Kit #05046
Skill Level 4

Made In USA

FLYING MACHINE

Flying Machine Parts List

Item #	Item Name	Qty
10068	Engine Mount Tube (AT-18/2.75)	2
10105	Laser-Cut Airframe Tube (AT-24/12) Slotted Pods	2
10160	Airframe Body Tube (AT-56/18)	2
10091	Airframe Tube (AT-24/3.75)	1
13031	Centering Ring (CR-18/24)	5
13035	Centering Ring (CR-24/29)	1
13029	Centering Ring (CR-13/18)	2
13311	Centering Ring (CR-24/56) 1/8" Plywood	2
13056	Launch Lug (1/4" X 3")	2
14114	Balsa Sheet 1/32"x3"x4"	3
12363	CBD-56mm 1/8" Plywood	1
13042	Coupler AC-56 (BT-70) Red	1
14352	Plywood support (Laser Cut)	2
15603	Fin Sheet A	1
15604	Fin Sheet B	2
17050	Forward Hook (cast resin)	2
17051	Aft Hook (cast resin)	2
18904	Vac-Formed Canopy for Flying Machine	1
18905	Vac-Formed Port Holes for Flying Machine	1
19400	Plastic Nose Cone PNC-24A	2
19402	Plastic Nose Cone PNC-24A Slotted Shoulder	2
19470	Plastic Nose Cone PNC-56mm (BT-70)	1
29004	Mylar Streamer 2"x18"	2
29624	Wood Screw Eye Size 9	1
35576	24mm Display Stand Cardstock LC	1
37034	Pattern Sheet A - Vertical Tail	1
37035	Pattern Sheet B - Fins & Canards	4
37036	Pattern Sheet C - Ornamental Decor	1
37037	Tube Marking Guide	1
24043	Regular "D" Crimped Engine Hook	2
24044	E Size Engine Hook	1
29101	32"/24" Parachute Pack	1
29515	100# Kevlar® Shock Cord x8ft	1
29520	300# Kevlar® Shock Cord x8ft	1
31136	Flying Machine Instruction Sheet A	1
31137	Flying Machine Instruction Sheet B	1
31138	Flying Machine Instruction Sheet C	1
41048	Flying Machine Printed Decal Sheet	1
39037	Flying Machine Face Card	1
47133	Plastic Bag	1

See back page for tools & supplies list

Skill Level 4

Slightly Challenging

The Flying Machine is a fun and stimulating kit to build and fly. It has a steampunk look that will have you speculating how rockets might have been built if Jules Verne, the father of science fiction, was putting this rocket together. The rocket itself features a large core tube that is powered by a 24mm diameter rocket motor, plus it has two strap-on booster pods that give it extra oomph coming off the pad. These booster pods are jettisoned off the core vehicle when they burn out, creating a dazzling display in the sky that is rarely seen. It always catches onlookers by surprise, because they don't expect to see parts safely falling away from a rocket in flight. The core rocket continues safely on its mission, and ejects a large parachute when it reaches apogee. Seeing three parts falling out of the sky adds extra excitement to the aerial display.

The kit is considered a Skill Level 4 rocket not because of the assembly, but because it uses a cluster of motors that have to be ignited simultaneously at launch. We consider a cluster of motors to be a more advanced skill. They can be a little tricky because it requires a slightly different method of hooking up the igniters and a more powerful launch system. The kit itself is of average complexity, and isn't difficult to assemble. Decorating the rocket with its hundreds of little rivets is a little time consuming and requires extra patience. They are optional if you prefer not to add them; you'll still have a great looking rocket that wows spectators when they see it fly.

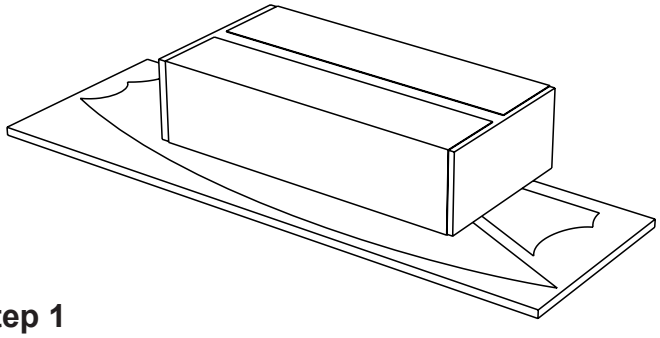
Apogee Components

Manufactured in the USA by:
Apogee Components Inc.
Colorado Springs, Colorado, USA
Visit us online at:
www.ApogeeRockets.com

*Updated 9/28/2018

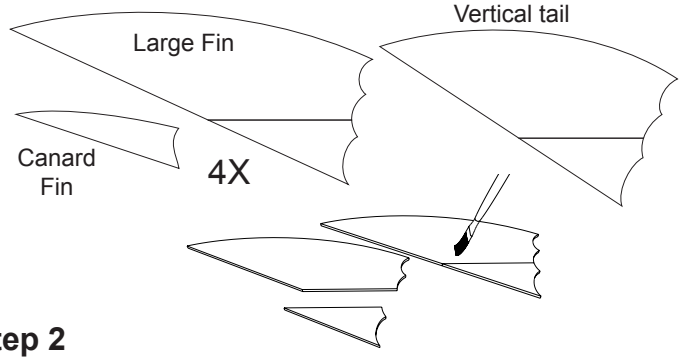
Assembly Steps

☐ 1. Fine sand the balsa wood laser-cut sheets using 200 and then 400 grit sandpaper before removing the fins. Carefully remove all the pieces from the sheet by freeing the edges with a sharp hobby knife. Do not sand the edges of the fins until after assembling them in the next step.



Step 1

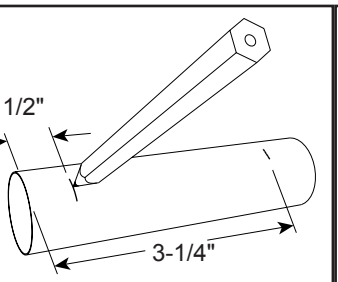
☐ 2. Assemble the four large fins and the single vertical tail by gluing the edges together as shown using wood glue. Sealing the surface of the balsa with sanding sealer makes the surface of the wood consistent and improves the rocket's appearance. Apply the sealer with a paintbrush to all of the fins. When dry, sand it with 400 grit sandpaper. Repeat the procedure until the balsa grain is filled and the fins look and feel smooth.



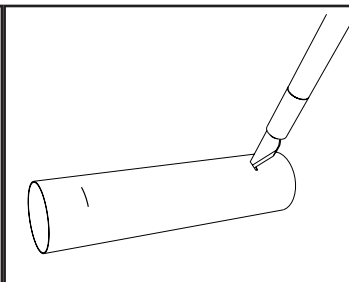
Step 2

☐ 3. Locate the 24mm (approximately 1 inch) diameter engine mount tube. Mark it in two places, 1/2 inch (12mm) and 3-1/4 inch (83mm) from one end as shown.

☐ 4. Using a hobby knife, cut a ⅛-inch (3mm) wide slot in the tube at the 3-1/4 inch (83mm) mark on the tube.



