



Skill Level 1

Clipper

Designed By C. P. McGraw

Revision Date: January 4, 2006

Length:	12.9"
Diameter:	0.976"
Fin Span:	5.74"
Weight:	0.6 oz

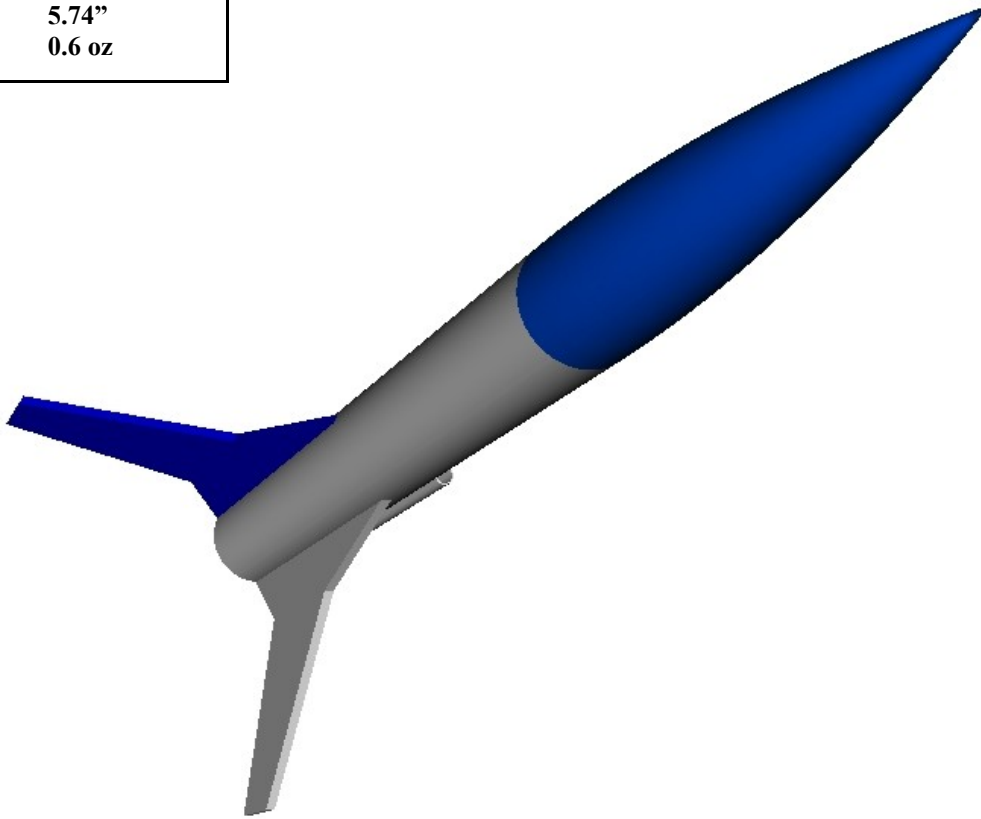
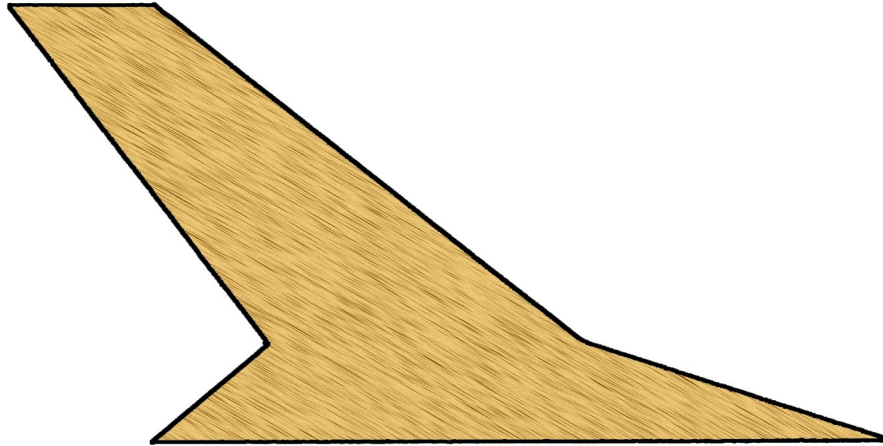


