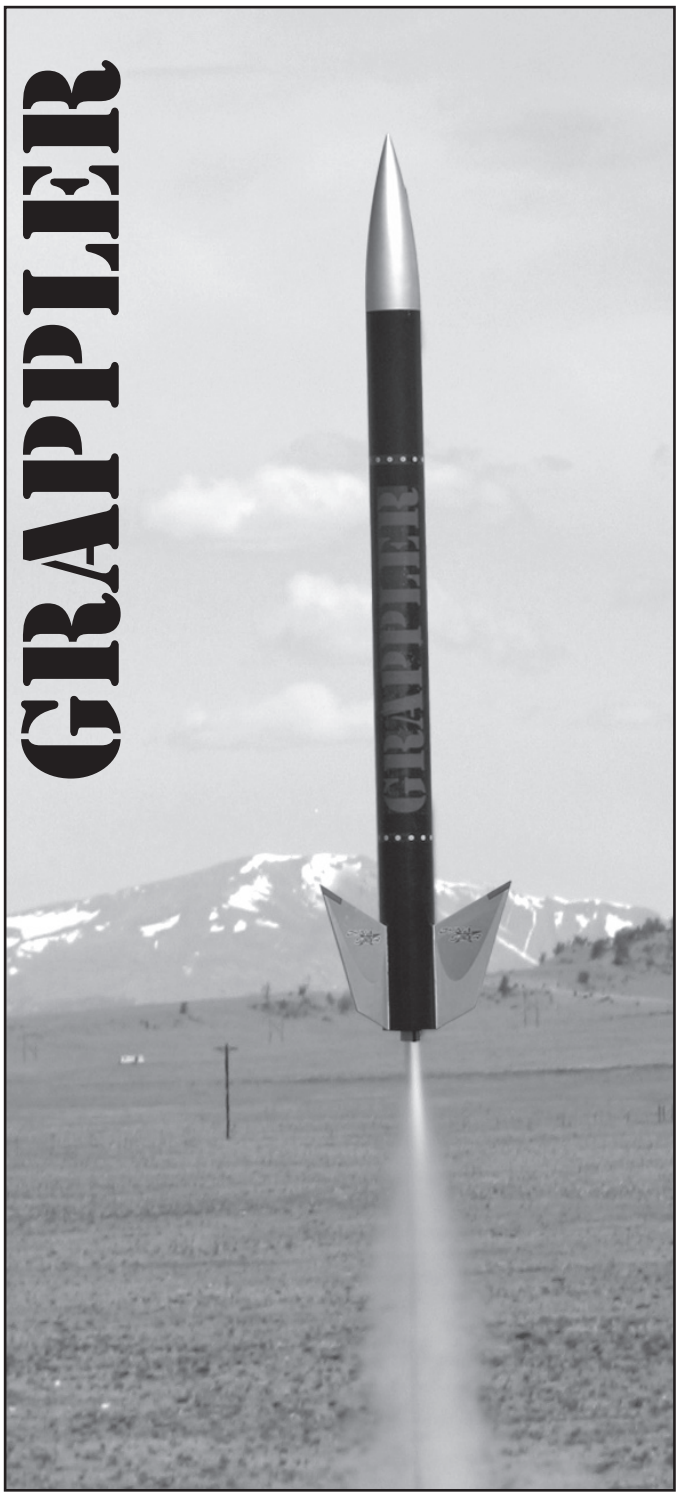


Skill Level 2 – Previous Experience Suggested

The Grappler is about the biggest model rocket you can make that still is under 1-pound in weight at lift-off. This is important, because you don't need FAA permission to launch it. That gives you high-power thrills with inexpensive low-power rocket engines. The Grappler is easy to build, uses readily available "D" and "E" size rocket motors, and is a real eye-catching model that is sure to get you noticed whenever you launch it.

While this is a big rocket, it is easy to build: it is only ranked as a skill level two in difficulty. It can be assembled by anyone that has built any other model rocket kit.

GRAPPLER

Kit #5032

Grappler Parts List

P/N	Description	Qty
10092	Yellow Engine Mount Sleeve (AS-24/4.00)	1
10097	Engine Mount Tube (AT-24/15)	1
10197	Airframe Tube (AT-66/18)	2
13031	Centering Ring (CR18-24)	1
13035	Centering Ring (24-29)	2
13044	Airframe Coupler (AC-66)	1
15027	Die-Cut Ring Set CR24-66	1
13056	Launch Lug (1/4" X 3")	1
15540	Die-cut balsa fin sheet	1
19480	Plastic Nose Cone PNC-66A	1
24041	Standard Engine Hook	1
23011	Parachute Reinforcement Rings (8)	1
29500	Parachute Shroud Line (21.3 feet)	1
29117	32" Plastic Parachute canopy	1
29506	300# Test Kevlar® Shock Cord (8 ft)	1
31066	Grappler Instruction Sheet A	1
31067	Grappler Instruction Sheet B	1
37020	Grappler Tube Marking Guide Sheet	1
41029	Printed Decal Sheet	1

Other Tools and Materials Needed

- Scissors
- Hobby Knife
- Pencil
- Carpenter's Wood Glue (or White Glue)
- CyA Adhesive (medium viscosity)
- Masking Tape
- Sandpaper (200 and 400 grit) & Sanding Block
- Aluminum "Angle" to draw lines on the tube
- Ruler
- Wood filler or sanding sealer to smooth balsa fins
- Paint Brush
- Spray Paint
- 24mm Spent Engine casing to insert engine block.
- Long wood dowel to spread glue deep inside tubes.
- 3 1/4 inch wooden dowel

DYNA STAR

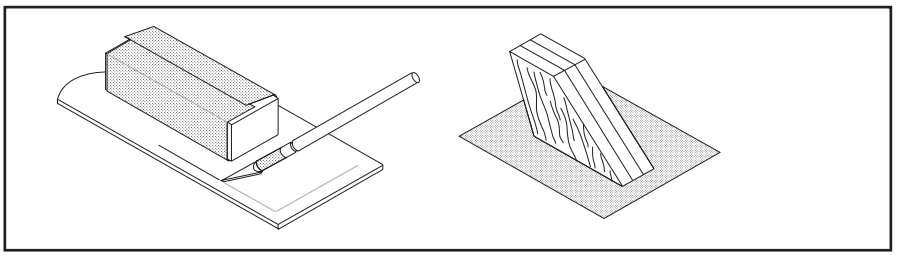
Mid-Power Model Rockets

1130 Elkton Dr., Suite A
Colorado Springs, CO 80907 USA

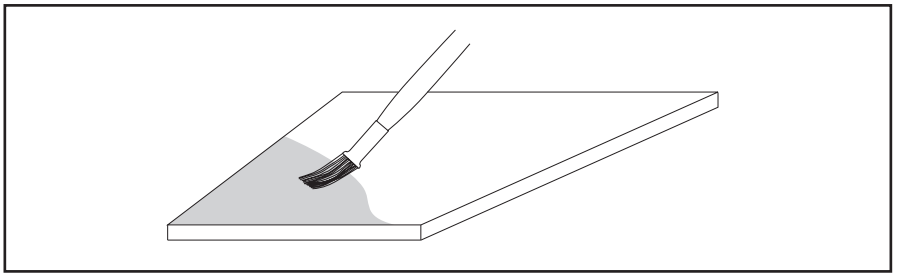
web site: www.DynaStar-Rockets.com

Grappler Rocket Assembly

☐ 1. Using 400 grit sandpaper, fine sand the balsa die-cut sheets before removing the fins. Carefully remove all the pieces from the balsa sheet by freeing the edges with a sharp hobby knife.

