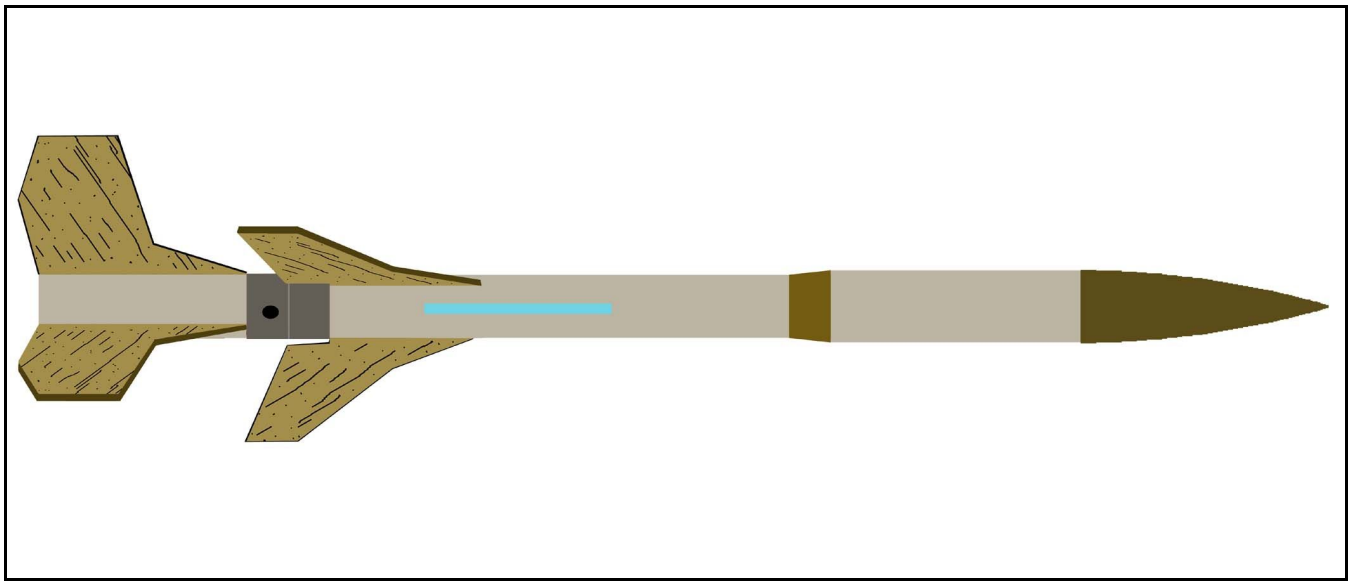
BARCLONE
Rocketry Products

Hawk

Created by C. P. McGraw



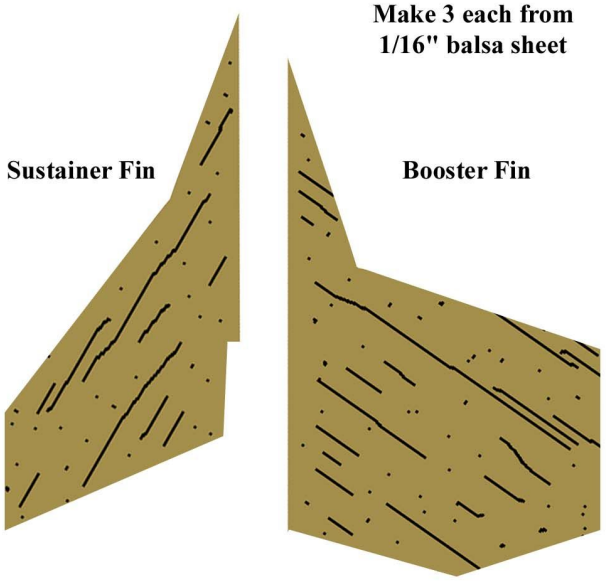
Length	**15.750”**
Diameter	**0.908”**
Weight	**1.4 oz**
Fin Span	**4.085”**