Image created with RockSim 8

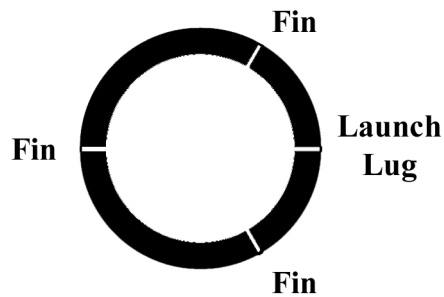
Main Parts List

Nose Cone.....	BNC-50Y	Launch Lug.....	LL-225
Body Tube.....	BT-50H	Streamer.....	21" x 2.1" Mylar
Motor Tube.....	BT-20J	Shock Chord.....	SC-24
Centering Rings.....	(2) CR-2050	Shock Chord Mount.....	SCK-24
Thrust Block.....	CR-520	Screw Eye.....	SE-1
Engine Hook.....	EH-275	Snap Links.....	(2) #12
Fin Stock.....	3/32" Balsa Sheet		

Fin Pattern & Locater Guide



Make 3 from 3/32" Balsa Sheet



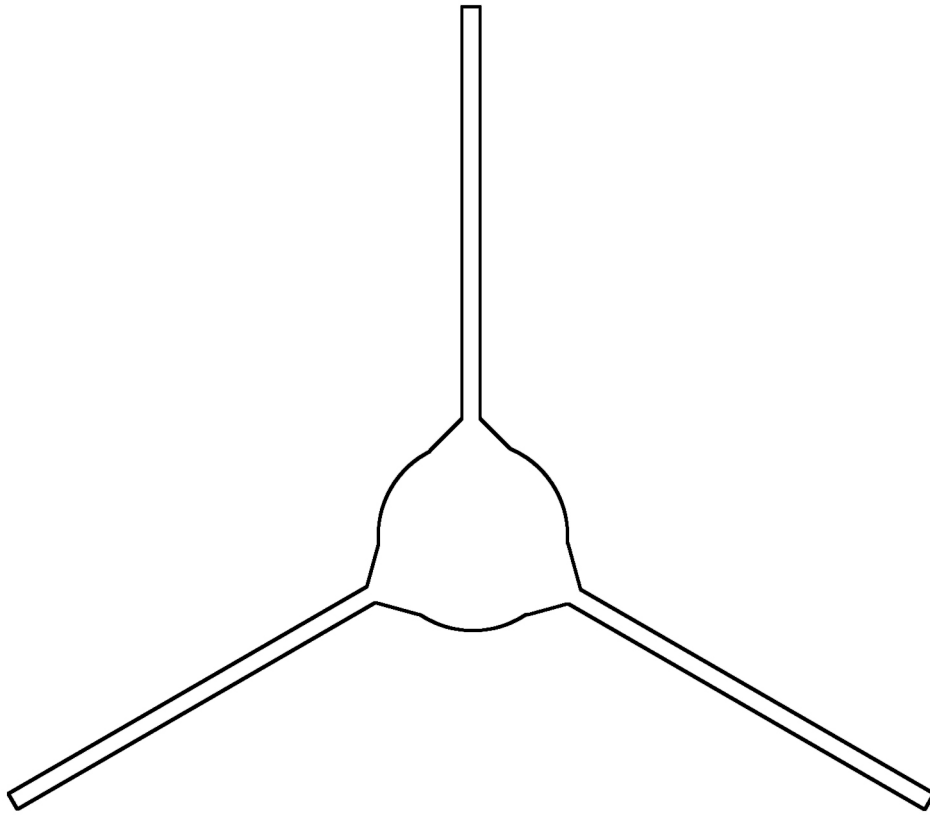
Cut from cardstock

Additional Items Required

Small bottle of yellow carpenter's glue; sharp hobby knife; 0.05mm pencil; steel ruler; sheets of 220-, 400-, and 600-grit sanding papers; lightweight filler compound; tack rag; sprayable primers, paints, and Acrylic gloss clear coat; small, soft-bristle hobby brushes; various clamps and weights.

It is also recommended that you have a personal copy of **The Model Rocketry Handbook, Seventh Edition**, by G. Harry Stine and Bill Stine. Read and understand the sections on Construction, Recovery, and Safety.

Fin Alignment Guide



Cut from 0.05" fiberboard, or multiple layers of cardstock.

