RAC #10000

Crossfire

ROGUE AEROSPACE

ROGUE AEROSPACE CORPORATION
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Skill Level 2

A two-stage sport rocket that's fun to build and fun to fly!

Recommended Engines: **Booster** B6-0, C6-0 **Sustainer** B6-6, C6-7

Rules to Live By

1. Before you begin to build your model, **make sure you have read and understood all steps in these instructions**. It's much better to spend a few minutes becoming familiar with these instructions now, than a few hours trying to correct a major mistake later. A good rocketeer is a careful modeller. Do not proceed with any step until you are certain you know what to do. Make all measurements twice before cutting or gluing.

2. **Do not alter the basic design of this model rocket in any way.** Most importantly, do not reduce the number or size of fins, shorten the body tube, use a different nose, or add fins to the rocket. Any of these changes would affect the stability of the rocket and could cause it to lose the ability to fly straight. An unstable rocket is less than worthless and is no fun for anyone. Of course, you can change the color scheme, decals, and so forth as you wish.

3. Once you've finished your rocket, **launch it only in accordance with the Model Rocket Safety Code** created by the National Association of Rocketry. A copy of the Code is included with your model. If you don't follow the Code, you could jeopardize the future of model rocketry…and make every other model rocketeer in the world angry. Follow the Code.

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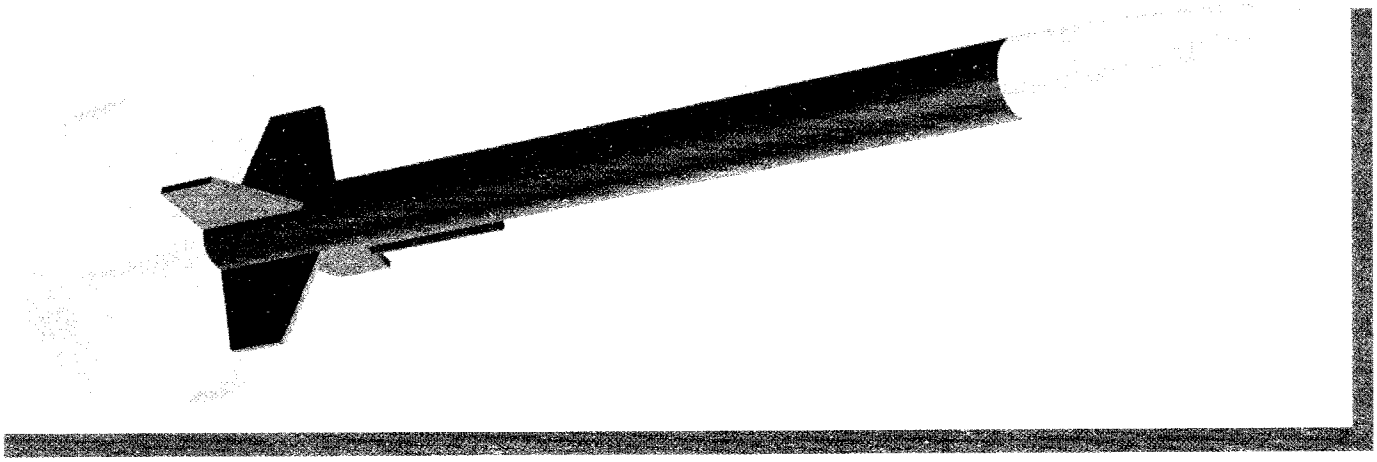

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Materials Included in this Kit

T-25 paper tube (36.2cm [14.25"] long)	LL-3 3mm (1/8") launch lug (3.8cm [1.5"] long)
T-25 paper tube (7cm [2.75"] long)	Two engine clips
T-117R paper tube (2.5cm [1"] long)	KC-4 Kevlar tether (1m [39"] long)
Two T-19E paper engine mount tubes (each 7cm [2.75"] long)	PP-30 nylon parachute (30cm [12"] diameter)
PNC-25A plastic nose cone & retainer	PW-25 Perma-Wadding (10cm [4"] x 10cm [4"])
Two TR-18 thrust rings	Balsa fin stock (2mm [3/32"] thick)
Four CR-1925 centering rings	Balsa fin stock (1.5mm [1/16"] thick)
SC-25S stage coupler (2.5cm [1"] long)	Decal sheet

