



**Tinder Rocketry's –RAPTOR CO2 Ejection System**



**Proudly made in AMERICA!**

The New RAPTOR is another CO2 ejection system designed and manufactured by Tinder Rocketry for parachute deployment in high powered rockets at any altitude. The newest Peregrine, The RAPTOR, is lightweight, compact and versatile! It is designed to be easy to use and works with many CO2 cartridges ranging in size **from 20 to 85 grams!** Best of all, **the RAPTOR is for all practical purposes acceleration immune** regardless of mounting orientation!

Some have asked “Why would I want to use a CO2 ejection system in my rocket?” Well, there are actually two reasons you might want to consider CO2 deployment. The first and most obvious reason is that it is clean! There is very little flame or the resulting BP residue all over the inside of your rocket! As a result of not having a large BP flame, you can do away with a lot of the flame resistant cloths that now protect you valuable parachutes! (Note: There is still a small amount of pyro exhaust so some parachute protection is strongly advised!) If there was no other reason for going to CO2 deployment, a clean interior is more than enough motivation! However there is another reason that you might want to consider CO2 Deployment and that is high altitude flights.

It is well known that BP begins to burn inconsistently at much over 20,000' ASL and will not even sustain a burn at over 50,000'. There have been many attempts and devices made to try and contain BP so that it will burn at high altitudes, some of them have worked, many have not. CO2 deployment systems, such as the RAPTOR, where the small pyro charge is sealed from the outside air (or the lack there of), are capable of deployment at any altitude. The new RAPTOR has been tested down to almost 29 inches Hg which simulates to about 80,000 feet!

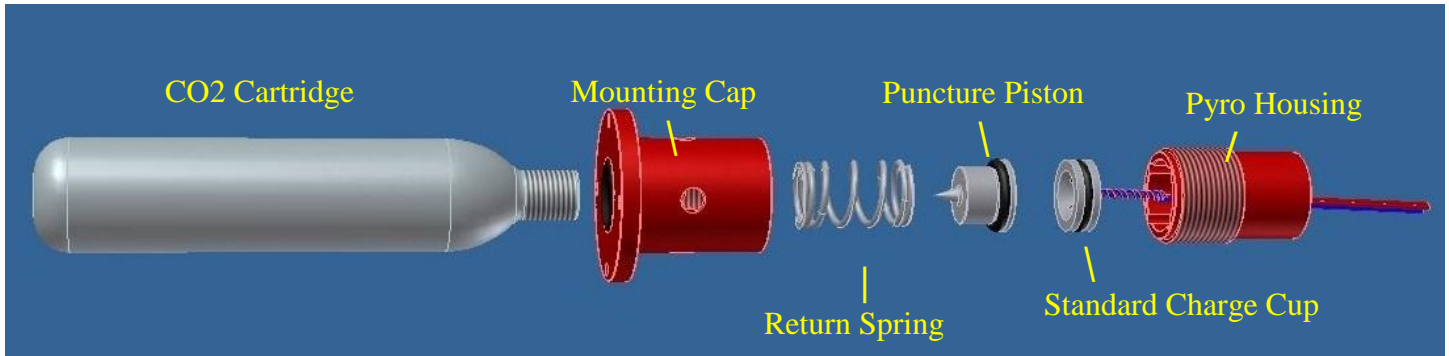
### Parts Diagram



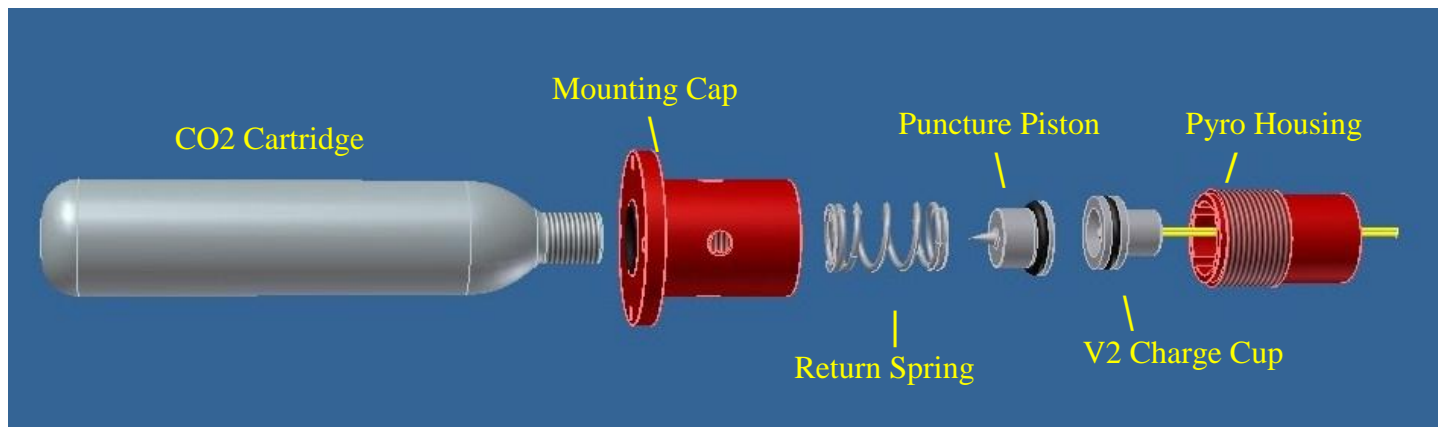
## **Loading/Re-loading Guide**

This guide will show how to prepare the RAPTOR for flight. While this guide illustrates the RAPTOR with a 35 gram CO2 cartridge, be assured that cartridges sharing the same thread size from 20 to 85 grams can be used!