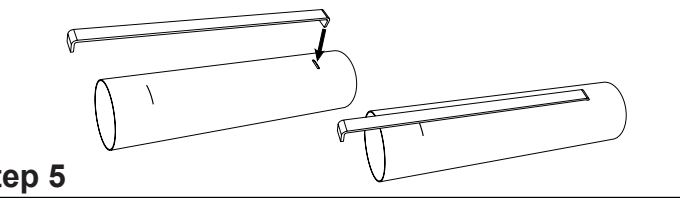
Step 3



Step 4

☐ 5. Insert one end of the long metal engine hook into the slot of the tube as shown.

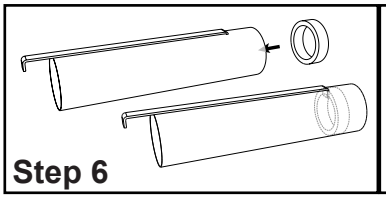
☐ 6. Locate a green ring that will slide into the engine mount tube. Glue it inside the front end of the tube using wood glue. You can use a rocket engine to push it in until it butts against the metal engine hook tang on the inside of the tube. Remove the rocket engine casing immediately, and wipe away the excess glue on both sides of the engine block. Allow the glue time to dry.



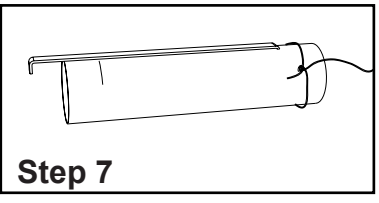
Step 5

☐ 7. Tie one end of the thicker long yellow shock cord around the front end of the engine mount tube.

☐ 8. Locate the large green paper centering ring. With a hobby knife, cut a notch on the inside of the ring as shown.

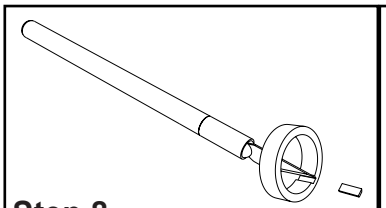


Step 6

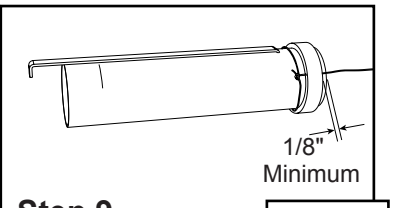


Step 7

☐ 9. Slide the green ring with the notch in it (from the previous step) over the shock cord and the end of engine mount tube as shown. Glue it into place using wood glue so it is slightly more than 1/8-inch (4mm) from the end of the tube. While the glue is wet, pull the shock cord so it is tight up against the green ring.

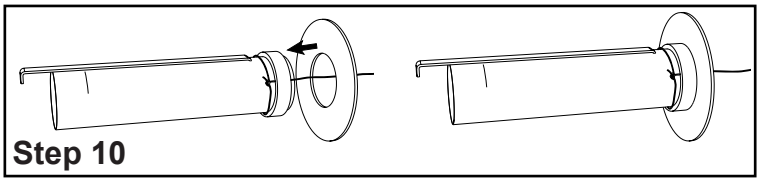


Step 8

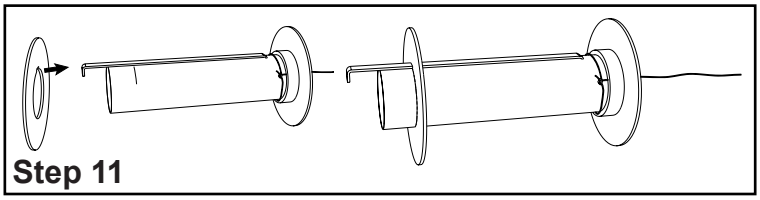


Step 9

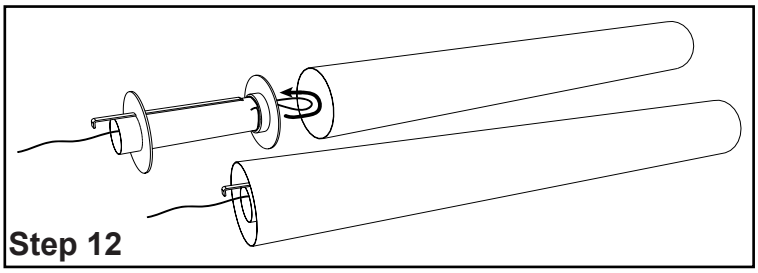
☐ 10. Slide one of the large plywood rings over the front end of the engine mount tube, and glue it in place up against the green centering ring. Put a fillet of glue around both sides of the perimeter of the tube/ring joint to hold the ring and the cord in place. Allow the glue to dry.


Step 10

☐ 11. Glue the remaining wooden centering ring over the tube and engine hook at the 1/2 inch (12mm) line using wood glue. There is a small notch on the inside of the ring that slips over the engine hook.

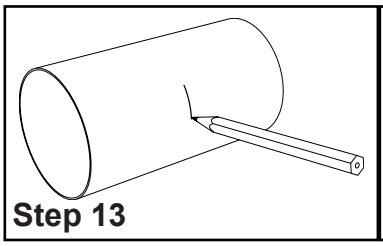

Step 11

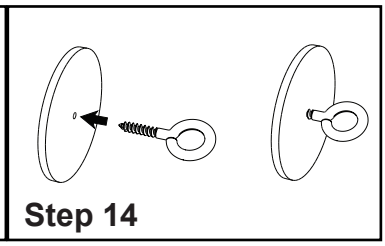
☐ 12. Temporarily pass the shock cord through the motor mount and out the rear. This will keep it glue-free when gluing the engine mount into the tube. Using a scrap stick of balsa, apply glue 3-1/2 inches (89 mm) inside the aft end of one body tube. Also, put glue on the aft ring of the motor mount. Quickly and smoothly insert the motor mount tube into the aft end of the body tube so the ends of the tubes are flush with each other. When the glue is dry, pass the shock cord back through the motor mount, so that it comes out the front end of the rocket.


Step 12

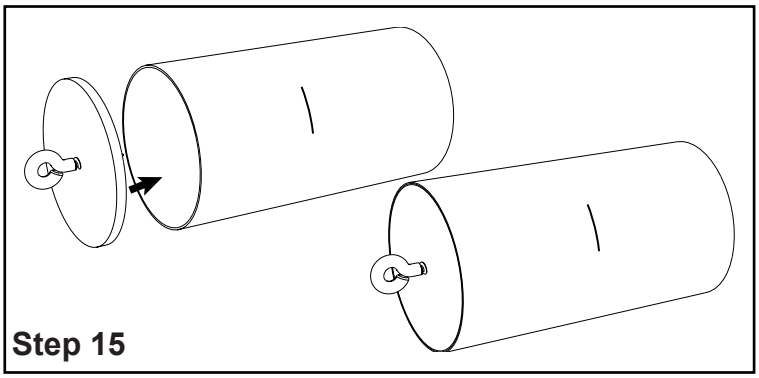
☐ 13. Mark the approximate center of the red tube coupler.

☐ 14. Apply wood glue to the threads of the metal screw eye, and screw it into the plywood bulkhead. Do not twist it in past the threads on the shank. Apply glue to both sides of the bulkhead where it exits the hole.

