



RFS Class II Rocket Assembly Instructions

This is Rocket Science



Instructions by:

Loc Precision

Photos by:

Great Lakes Space Port Sheboygan Education Foundation, Inc.



Welcome and thank you for joining the Rockets for Schools Competition

We have developed these expanded instructions for those of you who may not have much modeling experience. If you have any problems during your rocket's construction, feel free to call me with your questions.

Randy Lutz
Co-Director
Rockets for Schools

Daytime Phone — 920.451.3801
Evening Phone — 920.458.6299

Additional Items and Supplies You Will Need:

Mid-Cure Epoxy (15 minute)	Plastic Gloves
150 Grit & 220 Grit Sandpaper	Hammer
3/32", 5/32" & 3/16" Drill Bit	Ruler
Electric Drill	Pencil
3/4" Masking Tape	Primer
	Paint

General Assembly Tips (PLEASE READ)

IMPORTANT: *Before epoxying any parts to the phenolic tubing, make sure you lightly sand it with 150 grit sandpaper to create a better bond. This is very important to ensure this rocket can withstand the aerodynamic forces it will encounter during its flight*

- Before you start building your rocket, familiarize yourself with these instructions and the proper sequence of assembly steps as outlined.
- This rocket is flown with high-impulse rocket motors. For maximum strength and model integrity you must use of epoxy throughout its entire construction unless noted otherwise.
- Test fit all components prior to bonding them together with epoxy. Some components may require light sanding to ensure a proper fit.

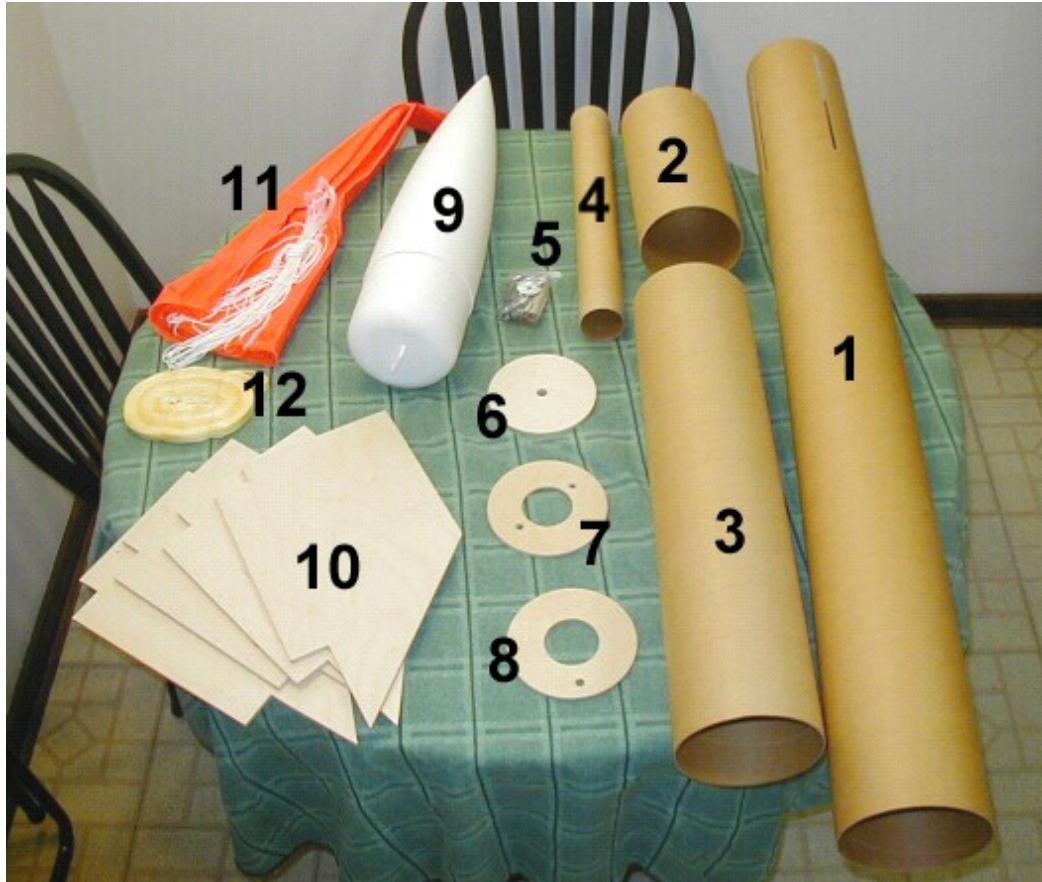
Helpful We Sites:

<http://www.info-central.org/infocentral.shtml>
<http://www.ninfinger.org/~sven/rockets/rmrfaq.toc.html>
<http://www.thestorefinder.com/rockets/library/rocket-FAQ.html>
<http://www.jcrocket.com/kitbuilding.shtml>

Step #1

Parts Identification

1.1 Layout all the parts from the kit and identify them with the parts list below

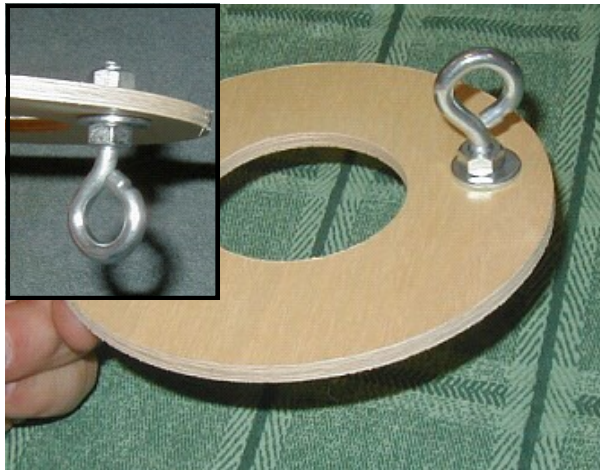


ID No.	Quant.	Description
1)	1	48" length / 5.5" dia. Pre-slotted Booster Tube
2)	1	11" length payload coupler
3)	1	24" length / 5.5" dia. Payload Tube
4)	1	18" length / 54mm dia. Motor Tube
5)	1	Bag Hardware
6)	1	Payload Bulkhead
7)	1	Aft Centering Ring
8)	1	Forward Centering Ring
9)	1	Plastic Nose Cone
10)	4	1/4" Birch plywood Fins
11)	1	36" Parachute
12)	40 Ft.	9/16" Wide Tubular Nylon Cord

Step #2

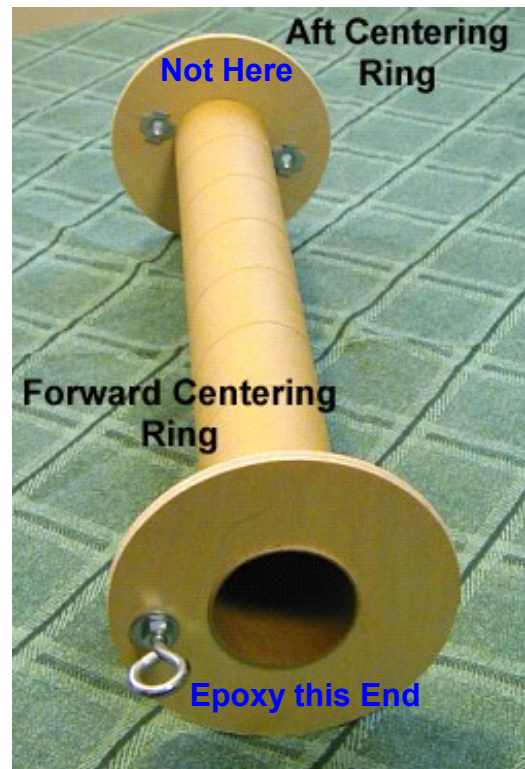
Assembly of the Motor Tube

2.1 Take the Aft centering ring (the one with the two small holes in it) and insert the 1/4" T-nuts in the holes as shown. Use a hammer to pound the T-nut flush with the centering ring. Dab some epoxy on the T-nut flanges to ensure they do not back out of the holes. **Do not get epoxy in the threaded holes of the T-nut.**



2.2 Mount an eyebolt through the 3/8" hole in the Forward Centering Ring. Install a nut / washer on the top side of the centering ring and a washer / nut on the bottom. Tighten the nuts and secure both nuts with a drop of epoxy.

2.3 Test fit the centering rings onto the motor tube. Sand as necessary to insure a secure fit. Position the forward centering ring 1/4 inch from the end of the motor tube. Apply a fillet of epoxy on both sides of the forward centering ring where it meets the motor tube. **Do not epoxy the Aft centering ring at this time!** Set the Motor tube aside to let the epoxy cure.

