

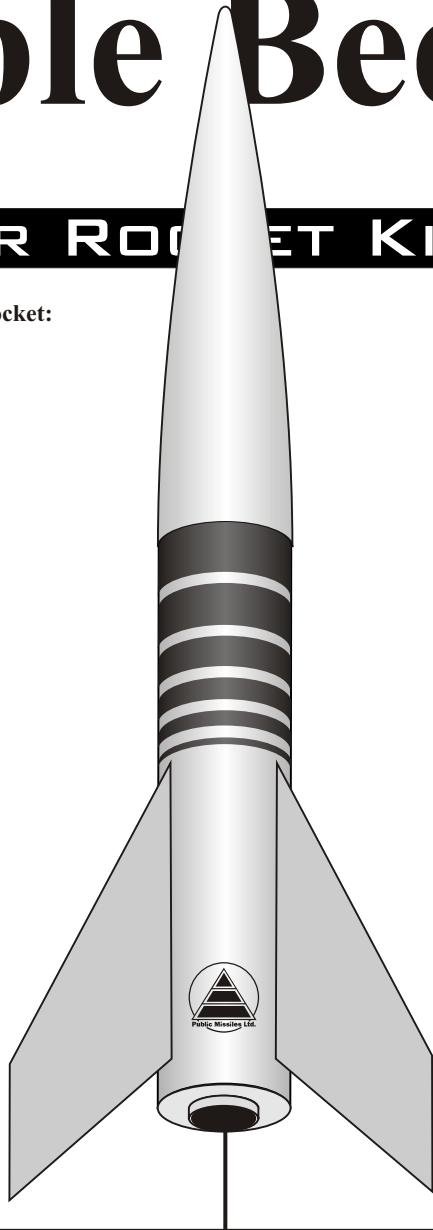
# Bumble Bee

## HIGH POWER ROCKET KIT

The Bumble Bee kit contains all the parts necessary\* to build a flying high power rocket:

- (1) Pre-slotted main airframe
- (1) Recovery tube
- (1) Nose cone
- (3) Fins
- (1) Piston ejection kit:
  - (1) Piston tube
  - (1) Slotted bulkplate
  - (1) 3/4" wide piston strap
- (1) D-ring
- (1) Parachute
- (1) Motor mount tube
- (2) Recovery tube to airframe centering rings (CR-3.9-3.0)
- (1) Airframe to MMT centering ring (CR-3.9-1.5)
- (1) Notched recovery tube to MMT cent. Ring (CR-3.0-1.5)
- (1) Shock cord (premounted to nosecone)
- (2) Launch lugs
- (1) Decal sheet
- (1) Instruction sheet (this one!)

\*Epoxy, paint, and motor not included.



**Please read and understand all instructions before building!**

The center of pressure (CP) of this rocket is 24.8 inches from nose tip. After finishing your rocket, permanently mark the center of pressure on the airframe. After loading the rocket with a motor, make sure that the center of gravity (balancing point) is at least one body diameter forward of the center of pressure mark. The center of gravity can be moved forward by adding weight to the nose cone.



# Basic Construction FAQ

The major parts involved in each step are shown shaded at the beginning of that step. Areas where epoxy should be applied are shown as well.

## PREP & ASSEMBLY

Read and understand the instruction steps fully before you begin the step.

ALWAYS sand the parts to be bonded with 100-120 grit sandpaper.

We strongly recommend you dry-fit (assemble without gluing) all parts in each step

BEFORE epoxying them together. Sand or adjust fit as needed before gluing.

Most epoxies work fine. Use 5 or 15 minute depending on how quickly you feel you can complete the step. Use longer set-time epoxy if you're unsure.

To make internal fillets to the fins deep up into the airframe, "load up" the end of a dowel with a blob of epoxy, then stick the dowel into the airframe and onto the fin joint you're working on. After depositing enough epoxy in this fashion, you can pull the dowel toward you, making a fillet with the rounded edge of the dowel.

Be sure to follow the "Do's & Don'ts" sheet provided with QT tubing.

Fins do not need to be "shaped". Lightly sand the edges to remove any manufacturing burrs.