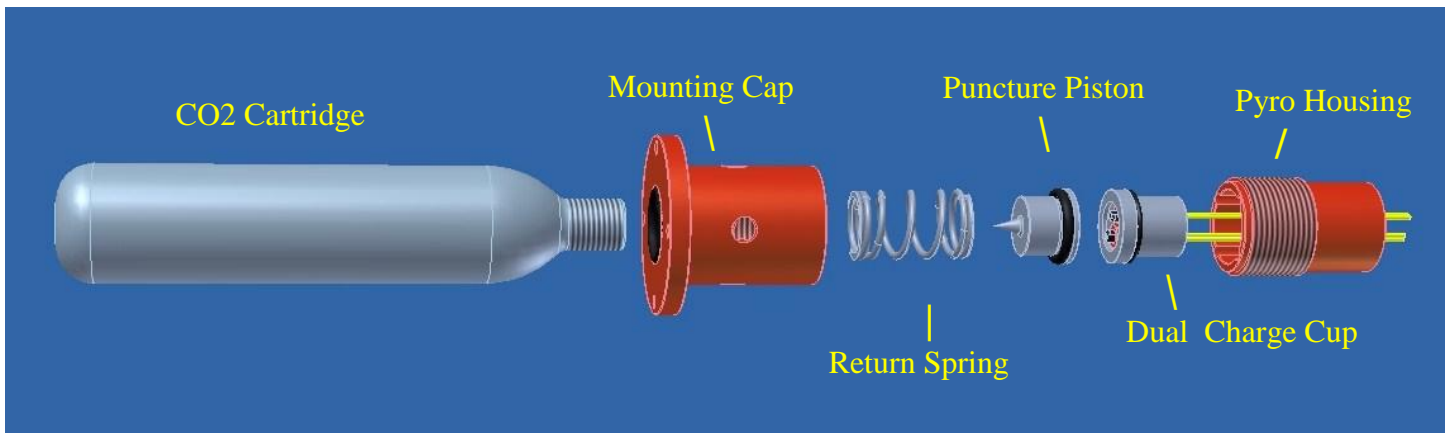
The illustrations below show all the internal components of the RAPTOR with the three different charge cups:



**The RAPTOR shown with the (Discontinued) STANDARD Charge Cup for use with Q2G2 initiators.**



**The RAPTOR shown with the V2 Charge Cup for use with J-Tek type initiators.**

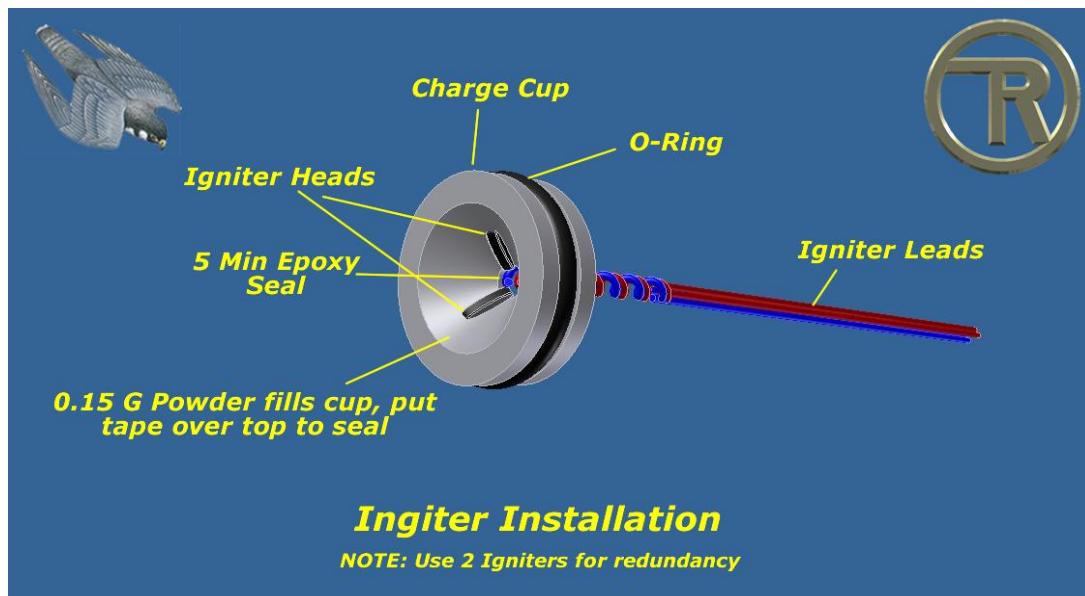


**The RAPTOR shown with the Dual Charge Cup for use with Dual J-Tek type initiators.**

## To make The RAPTOR ready for flight, follow these steps:

**WARNING:** Always handle the initiators with caution and respect! Always twist the bare wires on the initiators together to avoid possibly setting them off with a static charge! Once these charge cups are loaded, even though a very small pyro charge is used, they can be dangerous!

1. **Once The RAPTOR has been fired**, disassemble the unit as seen in the above diagram, but without removing any of the o-rings.
2. Use hot soapy water to thoroughly wash the residue from the inside of the Pyro Housing and the Mounting Cap.
3. Fold a paper towel in half then roll up like a small cigar and use to swab the Pyro Housing clean and dry. Use opposite end of rolled up towel and repeat. Set aside.
4. Use Cotton Tipped Applicators (Q-tip or equivalent) to swab clean and dry the Mounting Cap. Set aside.
5. If using the (Discontinued) Standard Charge Cup and the Q2G2 initiator, use pliers to grab the wires close to the bottom of the charge cup and twist until the wires break off. Use a small finishing nail punch to gently tap on the cut wires from the bottom of the charge cup to dislodge the spent initiators and epoxy from the charge cup. Clean charge cup as necessary. Set aside.
6. If using the V2 Charge Cup or the Dual Charge Cup, use pliers to grab the wires close to the bottom of the charge cup and twist until the wires break off. Use a small finishing nail punch to gently tap on the cut wires from the bottom of the charge cup to dislodge the spent initiator(s) and the epoxy from the charge cup. You may need needle nosed pliers to grip and pull the spent initiators from the charge cup. Clean and dry charge cup as necessary. Set aside.
7. Completely clean all other components with a paper towel. Set aside.
8. With a cotton tipped applicator (Q-tip or equivalent) use silicone grease (such as Super Lube) to generously lube the Pyro Housing. Set aside. **NOTE: It is VERY IMPORTANT NOT to use a petroleum based lube such as Vaseline! Doing so could cause the o-rings to swell possibly leading to a catastrophic failure of this device!**
9. Use the cotton tipped applicator with silicon lube, to wipe a residue of lube on the inside surface of the charge cup. Remember – this is ONLY a **RESIDUE** of lube! Be careful not to get any lube on the top surface of the charge cup!
10. **Now prepare the charge cup.** There are three options for charge cups The (Discontinued **Standard Charge cup**, The **V2 Charge Cup** and the **Dual Charge cup**.
11. Below is an illustration of the (Discontinued) STANDARD charge cup with the initiators installed. To save time you can prepare several sets at a time to simplify the reloading of your RAPTOR in the field.



