Teflon tape such that the nose cone fits very snugly in the body tube. After completing the epoxy coat the separation line between the nose cone and the body tube will be invisible, so you'll need to measure up to the separation line from the aft end of the body tube. Wrapping a straight-edged piece of paper will give you a guide line to circumscribe the body tube with a sharp hobby knife or razor knife and (hopefully) separate the nose cone from the body tube (Figure 10). If the rocket ejection separates at a cardboard coupler there is a high probability that you'll cut into the coupler during this process. For this reason I only apply swirl pattern to part of the rocket in those cases, blending the swirl pattern into solid color for the rest of the rocket. That allows me to treat the upper and lower sections and avoid accidentally cutting into (and thereby weakening) the coupler.

Once you've selected your approach and have your



**FIGURE 10: PAPER GUIDE FOR SEPARATING THE NOSE CONE FROM THE BODY TUBE.**

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rocket set up on the cup turner, start the rocket spinning and mix your epoxy thoroughly. Mix enough epoxy to coat the entire rocket liberally at one time. For a rocket with a 1-inch body tube diameter and 9-inch length I mixed 10 milliliters (mL) of each epoxy part for a total mixed volume of 20 mL. That was plenty to heavily coat the rocket entirely with some excess left over. If you're used to spray painting you know that spray paint should be applied in several light coats. For this application throw that mindset out the window. Coat the rocket heavily and uniformly using the tip of a gloved finger (Figure 11). Excess epoxy dripping from the rocket is OK, if not a good sign that you've applied enough. Gently heat the rocket with a heat gun to reduce the epoxy viscosity and help it to even out across the rocket surface as the cup turner rotates. Keep the heat gun moving and don't overdo it as excessive heat can scorch the epoxy and cause it to cure with ripples rather than smoothly. Redistribute the epoxy using your gloved finger as needed to get a reasonably (although not necessarily perfect) coat of epoxy across the whole rocket.



**FIGURE 11: USE A GLOVED FINGER TO HEAVILY AND UNIFORMLY SPREAD THE COATING EPOXY ACROSS THE ROCKET IN ONE APPLICATION.**

Once the rocket is completely and relatively evenly coated with epoxy it's time to start applying inks. As the rocket is rotating apply drops of ink randomly across the rocket where you want the swirl pattern to appear. You can vary the density and distribution of the drops to allow more or less of the base coat color to show through. In Figure 12 I've started adding drops of orange alcohol ink to a rocket that painted metallic silver and covered with coating epoxy. I actually rather liked the burnt orange and silver effect that resulted and considered stopping there but decided to continue with the swirl pattern since the purpose of the rocket was to demonstrate the technique for this article. In Figure 13 I've proceeded to add drops of white alcohol ink.



**FIGURE 12: ADDING THE FIRST DROPS OF ALCOHOL INK TO A ROCKET THAT HAS BEEN COATED IN COATING EPOXY.**

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**FIGURE 13: ADDING A SECOND COLOR OF ALCOHOL INK**

After alcohol ink droplets are applied it's time again to gently and evenly warm the epoxy with a heat gun (Figure 14). I use medium heat with a low fan speed to effectively warm the epoxy without physically blowing it around with the fan which could encourage uneven areas to form. As a reminder, it is possible to scorch the epoxy with excessive heat so keep the heat gun moving to avoid developing hot spots. Overheated epoxy may cure to a wavy, uneven surface. Once the epoxy is warmed tilt the rocket point up for a few seconds followed by tipping the rocket point down for a few seconds. This will encourage mixing of the ink colors and promote development of swirl patterns (Figure 15).

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**FIGURE 14: WARMING THE EPOXY WITH A HEAT GUN.**



**FIGURE 15: SWIRL PATTERNS DEVELOP AS THE ROCKET ROTATES.**

At this point wait a few minutes while the rocket rotates and you should see swirl patterns start to emerge. You can add additional drops of ink if there are areas you'd like to have more color as long as it's done soon after the epoxy is mixed. Once the epoxy begins to harden the opportunity to achieve swirl effect is gone.

Once the inks are applied let the rocket continue to rotate for at least five or so hours. Swirl patterns will continue to gradually evolve and the rotation will cause the epoxy to cure in a smooth, even coat. In practice I often just let the rocket rotate overnight. Once the epoxy is fully cured the result will be a hard, very high-gloss finish. Don't handle the

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rocket for a full day or so to make sure the epoxy coat has fully hardened. Handling too soon can result in fingerprints or impressions.

To give another idea of other possible color combinations, Figure 16 shows a low-power rocket painted in a flat black base coat and treated with aquamarine and white alcohol inks. A dark base coat can be combined with other dark colors if white is added. The white will make the dark alcohol ink stand out from the background color.