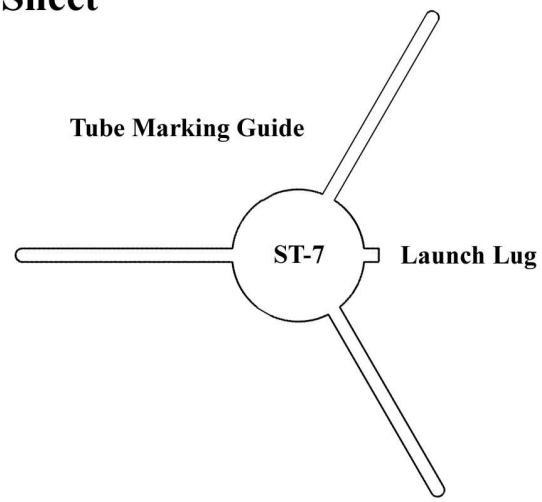
All of the major components needed to build this model can be ordered directly from **Semroc Astronautics Corporation**, through their website at **http://www.semroc.com**. Snap links can be found locally in sporting goods shops and departments within most superstores.

In addition to the items in the Parts List, you will need a sharp hobby knife, a small bottle of yellow carpenter's glue, sheets of 220-, 400-, and 600-grit sanding papers, a tack rag, soft hobby brushes, a pencil, and a steel (or steel-edged) ruler. Some suggested tools include a 12” length of 1/2” hard brass angle stock for drawing the alignment lines, and the plastic spindle from an empty CD-R package for use as a holding spike.

One item which you will find most useful is a copy of **The Model Rocketry Handbook, Seventh Edition**, written by G. Harry Stine and Bill Stine. Especially helpful are the chapters on **Construction** and **Tools**. This model is designed with the double-glue technique for attaching fins to the body tube, so reading and understanding this information will make the construction easier.

Hawk Pattern Sheet





Launch Lug Standoff
Make 1 from 1/8" strip stock

PARTS LIST FOR BOTH VERSIONS

Nose Cone	BC-830	Balsa Stock	1/8″ x 1/8″ x 2.5″
Booster Body	ST-73	Thrust Blocks	TB-7 (2)
Main Body Tube	ST-76	Parachute	CPK-12
Payload Body	ST-83	Kevlar Thread	SCK-18
Reducer	BR-78	Shock Chord	SC-18
Launch Lug	LL-18	Screw Eye	Large
Balsa Sheet	1/16″ x 3″ x 12″	Snap Links	Medium (2)

ADDITIONAL 13mm VERSION PARTS

Engine Mounts	EM-58 (2)	Centering Rings	TB-7 (2)

These first few steps in the instruction sequence apply to both versions of the Hawk.

- **Step 1** Give all three body tubes a light sanding with 220-grit paper to remove the shine from the surface. Do not sand through to the inner layer of the tube. Give the nose cone and the transition pieces a light sanding to remove any surface "fuzzing" caused by humidity.

- **Step 2** Cut out the fins and the launch lug standoff as shown on the Pattern Sheet. Give the surfaces a light sanding with the 220-grit paper. Round over all of the outer edges of the fins, but do not round the root edge. Round over the leading edges and the trailing edges of the standoff, but not the root edge or the lug contact edge. Square up the root edges of all the pieces to provide the best glue face against the body tube. Apply a thinned layer of glue to the root edges of all fins and the launch lug standoff, and allow to dry.