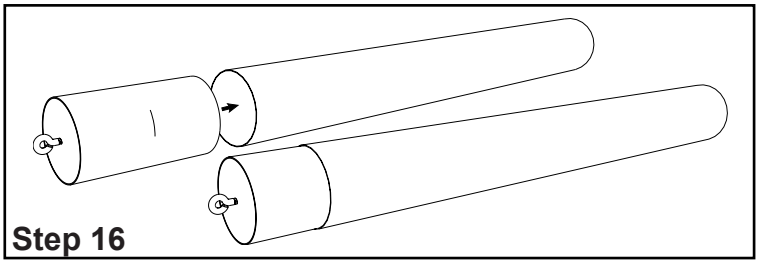

Step 13


Step 14

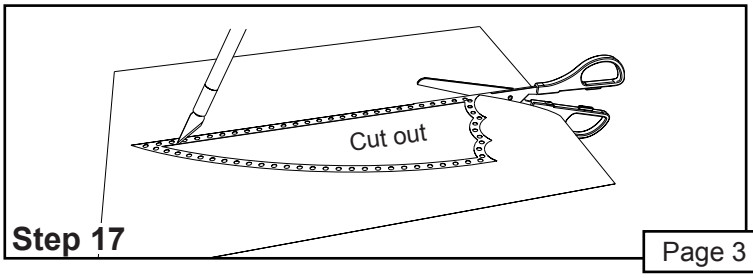
☐ 15. Glue the bulkhead with the screw eye into one end of the red tube coupler using wood glue. Recess it slightly into the end of the tube. When the glue has dried, put a fillet of glue on both sides of the bulkhead where it touches the inside of the tube.


Step 15

☐ 16. Glue the tube coupler into the other body tube using wood glue. It should stick out halfway as shown.

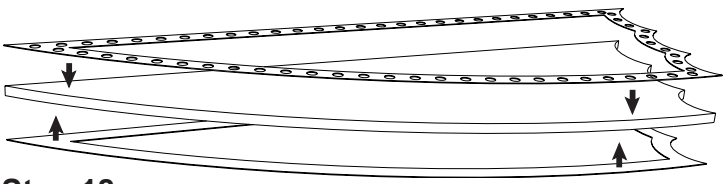

Step 16

☐ 17. Using scissors or a hobby knife, cut out all the fin edge details from the cardstock sheets.



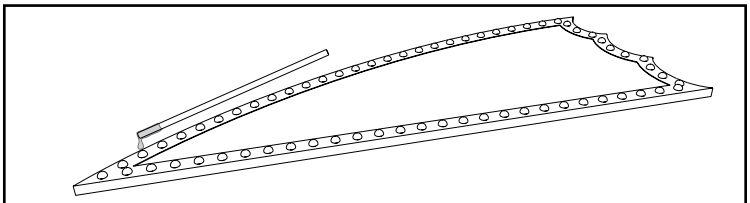
Step 17

☐ 18. Using wood glue, attach the fin edge details to the fins as shown.



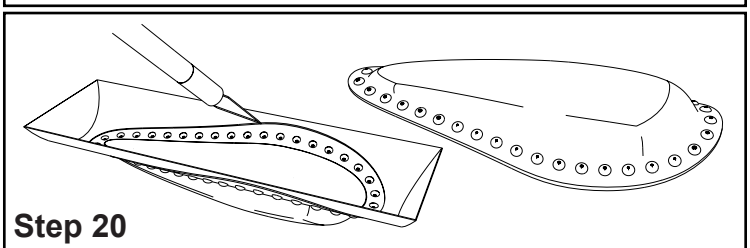
Step 18

☐ 19. Apply the decorative glue rivets to the fins. It is easier to add these rivets before attaching the fins to the rocket. These are purely decorative, but give the rocket a really nice steampunk look. Some modelers like to use puffy glue from a craft-store to make the rivets. We found that RocketPoxy (available from the Apogee Components website) thinned with a small amount of rubbing alcohol, makes a nice rivet which doesn't shrink when it hardens. They are applied one at a time by dipping a small dowel (like the end of a large paperclip) into the adhesive and touching it to the surface to make a dot. You'll need to do one side at a time, allowing the simulated rivets time to cure before flipping it over and doing the other side.



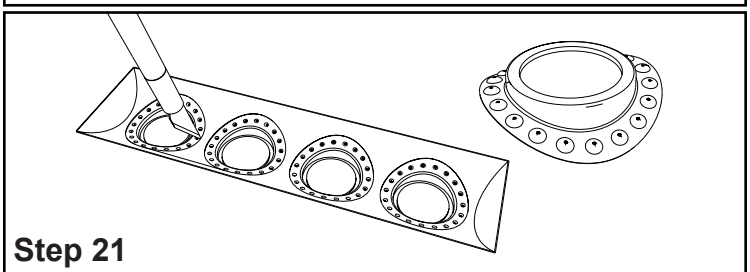
Step 19

☐ 20. Cut out the canopy from the vacuum form sheet by scoring the plastic on the inside surface with a sharp hobby knife. Then bend the plastic back and forth until the scoreline cracks. Once the canopy is removed, clean up the edge with some medium grit sandpaper.



Step 20

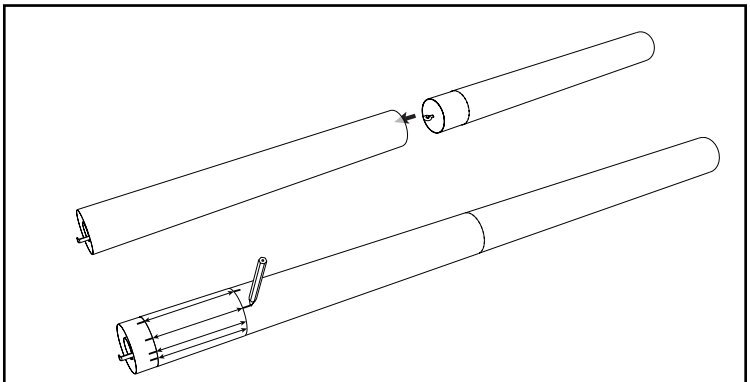
☐ 21. Remove the four port-holes from the vacuum form plastic using the same technique used for the canopy.



Step 21

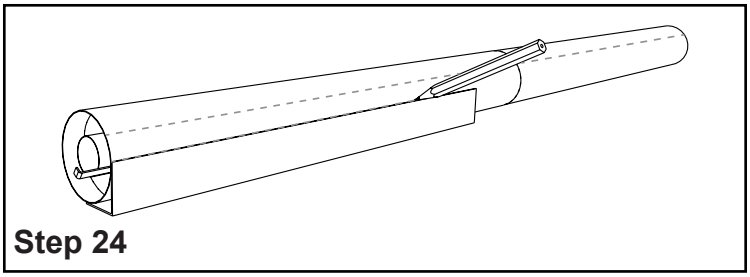
☐ 22. Temporarily join the two large tubes together. Do not glue!

☐ 23. Cut out the tube marking guide from the pattern sheet. Wrap it around the end of the tube closest to the engine mount, and tape it in place so it can't move. Mark the tube at each arrow, and label each mark.



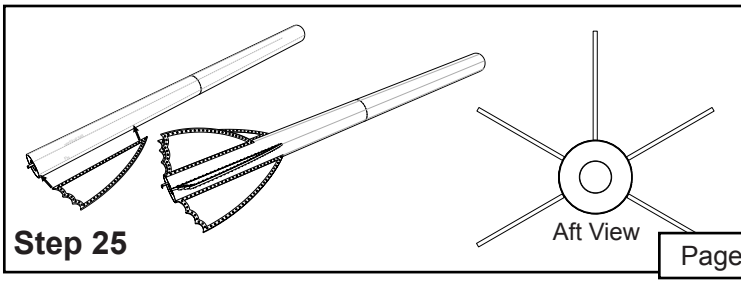
Step 22-23

☐ 24. Using an aluminum angle, draw a straight line along the tube at each of the marked locations from the previous step.