## PAINTING/FINISHING

Before you paint the fins, scuff the entire surface with 220 grit sandpaper. This is easiest to do before mounting the fins.

Plastic nosecone imperfections can be filled with plastic model kit putty.

Stay with the same brand of paint throughout the process; primer, base color, accent colors, and clear coat. DO NOT skimp on the "shake the can for at least two minutes after the ball rattles" step! For the best finish, let each coat dry overnight and sand lightly with 320 or 400 grit sandpaper.

Apply the last color coat as heavy as possible without running or sagging. Let the paint cure for at least 48 hours before handling!

We recommend a clear coat of some sort to help protect the decals as well as "seal" their edges to help prevent them peeling off. When using any clear coat, put on only VERY thin, light coats, and wait at least 5 minutes between coats. The clear coat can damage your decals or paint if you put it on too heavily or don't wait long enough between coats!

## FINAL FITTING/PREPARATIONS FOR FLIGHT

The piston should be a smooth slip-fit in the airframe; this is critical. Sand the piston as needed so it can be easily inserted, and pulled out with just a gentle tug on the shock cord.

Keep sandpaper in your range box in case you need to adjust the fit the first few times at the field to deal with differing temperature and humidity.

Couplers should also be sanded to allow easy separation of the rocket.

If the coupler or nosecone is too loose, use masking tape to build it up to a good fit. If the nosecone is too tight, sand the ribs on the shoulder until it fits well. The parts fit properly if the rocket can be held upside down and gently shaken with nothing moving or coming apart.

Ejections will leave a black, gritty residue inside the airframe. Occasionally wipe the tube interior with a damp cloth wrapped around a dowel or broomstick; allow to dry.

See our website FAQ for information about thrust rings and motor retention. Motor recommendation information is available on our website on the Specs Page.

For our complete FAQ, see the FAQ Page on our website at [www.publicmissiles.com](http://www.publicmissiles.com).

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### Other items you will need:

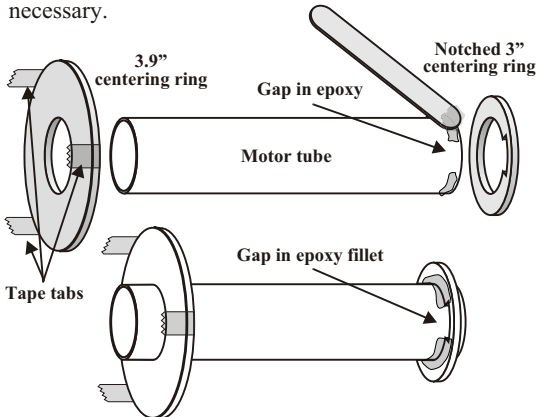
One set of epoxy  
One sheet each 120 and 220 sandpaper  
Ruler and pencil

Masking tape  
Cellophane tape

**Please read and understand all instructions before continuing!  
All surfaces to be bonded must be scuffed with 120 grit sandpaper.**

### Step 1

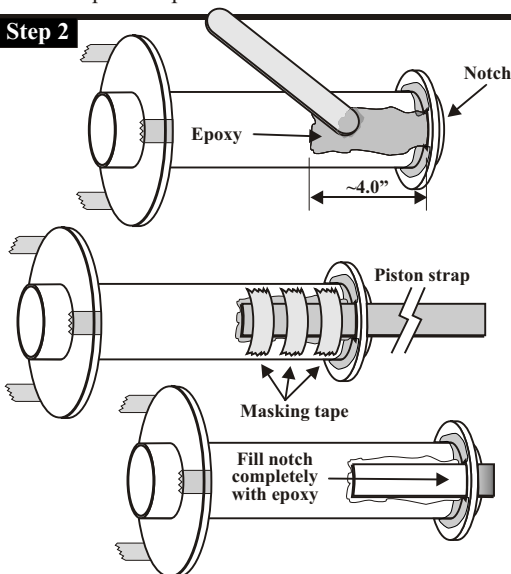
Dry fit both centering rings into the airframe and dry the motor mount tube. The notched ring can be a little snug in the airframe and on the motor tube. If it is tight, sand the ID and/or OD for a better fit. The standard centering ring should be a little looser in the airframe and over the motor mount tube to aid in later removal. Sand the ID and/or OD for a looser fit if necessary.