### Steps to load the (Discontinued) STANDARD charge cup:

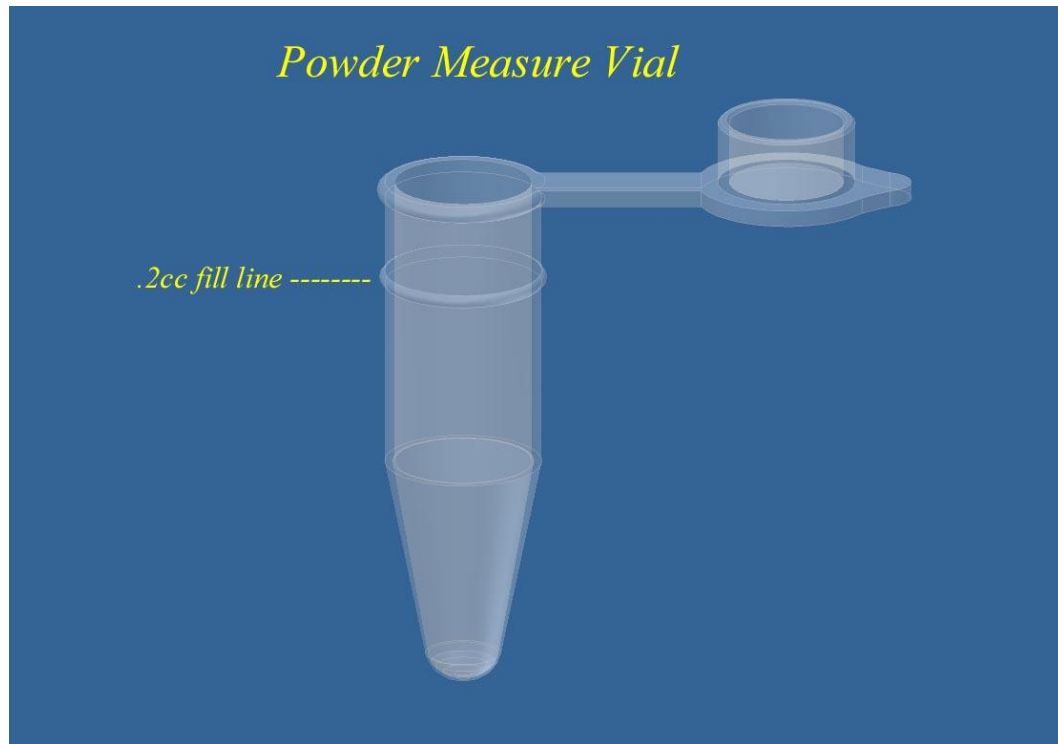
**WARNING:** Always handle the initiators with caution and respect! Always twist the bare wires on the initiators together to avoid possibly setting them off with a static charge! Once these charge cups are loaded, even though a very small pyro charge is used, they can be dangerous!

- Twist two initiator leads together so the heads form a “Y”. The (Discontinued) STANDARD Charge cup was designed to use the Quest Q2G2 initiator. You may be able order these at: <http://www.questaerospace.com>
- Many model rocketry resellers may also carry these both in the US, Europe and other countries.
- Drop the twisted leads through the cup opening. The splayed igniter heads will support the igniter in the cup and keep them from falling through.
- Mix a little 5 minute epoxy and carefully dab a little epoxy in the center hole. Avoid getting epoxy on the initiator pyrogen. Let it cure for at least 10 minutes.

**NOTE:** This will seal the cup and will keep exhaust gas from leaking out the back!

- Once the epoxy has hardened, **measure out .2cc of either 4F (FFFFG), 3F (FFFG) Black Powder, or Triple Seven (in the 3F granulation) (Listed in order of preference)** propellant with the provided measuring scoop. Triple Seven, a black powder substitute, can be found at your local sporting goods store. Black powder is a bit more difficult to find these days, but it can still be found at many gun stores. Fill the provided scoop to the line on the scoop as shown in the diagram below.
- Do not use more than the recommended amount of powder!**
- Do not use any powder not listed above!**





- h. Pour powder into the prepared charge cup. Apply a Pyro Charge Cover Disk or use a piece of 3M blue masking tape over the charge cup to seal in the propellant. Trim the edges as necessary around the cup so the tape is flush with the edges. The tape will seal in the powder.

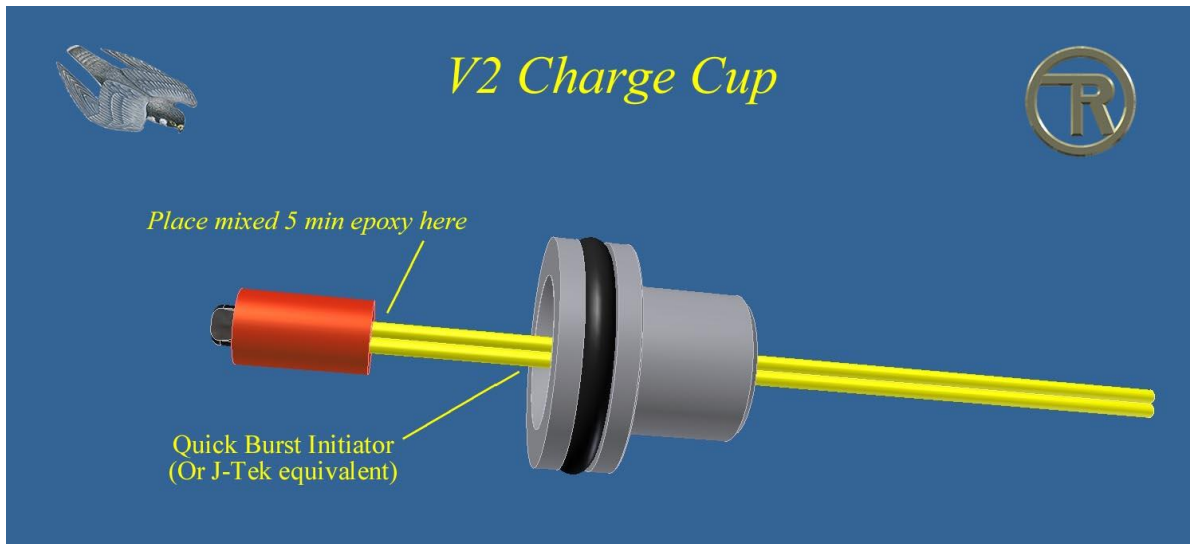
### **Steps to load the V2 charge cup with a single or dual initiator.**

