SOUTHWEST OHIO ROCKETRY ASSOCIATION (SORA)

LAUNCH REPORT FEBRUARY 11, 2024
1:00PM TO 5:00PM   NAR SECTION #624

Launch Conditions: Partly cloudy skies, temperatures low50's, gusts to 10MPH

Total Number of Launches: 39   **Rockets Recovered:** 38   **Lost:** 1*   **Found Rocket (not launched):** 1
*Rocket was snagged high in a tree but recovered three days later.

Total Number of 100% Fully Successful Flights (excluding simple fin breaks on landing, etc.): 32

Success Rate: 82%

Number of Individuals Who Launched Their Rockets: 25   **Number of Family/Friends/Observers:** 20

Teams and Competitions: 0   **Scouts/Home School/4-H:** 1 home school group

Types and Number of Motors: 40 total

A: 22   B: 4   C: 7   D: 2   E: 4   F: 1   G: 0   H: 0   I: 0   Higher: 0
One two-stage rocket E16-0 to a E16-6

Ground Fires: 0   **Medical Incidents:** 0   **Damage to vehicles/facilities:** 0

Donations and drink/food sale, sale of merchandise:

straight out donations: $19   t-shirts: 0 at $20 = $40
mugs: 0 at $10 = $0   stickers: 0 @$0.25 = $0.0
food and drinks: 0 at $.75 = $0
Total: $ 19.00

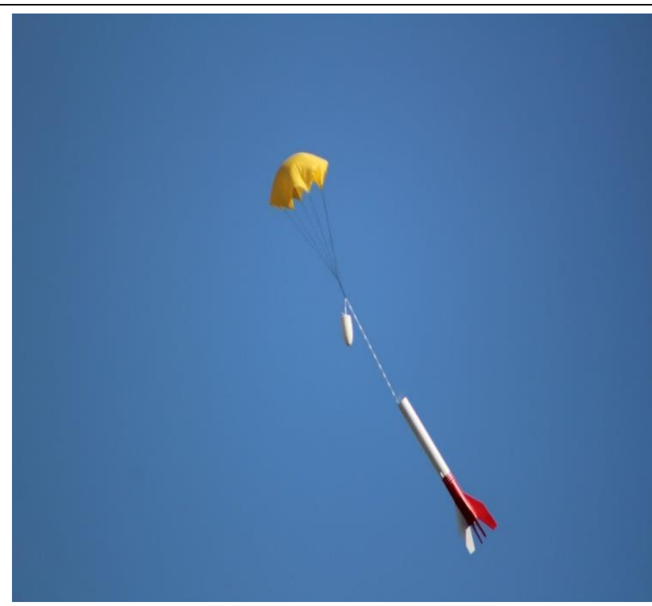
Rocket Topics and Issues:

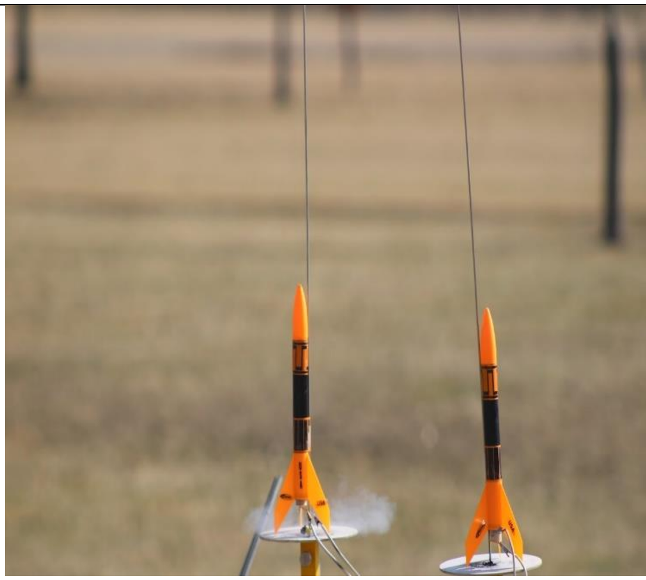
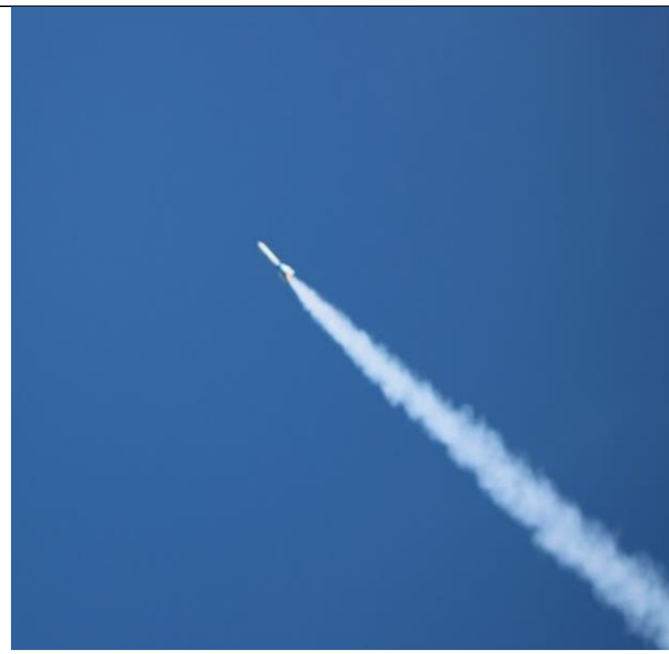
1. With a large group of homeschoolers launching their first rockets, it took the full resources of the experienced rocketeers to help the next generation of rocketeers prep their rockets. Thanks to Bob, Tim, Jon, Dave, Deb, and Gary.
2. With this many launches with new rocketeers, there are bound to be failures. There were three where the parachute did not unfurl after being ejected, one shock cord broke, one non-ejection of the chute, one where the Kevlar shock cord burned through, one chute tangled on body of rocket, and one where the rocket arced over due to CG issues which resulted in the rocket snagging high in a tree at the north end of the field. Even with these less-than-perfect flights, the overall success rate was 82% which is not bad at all.

3. Elijah Bass launched a Daedalus two stage rocket on a E16-0 going to a E16-6. With a slight arc due to a center of gravity issue, the rocket ended up high in a tree on the north side of the field. Rick and his friend Bob recovered the rocket three days later using a combination of extendable poles, tree climbing gear, and an extendable aluminum ladder. The rocket was damaged but repairable. The electronics package was saved.

4. Dave launched a Aerotech Strong Arm on a F42 for the highest powered flight of the day for a single stage. Excellent flight and recovery!

Next meeting: **Tuesday March 5, meet at Lebanon Library 6:30PM**
Next Launch: **Sunday, March 10, Hisey Park**

	
Amazon on a C6-5	**Tim's Estes Guardian on a C6-5**
	
Baby black Bertha	**Nice chute!**

	
Estes Alpha III with A8-3s motors were the hit of day with the new rocketeers	**Families, friends, dogs?**
	
Um, what about that angle????	**Daedalus on two stage Es**

	
Dave’s Aerotech Strong Arm on a F42. Perfect flight.	Ohhhh, noooo, Daedalus

Did you know about….. (from Apogee Newsletter #149)

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APOGEE
PEAK OF FLIGHT

"Are Your Descent Rates Decent?": Calculating How Fast Your Models Fall

by John Manfredo

{Ed. Part I of this article comes from the book: "Model Rocket Design and Construction" by Tim Van Milligan.}