General Assembly Sequence

- **Step 1** Give the body tube and the nose cone a complete sanding with 220-grit paper. This will remove the shine from the surface of the tube, and will remove the fuzzing of the balsa due to humidity and temperature.

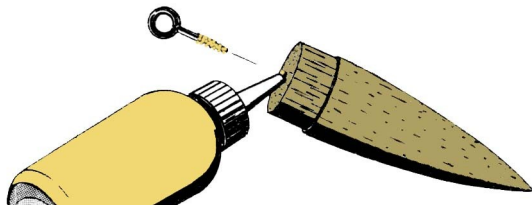


Figure 1

- **Step 2** Use the threads of the screw eye to cut matching threads into the base of the nose cone, then carefully reverse the screw eye out of the hole. As shown in Fig. 1, force glue deep into the hole, and coat the screw eye threads with glue, then reinsert the screw eye into the hole. Do not wipe away any glue. Set this aside to dry for about 30 minutes in a vertical attitude, pointing downward.

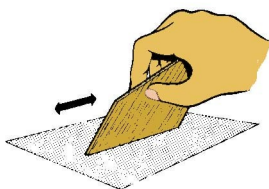


Figure 2

- **Step 3** Cut out the three fins from 1/16" balsa sheet, using the template provided. Give the surfaces a careful sanding with 220-grit to remove the fuzziness. Round over all of the **outer edges** except the root edge with 400-grit paper. Square up the root edge as shown in Fig. 2. Clamp the fins together, then apply a layer of

thinned glue to the **root edges**. Allow about 30 minutes to dry.

- **Step 4** Slide the fin locator guide over the body tube and mark the tube for three fins and the launch lug. Extend these lines upward from the bottom edge of the tube using the trim around a door, or a piece of brass angle stock. All four lines should be 4" long. Measure rearward from this location 2.25" and mark the lug line.
- **Step 5** Apply a layer of **thinned** glue to the fin alignment lines and to the lug alignment line between the marks at 4" and 1.75" on the body tube. Set these aside for at least 30 minutes to dry.

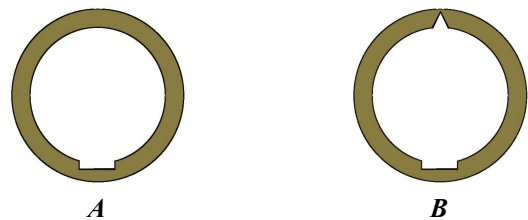


Figure 3

- **Step 6** Modify the two CR-2050 centering rings with flat notches, as shown in the left-side "A" image of Fig. 3. Modify **one** of these rings with a "V" notch as shown in the right-side "B" image.
- **Step 7** Mark the BT-20J motor tube 1" and 2.5" from one end. Draw lines completely around the tube at these locations. Draw one line down the full length. At the intersection of this line with the 2.5" line, cut a slot in the tube for the tip of the engine hook.

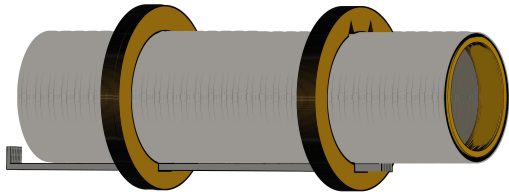


Figure 4

- **Step 8** Insert the engine hook into the slot, then slide the “A” ring up from the bottom of the tube, with the flat notch over the hook, until the ring is touching the line at 1”. Slide the “B” ring down from the top until it is just below the line at 2.5”. Make sure the engine hook is parallel to the tube, not angled or “canted” to one side. When all of the parts are in place, the mount should look like the illustration in Fig. 4 above.

- **Step 9** Apply a thin layer of glue inside the top end of the tube, spreading the glue with a soft brush, then insert the CR-520 ring into the top of the tube and push down until it “bottoms out” against the tip of the hook. Use the brush to apply glue around the joints of the CR-2050 rings to secure them to the tube. Clean out any glue that fills the “V” notch in the “B” ring. This notch will be needed in the next step. Set this subassembly aside for about an hour to dry completely.

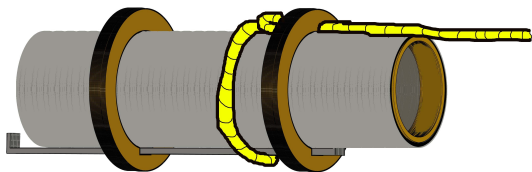


Figure 5

- **Step 10** Tie a slip knot around the middle of the engine mount using the Kevlar thread, as shown in Fig. 5.