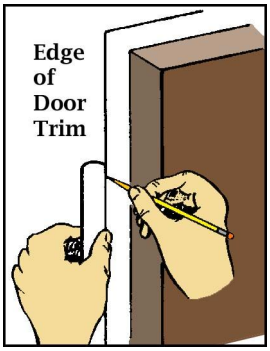


Fig. 1

- **Step 3** Mark the ST-76 main body tube for three fins and the launch lug using the marking guide on the pattern sheet. Mark the ST-73 booster only for the three fins. As shown in Fig. 1, use a straight edge such as the trim around a door, or the brass angle stock, to extend the fin lines upward from the base of the ST-76 tube to a height of 3", and the lug line upward to 4". Extend the lines the full length on the ST-73 tube. Place marks on each of the ST-76 fin alignment lines at 1/2" and 3" from the base. Place marks on the lug alignment line at 1.5" and 4" from the base. Place marks on the ST-73 at 1/2" from the top end.

- **Step 4** Using a soft-bristle hobby brush, apply a layer of thinned yellow glue to the main body tube and the booster body tube along the fin alignment lines and the lug alignment line.

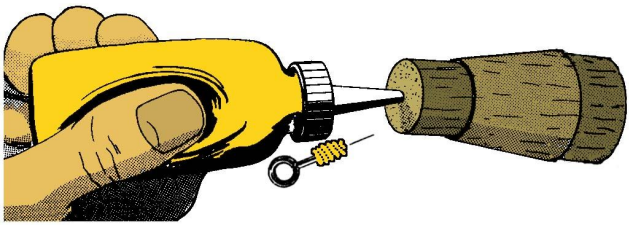


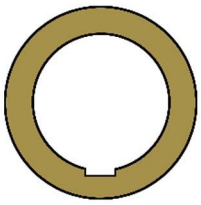
Fig. 2

- **Step 5** Insert the screw eye into the small end of the balsa transition, carefully cutting the threads into the wood. As shown in Fig. 2, remove the screw eye and force some glue into the hole. Coat the threads of the screw eye with glue and reinsert into the hole. Do not wipe away the excess glue. Allow to dry.

- **Step 6** Assemble the parachute as shown in the Semroc instructions, except attach the shroud lines to the barrel end of one of the snap links instead of to the screw eye.

- **Step 7** You must now decide which version of the Hawk you are going to build. The standard version is designed to use existing 18mm boosters and sustainers, and does not require the additional motor mount components. The 13mm version of the Hawk is presented to give support to the efforts being made by others in getting "T"-series boosters put back in production. Currently there are no boosters being made to fly this configuration.

Only work these steps if you wish to build a 13mm "T"-motor model. Skip these steps and proceed with Step 8 if you are building a standard 18mm version.



Flat notch to fit motor hook

Fig. 3

- **Step 7A** Modify the four TB-7 rings with flat notches to fit over the motor hooks, as shown in Fig. 3. This will prevent the motor tube from becoming off-center when the mounts are inserted into the ST-7 tubes.

"V" Notch

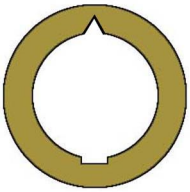


Fig. 4

- **Step 7B** Modify one of the four TB-7 rings with a "V" notch as shown in Fig. 4. This will allow the passage of the Kevlar thread later.

- **Step 7C** You will now substitute the four modified TB-7 rings for the CR-58 rings included in the two EM-58 kits. Use two of the rings with only the flat notches for one mount. This will become the booster motor mount subassembly. Use the remaining rings for the other mount, with the "V"-notched ring to the front of the mount. This will become the sustainer motor mount subassembly. If any glue blocks the "V" notch, clean it out immediately, before the glue has time to harden. This notch must remain open for the next step. Allow to dry completely.

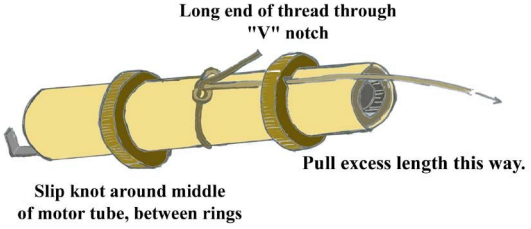


Fig. 5

- **Step 7D** Tie a slip-knot in one end of the SCK-18 Kevlar thread,

and loop this around the middle of the sustainer motor mount subassembly, as shown in Fig. 5. Push the long end of the thread through the "V" notch, and slide the loop up against the back of the forward ring, pulling the long thread as you go. Apply a layer of glue to the thread to secure it in place. Allow to dry completely.