PART I

Parachute Design

Parachutes can be used on almost any size rocket. A parachute can control the model's descent speed more accurately and bring the model down more slowly than any other recovery method. The best parachutes are made from strong, thin, soft, flexible material. For small models, thin plastic sheets work very well because they can be folded up tightly to fit into small-diameter body tubes. Some sources for parachute canopies include: Mylar®, plastic drop cloths, dry-cleaning bags, trash bags, and gift-wrapping plastic. Use care when selecting a plastic material for a parachute. Test it by trying to tear it in both directions-sometimes the material is strong in one direction but weak in another. Use only plastic that is strong in both directions. For rockets with a descent mass greater than 300 grams (10.5 oz.) use a cloth material like cotton, silk, polyester, or nylon. These materials can withstand the larger opening forces that bigger models can create. Heat-resistant parachutes can be made from certain types of plastics and cloths. For a plastic chute, you can try oven-roasting bags. They are used to cook large turkeys and other game birds, and are typically made out of nylon®. For a heat resistant cloth, Nomex® works very

Rocket Under Nice, Open Parachute

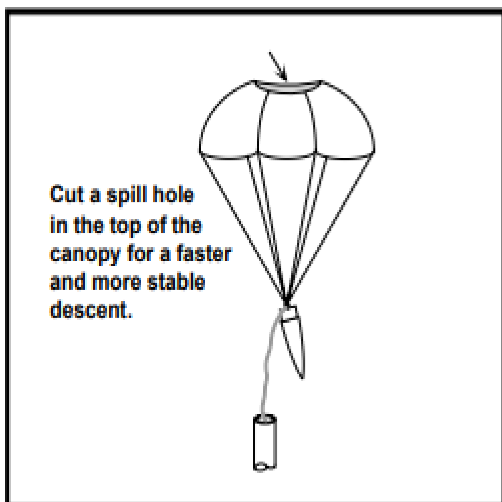

Fig. 1 Use of Spill Hole in a Parachute

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well. It is often used to make flight suits for pilots and jackets for fire fighters. Some model rocket manufacturers sell Nomex® parachutes.If you want the rocket to come down slightly faster and without drifting far in windy conditions, cut a spill hole in the top of the canopy (Fig. 1). This allows air to flow through, increasing the descent rate.The larger this *spill hole* the faster the model will fall. Again, try to find a material with a high-visibility color, both in the sky and on the ground.

Parachute Size

As a general rule of thumb, design the 'chute so the descent velocity of your rocket is 3.5 to 4.5 meters per second (11.5 to 14.8 feet per second). You can determine the area of the parachute from the following equation:

$$S = \left(\frac{2 \times g \times m}{\rho \times C_d \times V^2} \right)$$

Fig. 2 Area for Round Parachutes

where S is the area of the parachute, g is the acceleration due to gravity; which has a value of 9.81 m/s2 at sea level, m is the mass of the rocket (with empty engine) as measured in grams, r is the density of air (1225g/m3) at sea level, Cd is the coefficient of drag; estimated at 0.75 for a round canopy, and V is the descent velocity you choose. If you want a round canopy, the diameter is found by the formula:

$$D = \sqrt{\frac{4 \times S}{\pi}}$$

Fig. 3 Diameter for Round Canopies

where D is the diameter of the parachute and π (pronounced "pie") has a value 3.14. The chart shown in figure 4 is a quick reference for typical sizes of parachutes versus their descent mass, based on a round canopy. If you are using a canopy of another shape you can easily find the area from the following formula valid for regular polygons:

Rocket Mass	Parachute Diameter
20g	22cm (8.5")
40g	31cm (12")
80g	43cm (17")
100g	48cm (19")
150g	59cm (23")
200g	69cm (27")
300g	84cm (33")

Fig. 4 Round Canopy Decent Masses

$$Area = \frac{n}{4} \times D^2 \times \tan\left(\frac{180^\circ}{n} \right)$$

Fig. 5 Formula for Polygon Parachutes

where n is the number of sides, and D is the distance as measured across the polygon's flats. As shown in figure 6, there are listed the areas of four common parachute shapes, which are circles, squares, hexagons, and octagons.

Parachute Shape	Area Formula
Square	D^2
Hexagon	$0.866 \times D^2$
Octagon	$0.828 \times D^2$
Circle	$1/4 \times \pi \times D^2$

Fig. 6 Common Parachute Shapes

PART II

Putting it into Practice

Before going any further, please understand that it is critical to our calculations that we use measurements that are uniform. If you want to use English measurements, use them in all calculations; if you choose to use Metric, use Metric in all. For our purposes here we will use Metric.