Push the free end of the Kevlar thread through the “V” notch in the forward ring, pulling the excess all the way forward as you slide the loop up against the back of the ring. Secure this loop to the mount with a layer of thinned glue, then set aside for at least 30 minutes to dry.

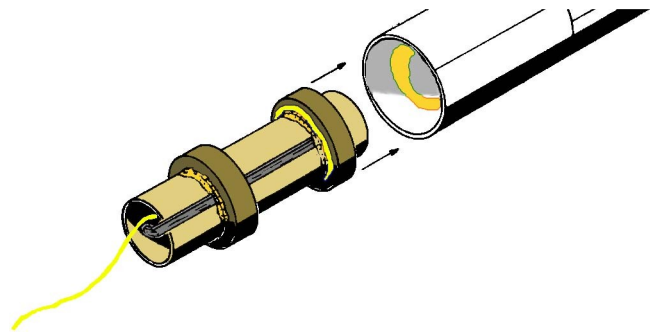


Figure 6

- **Step 11** Push the Kevlar thread down through the center of the mount and pull the excess out of the way. As shown in Fig.6, apply a generous bead of glue up inside the **bottom end** of the body tube, about 1.5” from the edge. With **one continuous motion**, push the engine mount into the body tube and through the glue, until the bottom edge of the motor tube is even with the bottom edge of the body tube. Do not stop during this push, or the glue will “freeze” the mount in the wrong place. Set aside in a vertical attitude, top end up, for about an hour to let the glue dry..

- **Step 12** Apply a bead of glue around the outer edge of the rear CR-2050 ring where it contacts the main body tube, then set this aside in an inverted, or top-down, attitude for at least 30 minutes to let the glue dry.

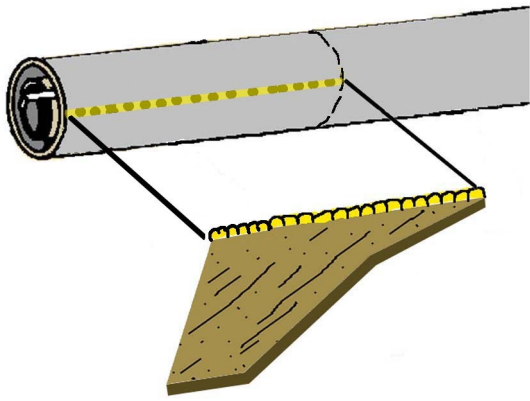


Figure 7
(Not this model shown)

- **Step 13** As shown in Fig. 7, apply a narrow bead of full-strength glue to one of the fin alignment lines, and to the root edge of one fin. Press the root edge of the fin against the body tube over the alignment line, with the trailing edge of the fin even with the edge of the body tube. Hold the fin in place for about 15 seconds before releasing it. Use a moist, soft-bristle brush to smooth down the glue which squeezes out from the joint. Slide the fin alignment guide down from the top of the tube and over the fin, carefully adjusting the angle to fit the slot. Allow this to dry in a horizontal attitude, with this fin located TDC, for about 30 minutes before removing the guide. Repeat this sequence for each remaining fin.
- **Step 14** Attach the launch lug to the body tube on the lug alignment line, with the top of the lug at the 4" end of the line, and the bottom of the lug at the mark 1.75" mark. Set aside to dry for about 30 minutes.
- **Step 15** Apply a bead of glue along both sides of each fin at the base, and smooth this out with a moist finger or

soft-bristle brush. This forms a reinforcing fillet to strengthen the fins. Apply a similar fillet to both sides of the launch lug. Place the model in a horizontal attitude until the glue has dried completely.

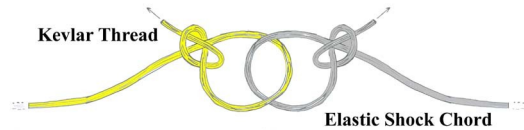


Figure 8

- **Step 16** Tie a slip knot in the free end of the Kevlar thread, as shown in Fig. 8. Insert one end of the elastic shock chord through the loop and tie a slip knot in it, then pull the two knots tight against each other. Attach the barrel end of one of the snap links to the free end of the elastic chord. Apply a layer of thinned glue to all of the knots to secure them, and allow to dry for about 30 minutes.
- **Step 17** Assemble the streamer with a 12" leader attached to one end. Review general assembly practices in the Handbook for streamers. Tie the barrel end of the second snap link to the free end of the leader line. Pull the shock chord and Kevlar thread back through the mount and out the top of the model. Do not attach either of the snap links to the nose cone at this time.