Step 24

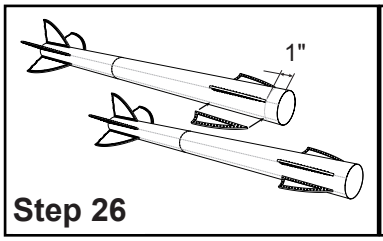
☐ 25. Attach the four large fins and the vertical tail to the end of the tube with the engine mount. Each part is flush with the edge of the tube.



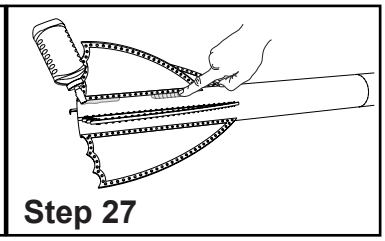
Step 25

☐ 26. Attach the four small canard fins to the front of the tube along the fin lines. They are placed so the front edge of the fin is 1 inch (25mm) from the edge of the tube.

☐ 27. Add wood glue fillets along the edges of all the fins. Lay the rocket horizontally while the glue dries to prevent runs.



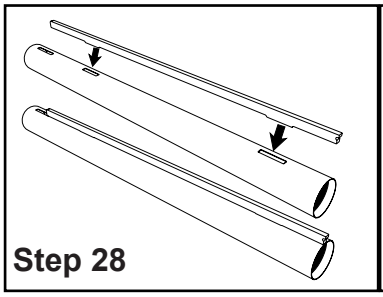
Step 26

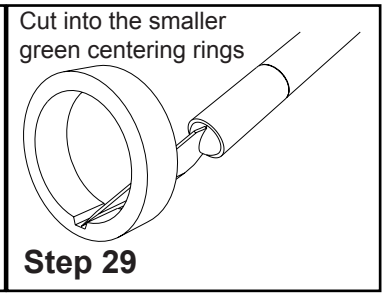

Step 27

Assemble the Strap-on Booster Pods

☐ 28. Using wood glue, attach the laser cut plywood support to the side of the laser cut pod. The tabs on the side of the wood will be inserted into two of the slots of the body tube. Allow the glue some time to dry completely. Then, add a small glue fillet along the joint where the wood meets the tube.

☐ 29. Cut a small notch on the inside of one of the 18-24 centering rings. This notch will be for the shock cord to fit under the ring and over the engine mount tube.

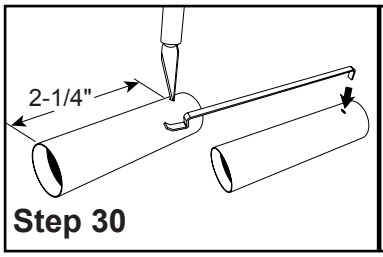

Step 28



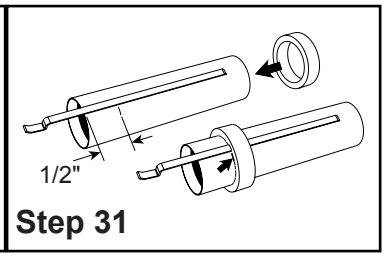
Step 29

☐ 30. With a pencil, mark the engine mount tube 2-1/4 inch (5.71cm) from one end. Using a hobby knife, make a small slit at the mark for the engine hook. Insert the end of the engine hook into the slit as shown.

☐ 31. Mark the engine mount tube at 1/2 inch (12.7mm) from the aft end as shown. Glue a green centering ring without the notch over the tube and engine hook forward of the line you just made.

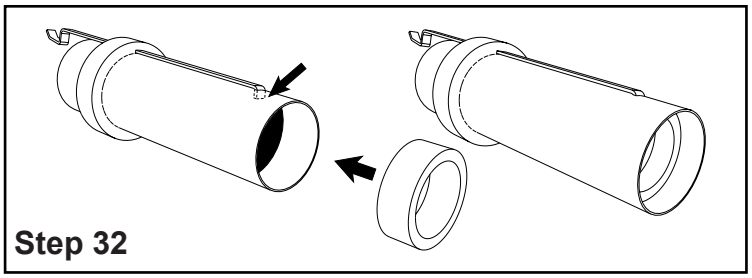


Step 30

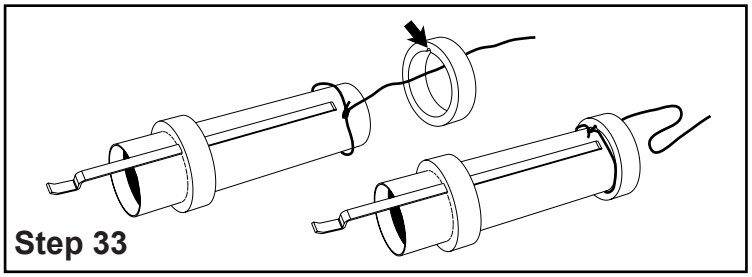


Step 31

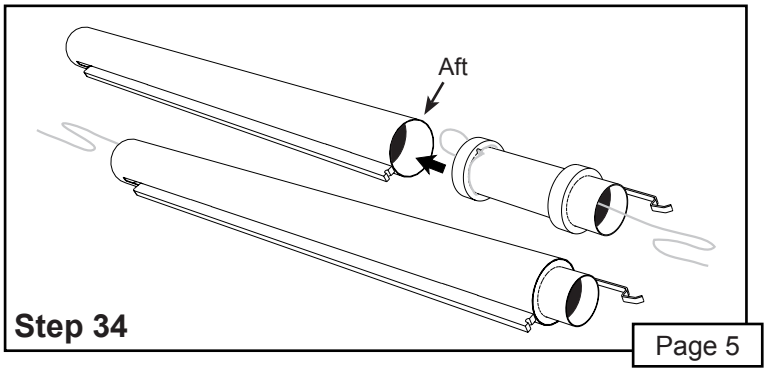
☐ 32. Take a blue ring and glue it inside the front end of the tube. It should butt up against the part of the engine hook that protrudes inside the tube. Wipe away any excess glue.


Step 32

☐ 33. Cut the thin yellow shock cord in half. You only need one piece per pod. Pass one end of the shock cord through the green centering ring with the notch cut inside of it, and tie the cord around the motor mount tube. Cinch the cord tight to the tube. Run a bead of wood glue around the forward end of the motor mount tube. Slip the ring onto the forward end of the motor mount tube so the front edge of the ring is even with the end of the tube, and the shock cord is running in the pre-cut slot. Apply glue fillets to both sides of the centering rings and allow to dry.

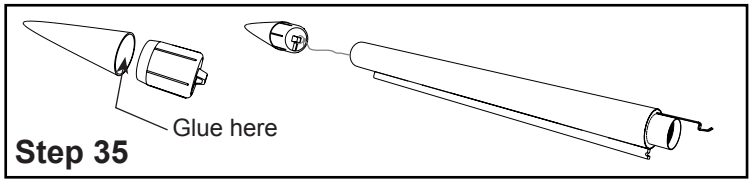

Step 33

☐ 34. Temporarily pass the shock cord through the motor mount and out the rear. This will keep it glue-free when gluing the engine mount into the tube. Using a scrap stick of balsa, apply glue 2-1/2 inches (63.5 mm) inside the aft end of the pod tube you glued the plywood to. Also, put glue on the aft ring of the motor mount. Quickly and smoothly insert the motor mount tube into the aft end of the pod tube. The engine hook should be positioned opposite of the wood support that is glued on the side of the body tube, and the edge of the green centering ring should be even with the rear of the body tube. When the glue is dry, pass the shock cord back through the motor mount, so that it comes out the front end of the rocket.