Materials You Must Supply

Adhesives (see note below)	Masking tape
Pencil	Fine and extra-fine sandpaper
Scissors	Paint
Hobby knife	Sanding sealer (optional)
Metal ruler	

A Note on Adhesives

There are several different kinds of adhesives (glues) you can use to build this kit. The most common is white or "school" glue. This glue works fine, but you must hold freshly glued parts in place for quite a while before the glue sets. Wood or carpenters' glue is stronger than white glue. A very useful adhesive is cyanoacrylate (CA), also known as "super glue" or "hot stuff." If you want to use CA, you should buy "medium thickness" CA from a hobby shop – and you should be *very* careful not to glue yourself to your model! When you use CA, always have "debonder" on hand in case of emergency.

Whenever you must glue parts together in building this kit, you can use any of the glues listed above, unless a specific glue is mentioned in the instructions. You can generally substitute wood glue for white glue, and CA for plastic cement.

Assembly Instructions

1

Assemble *booster* (first stage) engine mount.

a) Select one green engine mount tube. Make 3 marks on the tube: at 4mm (5/32"), 8mm (5/16"), and 5cm (2") from one end.

b) At the 4mm (5/32") mark, cut a slit about 3mm (1/8") wide. Note that one of the engine clips has an extra "hook" at one end. Insert the straight end of this engine clip into the slit.

c) Using a hobby knife, make a small notch on the inside of a centering ring. The notch should be about 3mm (1/8") wide, and no deeper than about one-third to one-half the thickness of the ring.

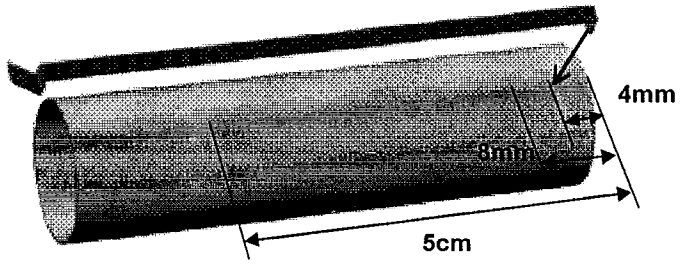
d) Make a notch in a second centering ring.

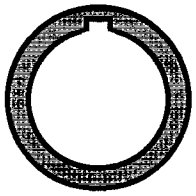
e) Apply glue around the engine mount tube at the 5cm (2") mark and slide one notched centering ring on from the front of the tube until it is even with the mark. Make sure the engine clip lies straight down the tube and is within the notch you cut in the centering ring.

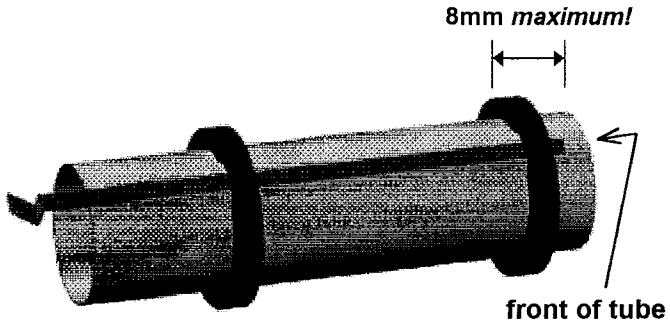
f) Apply glue around the tube just in front of the 8mm (5/16") mark and slide the other notched centering ring onto the tube, ***making certain that the back of the ring is at or in front of the mark.*** ***IMPORTANT:*** Proper positioning of this centering ring is ***essential*** for proper stage attachment! Make sure the notch in the centering ring lies over the engine clip.

g) Apply glue around the inside of the front of the tube and slide one thrust ring just inside the tube so it rests against the end of the engine clip.

engine clip with hook (may vary slightly from illustration)