**For use with a SINGLE J-Tek E-Match type initiator:**

**NOTE:** For best results please completely follow these directions!

- a. Completely remove the plastic protective sheath from over the initiator head.
- b. Cut the plastic protective sheath to about 3/8<sup>th</sup> inch and re-install on the initiator.
- c. Use the cotton tipped applicator with silicon lube **to wipe a residue of lube to the inside cavity** of the charge cup. Remember – this is **ONLY** a **RESIDUE** of lube! Be careful not to get any lube on the top surface of the charge cup! **Note:** This is an IMPORTANT STEP! Failure to lube the inside of the charge cup may make removal of the spent e-match VERY difficult!
- d. Install and pull initiator to within an inch or so of the V2 Charge Cup as shown below.
- e. Mix a small amount of 5 min epoxy. Dab a small amount of this epoxy completely around the bottom of the initiator protective sheath as shown in the diagram below:

**NOTE:** This will seal the cup and will keep exhaust gas from leaking out the back!



- f. Assemble and let cure for at least 10 minutes. Assembly should look like the diagram below:



- g. Once the epoxy has hardened, **measure out .2cc of either 4F (FFFFG), 3F (FFFG) Black Powder, or Triple Seven (in the 3F granulation) (Listed in order of preference)** propellant with the provided measuring scoop. Triple Seven, a black powder substitute, can be found at your local sporting goods store. Black powder is a bit more difficult to find these days, but it can still be found at many gun stores. Fill the provided scoop just to the line on the scoop as shown in the diagram above.
- h. **Do not use more than the recommended amount of powder!**
- i. **Do not use any powder not listed above!**
- j. **WARNING: If using the "Firewire" Initiator it is strongly recommended that you use Black powder only! (The Firewire does not burn as hot as regular e-matches and may not burn hot enough to properly ignite Triple Seven well enough for a proper cartridge strike!)**
- k. Pour powder into the prepared charge cup. Apply a Pyro charge cover disk or use a piece of 3M blue masking tape over the charge cup to seal in the propellant. Trim the edges as necessary around the cup so the tape is flush with the edges. The tape will seal in the powder. Set aside.

**For use with DUAL J-Tek E-Match type initiators using the V2 Charge Cup:**

**WARNING:** Always handle the initiators with caution and respect! Always twist the bare wires on the initiators together to avoid possibly setting them off with a static charge! Once these charge cups are loaded, even though a very small pyro charge is used, they can be dangerous!

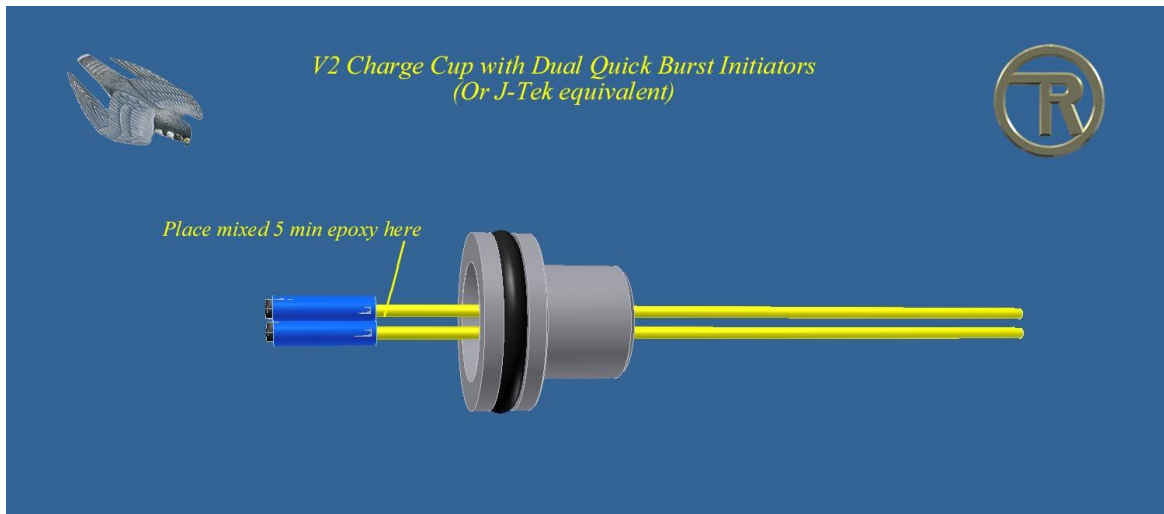
**NOTE:** For best results please follow these directions!

- a. Completely remove the plastic protective sheath from over the initiator heads and discard.
- b. Cut a strip of blue painters masking tape about ½” x ¾” install on initiator as shown below.
- c. Do this on both initiators. (This will insulate both initiator from each other and the SS Charge cup!)