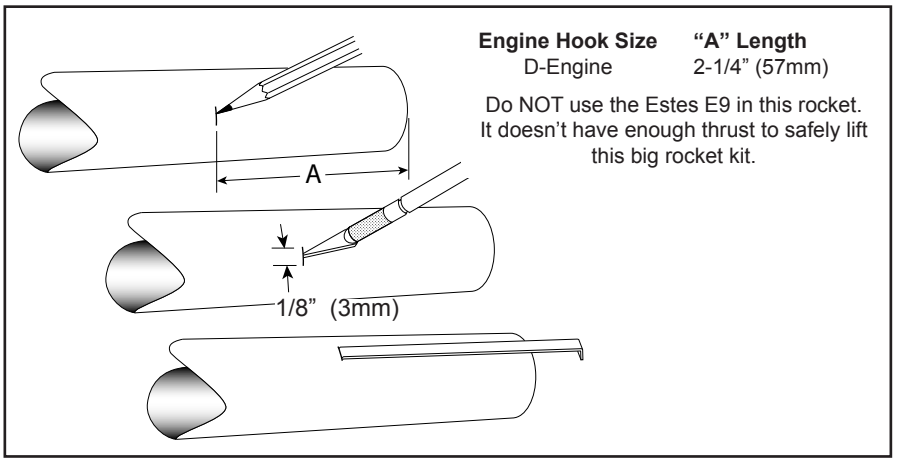


☐ 2. Group the three fins together, and gently sand the edges as shown in the illustration.



☐ 3. You can apply sanding sealer to the surfaces of the balsa fins. Coat both sides at the same time to minimize the chances of the fins warping. Do not allow the sanding sealer to get on the root edge of the fin. This could prevent the fin from bonding well to the body tube when it is glued on later in step 17. Set them aside to dry completely. When they are dry, sand the sealer smooth until you get a desirable surface finish. You may need to repeat this step several times depending on the level of quality you wish to achieve.

☐ 4. Mark a line on the outside of the motor mount tube 2 1/4 inches (57mm) from one end. This end will be the aft end of the rocket. Make this line about 1/8 inches (3mm) long as the picture shows. Take a hobby knife and cut a 1/8 inches (3mm) long slit in the engine tube along the line as shown in the picture. Insert one end of the motor hook into this slit.

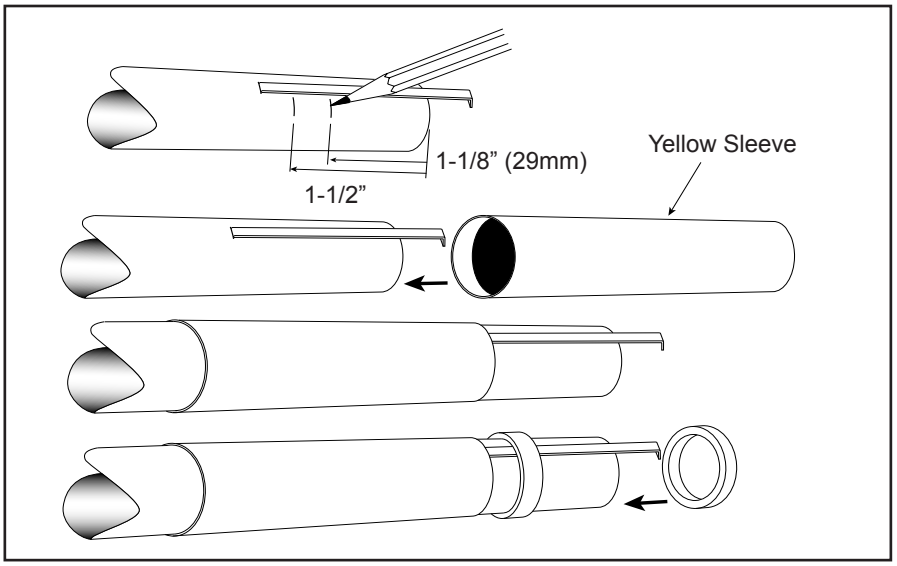


Engine Hook Size	"A" Length
D-Engine	2-1/4" (57mm)

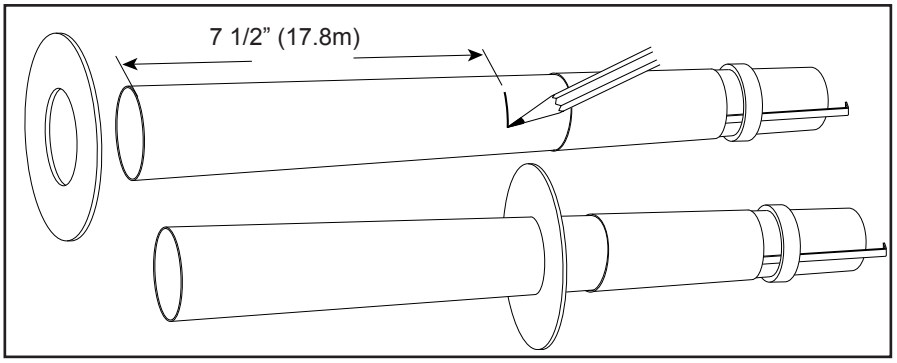
Do NOT use the Estes E9 in this rocket. It doesn't have enough thrust to safely lift this big rocket kit.

☐ 5. Make a mark 1 1/2 inches (38.1mm) from the rear of the engine tube. Locate the yellow airframe sleeve. Apply a layer of glue around the tube for a 2 inch length, forward of the mark that you made. Slide the yellow sleeve over the engine hook and onto the engine tube until the rear end of the sleeve is lined up with the mark. Apply a fillet of glue to both ends of the sleeve (Be sure that the engine hook remains perpendicular to the engine tube).