Spread a bead of epoxy around the circumference of one end of the motor tube leaving a 1" gap in the bead for the notch in the centering ring. Slip the notched centering ring over the motor tube with the notch aligned with the gap in the epoxy bead. Be sure the notch in the ring remains clear of epoxy. Locate the ring 1/2" from the end of the motor tube and allow the epoxy to set. Apply an epoxy fillet to each side of the ring still keeping the notch clear.

Slide the standard centering ring over the motor tube until ~3/8" of the motor tube is protruding beyond the ring. Make 3 or 4 tabs using cellophane tape as shown above to aid in removing this ring later. Do not use any glue at this time, this centering ring will be removed in a subsequent step.

### Step 2

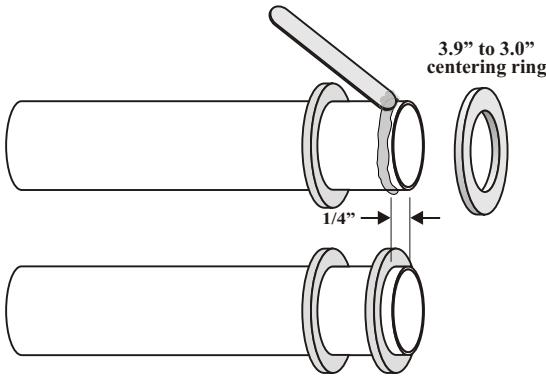
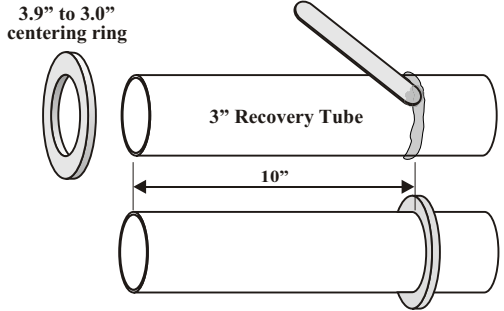


Spread a layer of epoxy about 1" wide and 4" long on the motor tube just below the notch in the upper centering ring. Slip one end of the piston strap (the widest strap in the kit) through the notch in the centering ring. Pull about 4" of this strap through the notch and press it firmly into the epoxy on the side of the motor tube. Hold the strap in place against the tube with masking tape until the epoxy cures. Remove the masking tape. **Fill the entire centering ring notch with epoxy.** Stuff the free end of the strap into the motor tube to keep it out of the way for the next step.

### Step 3

Dry fit both centering rings into the airframe and over the 3" recovery tube. Both rings can be a little snug in the airframe and on the recovery tube. If they are tight, sand the ID and/or OD for a better fit.

Spread a bead of epoxy around the circumference of the 3" recovery tube, 10" from one end. Slip the centering ring over the recovery tube. Locate the ring 10" from the end of the recovery tube as shown and allow the epoxy to set. Apply an epoxy fillet to each side of the ring.

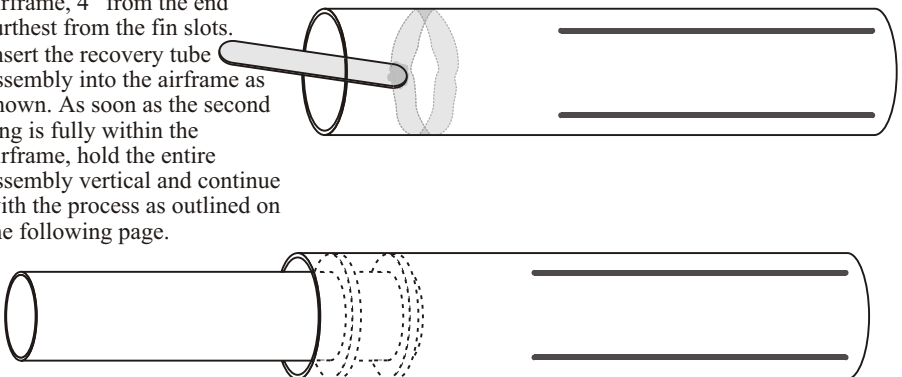


Spread a bead of epoxy around the circumference of the 3" recovery tube, 1/4" from the end nearest the ring previously installed. Slip the centering ring over the recovery tube. Locate the ring 1/4" from the end of the recovery tube as shown and allow the epoxy to set. Apply an epoxy fillet to each side of the ring.