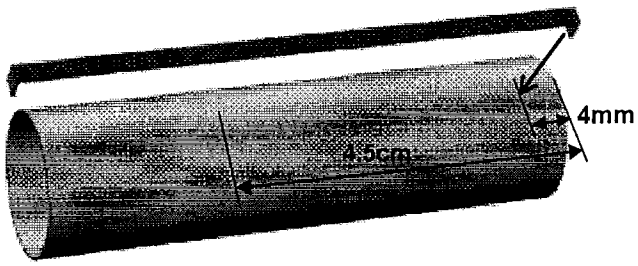
2

Assemble *sustainer* (second stage) engine mount.

a) Make 2 marks on the other green engine mount tube: at 4mm (5/32") and 4.5cm (1 3/4") from one end.

b) At the 4mm (5/32") mark, cut a slit about 3mm (1/8") wide. Note that one end of the remaining engine clip is slightly shorter than the other. Insert the short end into the slit.

c) Make a small notch on the inside of one of the remaining centering rings, as you did in step 1c above. Do not notch the fourth centering ring.

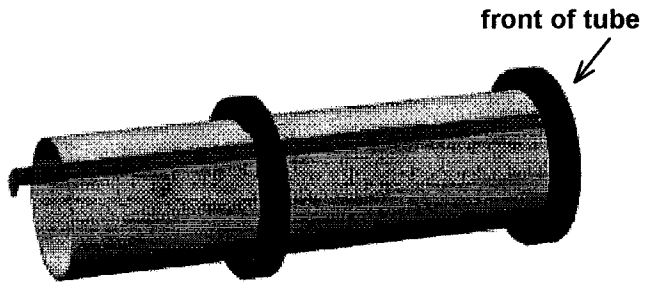


d) Apply glue around the engine mount tube at the 4.5cm (1 3/4") mark and slide the notched centering ring on from the front of the tube until it meets the mark. Make sure the engine clip lies straight down the tube, and is within the notch you cut in the centering ring.

e) Apply glue around the outside of the front of the tube and slide the unnotched centering ring onto the tube until it is even with the front of tube.

f) Tie the Kevlar tether *securely* to the remaining thrust ring.

g) Apply glue around the inside of the front of the tube and slide the thrust ring just inside the tube so it rests against the end of the engine clip.



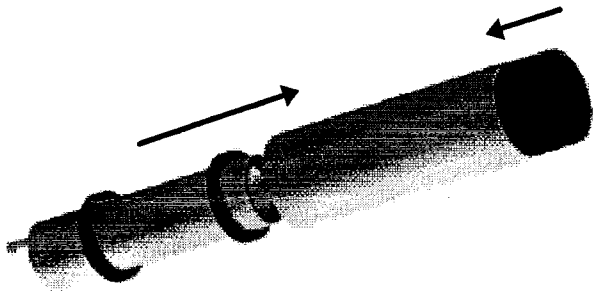
3 Assemble booster body.

a) Mark the stage coupler 13mm (1/2") from one end.

b) Apply glue around the inside of one end of the booster body tube (the short white tube). Slide the stage coupler into the tube until the mark on the coupler lines up with the end of the body tube.

c) Test fit the booster engine mount by inserting it into the aft end of the body tube. Slide the engine mount in until the forward centering ring rests against the stage coupler. About 8mm (5/16") of the green engine mount tube should be sticking out the rear of the booster when the engine mount is properly installed.

d) Remove the engine mount. Apply glue around the inside of the aft end of the booster body tube, about 2cm (3/4") from the edge, and re-insert the engine mount. ***NOTE:*** The engine mount must be inserted in one smooth motion, or the glue may "grab" it in an incorrect position.



4 Mark body tubes for fins and launch lug.

a) Cut out the tube marking guide. Wrap it around the sustainer body tube (the long white tube) and tape its ends together with masking tape.

b) While holding the guide steady, use a pencil to mark the body tube at the arrows. Draw an "L" next to the launch lug mark so you will recognize it later. Remove the guide from the tube.

c) Slide the booster stage into one end of the sustainer body tube.

d) Using a door jamb or angle aluminum as a guide, draw straight lines through all marks, extended over the length of both the booster tube and the sustainer tube.

e) Remove the booster from the sustainer body tube.