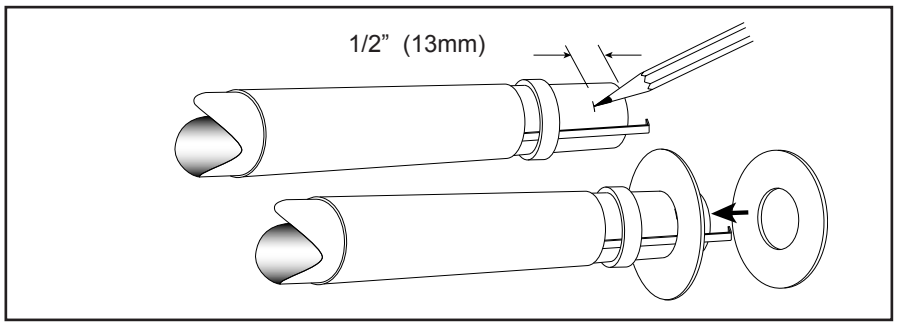
☐ 6. Now mark 1 1/8 inches (29mm) from the rear of the engine tube. Find one of the large green rings that fits over the 24mm diameter engine mount tube. Make a thin layer of glue around the engine tube behind the mark you made. Take the green ring, slide it over the engine hook, and then onto the engine tube until the rear end of the ring is lined up with the mark you made (Be careful of the hook as above).



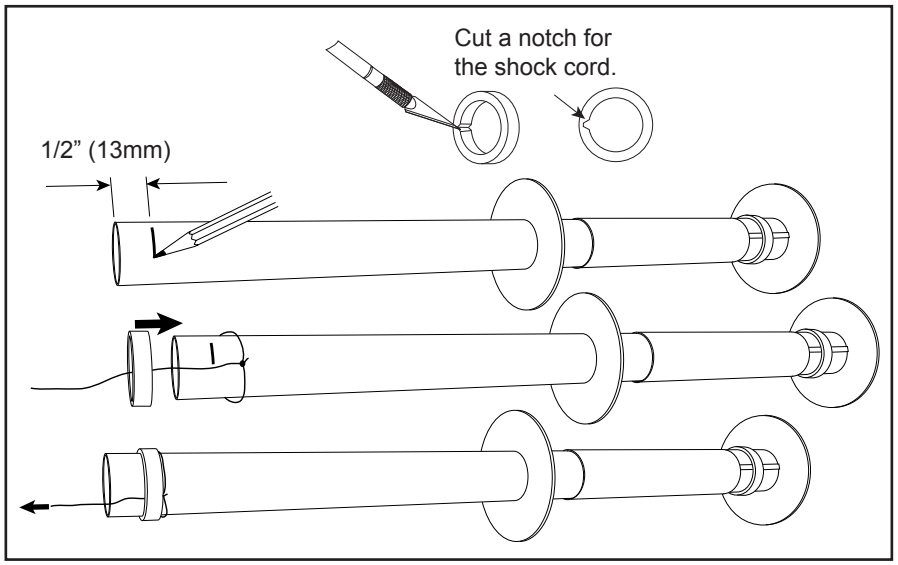
☐ 7. Remove one of the three large centering rings from the die-cut card sheet and apply a bead of wood glue 71/2 inches (17.8 cm) from the front end of the engine tube, Slide the cardboard centering ring into the bead of glue. Check to be sure the ring is aligned straight on the tube. Allow the glue to dry.



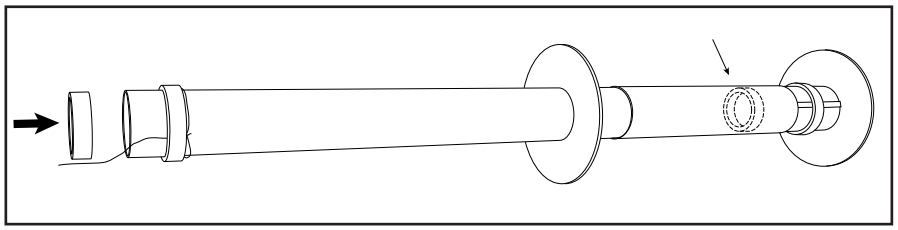
☐ 8. Remove a second large centering ring from the die-cut card sheet. Apply a bead of wood glue around the engine mount tube, 1/2 inch (13mm) from the aft end. Slide one of the cardboard rings onto the engine tube over the engine hook and into the bead of glue. Check to be sure the ring is aligned straight as shown.



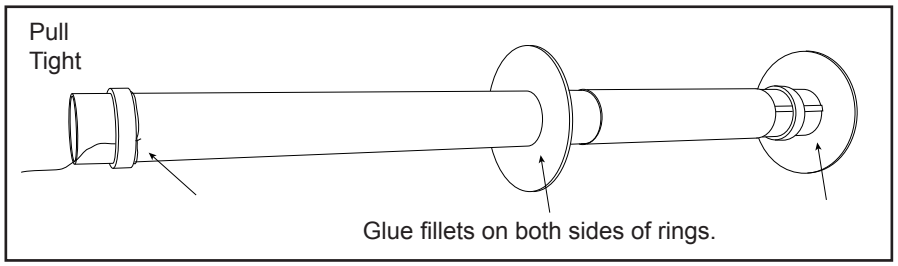
☐ 9. Make a mark 1/2 inch (13mm) from the front of the engine tube. Find the other large green ring that fits over the 24mm diameter engine mount tube. Cut a notch on the inside with a hobby knife. Tie the yellow Kevlar® shock cord around the front end of the engine mount tube. Apply a thin layer of glue in front of the mark. Slide the green ring over the shock cord and onto the tube, into the glue, and up against the mark. The shock cord should fit tightly up against the ring.



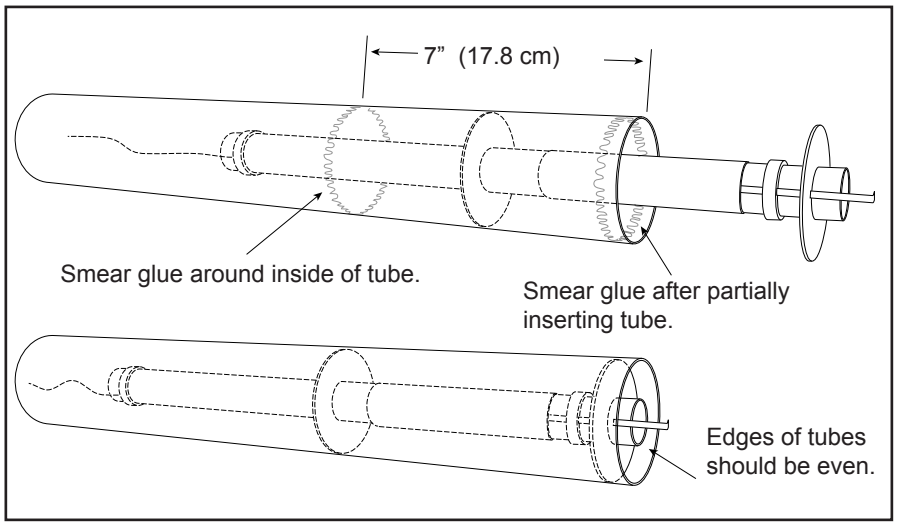
☐ 10. Engine block installation: Using wood glue, glue the smallest green ring (the engine block) into the forward end of the engine mount tube. Push it in using a long wood dowel until it rests against the top of the engine hook. Once it is in place and dry, add a fillet of glue around the front edge of the green engine block using a 3 1/4 inch wooden dowel.