### Step 4

**Please read and fully understand this step before proceeding as it is critical that it is completed quickly and without pause. Use a slower setting epoxy to allow yourself more time.**

Spread a bead of epoxy around the inside circumference of the airframe, 4" from the end furthest from the fin slots. Insert the recovery tube assembly into the airframe as shown. As soon as the second ring is fully within the airframe, hold the entire assembly vertical and continue with the process as outlined on the following page.

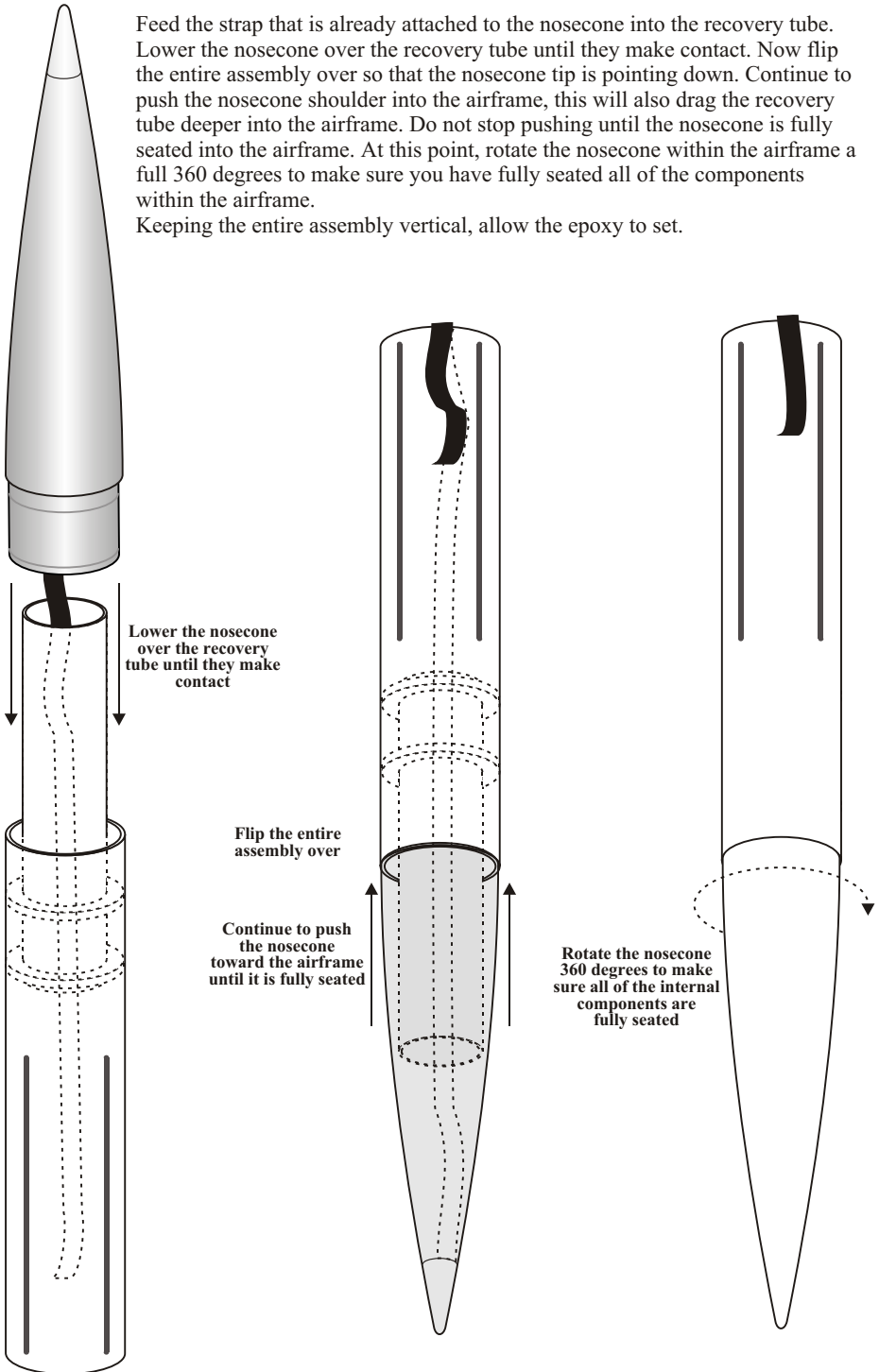


**Please do not hesitate at this point. Continue the process on the following page.**

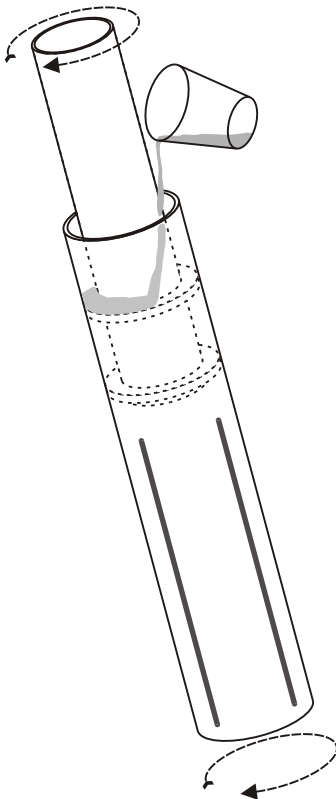
**Please do not hesitate at this point. Continue the process from the previous page.**

Feed the strap that is already attached to the nosecone into the recovery tube. Lower the nosecone over the recovery tube until they make contact. Now flip the entire assembly over so that the nosecone tip is pointing down. Continue to push the nosecone shoulder into the airframe, this will also drag the recovery tube deeper into the airframe. Do not stop pushing until the nosecone