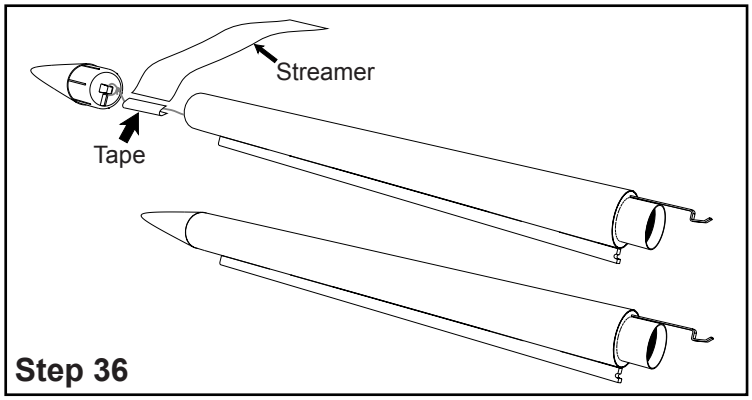
Step 34

☐ 35. Using super glue, smear some glue just inside the nose cone, and slide the plastic shoulder in as far as it will go. Allow the glue time to harden. Tie the shock cord to the loop on the base of the nose cone.



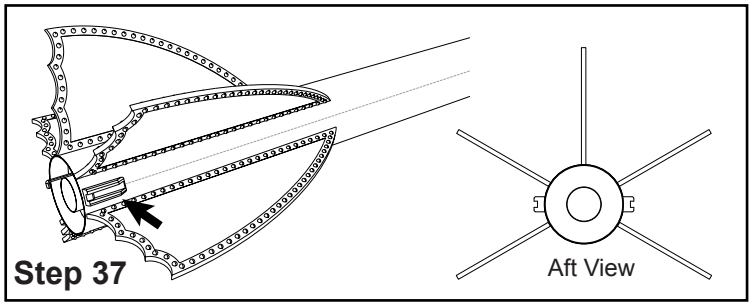
Step 35

☐ 36. Tape the streamer to the shock cord using plastic packaging tape about 3 inches (7.6 cm) below the nose cone. Roll up the streamer and put the nose on the pod tube.



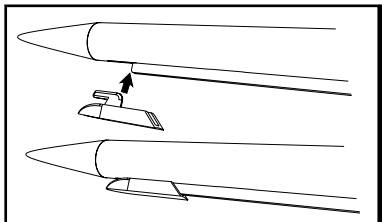
Step 36

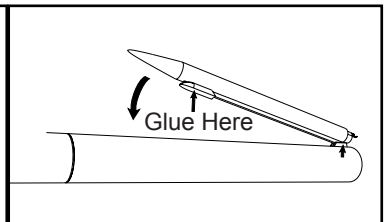
☐ 37. Using super glue, attach the aft hooks to the base of the rocket between the fins. The back edge (the flat edge) should be aligned with the back edge of the tube of the rocket as shown.



Step 37

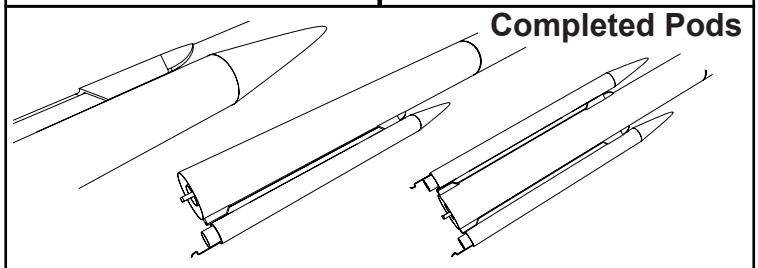
☐ 38. Pull the nose cone out of the pod tube. Slide the hook of the forward attachment into the slot on the tube. Then push the nose cone back in to temporarily hold it in place. The slot on the base of the nose cone slides over the hook. This is what holds the hook to the pod.


Step 38



Step 39

☐ 39. Apply super glue to the bottom surface of the front attachment hook. Place the notch (at the rear of the plywood support) into the slot of the rear attachment hook that was glued on to the rocket in step 37. Rotate the strap-on pod toward the tube so that the forward hook touches the core tube. Make sure the pod is straight along the tube before you press it into place. Allow the glue time to harden before removing the nose cone and taking off the pod.

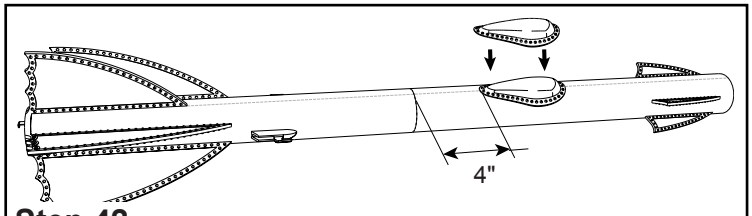


Step 39 (cont.) *(Fins not shown)*

☐ 40. Repeat steps 28-39 with the other side pod.

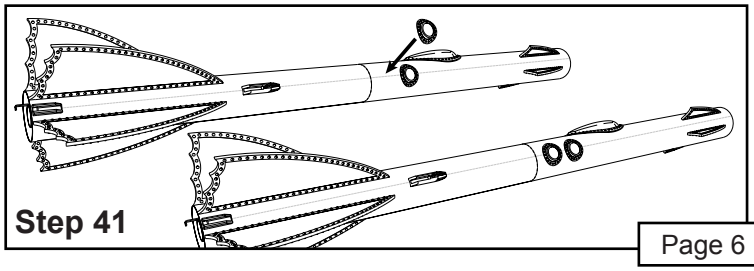
Complete the Rocket Assembly

☐ 41. Using super glue, attach the canopy down along the vertical tail line on the rocket, so it is four inches in front of the joint line between the two body tubes as shown.

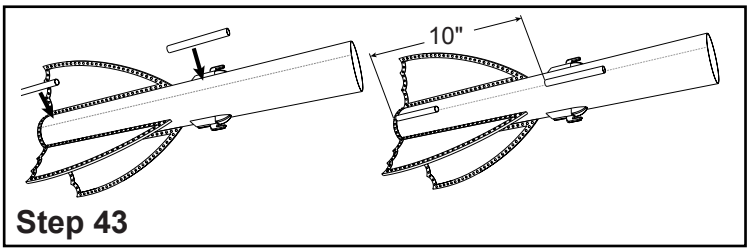


Step 42

☐ 42. Using super glue, attach the vacuum formed plastic portholes to the side of the rocket, in line with the strap-on booster pods, forward of the joint between the tube large tubes. There are two portholes on each side of the rocket as shown.