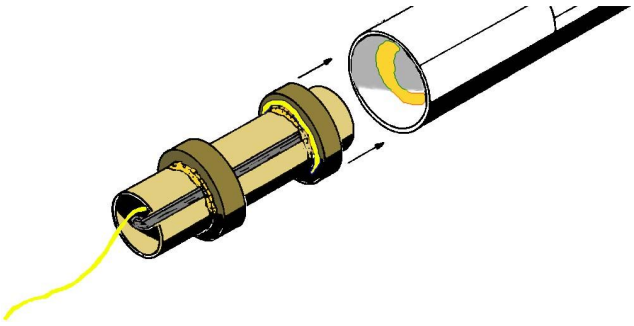


Fig. 6

- **Step 7E** Push the loose end of the Kevlar thread down from the top through the sustainer motor mount and pull tightly. As shown in Fig. 6, apply a generous bead of glue around the inside of the ST-76 body tube, about 1" up from the base of the tube. With a continuous motion, push the motor mount into the main body tube, through the bead of glue, until the base of the motor tube is even with the base of the body tube. Do not pause during this critical step! If you stop before the mount is fully in position, the glue will "freeze" the mount in the wrong place.

- **Step 7F** Using the same technique in Step 7E, insert and glue the booster motor mount subassembly into the base of the ST-73 body tube. Allow both motor mounts to dry completely.

Follow these instructions only if you are building the 18mm version. Skip to Step 9 if you are building the 13mm version.

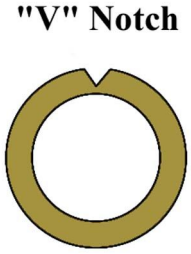


Fig. 7

- **Step 8A** Modify one of the two TB-7 rings with a "V" notch, as shown in Fig. 7.

- **Step 8B** Tie one end of the Kevlar thread around the notched TB-7 ring, with the thread down in the notch, and pull tightly. Make sure the knot is moved to one of the "faces" of the ring, or to the inside diameter of the ring, and not in the "V" notch itself. Apply a thinned layer of glue to the knot only and let dry.

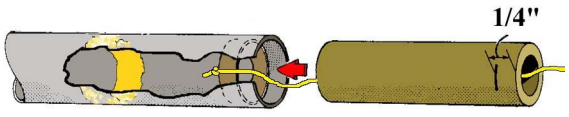


Fig. 8

- **Step 8C** Mark one end of an expended (used) motor 1/4" from one end. This will act as a pushing ram and as a depth gage. Using a soft hobby brush, apply a bead of glue up inside the ST-76 body tube

about 2” from the base of the tube. Now, insert the modified TB-7 ring, with the Kevlar thread running down through the casing, as shown in Fig. 8 and push until you reach the depth mark. Do not stop pushing until the depth mark has been reached, or the glue will “freeze” with the ring in the wrong place. Remove the casing immediately and set this tube aside to dry.

- **Step 8D** Using the same method as Step 8C, apply a bead of glue up inside the ST-73 body tube about 2” from the base of the tube. Insert the second (unmodified) TB-7 ring as shown in Fig. 8 and push with the marked casing until you reach the depth mark. Set this tube aside to dry.

The remaining steps in this instruction sequence apply to both versions.

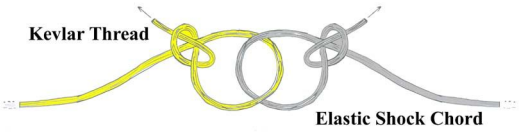


Fig. 9

- **Step 9** When all of the glue in the motor mount areas have dried, push the loose end of the Kevlar thread back through the mount, and out the top end of the ST-76 tube. As shown in Fig. 9, tie a slip knot in the loose end of the Kevlar thread. Push one end of the elastic shock chord through the loop, and tie a slip knot at this end around the Kevlar loop. Pull both knots tightly against each other. At the other end of the elastic shock chord, attach the barrel end of the remaining snap link. Secure both knots with a layer of thinned yellow glue. Set aside to dry.