is fully seated into the airframe. At this point, rotate the nosecone within the airframe a full 360 degrees to make sure you have fully seated all of the components within the airframe.

Keeping the entire assembly vertical, allow the epoxy to set.



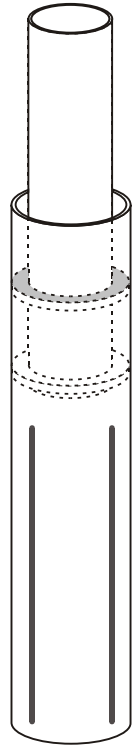
## Step 5



Once the epoxy has set, flip the assemble back over and remove the nosecone. Mix up a batch of epoxy and pour a small amount into the airframe while holding the assembly at an angle as shown. Allow the epoxy to run along the 3" recovery tube down to the centering ring. Do not allow the epoxy to contact the inside of the airframe until it has reached the centering ring. Pour just enough epoxy to cover the centering ring.

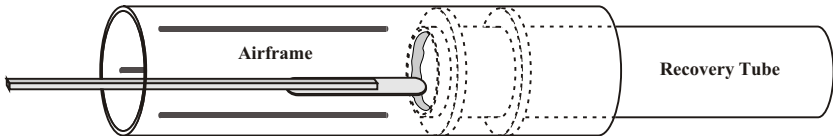
**NOTE: Do not pour too much epoxy into the airframe at this point, just enough to bond the centering ring to the airframe. The total depth of the epoxy should not exceed 1/8". Too much epoxy will not allow the nosecone to seat fully!**

While still holding the assembly at an angle, rotate the assembly to spread the epoxy. Once spread, allow the epoxy to set with the assembly in an upright position.