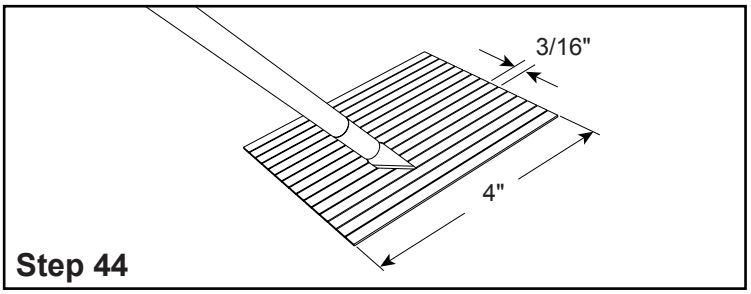

Step 41

☐ 43. Attach the two launch lugs to the bottom side of the rocket using wood glue. One lug is positioned at the end of the tube, and the other is 10 inches (25.4 cm) from the aft end of the tube.



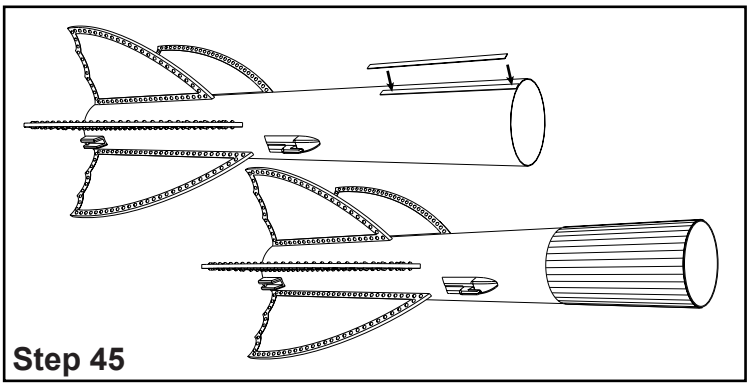
Step 43

☐ 44. From the thin balsa wood sheets, cut 36 pieces of wood, 4” X 3/16” (101mm X 5mm).

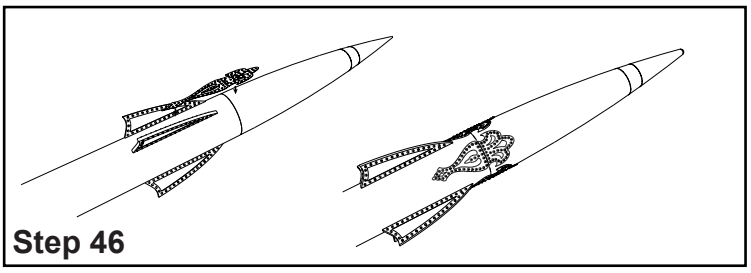


Step 44

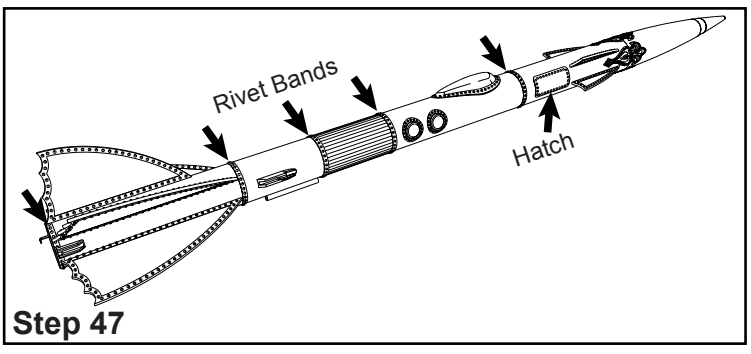
☐ 45. Using wood glue, attach the planks of wood around the front end of the aft tube as shown.


Step 45

☐ 46. Cut out the four decorative panels from the card-stock sheet and attach to the rocket between the canards as shown. The section attached to the tube can be affixed with wood glue. The part on the nose cone can be attached with super glue.


Step 46

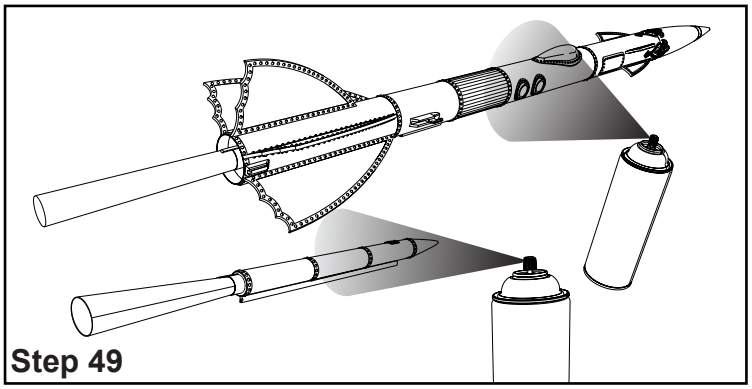
☐ 47. Attach the five decorative paper rivet bands and the large hatch to the tube in the approximate locations as shown using wood glue. The longer rivet bands are placed over the balsa wood planks in the middle of the rocket.



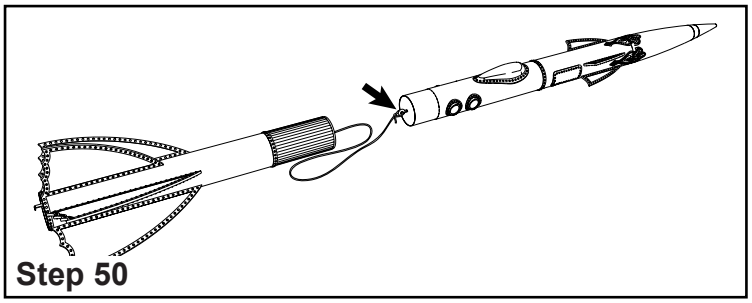
Step 47

☐ 48. Attach four decorative rivet bands and a hatch to each of the two strap-on boosters using wood glue. Now finish applying all the decorative glue (or epoxy) rivet heads to the rocket as desired.

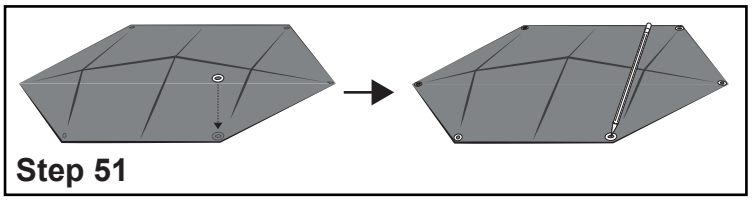
☐ 49. Roll a piece of paper and insert it into the back of the rocket to hold the model while you paint it. Similarly, roll a sheet of paper and insert it into the back of each strap-on pod. For best results, paint the model with primer before using the final paint colors. Follow the directions on the paint can, and always paint outdoors with the wind against your back. Let the paint harden at least 24 hours before proceeding. You may paint the model your favorite color. We chose a bright silver with wood stain for the balsa panels on the rocket. Allow the paint time to dry and install the sticker decals as desired.


Step 49

☐ 50. Tie the free end of the thicker yellow shock cord to the screw-eye on the base of the tube coupler. Put a little bit of wood glue on the knot to prevent it from coming undone.

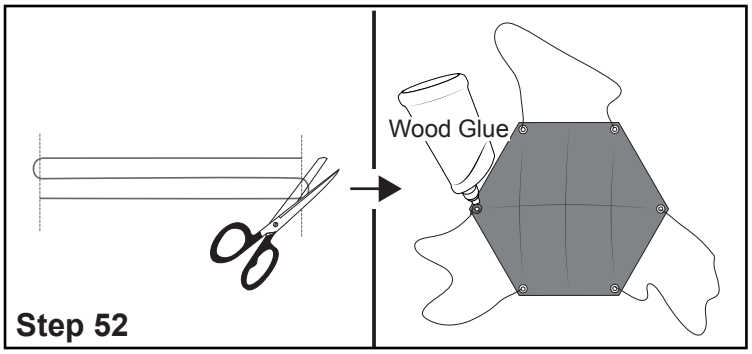

Step 50

☐ 51. Cut the parachute to the 24” size, as shown on the parachute instructions printed on the parachute sheet. Place one reinforcement ring on each of the corners of the plastic parachute canopy. Take a sharp pencil or knife and poke a hole through the plastic in the center of each ring.