**FIGURE 16: DARK COLOR ALCOHOL INK OVER DARK BASE COLOR COMBINED WITH WHITE ALCOHOL INK.**

Once the epoxy is fully cured it's time to separate the nose cone from the body tube if you were brave enough to coat the nose cone and body tube together at the same time. Pull out that high-precision measurement that you took before adding the epoxy. More than likely the separation line between the nose cone and the body tube will be completely obscured. Measure up from your reference point and wrap a straight-edged piece of paper around the circumference of the rocket and secure it with masking or electrical tape. The edge of the paper should delineate the seam between the nose cone and the body tube (refer back to Figure 10). Carefully and gradually trace the edge of the paper with a sharp hobby knife or razor knife until you encounter the plastic nose cone shoulder. If the Teflon tape was applied well enough in early steps the nose cone should pull free from the body tube with some encouragement.

I'll reiterate here that for early attempts at the epoxy coating technique I suggest treating the body tube and nose cone separately to avoid frustrating marriages between nose cone and body tube. Should such a fusion occur, one can cut off the body tube just below the nose cone shoulder and probably peel the fused body tube away from the nose cone shoulder. In that case the rocket will lose a bit of body tube length and the swirl patterns won't match up between body tube and nose cone but it's better than losing the whole rocket.

### Larger Rockets

For larger rockets the cup turner stand may not be enough to support the horizontally-mounted rocket without it tipping over. Furthermore, larger rockets often eject separation in the middle of the body tube rather than at the nose cone-body tube boundary. Consequently, that separation point is often a cardboard coupler rather than a plastic nose cone shoulder. It is therefore wise to epoxy coat the upper and lower sections of the larger rocket separately as the risk of cutting through the coupler would be very high when the attempt to separate the two sections is made after the epoxy cures.



**FIGURE 17: MID-POWER ROCKET ON THE PAINT RACK WITH BASE COAT PAINT COLOR AND MATTE CLEAR COAT APPLIED.**

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For the 2.6 inch diameter mid-power rocket in Figure 17 I started by applying my base colors with the aid of PVC paint rack stands and finished with matte clear coat. Once the clear coat had fully cured I set the rocket up as described above so that it was level and freely rotated while the turner machine drove its rotation (see Figure 5). For this rocket at 2.6 inches body tube diameter and body tube section 38 inches long I mixed 100 mL of each epoxy part for a total mixed volume of 200 mL, which left me with a little bit of excess after heavily coating the whole rocket. I applied a heavy coat of coating epoxy over the entire rocket and fins followed by sporadic drops of alcohol inks (in this case green and dark gray, Figure 18). I spaced the drops more densely near the transition between the two base coat paint colors to help blend the color transition. Again, gently heating will help to lower the viscosity of the coating epoxy which will encourage the epoxy to smooth out and help initiate the swirl patterns. Tipping the rocket up for a few seconds and then down for a few seconds will also help encourage the swirls to form.



**FIGURE 18: ALCOHOL INK DROPS APPLIED TO A MID-POWER ROCKET WHILE IT ROTATES ON THE CUP TURNER.**

After the inks are applied it is time to let the rocket rotate for about five hours or so until the epoxy cures. Figures 19 and 20 show the final result.



**FIGURES 19 & 20: FINISHED MODEL ROCKET VARIATIONS**

Given the possible permutations of base colors and alcohol ink colors, the potential for unique results is practically limitless. However, there are a few other variations to consider.

One option, as discussed above, is to omit the swirl pattern alcohol inks entirely. Any paint job can be treated to a durable, ultra-high-gloss finish using coating epoxy. The other end of the spectrum is to treat the entire rocket with swirled alcohol ink colors. In between is to apply alcohol inks to select parts of the rocket. While there will always be some random aspect to the final appearance of the swirl pattern, the builder does have some degree of control as to the rocket's overall character depending on which parts of the rocket are treated. For example, the rocket in Figure 19 has only been treated with alcohol inks in the lower section of the body tube but not including the fin can area. While the cylindrical shape of the body tube tends to result in well-developed alcohol inks swirls, alcohol inks applied to flat surfaces such as the fins tend to appear more fan-shaped or blotchy (Figure 21). For the rocket in Figure 19 I wanted the swirl effect to dominate so I didn't apply alcohol inks to the fin can. For some builds, however, the blotchy or fanned out colors may add character to the fins.

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**FIGURE 21: LOW-POWER ROCKET WITH ALCOHOL INKS APPLIED TO BODY TUBE AND FINS.**

### Conclusion

With minimal equipment and materials a rocket can be finished with coating epoxy to create a durable rocket finish with a beautiful, smooth gloss. Adding alcohol inks to create swirl color patterns can be combined with the coating epoxy to add attitude to any rocket build. By combining different base colors with various alcohol ink colors the possible unique results are practically infinite, and the random effects of the alcohol inks guarantee a rocket that is one-of-a-kind. You're gonna need more rockets....

### About the Author



Josh Frizzell got into rocketry during his childhood. When his own child was born he had to get into action photography to make his camera keep up with his very active son. Now Josh enjoys getting rocket action shots at club launches but his son remains one of his favorite photography subjects.



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