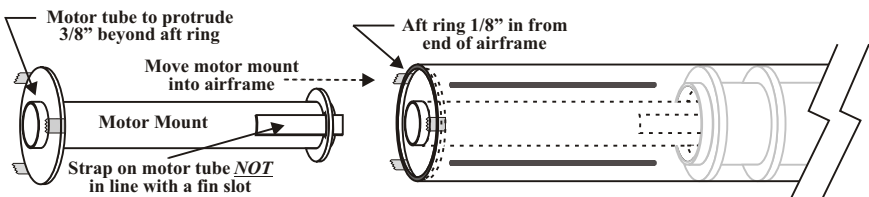


## Step 6

You will need a long stick or dowel for applying epoxy in this step. Just below is a drawing of one good method for creating an extended epoxy applicator. Simply epoxy a dowel or stick to a tongue depressor or popsicle stick.



Reaching through the slotted end of the airframe with your extended applicator, spread a bead of epoxy around the inner circumference of the recovery tube. Push the assembled motor mount (from Step 1) through the airframe and into the recovery tube until the aft centering ring is 1/8" in from the end of the airframe. Be sure that the motor tube is still protruding from the temporarily mounted centering ring by 3/8". **Once the motor mount is in place, hold the assembly vertical (slotted end down) until the epoxy sets up.**



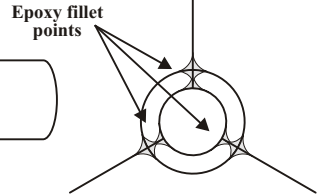
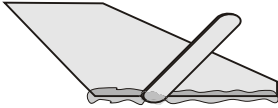
## Step 7

**A)** Apply a bead of epoxy to the root edge of a fin. Push the fin through the slot in the airframe and against the motor mount tube. Make sure that the fin is perpendicular to the airframe. Use tape to hold the fin in position while the epoxy cures. Repeat this process for all fins.

**B)** Apply an epoxy fillet to both sides of each fin. Carefully smooth the epoxy with your finger before it begins to gel. Allow the epoxy to set up before rotating the rocket to do the next set of fins. Once the epoxy has fully cured, you should sand the fillet smooth with fine sandpaper. Sanding will help the primer hold better to the epoxy.

**C)** Gently pull the centering ring off the end of the rocket by tugging on the tape tabs. Using a stick, apply an epoxy fillet to the fins at the motor mount tube and the inner airframe wall.

**D)** Remove the tape tabs from the centering ring and permanently epoxy it in the base of the rocket 1/8" in from the bottom of the airframe.



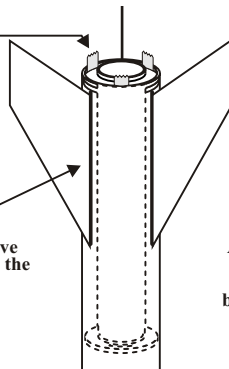
### Optional but highly recommended step:

Encapsulate your fin roots with PML Adjustable Density Expanding Foam in addition to or instead of using internal epoxy fillets for a much stronger and easier to form bond.

If you have never used Expandable Liquid Foam, we recommend that you mix a small batch and allow it to expand and cure to get a feel of how it flows and how much it expands. Once poured, do not touch the foam until it is fully cured because you can easily ruin the expansion.

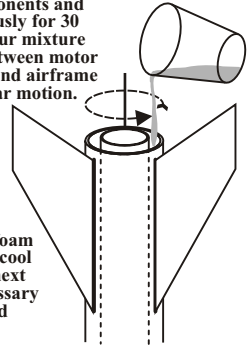
Use the tape tabs on centering ring to aid in ring removal

Be sure that you have completed and cured the external fillets

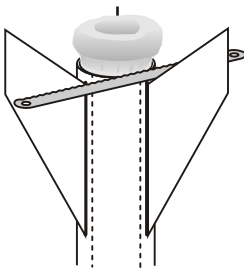


Mix a 1 ounce batch (maximum expansion) of foam components and stir vigorously for 30 seconds. Pour mixture into space between motor mount tube and airframe in a circular motion.

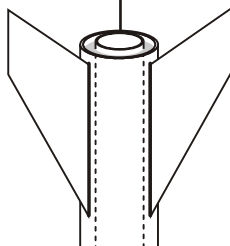
Allow each batch of foam to expand, cure, and cool before pouring the next batch. Repeat as necessary until cavity is filled with foam.