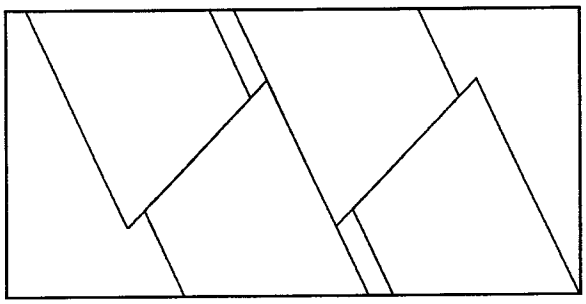
5 Create booster fins.

a) Cut out the fin pattern for the booster fins.

b) Trace the pattern onto the thicker balsa fin stock (the larger of the two pieces) four times in the arrangement shown. Make certain the balsa grain is aligned as shown on the fin pattern!

c) Carefully cut out the fins using a hobby knife. It is easiest to make a straight cut if you use a metal ruler or straight-edge as a cutting guide.

d) Stack all four fins together and sand their edges even and smooth.



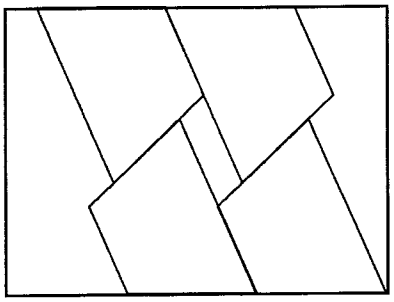
6 Create sustainer fins.

a) Cut out the fin pattern for the sustainer fins.

b) Trace the pattern onto the thinner balsa fin stock four times in the arrangement shown. Make certain the balsa grain is aligned as shown on the fin pattern!

c) Carefully cut out the fins using a hobby knife. It is easiest to make a straight cut if you use a metal ruler or straight-edge as a cutting guide.

d) Stack all four fins together and sand their edges even and smooth.

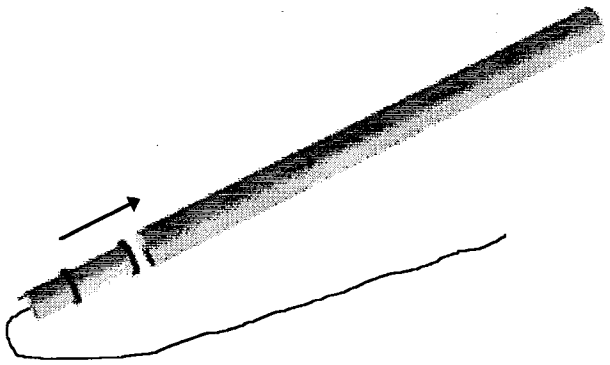


7 Assemble sustainer body.

a) Spread glue around the inside of one end of the sustainer body tube.

b) Thread the Kevlar tether back through the engine mount, then slide the engine mount into the sustainer tube until the aft edge of the green engine mount tube is ***exactly even*** with the aft edge of the sustainer tube. Make certain the Kevlar tether is not trapped by glue or by the engine mount.

c) Feed the tether back through the engine mount and out the front of the sustainer tube.



8 Assemble nose cone.

a) Using a hobby knife, drill a small hole in the base of the nose cone shoulder piece just large enough for the Kevlar tether to pass through.

b) Thread the free end of the Kevlar tether through the hole and tie it ***securely*** to the retainer (small bead).

c) Test fit the shoulder into the nose cone. If necessary, lightly sand the shoulder or the inside of the nose cone for an improved fit.

d) Mark the shoulder about 5mm (1/4") from its open end. Apply CA or a *very small amount* of plastic cement to the shoulder. (Large amounts of plastic cement can deform the nose cone.) Insert the shoulder into the nose cone up to the mark. Make certain the shoulder is straight.