- **Step 10** Mark the top end of the ST-73 tube (opposite the motor mount end) 1/2” from the edge, and draw a line completely around the tube at this point. Apply a thin layer of full-strength yellow glue to the inside of the HTC-7B coupler, for a depth of 1/4” from the edge of the coupler. Do not apply glue any deeper than this. Push this end of the coupler over the top end of the ST-73 tube, until the edge of the coupler meets the 1/2” mark. Do not push the coupler any farther. Set aside and let dry.

- **Step 11** Punch two small holes, about 3/16” to 1/4” in diameter, through the coupler and the body tube, 180 degrees apart, with the centers of the holes 2 3/4” up from the bottom of the tube. These will allow the pressure from the booster motor to escape first, giving the second stage time to fully ignite before the booster is blown off. See the chapter on Multi-Stage Models in The Model Rocketry Handbook for a thorough explanation of what is happening here.

- **Step 12** Apply a bead of glue along a fin alignment line on the

ST-76 tube, between the 1/2” mark and the 3” mark. Do not get any glue below the 1/2” mark. Apply a bead of glue along the root edge of a sustainer fin, and attach this fin to the ST-76 as shown in Fig. 10. Use a soft hobby brush, slightly damp, to smooth out the glue that squeezes out from the joint. Hold this fin in proper alignment for at least one minute before turning it loose. Allow this to dry for about an hour, then repeat for the remaining two fins.

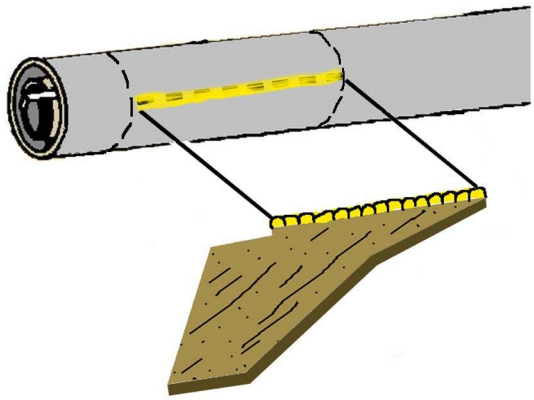


Fig. 10

- **Step 13** Attach the launch lug standoff to the ST-76 tube in a similar manner, between the 1.5” mark and the 4” mark on the lug alignment line. Allow to dry, then apply a thinned layer of glue to the lug contact edge of the standoff. When this has dried for about 15 minutes, attach the launch lug to the standoff in the same manner as you attached the fins. Let this dry completely.

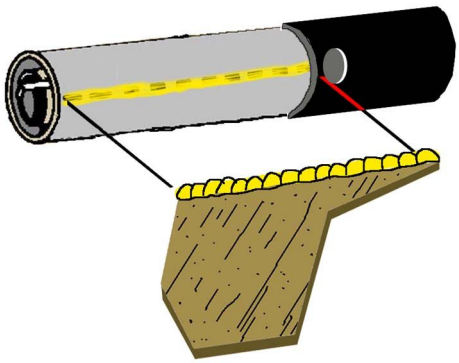


Fig. 11

- **Step 14** Attach the booster fins to the ST-73 body tube using the same method from Step 12. As shown in Fig. 11, the leading edge tip of each fin should just touch the back edge of the coupler, and the trailing edge at the fin root should be even with the back edge of the tube. Allow each fin to dry completely before proceeding with the next fin.