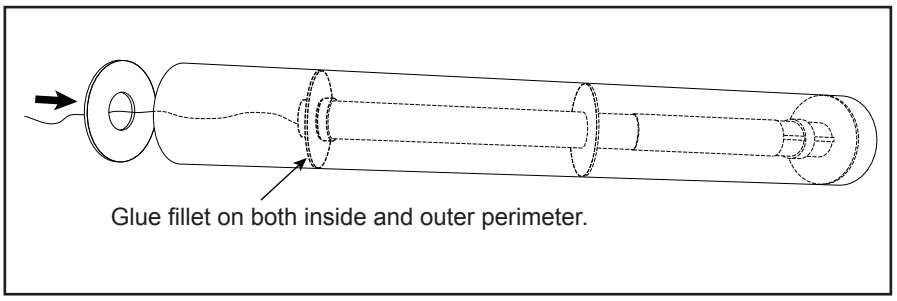
☐ 11. After the glue on the engine mount is dry, put a fillet of glue on each side of all three of the centering rings. These rings take a lot of stress at engine ejection, and you must make sure to have a good glue bond (Note: it is not necessary to use epoxy. Wood glue is plenty strong for this application). Allow the glue to dry completely before proceeding to step 11.



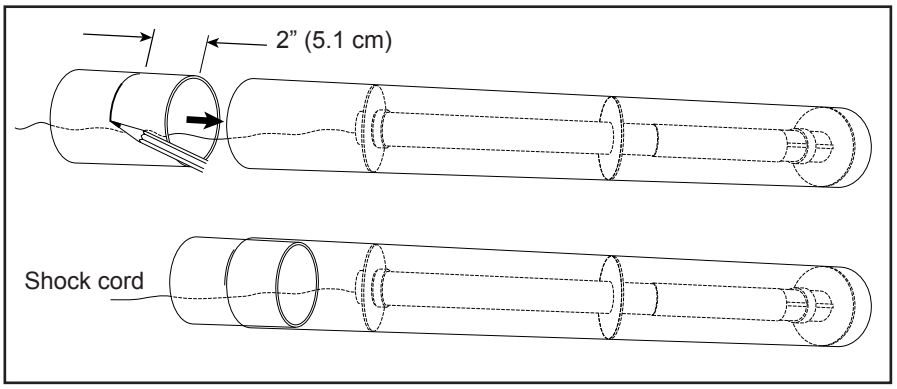
☐ 12. Test fit the engine tube assembly into one of the AT-66 tubes. If it is too tight, sand the centering rings slightly. Apply wood glue 7 inches (178mm) in from the aft end of the body tube. Insert the engine mount, and push with one motion until the middle centering ring makes it about 3 inches (76mm) past the aft end of the body tube. Quickly apply wood glue inside the body tube 1/2 inch (13mm) from the aft end. Immediately push the motor tube in until the aft end is flush with the body tube. Apply additional wood glue to the exposed centering ring/body tube, making another fillet. Stand tube upright with engine hook hanging over the edge of table until the glue is dry. This prevents excess glue from dripping forward in the tube.



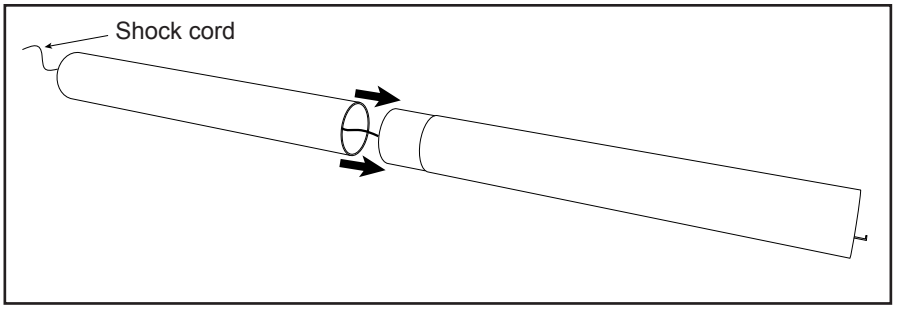
☐ 13. Thread the shock cord through the remaining cardboard centering ring. Then slide it into the front end of the body tube, and then over the forward end of the engine tube. Push it until it rests up against the green ring. Add a fillet of glue to the front side of the centering ring at the centering ring/body tube joint and also at the centering ring/motor mount tube joint. Place upright on a table to allow the glue to dry.



☐ 14. Take the red AC-66 Airframe Coupler and test fit it into the front end of the motor mount assembly. Mark the coupler with a pencil 2 inches (51mm) from one end, which will be the forward end. Run a bead of glue around the coupler on the rear half and smooth it out with your finger. Now, push and turn the coupler as you insert it into the forward end of the tube. Stop when it gets to the line. Wipe any excess glue away.

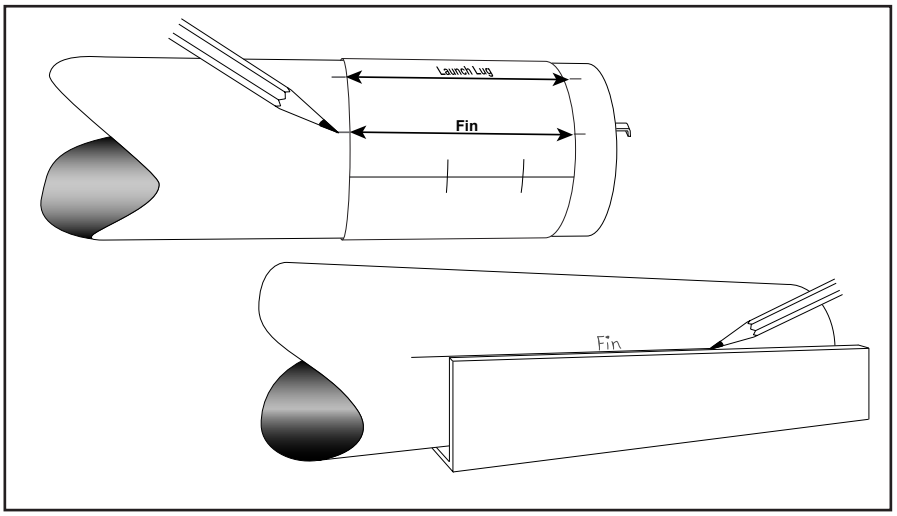


☐ 15. Apply wood glue to the exposed portion of the coupler tube and quickly twist on the upper body tube until the two body tubes are butted-up against each other. Allow the glue to dry.