9 Attach fins to booster.

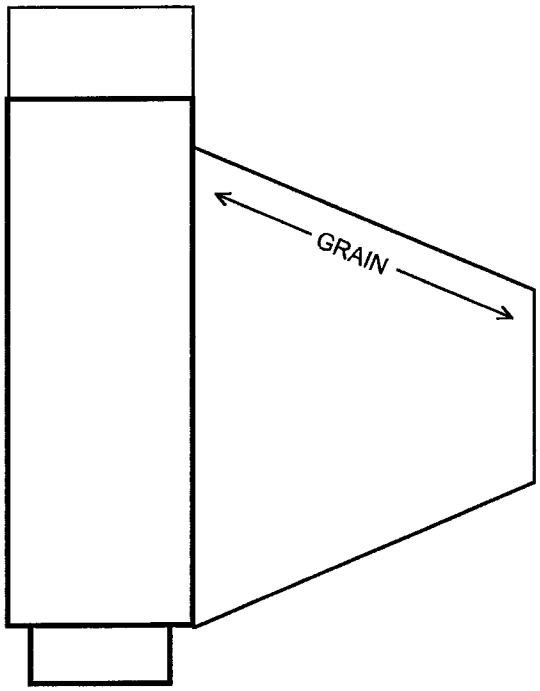
a) Apply a small amount of glue to the root edge of a booster fin and press it against the booster tube, aligned with a fin line and even with the rear of the tube.

b) Remove the fin immediately and allow the glue to dry.

c) Apply more glue to the fin root edge and press the fin against the booster tube in the same location. ***IMPORTANT:* Make certain the balsa grain runs *away* from the tube's front end as shown!** Ensure the fin points straight out from the body tube. Hold the fin in position until the glue sets.

d) Repeat steps a-c for the other three booster fins.

e) Stand the booster on its front end and allow the glue to dry completely.



10 Attach fins to sustainer.

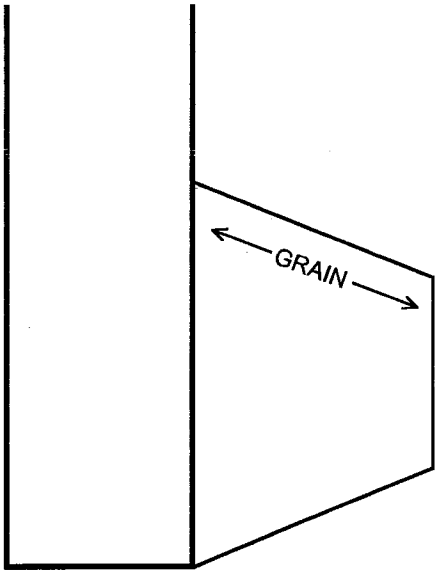
a) Apply a small amount of glue to the root edge of a sustainer fin and press it against the sustainer tube, aligned with a fin line and even with the rear of the tube.

b) Remove the fin immediately and allow the glue to dry.

c) Apply more glue to the fin root edge and press the fin against the sustainer tube in the same location. ***IMPORTANT:* Make certain the balsa grain runs *away* from the tube's front end as shown!** Ensure the fin points straight out from the body tube. Hold the fin in position until the glue sets.

d) Repeat steps a-c for the other three sustainer fins.

e) Stand the sustainer on its front end and allow the glue to dry completely.



11 Attach parachute canopy to model.

a) Tie an overhand knot in the Kevlar tether no more than about 3cm (about 1") from the nose cone, leaving a loop for parachute attachment.

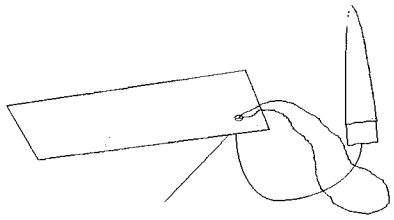
b) Gather the parachute shroud lines together to form a loop.

c) Pass the shroud line loop through the loop you made in the tether, and thread the parachute canopy through the shroud line loop.

12 Attach Perma-Wadding to model.

a) Form a loop in the Kevlar tether and pass it through the eyelet in the sheet of Perma-Wadding.