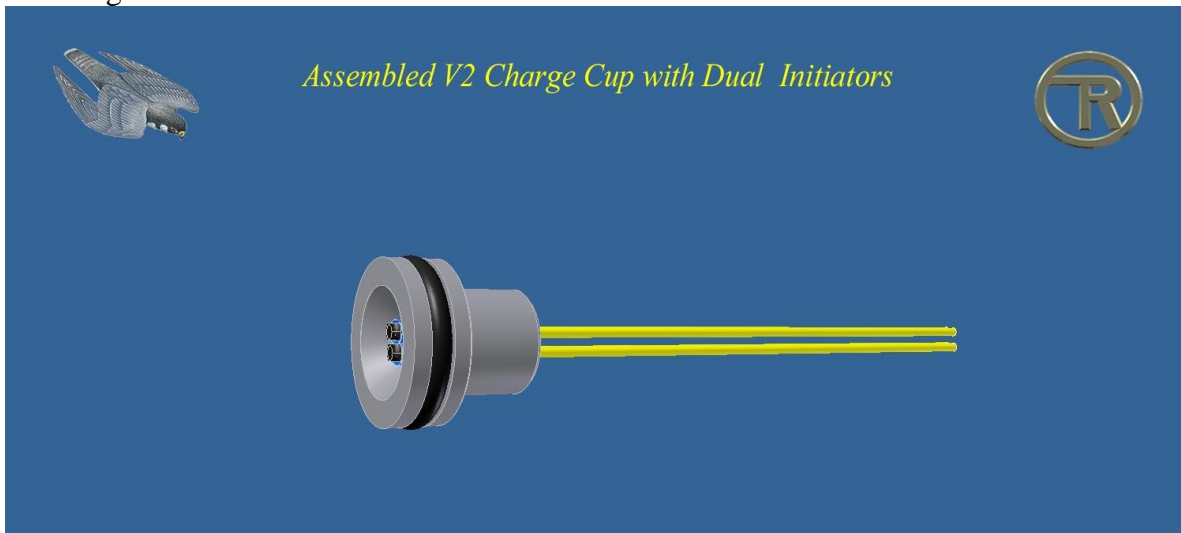


- d. Use the cotton tipped applicator with silicon lube to **wipe a residue of lube to the inside cavity** of the charge cup. Remember – this is ONLY a **RESIDUE** of lube! Be careful not to get any lube on the top surface of the charge cup! **Note:** This is an IMPORTANT STEP! Failure to lube the inside of the charge cup may make removal of the spent e-matches VERY difficult!
- e. Pull both initiators to within an inch or so of the V2 Charge Cup.
- f. Mix a small amount of 5 min epoxy. Dab a small amount of epoxy completely around the bottom of the initiators as shown in the diagram below:

**NOTE:** This will seal the cup and will keep exhaust gas from leaking out the back!



- g. Pull both initiators so that the tips do not extend past the top surface of the charge cup as seen in diagram below:



- h. Once the epoxy has hardened, **measure out .2cc of either 4F (FFFFG), 3F (FFFG) Black Powder, or Triple Seven (in the 3F granulation) (Listed in order of preference)** propellant with the provided measuring scoop. Triple Seven, a black powder substitute, can be found at your local sporting goods store. Black powder is a bit more difficult to find these days, but it can still be found at many gun stores. Fill the provided scoop just to the line on the scoop as shown in the diagram above.
- i. **Do not use more than the recommended amount of powder!**
- j. **Do not use any powder not listed above!**
- k. **WARNING: If using the "Firewire" Initiator it is strongly recommended that you use Black powder only! (The Firewire does not burn as hot as regular e-matches and may not burn hot enough to properly ignite Triple Seven well enough for a proper cartridge strike!)**
- l. Pour powder into the prepared Charge Cup. Apply a Pyro charge cover disk or use a piece of 3M blue masking tape over the charge cup to seal in the propellant. Trim the edges as necessary around the cup so the tape is flush with the edges. The tape will seal in the powder.



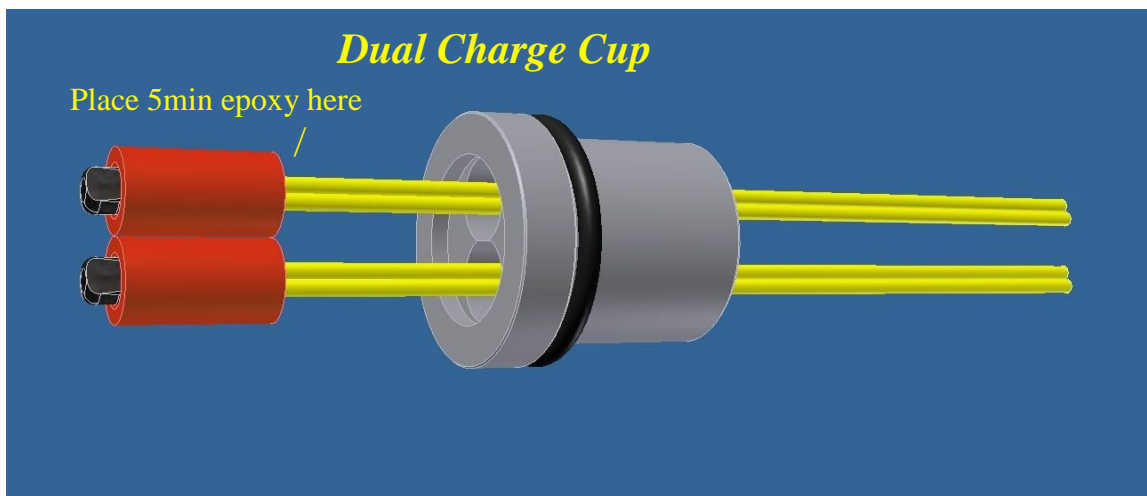
### Steps to load the DUAL charge cup

**Important note: The DUAL charge cup should ONLY be used with TWO initiators!**

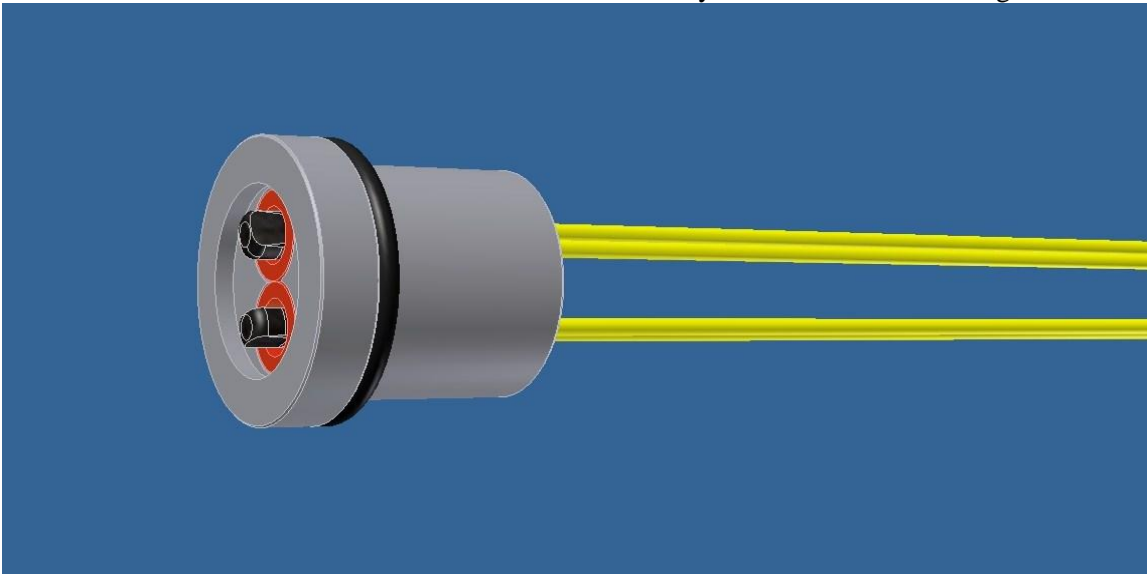
**NOTE:** For best results please completely follow these directions!