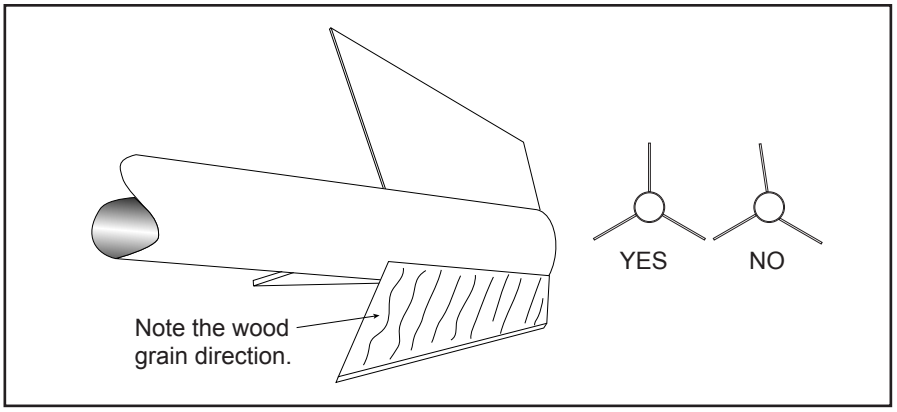


☐ 16. Cut out the tube marking guide from the pattern sheet (see page 8). Wrap the guide around the aft end of the bottom white body tube and tape the ends together. Mark a small line at each of the arrow points. Remove the marking guide.

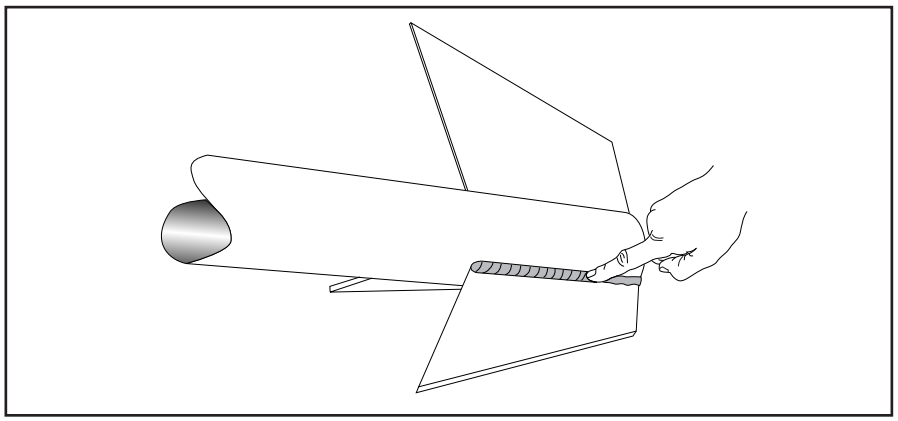
☐ 17. Using a your metal angle tool (a door frame will work, but it is not recommended on large diameter tubes), draw a pencil line down the outside of the body tube at each pencil mark. Label the launch lug line so you don't glue a fin in the wrong position.



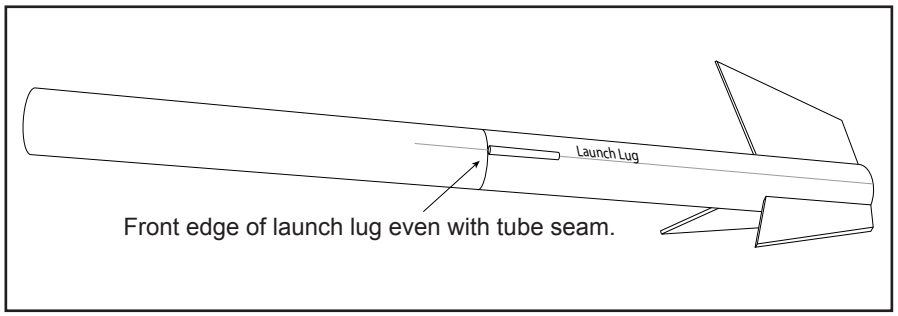
☐ 18. Lightly sand the area along which the fins will be attached; just enough to take the "sheen" off the tube. Apply a very thin layer of glue to the root edge of one of the fins. Allow the glue to dry slightly for five minutes, and then attach it along one of the lines on the body tube, as shown in the illustration. Each fin is attached so that it is flush with the end of the tube. Make sure the fin is straight along the tube. Allow the fin to dry before proceeding with the next fin. Repeat this step two more times as you attach the other two fins.



☐ 19. Apply a bead of wood glue to both sides of each fin-body tube joint. Pull your finger along the joint to smooth out and remove the excess glue. Lay the tube horizontally while the glue dries.

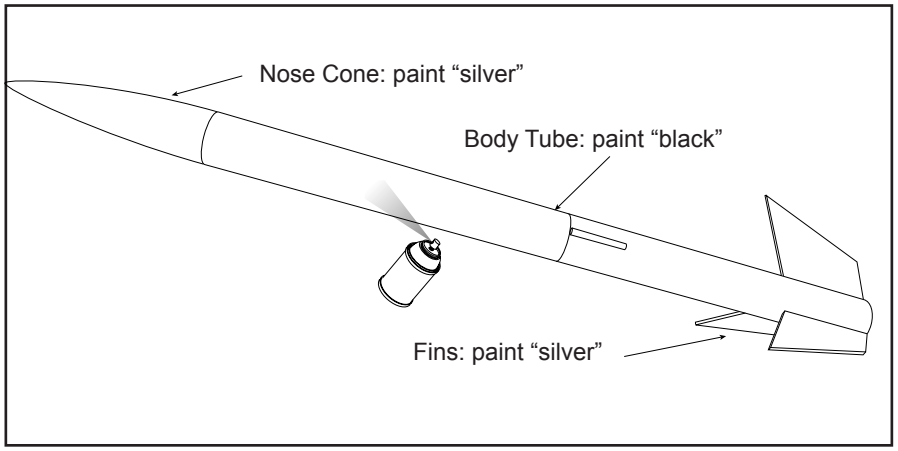


☐ 20. Using wood glue, attach the launch lug to the tube on the pencil line; position it so that it is flush with the seam where the two body tubes meet. Allow the glue to dry. Apply a bead of wood glue to both sides of each launch-body tube joint. Pull your finger along the joint to smooth out and remove the excess glue. Lay the tube horizontally while the glue dries.