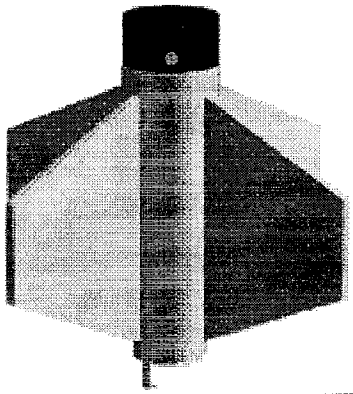
b) Pass the nose and parachute through this loop. The Perma-Wadding is now attached to the tether, but can be moved up and down it or removed if necessary.



13 Make booster exhaust ports.

a) Using a hobby knife, drill a hole about 3mm (3/32") in diameter in the booster stage coupler, about 6mm (1/4") from the front of the coupler, and located between two fins.

b) Drill identical holes between each remaining set of adjacent fins (four holes in all).



14 Apply fillets to fins.

a) Apply a line of glue down each side of the joint between each booster fin and the booster tube, smoothing the glue with your finger. These glue fillets reduce drag and improve performance. ***NOTE:*** If you use CA to make your fillets, do ***not*** touch the glue! Instead, apply a line of CA to the fin-tube joint, then spray CA accelerator on it to produce a fillet.

b) Repeat this procedure for the sustainer fins.

15 Sand and seal fins.

a) Sand all fin surfaces smooth with fine sandpaper.

b) [Optional] Apply sanding sealer to all fin surfaces and allow to dry. Sand with very fine sandpaper. Repeat this step until the fin surfaces are as smooth as possible.

c) [Optional] Improve performance by sanding the leading edges of all fins round.

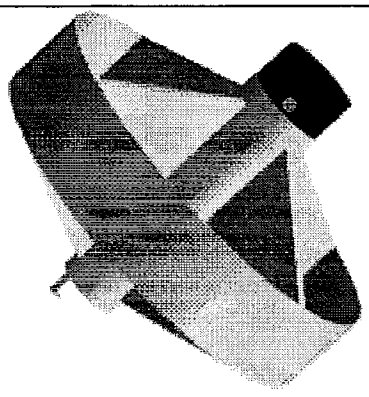
d) [Optional] Further improve performance by sanding the trailing edges of all fins round or tapered. ***NOTE:*** Do not round or taper the tips of the fins.

16 Mount booster fin ring.

a) Test the fit of the large paper ring by sliding it over the booster fins. If necessary, sand the tips of the booster fins down to obtain a snug fit that does not deform the shape of the ring.

b) Once you are satisfied with the fit of the fin ring, apply glue to the tips of all booster fins and slide the ring on, aligning it with the fin edges.

c) When the glue has dried, apply glue fillets to all joints.



17 Attach launch lug.

a) Glue the launch lug to the sustainer along the launch lug line marked in step 4, with the back of launch lug about 4cm (1 ½") from the back of the sustainer body tube.

b) Once the glue joint has dried, apply a glue fillet to each side of the launch lug.

18 Assemble rocket into flight configuration.

a) Slide the Perma-Wadding as far down the Kevlar tether towards the sustainer body as possible. Center it over the mouth of the tube, and use your finger to push the middle down into the tube, then the edges. Fold the parachute and shroud lines together, and loosely wrap the Kevlar tether around it a few times. Gather any extra length of Kevlar tether and place it on top of the Perma-Wadding. Insert the folded parachute into the body tube.

b) Insert the nose cone into the tube. Adjust the fit of the nose cone, if necessary, by sanding or by applying transparent tape to the shoulder.

c) Lightly sand the outside of the booster stage coupler, and slide it into the aft of the sustainer stage to form the completed two-stage rocket.

d) Ensure that the stage coupler fits snugly enough into the sustainer section that the booster will not fall off if you hold the rocket by the sustainer. However, you must also ensure the stage coupler does not fit too tightly, or damage to the rocket may result in flight. Continue to sand the booster stage coupler if necessary to obtain the proper fit.