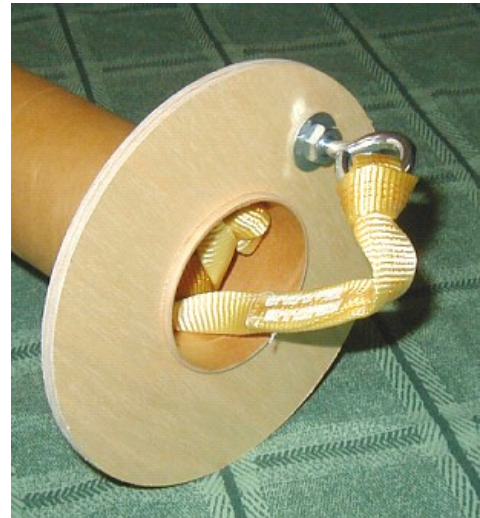


Step #3

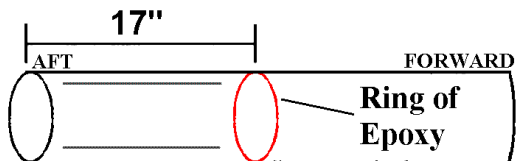
Mounting the Motor Tube in the Airframe



3.1 Attach the 40 ft. shock cord to the Forward Centering Ring by passing the loop at one end of the shock cord through the eye-bolt in the Front Centering Ring. Now pass the rest of the shock cord through the loop and pull snug. Place a little epoxy on the knot to secure it.

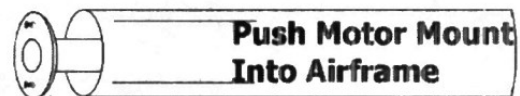


3.2 Now place the shock cord into the motor tube to keep it out of the way for the next step.

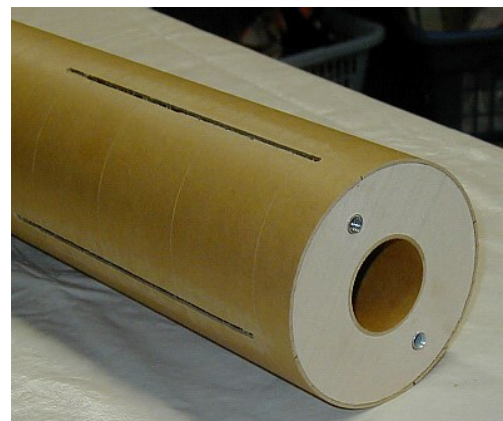


3.3 Start out by mixing up some epoxy. Using a stick or similar item apply a generous ring of epoxy 17" from the AFT end of the Booster Tube. The aft end of the tube contains the slots for the fins to be added later.

3.4 You can now slide the motor mount assembly into the airframe. Push the Forward Centering Ring into the booster tube first.

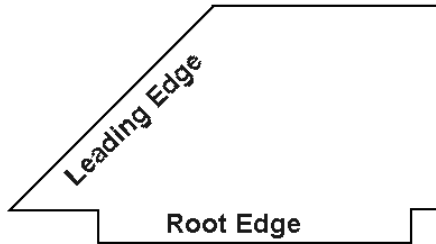


3.5 Slide the motor tube into the airframe until the Aft Centering Ring and motor tube are flush with the aft end of the airframe. **Do NOT epoxy the AFT centering at this time!** Stand the airframe upright and allow the epoxy to cure.



Step #4

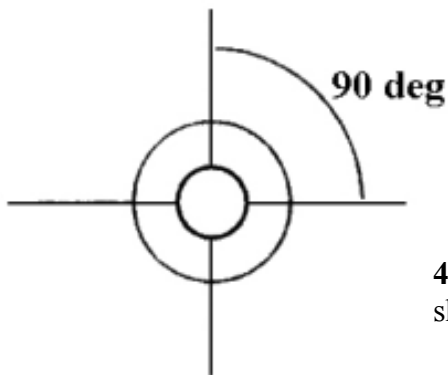
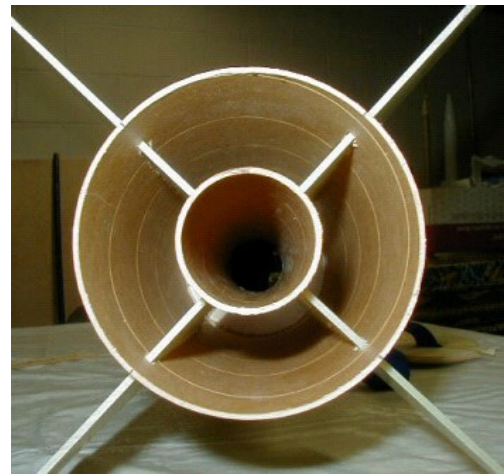
Attaching the Fins