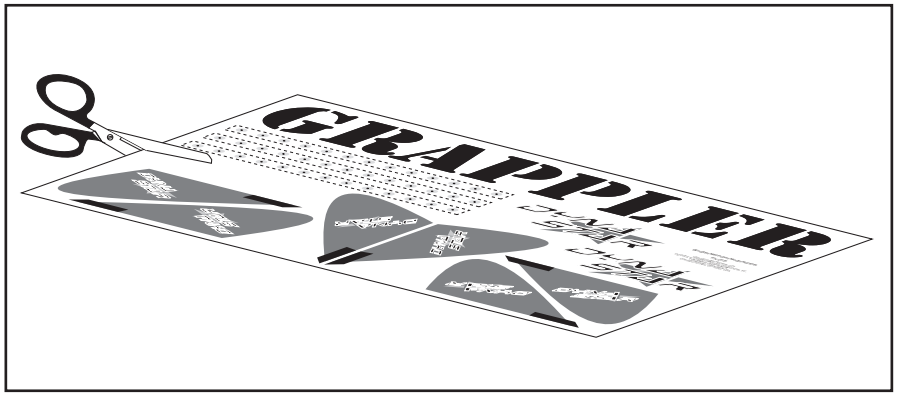


☐ 21. After all the glue has completely dried, you may now paint your Grappler model rocket (Note: you can temporarily put the nose cone on the white body tube while you paint the rocket).

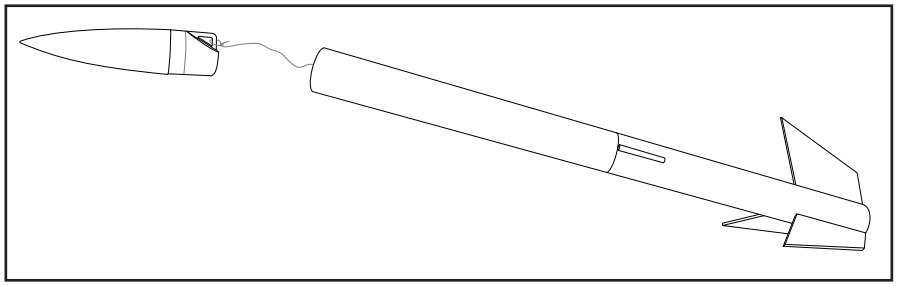
Roll a piece of paper and insert it into the aft end of the body tube so you can hold the model while painting it. For best results, paint the model with primer before using the final paint colors. Follow the directions on the paint can, and always paint outdoors with the wind against your back. Let the paint harden at least 24 hours before proceeding.



☐ 22. Cut around the perimeter of the decal with a pair of scissors. Peel off the paper backing, and affix the decal in place on the model. Use the picture on page 1 for decal placement.

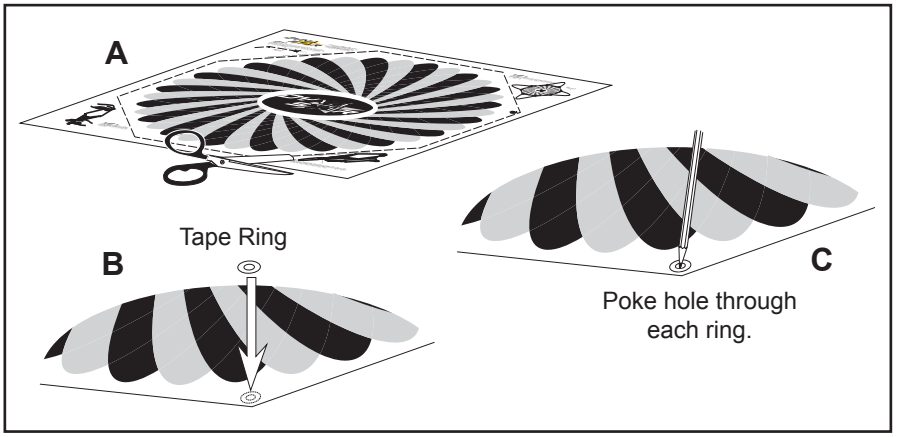


☐ 23. Tie the loose end of the shock cord to the loop on the base of the nose cone using 2 overhand knots. Apply a little bit of the wood glue onto the knot to keep it from coming untied.



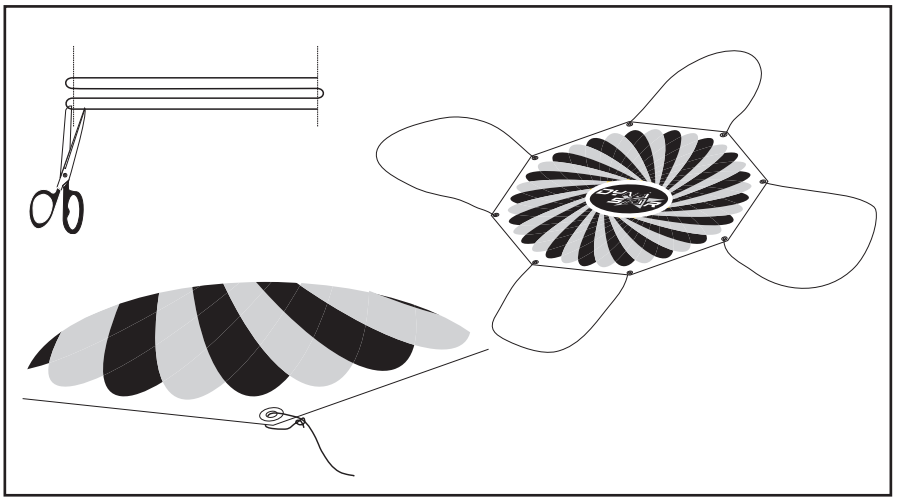
Parachute Assembly

☐ 24. Carefully cut out the parachute canopy along the dashed lines. Place one reinforcement ring on each of the marked corners. Take a sharp pencil or knife and poke a hole through the plastic in the center of each ring.



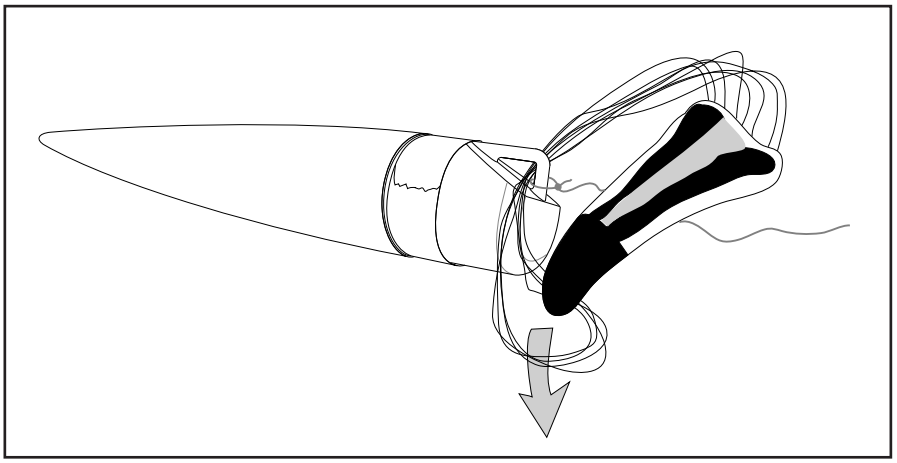
☐ 25. Fold the shroud line in half, and cut at the fold to make equal lengths; cut each piece in half again to make a total of four lines of equal length.