19 Paint model.

a) Painting your model improves its appearance as well as its performance. For best results, use enamel-type spray or bottle paints, and use several light coats of paint rather than one heavy one.

b) A suggested paint scheme is illustrated on the front of these instructions. To duplicate this scheme, detach the booster section from the sustainer section. Remove the nose and cover it in newspaper, then paint the entire sustainer section gloss black. Cover the exposed portion of the stage coupler with masking tape, and paint the entire booster section gloss yellow or metallic gold. After the paint has dried, cover the body of the sustainer section in newspaper, leaving the nose uncovered. Paint the nose gloss yellow or metallic gold. Reassemble the rocket after the paint has dried completely.

20 Apply decals.

a) You can use the included decals to enhance the appearance of your rocket.

b) Apply the large gold "Crossfire" decal on the body of the rocket to identify your model. Apply the black crosshairs around the booster's fin ring.

c) The numbers can be used to identify your rocket, and the logo decals can be used to tell the world where you got your kit!

21 Prepare for launch.

a) To launch your rocket, first make certain it is assembled as described in step 18. Note that *no recovery wadding is required,* as the reusable Perma-Wadding serves to protect the parachutes from the hot ejection charge.

b) Remove the booster stage from the rocket. Slide an engine of the recommended type into the rear of the sustainer so the nozzle is pointing outward. Slide the engine in until the engine clip snaps into place around it. Remember to use an engine *with a delay* (*i.e.,* with a designation *not* ending in zero, such as B6-6).

c) Insert the booster stage back into the rear of the sustainer stage. Slide an engine of the recommended type into the rear of the booster so the nozzle is pointing outward. Slide the engine in until the engine clip snaps into place around it. Remember to use an engine *with no delay* (*i.e.,* with a designation ending in zero, such as B6-0).

d) Install an electrical igniter into the booster engine as recommended by the engine manufacturer.

e) Mount a 1/8" launch rod on your launch pad. Slide the rocket onto the launch rod by guiding the rod through the launch lug.

f) Connect the igniter to your electrical ignition system. (Launch systems are available from your local hobby store.)

g) Launch your rocket! Remember to follow the National Association of Rocketry Model Rocket Safety Code whenever you launch.

h) Let us know how you like the design! Write to us or e-mail us at the addresses listed on the front of these instructions, and tell us what you did or didn't like about this kit. You can help us better the hobby by sharing your opinions and ideas!

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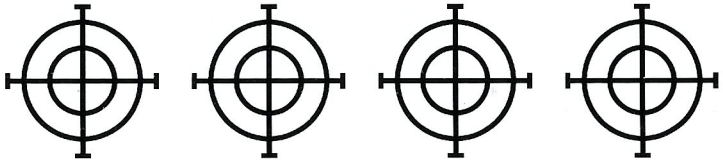

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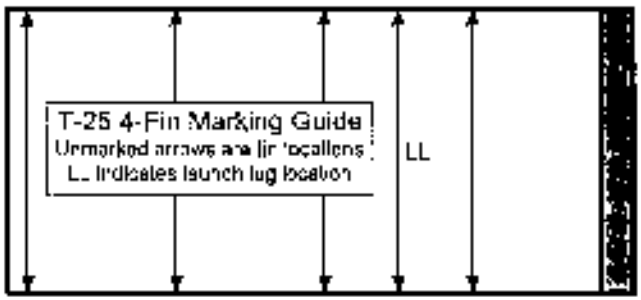
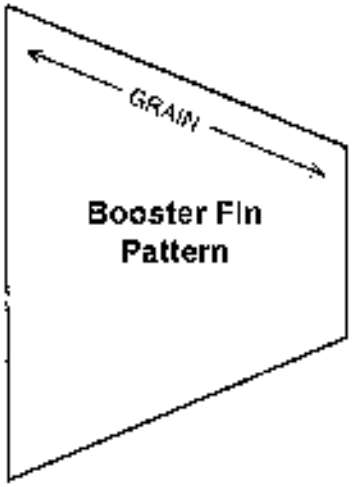

T-25 4-Fin Marking Guide
Unmarked arrows are fin locations
LL indicates launch lug location
LL


GRAIN
Booster Fin
Pattern


GRAIN
Sustainer Fin
Pattern

RAC #10300