So now that we see how to calculate the needed size of parachute, let's actually go through the process step-by-step. We'll start by figuring out the weight of the rocket you are trying to find the parachute size for. For instance, let's say that the given weight for our rocket is 25 ounces. The first thing to do is convert this over to grams. A handy web page for this is: http://www.metric-conversions.org/weight/ounces-to-grams.htm. It allows

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you to convert meters over to inches. Our 25 ounce rocket now weighs in at 708.74g (round out the numbers to 2 decimal places).

Now start plugging numbers into the equation from figure 2. Everything in that equation is entered in except for our descent velocity. We are going to choose 4.5 meters per second. Of course, due to the fact that the equation calls for "V^2" and not just "V", our 4.5 meters per second needs to be squared before entering it in to the formula. Therefore, 4.5 changes into 20.25 meters squared/seconds squared as you see in equation 1.

$$S = \frac{2 \times 9.81 \frac{m}{s^2} \times 708.74g}{1225 \frac{g}{m^3} \times .75 \times 20.25 \frac{m^2}{s^2}}$$

Equation 1

The fact that the equation asks you to square not only the descent velocity number but also the meters and seconds is easy to overlook! Make sure you watch this very closely. We can start by cancelling out a few things as you will see in equation 2.

$$S = \frac{2 \times 9.81 \frac{m}{\cancel{s^2}} \times 708.74\cancel{g}}{1225 \frac{\cancel{g}}{m^{\cancel{3}}} \times .75 \times 20.25 \frac{\cancel{m^2}}{\cancel{s^2}}}$$

Equation 2

$$\frac{m}{\frac{1}{m}}$$

Equation 3

The 2 "seconds squared" and the 2 "grams" can be cancelled out. The "meters squared" can be cancelled out totally and that leaves only 1 "meter" left with the density of air. This leaves us with 1 meter on top of the equation and 1 "meter" on the bottom, which is simplified in equation 3. With the top "meter" being a numerator and the bottom "meter" being a denominator within a denominator we need to move the bottom one up to the top as shown in equation 4.

$$S = \frac{2 \times 9.81m^2 \times 708.74}{1225 \times .75 \times 20.25}$$

Equation 4

$$S = \frac{13905.55m^2}{18604.69}$$

Equation 5

This gives us the final setup before multiplying and dividing things out seen in equation 4. After multiplying this out we come up with equation 5. Then, by dividing this, we come up with our area of the parachute needed as seen in equation 6.

$$S = .75m^2$$

Equation 6

$$D = \sqrt{\frac{4 \times .75}{3.14}}$$

Equation 7

Next, as shown back in figure 3, we will need to calculate the "diameter" of the parachute from the "area" that we now have. Plugging our numbers into the equation, we now have what is shown in equation 7.

After multiplying and dividing this we get the equation shown in equation 8. Finally, go ahead and find the square root of .96. Your answer should be .98.

$$D = \sqrt{.96}$$

Equation 8

The only thing left to do is to convert this answer back to inches so that we can find out what the diameter of the parachute is. For those of you who need a little help, you can go back to that handy web page to convert this number back again:http://www.metric-conversions.org/length/meters-to-inches.htm. The final answer is 38.58" in diameter.

Conclusion

Hopefully, this article will help you when you are trying to find just the right size parachute for your next project. For others, you may be thinking, "That's just too much 'number crunching' for me." That's okay! We have you covered on that. Go to: http://www.apogeerockets.com/rocksim.asp and try out the Rocksim software! It makes calculating parachute size a breeze as well as so much more!

Part II of this article is by John Manfredo. He is the Education Coordinator at Apogee Components. He's Level 1 High-Power Certified and has been building his own rockets for the last 30 years.

The Club's Motto……"Sapientia ducet ad astra" – Wisdom leads to the stars