- a. Completely remove the plastic protective sheath from over the initiator heads.
- b. Cut the plastic protective sheaths to about 3/8<sup>th</sup> inch and re-install on the initiators.
- c. Use the cotton tipped applicator with silicon lube **to wipe a residue of lube to the inside cavities** of the Dual charge cup. Remember – this is ONLY a **RESIDUE** of lube! Be careful not to get any lube on the top surface of the charge cup! **Note:** This is an IMPORTANT STEP! Failure to lube the inside of the charge cup may make removal of the spent e-matches VERY difficult!
- d. Install and pull initiators to within an inch or so of the Dual Charge Cup as shown below.
- e. Mix a small amount of 5 min epoxy. Dab a small amount of epoxy completely around the **bottom of the initiator protective sheath** as shown in the picture below:

**NOTE:** This will seal the cup and will keep exhaust gas from leaking out the back!



- f. Assemble and let cure for at least 10 minutes. Assembly should look like the diagram below:



g. Once the epoxy has hardened **measure out .2cc of either 4F (FFFFG), 3F (FFFG) Black Powder, or Triple Seven (in the 3F granulation) (Listed in order of preference)** propellant with the provided measuring scoop. Triple Seven, a black powder substitute, can be found at your local sporting goods store. Black powder is a bit more difficult to find these days, but it can still be found at many gun stores. Fill the provided scoop just to the line on the scoop as shown in the diagram above.

h. **Warning: Do not use more than the recommended amount of powder!**

i. **Do not use any powder not listed above!**

k. **WARNING: If using the "Firewire" Initiator it is strongly recommended that you use Black powder only! (The Firewire does not burn as hot as regular e-matches and may not burn hot enough to properly ignite Triple Seven well enough for a proper cartridge strike!)**

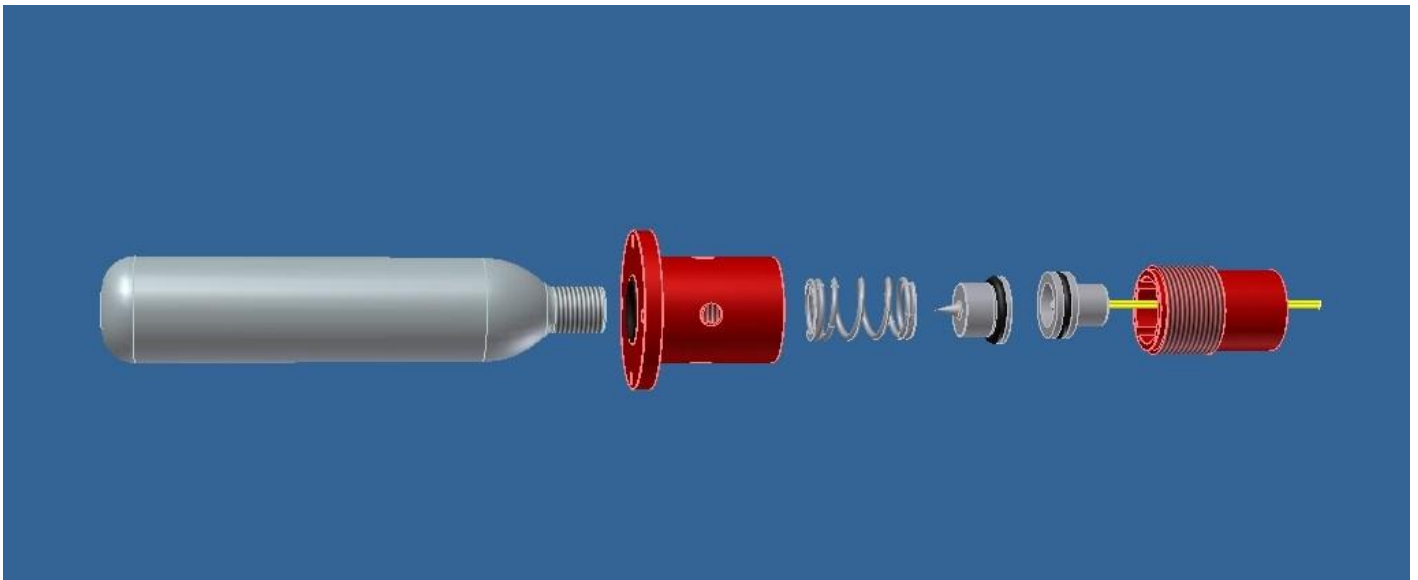
l. Pour powder into the prepared Charge Cup. Apply a Pyro charge cover disk or use a piece of 3M blue masking tape over the charge cup to seal in the propellant. Trim the edges as necessary around the cup so the tape is flush with the edges. The tape will seal in the powder.

11. Carefully place the Charge Cup into the Pyro Housing as shown in the exploded view below:

12. Carefully place the spring onto the Puncture Piston as shown in the exploded view below:

13. Insert the Puncture Piston into the Pyro Housing as shown in the exploded view below:

**Note:** For best results, push the Charge Cup just into the Pyro Housing. Align and start the Puncture Piston along with the spring into the Pyro Housing. Use a wooden stick or dowel to push the Puncture Piston and the Charge Cup all the way into the Pyro Housing until the Charge Cup is completely seated in the Pyro Housing. **It is VERY important that the Puncture Piston and the Charge Cup are touching (No air gap between them) and that the Charge Cup gets firmly seated into the Pyro Housing!**



**Exploded View – The RAPTOR**

14. Attach Pyro Housing to the Mounting Cap.

15. Choose and install the CO2 cartridge. The RAPTOR CO2 Ejection System will work with CO2 Cartridges from 20 to 85 grams. **For help choosing what size is best for you, see the page entitled:**