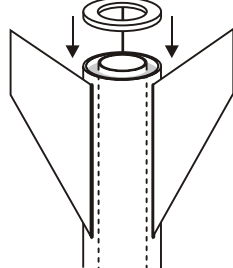
Once fully cured and cooled, cut off excess foam with hack saw blade. Do NOT cut the motor tube!



Grind or carve the foam below the end of the airframe until there is clearance for the centering ring. Remember that the motor tube must protrude 3/8" beyond the ring

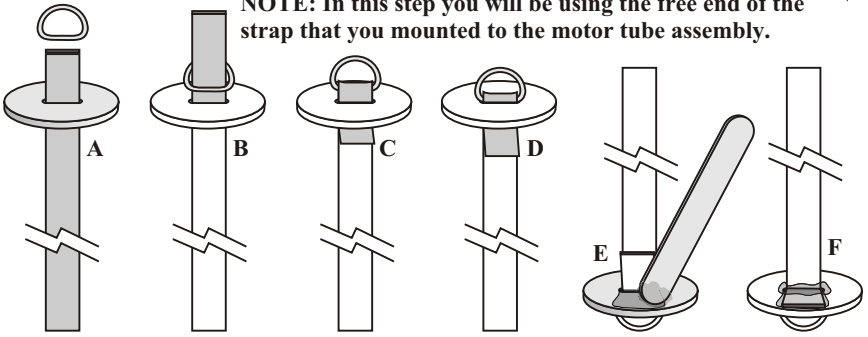


Now epoxy the centering ring in place.



## Step 8

**NOTE:** In this step you will be using the free end of the strap that you mounted to the motor tube assembly.



**A)** Pull the free end of the strap through the slot in the piston bulk plate.

**B)** Slip the metal "D" ring over the strap.

**C)** Feed the strap back through the slot.

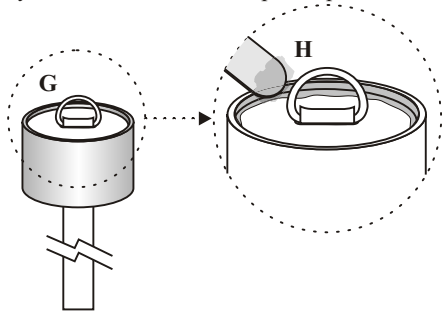
**D)** Pull on the strap until the "D" ring is wedged at the slot.

**E)** Flip the assembly over. Spread a layer of epoxy on the underside of the piston plate as shown. Fold the short end of the strap flat against the piston plate and press it into the epoxy. You can use a clamp to hold the strap in the epoxy while it sets.

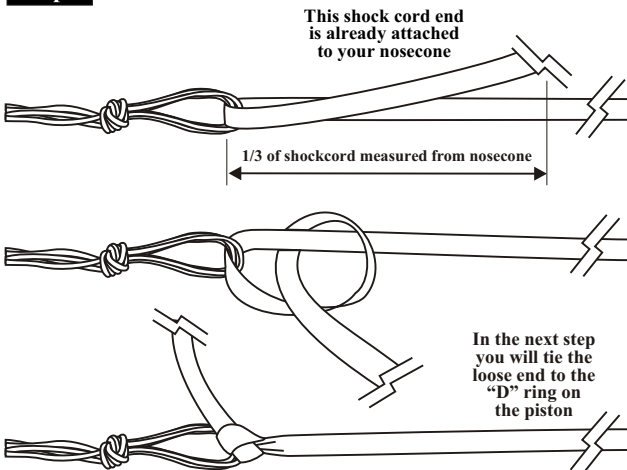
**F)** When the epoxy has cured, pull the strap until the "D" ring is wedged tight at the slot. Apply epoxy to the strap at the "D" ring.