☐ 26. Pull each parachute line end through a parachute reinforcement ring and tie using two overhand knots. Repeat for all the corners as shown.



☐ 27. Holding the parachute at the center of its top, pull the lines together to even up the ends. Thread the 4 looped lines through the loop at the base of the nose cone. Take the top of the parachute and pull it through all 4 string loops at the same time and then pull to tighten the knot. This securely attaches the parachute to the rocket.

☐ 28. Congratulations! Your Grappler is now complete.



Launch Supplies Needed

To launch your rocket you will need the following supplies:
◆ A model rocket launching system.
◆ Flame resistant recovery wadding.
◆ Recommended 24mm Diameter Rocket Engines — see the motor matrix to the right.

Motor Matrix: How High Will the Grappler Fly With Different Motors

Motor Type	Produced by:	Estimated Altitude (feet)	Estimated Altitude (meters)
D12-5	Estes	329 ft	100.5 m
E15-7	Aerotech	1164 ft	354.9 m
E30-7	Aerotech	1178 ft	359.2 ft

The Estes E9 is NOT recommended for use in this rocket. It doesn't have enough kick to keep the rocket going straight up. It will make the rocket go horizontal, which is very dangerous.

The above motor matrix was made using RockSim. Initial conditions: slightly breezy (3-7mph wind), straight up launch angle. You can use RockSim to find other motor combinations that will work well in the Grappler rocket kit. Download the RockSim file for this kit at: www.ApogeeRockets.com/grappler.asp

Rocket Preflight

☐ A. Loosely crumple and insert 8 sheets of recovery wadding into the body tube.

☐ B. Carefully fold the parachute and insert it into the tube with the shock cord.

☐ C. Insert the motor into the motor tube until the motor hook holds it in place.

☐ D. Insert and secure the engine igniter as directed on the package the engines came with.

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. Always use a launch pad that includes a blast deflector.

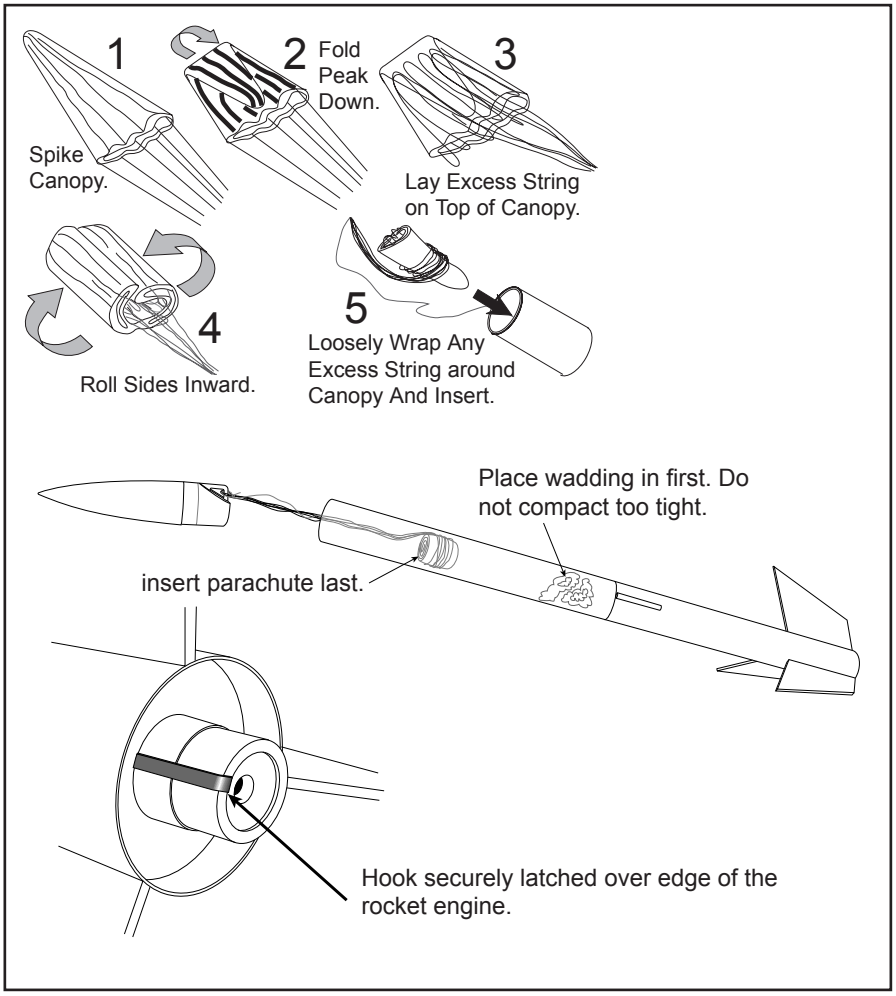
10. Remove the safety key from the launch controller
9. Slide the launch lugs over the launch rod to place the rocket on the pad. The rocket should slide freely over the rod.
8. Attach the micro-clips to the igniter. The clips must not touch the other or the metal blast deflector.
7. Stand back from 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.

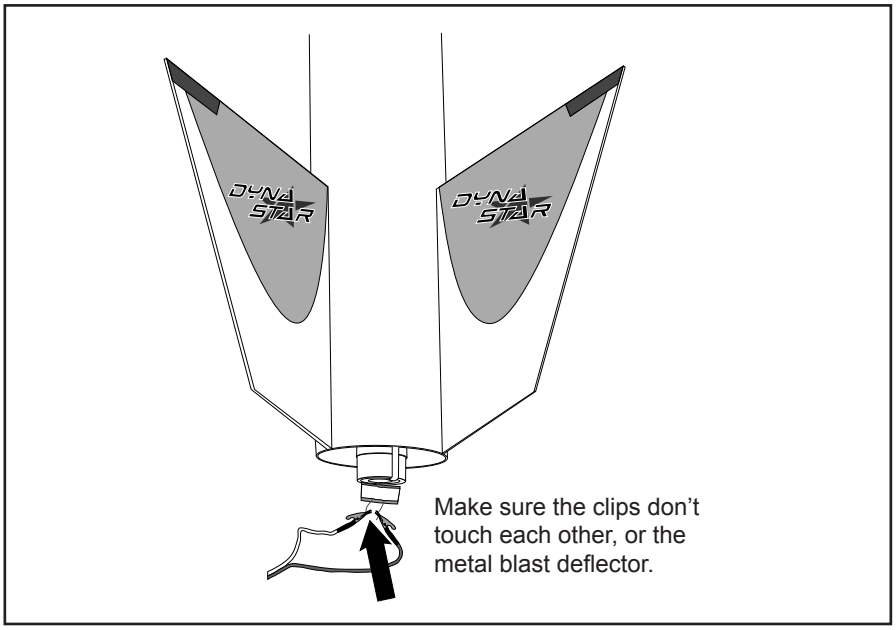
Give a loud countdown 5 ... 4 ... 3 ... 2 ... 1 ... LAUNCH!