**[“Choosing the Right CO2 Cartridge for your Rocket”](#)**

**Your RAPTOR is now ready for flight!**



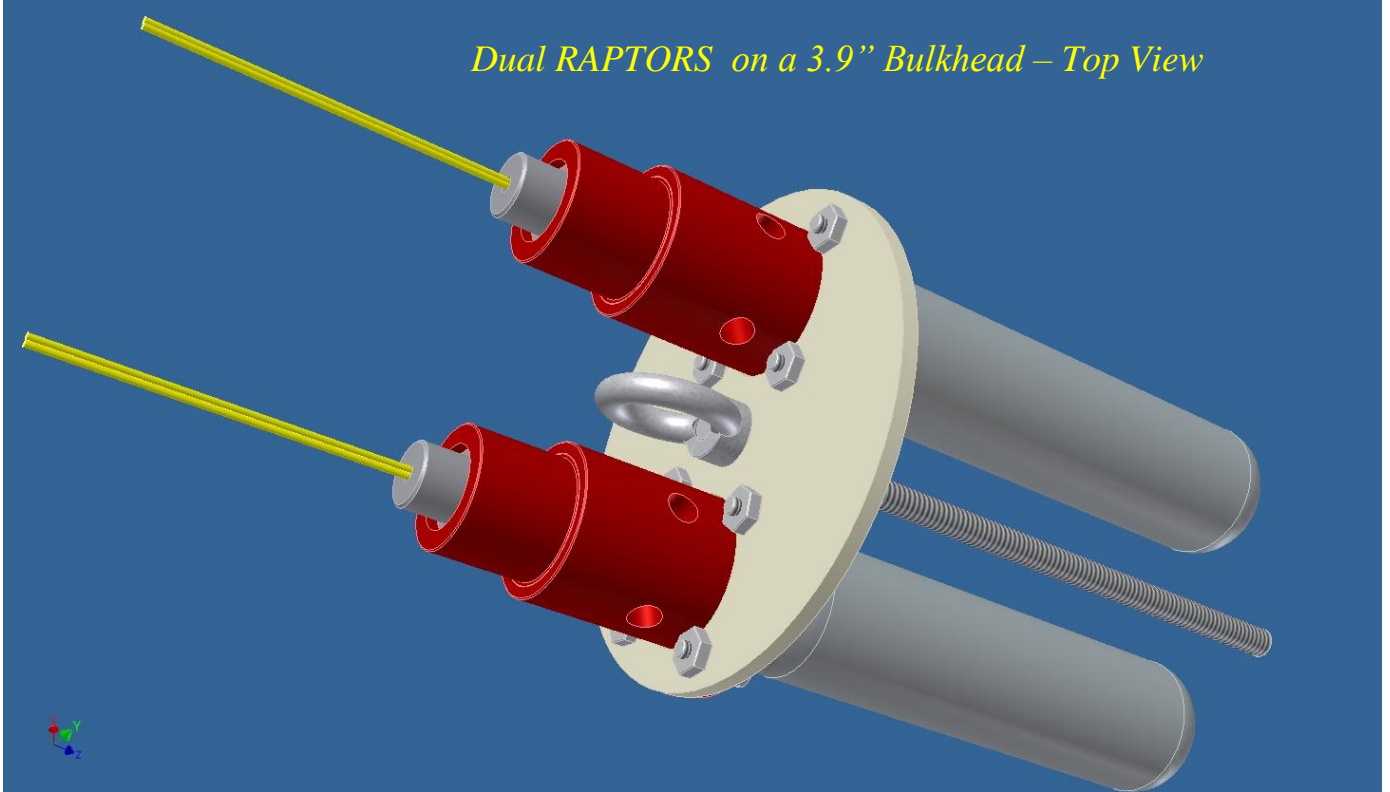
**23 and 35 gram RAPTOR's shown above**



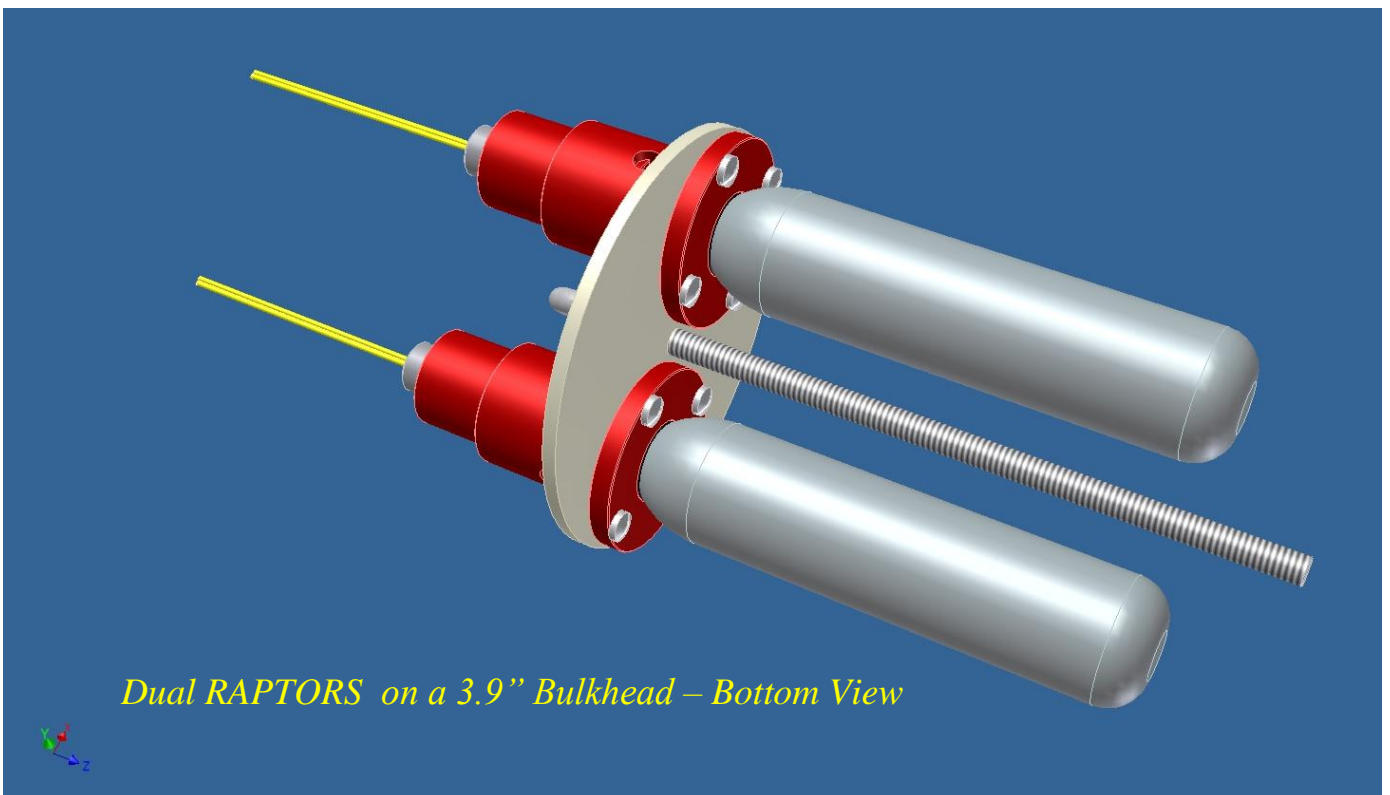
**The RAPTOR also works with LARGER CO2 cartridges such as 45, 60 & 75 gm cartridges shown above**