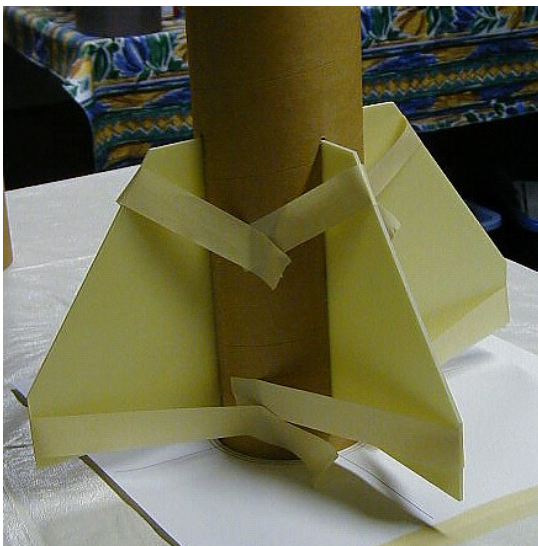
4.1 Sand the leading edge of the fins tapering them to a point. This will reduce the fin's drag when the rocket is in flight.

4.2 Apply an epoxy bead to the root edge of the fin.

4.3 Push the fin through the slot in the airframe onto the motor tube. Be sure the fin's root edge is in contact with the motor tube. The picture at the right has the aft centering ring removed for illustration only. **Do not remove the aft centering ring at this time.**

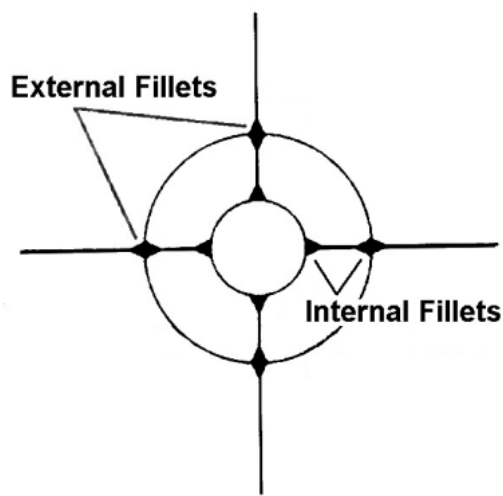
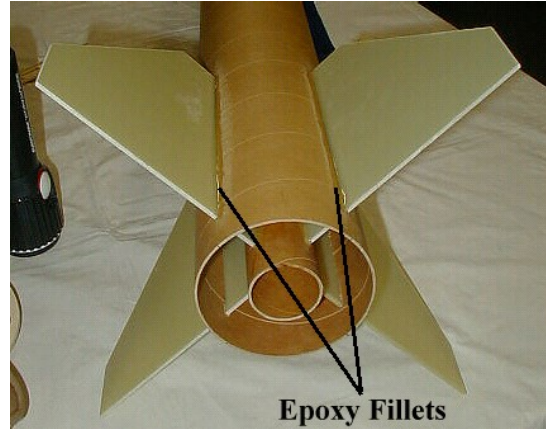


4.4 Make sure the fin is perpendicular to the airframe as shown.



4.5 Use masking tape to hold the fin in position while the epoxy cures. Repeat this process for all fins. Allow the epoxy to fully cure before proceeding to the next step.

4.6 Apply an epoxy fillet to both sides of each fin where the fin meets the exterior part of the airframe. Put on a pair of plastic or rubber gloves. Dip your finger in rubbing alcohol and carefully smooth each epoxy fillet with your finger before it starts to cure. Allow the epoxy to fully cure before rotating the rocket to do the next set of fillets. When the epoxy is fully cured sand with 220 grit sand paper. This gives better adhesion when the primer is applied.