Finishing Sequence

- **Step 18** Apply a thinned, lightweight filler compound to all exposed balsa surfaces, and to the spiral gap in the body tube. Allow a full day for this to dry, and sand smooth with 220-grit paper. Examine

the surface for gouges, scratches, and for the spiral wrap. If these are not fully filled, reapply filler, let dry, and sand again. Keep repeating this sequence until these flaws are eliminated. Wipe the model down thoroughly with a tack-rag to remove the sanding dust.

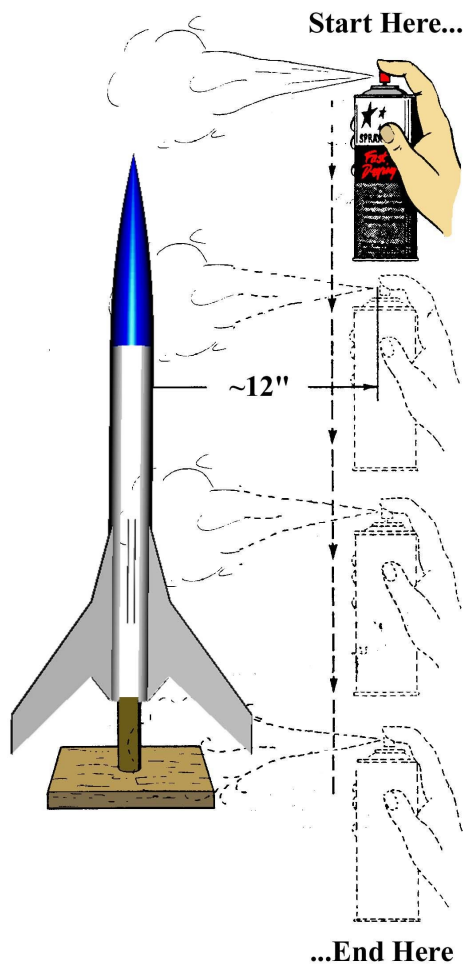


Figure 9

- **Step 19** The illustration in Fig. 9 shows the correct method for spraying your model, regardless of the equipment used. Keep the tip about 12" away from the model, and use a top-to-bottom spray pattern – **never** spray from side-to-side, or from bottom-to-top – to avoid runs in the spray. Use this technique for applying

primer, paint, or the gloss coats.

- **Step 20** Apply at least two complete coats of primer to the model, allowing a full day between coats to fully dry, before sanding with 220-grit paper. We recommend **Rust-O-Leum's White Clean Bare Metal Primer** for this task. Do not sand through the outer layer of the tube, or gouge the balsa pieces. Tack-rag the model and inspect for scratches or other blemishes that would remain visible in the final color coats. Re-prime, sand, and inspect as-needed to achieve the finish you want.
- **Step 21** The suggested color scheme is a simple white overall with a Medium to Dark Blue nose cone. One fin (the one opposite the launch lug) should be painted the same shade of blue. We recommend Liquitex tube acrylic paints thinned with airbrush medium and water. Paint the entire model white for a base color and allow at least two days drying time before masking with a low-tack painter's tape for the the fin color. We also recommend applying the color to the nose separately, using a scrap piece of BT-50 as a holder. This will make the color separation crisper.

- **Step 22** After the color coats have dried for at least two days, spray the model with Future Floor Finish to give it a protective gloss coat. Future can be thinned with pure, clean ammonia or with Windex, and sprayed with an airbrush. Allow this coat to dry for at least a day before handling. Apply any decals you may wish. When dry, wipe away any

adhesive residue with a soft cloth. Spray the model again and allow to dry for about two days. This will seal the decals to the model.