## *Dual RAPTOR Mounting Example - 1*

*Dual RAPTORs on a 3.9" Bulkhead – Top View*



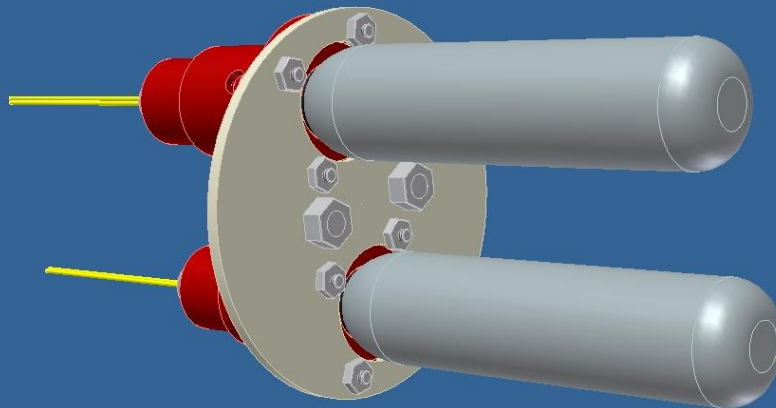
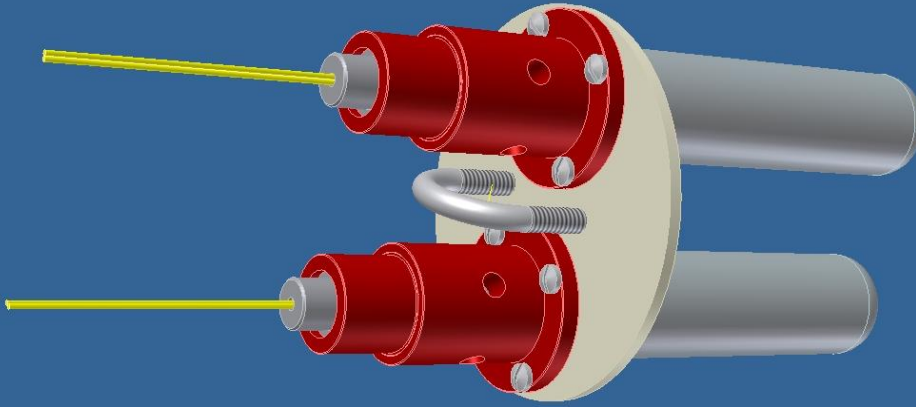
*Dual RAPTORs on a 3.9" Bulkhead – Bottom View*





## *Dual RAPTORS Mounting Example - 2*

*Dual RAPTORS on a 3.9" Bulkhead – Top View*



*Dual RAPTORS on a 3.9" Bulkhead – Bottom View*



## Choosing the Right CO2 Cartridge for your Rocket

*"Make everything as simple as possible, but not simpler."*

This is a quote from that really smart guy with the bad hair, Albert Einstein. Simple is good and simple is what we are going to try and do here.

### Choosing the right CO2 cartridge:

#### Method 1:

You may choose this method if you have flown your rocket (or you have ground tested it) and a known qty of BP has been used for deployment. **The factor is 5. Whatever the qty of BP that you have used in your rocket, measured in GRAMS, multiply that by 5 to get the equivalent grams of CO2 needed for the same deployment pressure.**

For example: A rocket that has been flown (or ground tested) with 4 grams of BP, would need about 20 grams (4 gms x 5) of CO2 to achieve the same ejection pressure. In this example you would choose either a 20 or 23 gram CO2 ctg and that would most probably work just fine, but you will still ground test!

Example #2: A rocket that has been flow (or ground tested) with 6 grams of BP, would need about 30 grams (6 gms x 5) of CO2 to achieve the same ejection pressure. In this case, round up and choose the 35 gram CO2 ctg and then ground test!

#### Method 2:

You may choose this method if you have never flown nor tested you rocket and have no idea as to how much BP you might need for adequate deployment. I recommend that you first follow this link to the [NASSA website](#) where they have a very useful BP calculator to determine how many grams of BP your rocket might need for BP deployment in your rocket. Then you would be well advised to follow this link to [Vern Knowles website](#) and study his discussion on "Ejection Charge Sizing". Once you have determined how many grams of BP that you would like to use in your rocket, use this number and go to Method 1. Then you must GROUND TEST!

There you go! The focus here is to get you to a starting point where you will then ground test this CO2 deployment system in your rocket before flight!

#### A word on CO2 cartridges:

For rocketry flights using CO2 for deployment, more is OK! Unlike BP, it is really difficult to use too much CO2! Always use enough gas and to **error on the high side when choosing a CO2 ejection cartridge!**

#### Another word on CO2 cartridges:

The CO2 cartridges that are used in The RAPTOR are somewhat difficult to find locally (READ: Nearly impossible). In addition, there are at least 5 different thread sizes and **only the 1/2-20 thread size works with the RAPTOR**. Because of this you may choose to order replacement CO2 cartridges directly from Tinder Rocketry to be sure that you get CO2 cartridges that are certain to work with your RAPTOR!

## **Replacement Parts**

Replacement parts may be purchased from the Tinder Rocketry website. Some of these items you will find locally (such as the Pyro Charge Cover Disks and Q-tips) and you are encouraged to purchase these locally. Other items such as the return spring and the Hard O-ring for the Puncture Piston are specialized and should only be sourced from Tinder Rocketry.

You have questions? Give me a shout and I will try to help you out!

[cameron@tinderrocketry.com](mailto:cameron@tinderrocketry.com)