4.7 Thread the two 1/4" bolts in the T-nuts on the aft centering ring. Gently pull off the aft centering ring by pulling on the bolts. Lay the booster on its side as shown above. Using a stick or similar item apply an internal epoxy fillet to the root edge of every fin. Also apply fillets that bond the fins to the inside of the booster tube. Allow the epoxy to fully cure before rotating the rocket to do the next set of fillets.

It's very important that this step is done correctly. If the fins are not attached securely, your rocket will not pass the safety check. When all the fillets are complete, you should be able to flex the end of each fin back and forth with out breaking them loose from the motor tube.

Step #5

Installing the Rail Buttons

5.1 For additional safety at launch, we are now using rail buttons instead of launch lugs. Also, please tape off the rail buttons when you paint your rocket - any paint on the rail buttons may interfere with their operation.

5.2 Place a ruler against the aft end of the rocket as shown. Mark a spot half way between the two fins.





5.3 Using a straight edge (a yard stick works well) site down the body tube and draw a line parallel to the center axis of the tube.



5.4 Drill a 5/32" hole 2" and 26" from the Aft end of the body tube along the center line.



5.5 Screw the rail buttons into the two holes using the #8 - 1/2" screws. Install the #8 nut on the screw to secure it.

Caution: Do not over-tighten the nut. This may deform the rail button.

5.6 Place a drop of epoxy on each of the nuts to lock them in place. After the epoxy hardens, place a piece of duct tape on the inside of the tube over the upper nut to prevent the parachute from snagging on it.

Step #6

Epoxying the AFT Centering Ring

6.1 You can now epoxy the AFT centering in place. Install the AFT Centering Ring so it is recessed approximately 1/4" into the airframe. Make sure the T-nuts do not line up with any fins.

Apply a generous epoxy fillet where the motor tube meets the centering ring and where the centering ring meets the airframe. Be sure not to get any inside the T-Nuts! Allow to cure.



Step #7

Assembling the Payload Section



7.1 Mount an eyebolt through the 3/8" hole in the bulkhead. Install a nut / washer on the top side of the shock cord mounting ring and a washer / nut on the bottom. Secure both nuts with a drop of epoxy.

Test fit the bulkhead into the 11" payload coupler. Sand the outer edge if necessary so the ring slides smoothly into the tube.



7.2 Recess the bulkhead 1/8" into the 11" long payload coupler. Epoxy the back side of bulkhead in place using stick or similar item. Once cured, epoxy the front side using a straw or similar item.



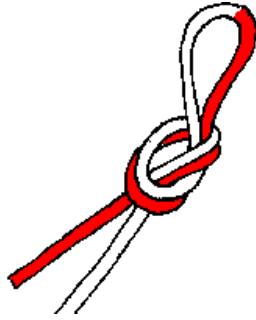
7.3 Test fit the coupler in the payload tube. It should be a snug fit. If the fit is too loose, put two wraps of masking tape on the coupler -- one 2" and one 4" from the end.

Measure and make a mark in the middle of the coupler. Smear a 3 inch band of epoxy just inside the AFT end of payload tube. Slide coupler into payload section up to the mark. Twist the coupler while inserting to help spread the epoxy. Allow to cure.

Step #8

Attaching the Recovery System

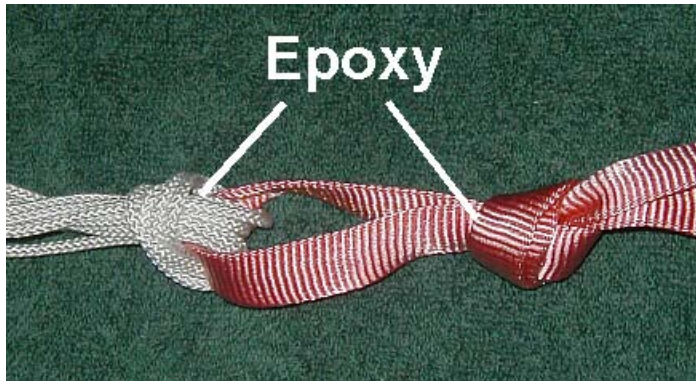
8.1 Remove the 40 ft. shock cord from the motor tube. Tie an overhand loop 8 feet from the end of the tubular nylon strap. See example below.



8.2 Attach the shorter end of the Tubular Nylon Cord to the eyebolt in the payload section using the quick link as shown



8.3 Gather the parachute's shroud lines at their mid-point making sure they are not tangled or twisted. Pass the shroud lines through the overhand loop in the Tubular Nylon Cord. Then pass the parachute through the shroud lines and pull taut.