- **Step 15** Apply a bead of glue around the large-diameter shoulder of the transition and insert this into one end of the ST-83 payload tube. Wipe away any glue which squeezes out using a damp hobby brush, or a damp, soft cloth. Insert, but do not glue, the nose cone in place at the other end of the ST-83 tube. This should be allowed to fit snug, but otherwise free to be removed to provide access to the payload compartment.

- **Step 16** Fill the grain of the fins, the body of the transition, and the body of the nose cone with your choice of lightweight filler

compound. Do not apply filler to the shoulder areas of the nose cone or the transition. We prefer Elmer's Fill-N-Finish, thinned to a pea-soup consistency, and brushed into the grain. Allow to dry thoroughly for at least a full day before attempting to sand smooth. Sand with 220-grit paper to remove the excess filler, then smooth and polish the remaining filler with 400- and 600-grit paper. Re-apply filler to any areas that may require attention, allow to dry, then sand, repeating this process until the surfaces are blemish-free. Tack-rag the entire model after each pass to remove sanding dust.

- **Step 17** The illustration in Fig. 12 shows the correct method of applying primers, paints, and clear coats to your model. This method applies to any form of spraying – airbrush, aerosol, or spray gun. Always spray in the same direction, top to bottom -- ***never*** side-to-side or bottom-to-top. Our preferred finishing method involves several coats of Rust-O-Leum White Clean Metal Primer, with sanding after the second coat to remove rough patches using 220-grit paper, followed by repeated coats of primer and sanding with 400-grit, and finally 600-grit paper. When the surface is smooth, and as free of imperfections as possible [ie – the spiral-wrap in the tube is completely filled, and there are no bare places where the tube shows through...], tack-rag the model to remove all of the sanding dust.

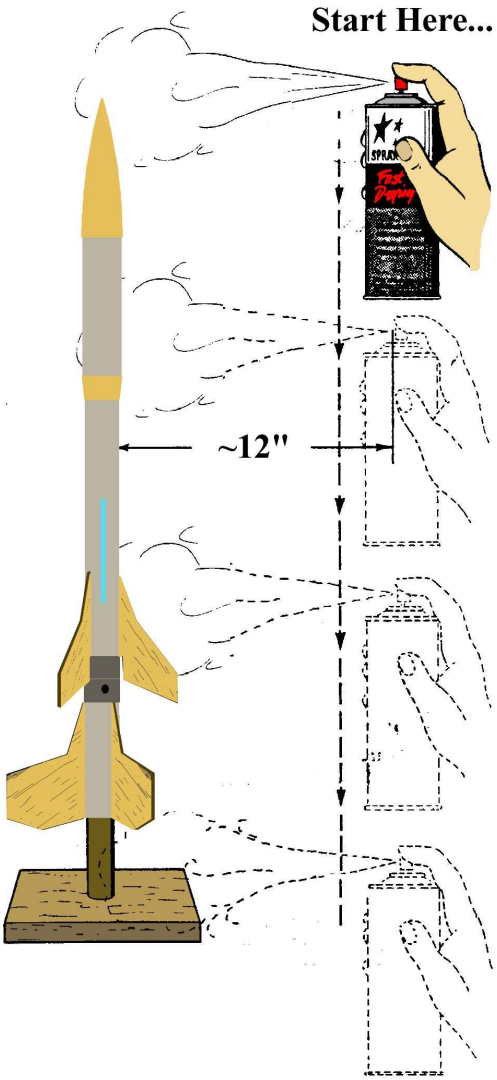


Fig. 12

- **Step 18** The colors you choose for your model, as well as the type of paint you wish to use, are entirely up to you. Be sure to test your paint on a prepared test surface with the primer you chose. Finding out after you've sprayed the model that your paint is not chemically compatible with your

primer is bad for your model...

- **Step 19** We suggest painting the nose cone and the payload subassembly as separate pieces, with a scrap piece of body tube as a holder. Do not get any primer, paint, or clear coat on the shoulder area of the cone or the bulkhead. Doing so may cause the shoulders to become too tight when they are slipped into the body tubes, damaging the tubes and possibly the shoulders themselves.