**G)** Epoxy the piston plate inside the piston body 1/8" from the top.

**H)** Apply an epoxy fillet to both sides of the piston plate.



## Step 9

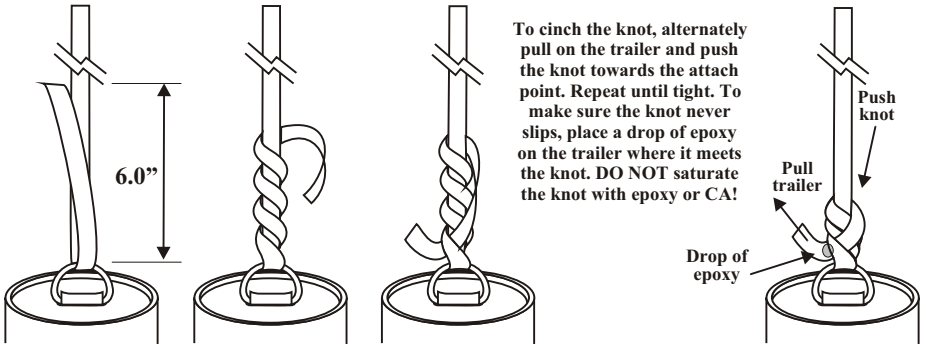


Prepare the parachute per the parachute instructions. Thread the shock cord through the loop you made in the parachute shroud lines and tie it using the knot illustrated on the left. Note that the chute should be attached to the shock cord at about the 1/3 point of the shock cord measured from the nosecone. Alternatively, you can tie the shock cord to a "kwik-link" and then attach the "kwik-link" to the loop in the shroud lines.



## Step 10

Thread the loose end of the shock cord through the “D” ring and tie it using the knot illustrated below. Alternatively, you can tie the shock cord to a “kwik-link” and then attach the “kwik-link” to the “D” ring.

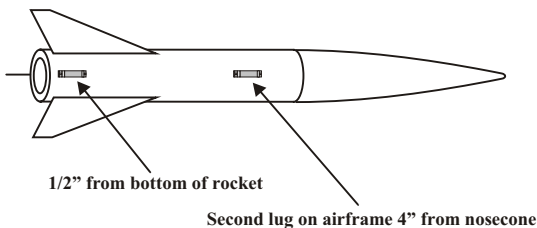


## Step 11

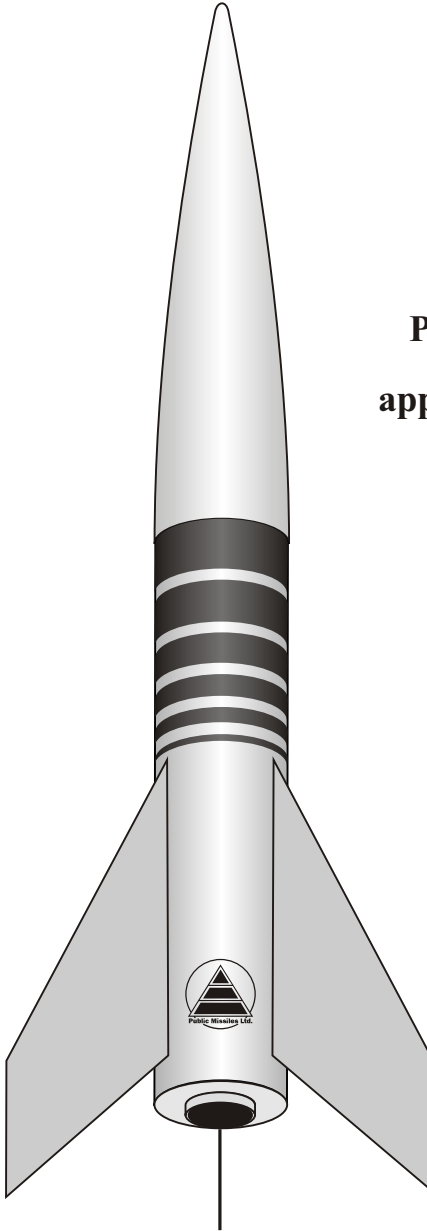
Epoxy\* one launch lug in place 1/2 inch from the bottom of the rocket and the other launch lug about 4” inches below the nosecone.

Be sure the lugs are perfectly in line with each other, parallel to the airframe and not in line with a fin.

\*J.B. Weld works best for all types of launch lugs (and motor retainers, for that matter).



# Bumble Bee



**Paint entire rocket  
bright yellow,  
apply decals as shown.**





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