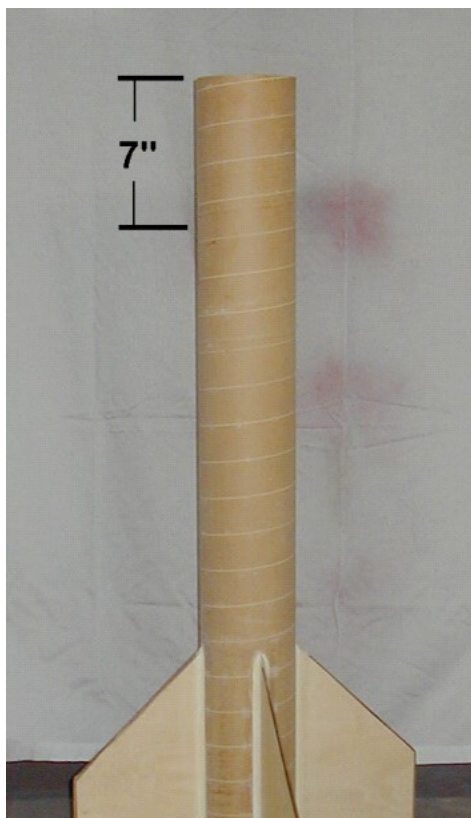
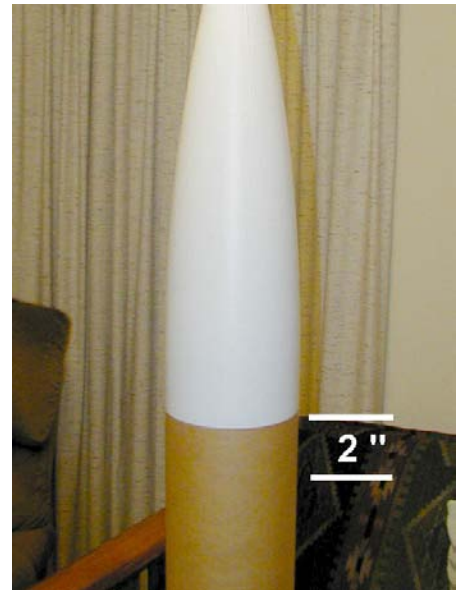


8.4 Put a small amount of epoxy on the knots to ensure they do not unravel.

Step #9

Finishing Up

9.1 Attach the nose cone using the (4) sheet metal screws. Make four marks 2" down from FORWARD end of payload section, one mark in line with each fin. Insert the nose cone into the payload section tube and drill four $3/32$ " holes. Insert the screws and make sure the nose cone is secure enough so it will not fall off in flight.



9.2 Mark a spot 7 inches down from the forward end of the booster tube. Drill a $3/16$ " hole at this point.

As the rocket rises in the atmosphere, the air pressure around the rockets drops. This hole bleeds off the higher pressure air in the booster tube to prevent the payload section from "popping off" due to a pressure buildup.

Step #10

Finishing

Use the following steps to finish your rocket:

- 10.1** Paint the fins with a 50/50 mixture of epoxy and rubbing alcohol. This will seal the wood to prevent damage to the plywood at splashdown.
- 10.2** For a better looking finish, fill the spiral grooves in the body tubes. We recommend Elmer's Finishing Wood Filler thinned with a little water.
- 10.3** Lightly sand the airframe and cone with a fine sandpaper to allow better adhesion of the primer.
- 10.4** Cover the two rail buttons with tape before you paint your rocket
- 10.5** Prime the rocket using primer of choice, following the instructions of the primer.
- 10.6** Fill any imperfections with Bondo or spot putty. Allow to dry and sand again.
- 10.7** Using a tack cloth or rubbing alcohol wipe down entire rocket to remove dust or any other dirt.
- 10.8** Prime the rocket again and when dry, lightly sand with fine sandpaper.
- 10.9** Paint the kit using your choice of spray paint, Krylon is the choice of the manufacturer. This is obviously a fictional kit, so there is no "correct" paint scheme. Let your imagination run wild!!
- 10.10** Once paint is applied and fully dry, clear coat the rocket using clear coat of choice. This seals the rocket and helps keep water from penetrating.



Congratulations!

This completes the assembly of your RFS Class II Rocket!