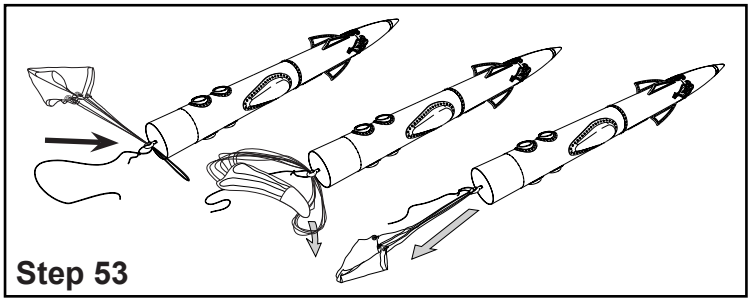

Step 51

☐ 52. Find the white cotton shroud line and cut the string into three equal lengths as shown. Tie the shroud lines through the ring holes as shown. Put a little bit of glue on the knots to secure them in place. Allow the glue to dry.

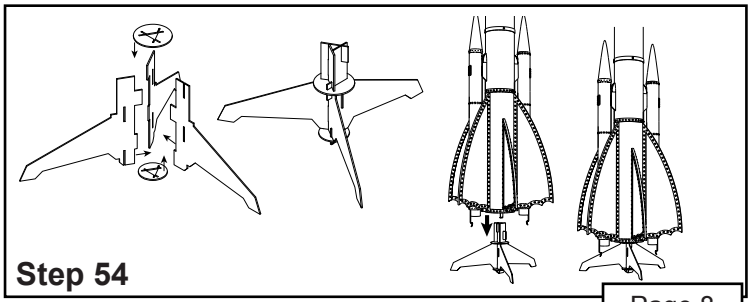
☐ 53. Holding the parachute at the center of its top, pull the lines together to even up the ends. Thread the three looped lines through the screw-eye at the base of the red tube coupler. Take the top of the parachute and pull it through all three string loops at the same time and then pull to tighten the knot. This securely attaches the parachute to the rocket.



Step 52


Step 53

☐ 54. Remove the five pieces of the display stand from the laser-cut sheet. Assemble the three leg pieces together. The tabs all have to engage in the slots at the same time. The smaller disk is inserted on the central part of the stand. You may have to flip the disk over if it doesn’t go on easily. Installation of the larger disk on the upper portion is optional. It just adds extra stability to the stand while the glue is drying, but it will interfere with the engine hook. You can cut a slot out for the engine hook if you choose to add it to the display stand. Run a thin bead of glue along all the joints between the pieces. When the glue is dry, the rocket can be placed on the stand.


Step 54

☐ Congratulations! Your Flying Machine Rocket is now complete.

Launch Supplies Needed

To launch your rocket you will need the following supplies:

- A model rocket launchpad and controller
- Flame resistant recovery wadding
- Recommended 24mm Rocket Engines for the core, and 18mm Rocket Engines for the strap-on boosters (2 required) listed below.

Core Motor	Booster Pods 2x	Manufacturer	Est. Altitude	
			Ft	m
D12-3*	A8-0	Estes	255.95	78.01
D12-5*	B6-0	Estes	346.27	105.54
D12-5*	C6-0	Estes	521.26	158.88
E9-4	B6-0	Estes	528.15	160.98
E9-4	C6-0	Estes	714.05	217.64
E12-4	B6-0	Estes	556.49	169.62
E12-6	C6-0	Estes	732.23	223.18
E15W-4*	w/o pods	Aerotech	672.46	204.97
F32T-6	w/o pods	Aerotech	1070.44	326.27
F44W-4	w/o pods	Aerotech	779.08	237.46

* When using shorter motors, add a 1" long spacer in front of the motor. You can make a spacer by cutting a piece off an old motor you've already flown.

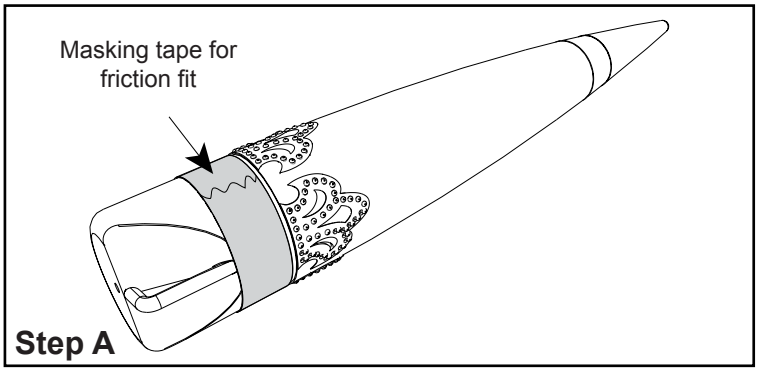
Rocket Preflight

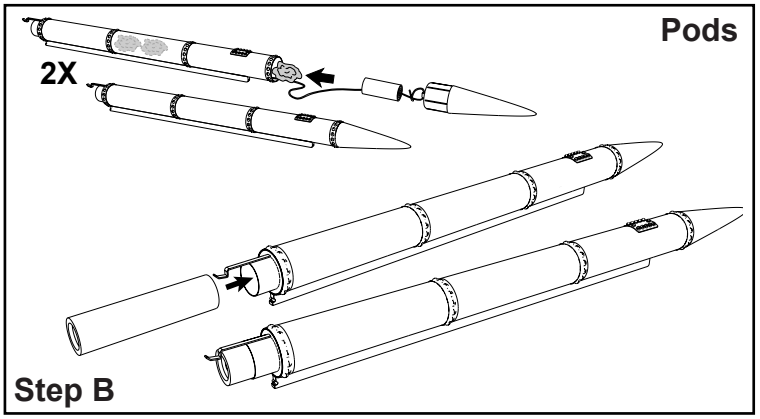
☐ A. Wrap tape around the perimeter of plastic nose cone's shoulder to create a tight friction fit when inserted in the tube. This is what holds it on during flight. Reinsert the nose on the front of the rocket.