Pre-Flight Sequence

- **Step 23** Attach the snap links on the shock chord and the streamer to the screw eye in the shoulder of the nose cone.
- **Step 24** Insert about 2” of shredded cellulose recovery wadding into the top of the main body tube, and gently push this down until it is just on top of the motor mount. Do not pack this material tightly. The wadding needs to be blown out to ensure deployment of the streamer. It's purpose is to create a gas seal and to block hot particles from contacting the streamer.
- **Step 25** Fold or roll the streamer just smaller than the inside diameter of the tube, and wrap the streamer's leader chord around it. Insert the shock chord into the body tube, followed by the streamer. Make sure the top of the streamer is at least 1” below the edge of the tube, to allow room for the nose cone's shoulder. Insert the nose cone.
- **Step 26** Select a motor from this list to fly the Clipper:

A3-4T.....435'.....2.2 FPS Dv
B6-6.....730'.....28 FPS Dv
C6-7.....1310'.....23 FPS Dv

Use of the A3-4T will require the use

of a 13mm-to-18mm adapter, and produces the most gentle deployment velocity.

- **Step 27** Review the safety code on the last page, then go fly!

**Developed for BARCLONE Rocketry
by C. P. McGraw**

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by C. P. McGraw**

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Model Rocket Safety Code

Materials: I will use only lightweight, non-metal parts for the nose cone, body, and fins of my rockets.

Motors: I will use only certified, commercially-made model rocket motors, and will not tamper with these motors or use them for any purposes except those recommended by the manufacturer.

Ignition System: I will launch my rockets with an electrical launch system and electrical motor ignitors. My launch system will have a safety interlock in series with the launch switch, and will use a launch switch that returns to the "off" position when released.

Misfires: If my rocket does not launch when I press the button of my electrical launch system, I will remove the launcher's safety interlock, or disconnect its battery, and will wait 60 seconds after the last launch attempt before allowing anyone to approach the rocket.

Launch Safety: I will use a countdown before launch, and will ensure that everyone is paying attention and is a safe distance of at least 15 feet away when I launch rockets with "D" motors or smaller, and 30 feet when I launch larger rockets. If I am uncertain about the safety or stability of an untested rocket, I will check the stability before flight and will fly it only after warning spectators and clearing them to a safe distance.

Launcher: I will launch my rockets from a launch rod, tower, or rail that is pointed to within 30 degrees of the vertical to ensure that the rocket flies nearly straight up, and I will use a blast deflector to prevent the motor's exhaust from hitting the ground. To prevent accidental eye injury, I will place launchers so that the end of the launch rod is above eye level or I will cap the end of the rod when it is not in use.

Size: My model rocket will not weigh more than 1,500 grams (53 oz) at liftoff, and will not contain more than 125 grams (4.4 oz) of propellant or 320 N-sec (71.9 lb-sec) of total impulse. If my model weighs more than one pound (453 grams) at liftoff, or has more than four ounces (113 grams) of propellant, I will check and comply with Federal Aviation Administration (FAA) regulations before flying.

Flight Safety: I will not launch my rockets at targets, into clouds, or near airplanes, and will not put any flammable or explosive payload into my rockets.

Launch Site: I will launch my rockets outdoors, in an open area at least as large as shown below, and in safe weather conditions with winds speeds no greater than 20 MPH. I will ensure that there is no dry grass close to the launch pad, and that the launch site does not present risk of grass fires.

LAUNCH SITE DIMENSIONS

Total Impulse (nSec)	Motor Size	Minimum Field Size
<i>0.00 – 1.25</i>	<i>1/4A – 1/2A</i>	<i>50'</i>
<i>1.26 – 2.50</i>	<i>A</i>	<i>100'</i>
<i>2.51 – 5.00</i>	<i>B</i>	<i>200'</i>
<i>5.01 – 10.00</i>	<i>C</i>	<i>400'</i>
<i>10.01 – 20.00</i>	<i>D</i>	<i>500'</i>
<i>20.01 – 160.00</i>	<i>E, F, G</i>	<i>1000'</i>
<i>160.01 – 320.00</i>	<i>2G</i>	<i>1500'</i>

Recovery System: I will use a recovery system, such as a streamer or parachute, in my rockets so that they return safely and undamaged and can be flown again, and I will use only flame-resistant or fireproof recovery system wadding in my rockets.

Recovery Safety: I will not attempt to recover my rocket from power lines, tall trees, or other dangerous places.

Model Rocket Safety Code
developed by the
National Association of Rocketry
Revised Code November, 2004