- **Step 20** We recommend the use of waterslide decals, either those printed commercially or those you can print yourself using a personal computer and an ink jet (or laser) color printer. Prepare the decals according to the instructions provided by the distributor of the sheet. Apply at least one complete coat of high-gloss acrylic clear [we've used both Krylon and Valspar brands with success...] to the model, and allow to dry thoroughly – at least one full day. Apply all of the decals and allow these to dry at least one full day before wiping down any adhesive residue with a dry, soft cloth. Finally, apply a sealing layer of the acrylic spray over the decals and allow this to dry at least a full day before handling the model.

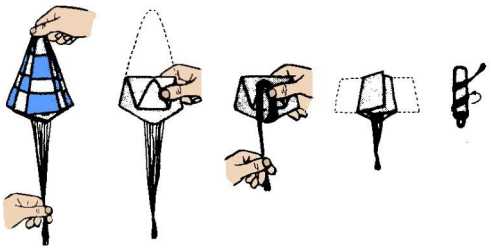


Fig. 13

- **Step 21** Study the method for packing the parachute shown in Fig. 13. The object is not to crush or compress the parachute in such a way that it cannot open when deployed. Wrap the lines around the folded material a little loosely, never tightly. In cold climates, or during winter, it is highly recommended that you give the parachute a dusting with talcum powder before folding. Never fold your parachute or pack it for storage inside the body tube of your rocket. Leave it opened, and separate from the rocket. That's why we suggest attaching it with a snap link – it's easier to remove it after flight.

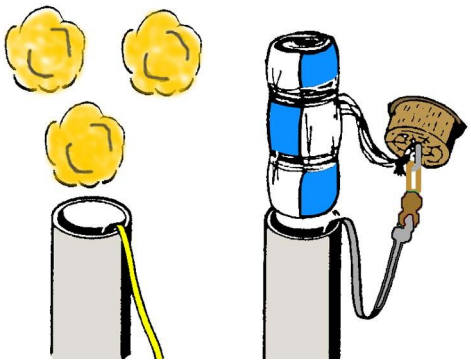


Fig. 14

- **Step 22** The correct method to pack your parachute into the model is shown in Fig. 14. If you are

using the traditional sheets of flameproof wadding (similar to a sheet of bathroom paper, but treated with a flame-resistant chemical) be sure to use at least three sheets, more likely four sheets, crumpled into loose wads. If you choose to try shredded newsprint cellulose insulation (just what it sounds like, uses the same type of flame-resistant chemical treatment), use enough to achieve about 2” to 3” of fill at the inside-bottom of the main body tube. Push the material into the body tube with a wooden dowel, or a large-diameter pencil, but do not pack either material tightly into the tube. The object with both materials is to create a gas seal, protecting the plastic parachute material from the hot gases and particles ejected from the top of the motor when the recovery deployment charge goes off. These wadding components must blow out of the rocket, pushing the parachute out ahead of them. One advantage to using the cellulose wadding is that it instantly disperses in the air and floats back slower than the wadding sheets, giving any hot residue more time to cool down. It also doesn't fall in one big lump, either. It scatters, making it less objectionable.

- **Step 23** When preparing the rocket for flight, fit the nose cone into the payload body and check to see if the fit is loose or tight. If loose, wrap a layer of masking tape around the shoulder of the cone and try fitting it again. You don't want an excessively tight fit, but you don't want the cone coming out in flight, either. The same applies to the shoulder of the transition into the sustainer tube.

Developed for BARCLONE Rocketry by C. P. McGraw

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 it's 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 Size
0.00 – 1.25	1/4A – 1/2A	50'
1.26 – 2.50	A	100'
2.51 – 5.00	B	200'
5.01 – 10.00	C	400'
10.01 – 20.00	D	500'
20.01 – 160.00	E, F, G	1000'
160.01 – 320.00	2G	1500'

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