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

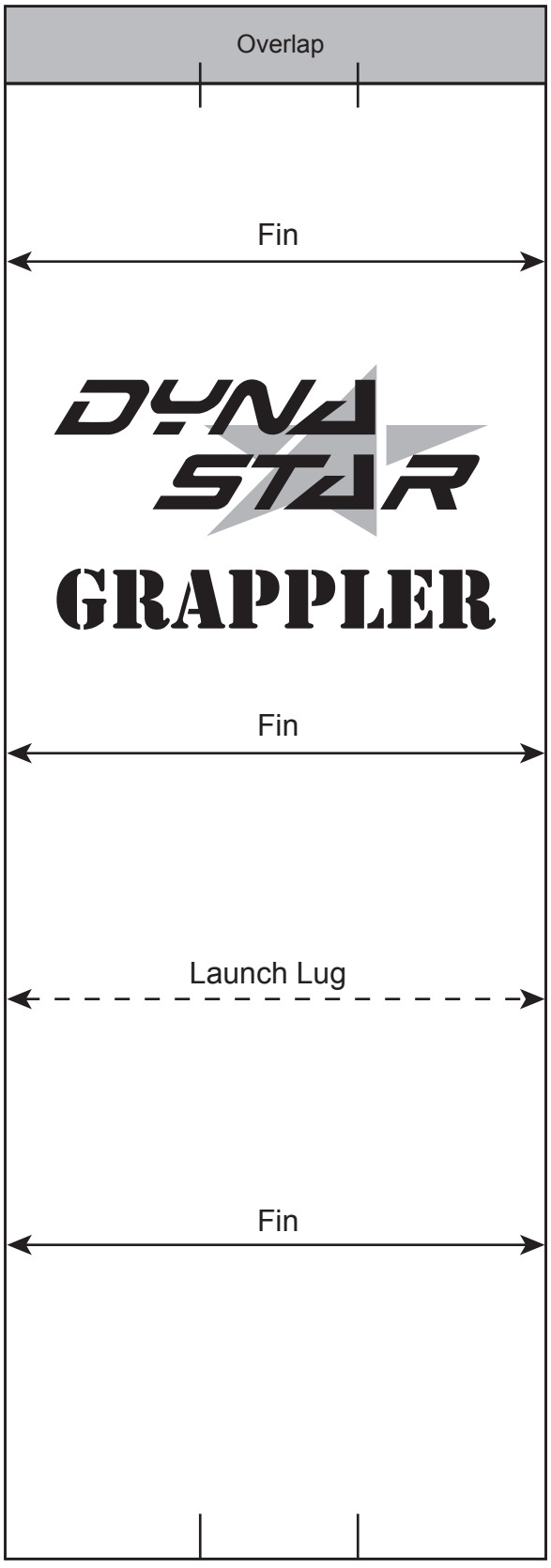
Occasionally the igniter will burn, but the motor will fail to ignite. If this happens, the cause is that the pyrogen on the igniter was not in contact with the engines propellant. When an ignition failure occurs, remove the safety key from the launch controller and wait 60 seconds before approaching the rocket. Remove the old igniter from the engine and install a new one. Make sure that the igniter is insert 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®

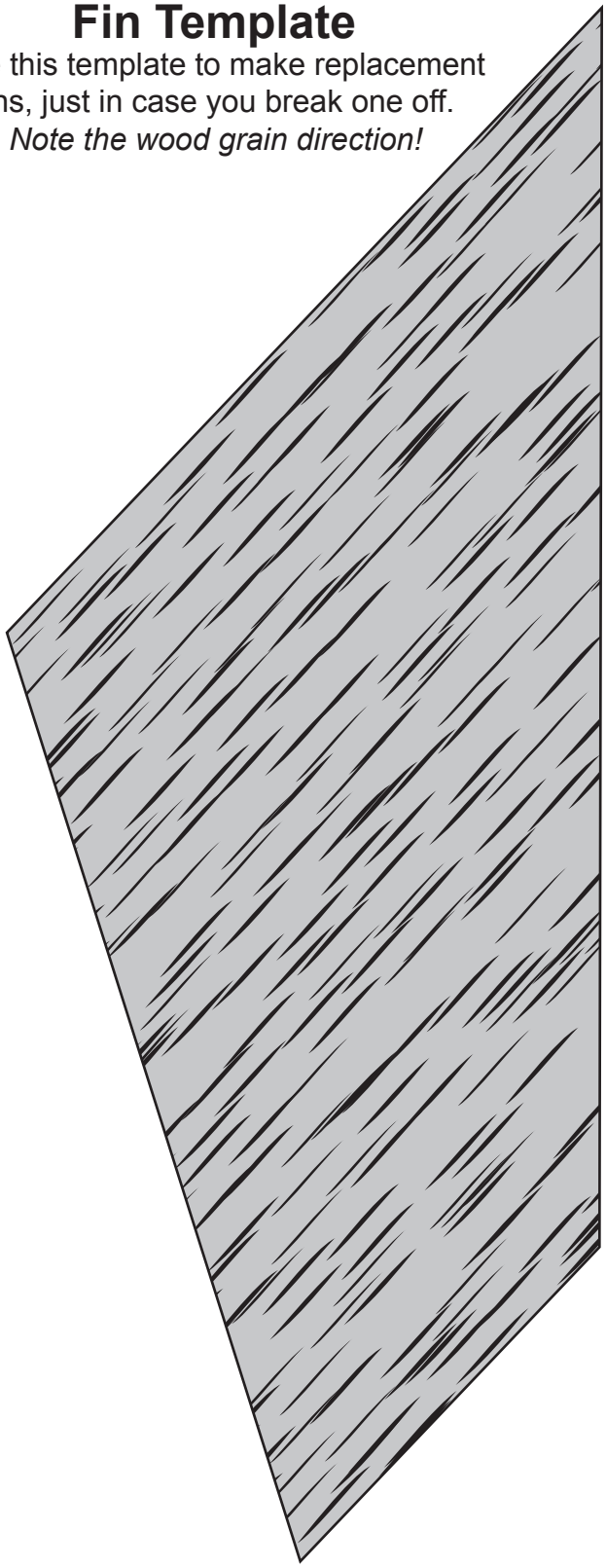


Tube Marking Guide Sheet
P/N 37020

GRAPPLER

Fin Template

Use this template to make replacement fins, just in case you break one off.
Note the wood grain direction!



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