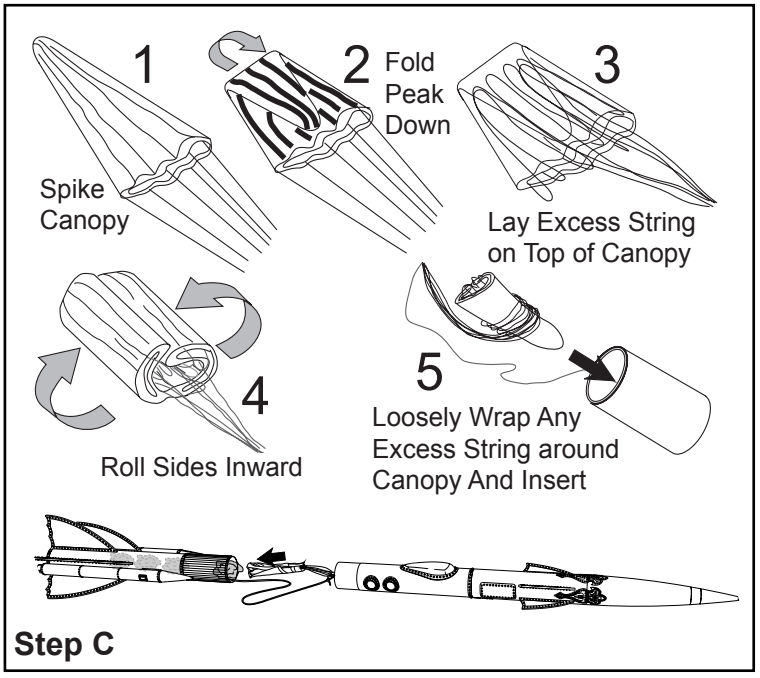
☐ B. Crumple and insert three sheets of recovery wadding into each the two strap-on booster pods. Roll up the streamer and insert the nose cone on the tube.

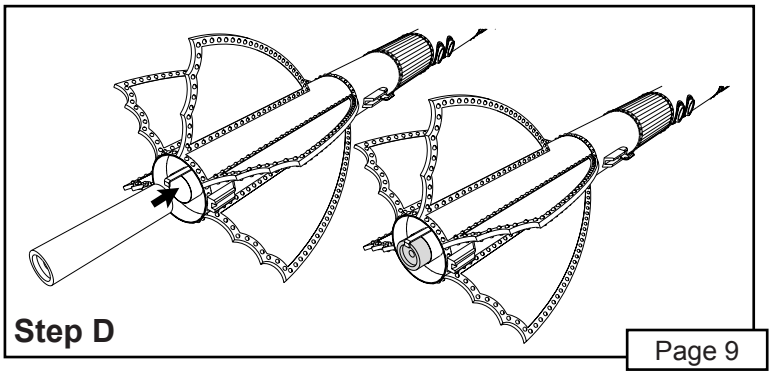
☐ C. Crumple and insert five or six sheets of recovery wadding into the main body tube of the rocket. Fold the parachute and insert it into the tube with the shock cord. Then insert the upper section into the tube.

☐ D. Insert the rocket motor into the aft end of the core vehicle by slightly bending the metal clip back and sliding it in. The clip should spring back to hold the motor in.









☐ E. Attach the strap-on booster pods to the core vehicle. Then insert and secure the engine igniter as directed on the package the engines came with. You will need a clip whip as shown (not included) if you are using the regular igniters that come with the motors. Or use the longer insulated igniters (sold separately from the rocket motors) and simply arrange and twist the leads together as shown. Note that the igniters must be connected in a parallel circuit.

Countdown and Launch Procedure

☐ Fly your rocket on a large field that isn't near any power lines, trees, or low flying aircraft. The larger the field, the greater your chances of recovering your rocket. The launch area around the pad must be free of dry weeds and brown grass. Launch only during calm weather with very little or no wind and good visibility.

☐ 10. Remove the safety key from the launch controller.

☐ 9. Slide the launch lugs over the launch rod to place the rocket on the pad. The rocket should slide freely over the rod.

☐ 8. Attach the micro-clips to the igniter. The clips must not touch each other or the metal blast deflector.

☐ 7. Stand back from your rocket as far as the launch wire allows (at least 5 meters - 15 feet).

☐ 6. Insert the safety key to arm the launch system. The light (or buzzer) on the controller should come on.

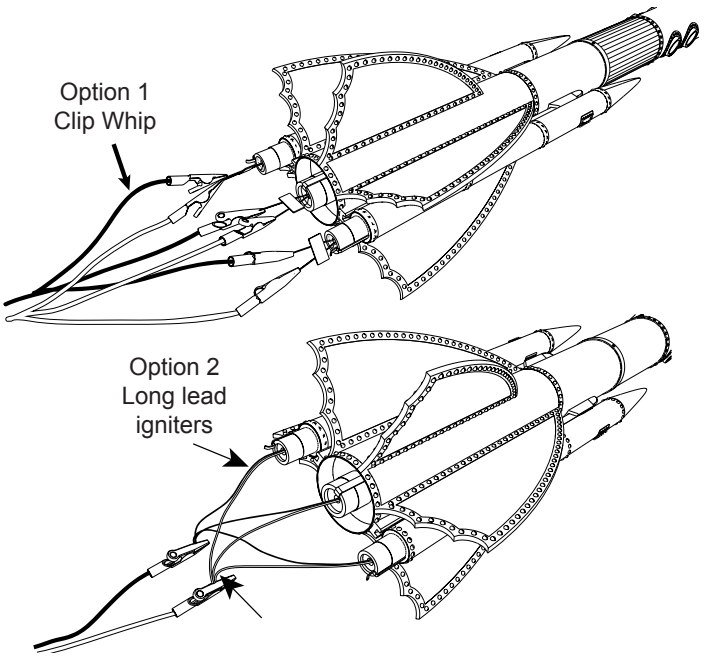
☐ Give a loud countdown! 5… 4… 3… 2… 1… LAUNCH!

☐ Push and hold the button until the engine ignites. Then remove the safety key and place the safety cap on the launch rod.

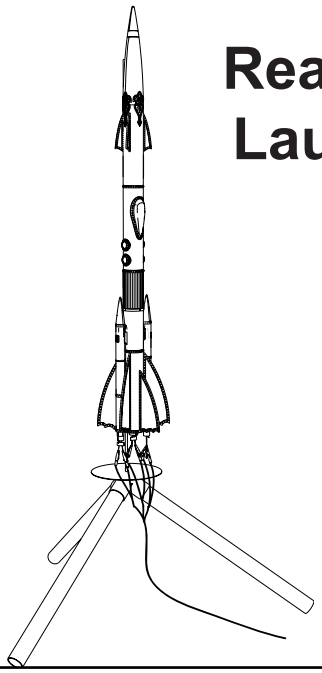
Misfire Procedure

Occasionally the igniter will burn, but the motor will fail to ignite. If this happens, the cause is that the pyrogen on the igniter was not in contact with the engines propellant. When an ignition failure occurs, remove the safety key from the launch controller and wait 60 seconds before approaching the rocket. Remove the old igniter from the engine and install a new one. Make sure that the igniter is inserted fully into the engine and touches the propellant. Secure the igniter as directed on the engine package and repeat the countdown and launch procedure. Always follow the NAR* Model Rocket Safety Code when launching model rockets.

*National Association of Rocketry **Kevlar® is a brand name of E.I. DuPont for their selection of aramid fibers. Only DuPont makes Kevlar®.



Step E



Ready to Launch!

Needed Tools and Materials

☐ Hobby Knife with Sharp Blades
☐ Ruler
☐ Wood Glue (recommended) or White Glue
☐ Sandpaper 200 grit, 400 grit and Sanding Block
☐ Masking Tape
☐ Pencil
☐ Scissors
☐ Paper Towel
☐ Wood Dowel

Optional Tools / Finishing Supplies

☐ 24mm Spent Engine Casing to insert engine block
☐ Aluminum "Angle" to draw lines on the tube
☐ Paint Supplies: Spray Paint, Brushes, etc
☐ Plastic Sheet (to cover the work surface)
☐ Safety Glasses (or general protection while building)
☐ Super Glue (CyA Adhesive medium viscosity)
☐ Wood Sealer/Sanding Sealer
☐ RocketPoxy