

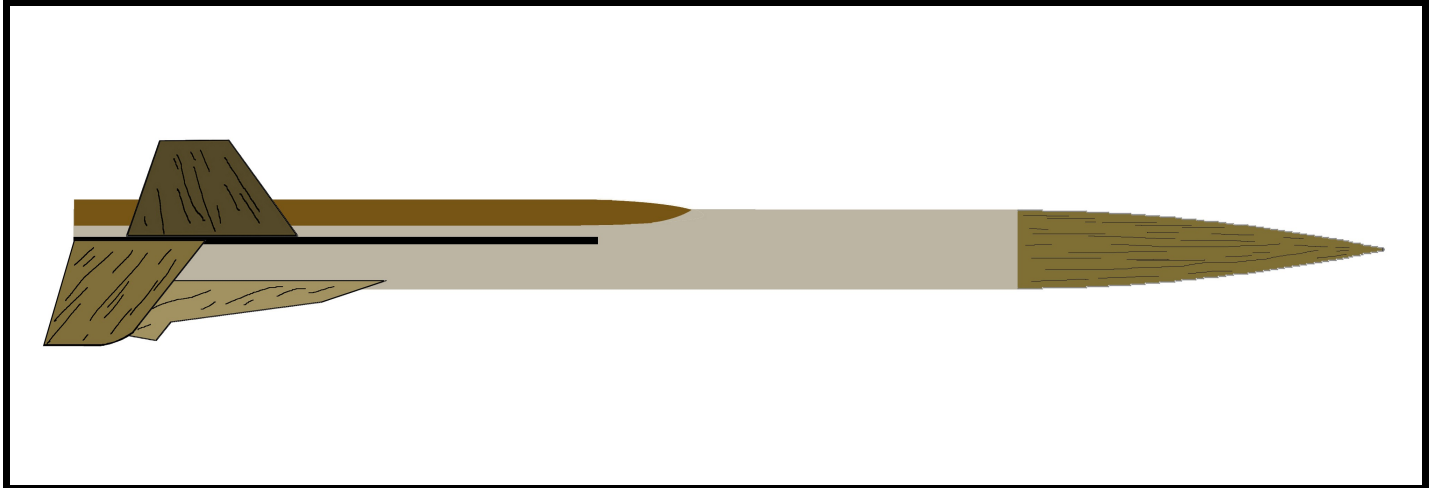


*Skill Level 2*

# Vulture

*Created By C. P. McGraw*

*Revision Date: Feb 27, 2005*



Length	12.793"
Diameter	0.759"
Fin Span	6.91"
Weight	0.80 oz

### *Parts List*

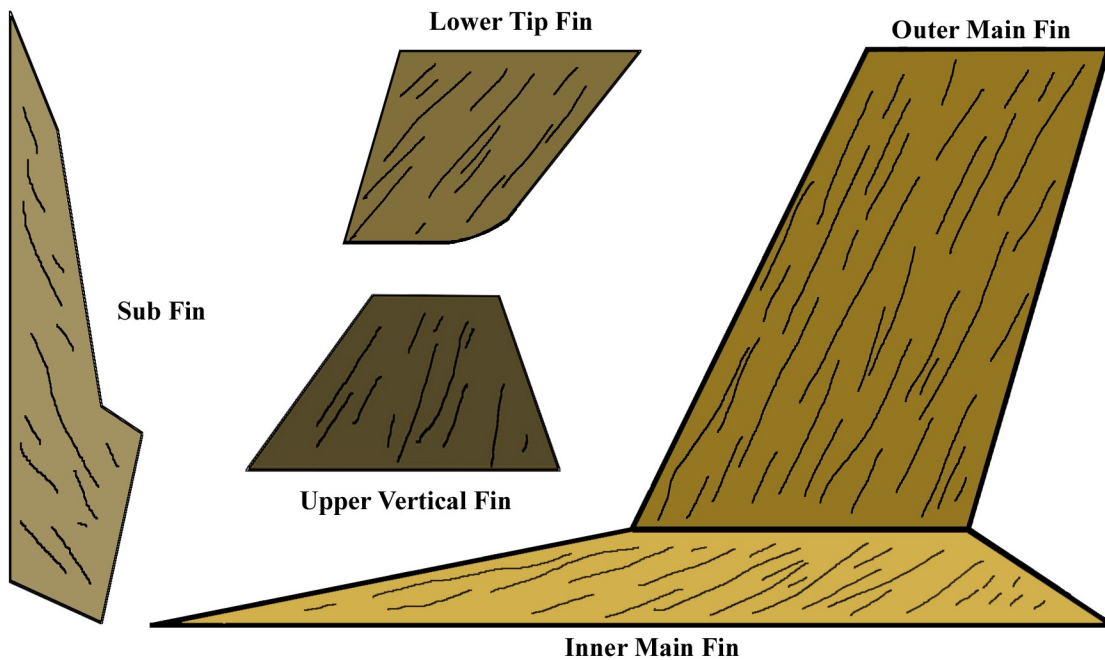
Nose Cone.....	BC-735
Body Tube.....	ST-790
Thrust Block.....	TB-7
Engineering Hump.....	1/2" x 1/4" x 6" Balsa Stock
Fin Stock.....	1/16" Balsa Sheet
Launch Lug.....	1/8" x 2.25"
Parachute.....	CPK-12
Shock Chord.....	SC-24
Shock Chord Mount.....	SCK-24
Snap Links.....	(2) #12

### **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; one expended 18mm motor casing; sheets of 110-lb cardstock for templates and patterns.**

**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.**

Make 2 Each From 1/16" Balsa Sheet



### Alignment Guide



End View



Top View



Side Profile



### "V" Notch

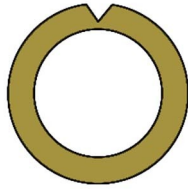


Figure 1

- **Step 1** Modify the TB-7 ring as shown in Fig. 1. Tie a slip knot around the ring using the Kevlar thread (shock chord mount), and pull the knot tight. The knot must be against one of the **faces** of the ring, and the thread must lay in the "V" notch. Secure the thread and the knot with a layer of thinned glue, and allow to dry.
- **Step 2** Give the body tube and the nose cone a sanding with 220-grit paper. Remove only the surface shine from the tube, and the fuzziness from the nose cone. Do not sand through the outer paper layer, or gouge the surface of the cone.
- **Step 3** You will find it very helpful to print out at least two copies of the fin pattern sheet, and three copies of the fin alignment guide. These should be printed on 110-lb cardstock. Remove only the silhouette from the alignment guides with a sharp hobby knife; leave all of the remaining outside area intact.

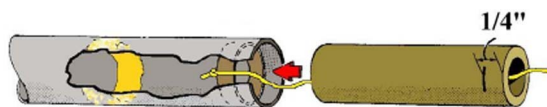


Figure 2

- **Step 4** Mark an expended engine casing 1/4" from one end. As shown in Fig. 2, apply a generous bead of glue around the inner diameter of the body tube, 2.5" from one end of the tube. This end will become

the bottom of the tube. Insert the TB-7 ring into the tube, with the Kevlar thread knot facing forward, and the remainder of the thread pulled toward the rear, through the center of the ring and the casing, with the short side of the mark also toward the rear. Use the casing to push the ring deeper into the tube, through the glue bead, until the mark on the casing is even with the rear edge of the tube. Remove the casing immediately, and set the tube aside in an upright position for about 20 minutes.

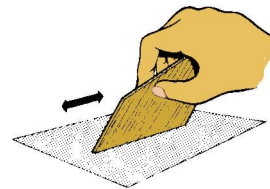


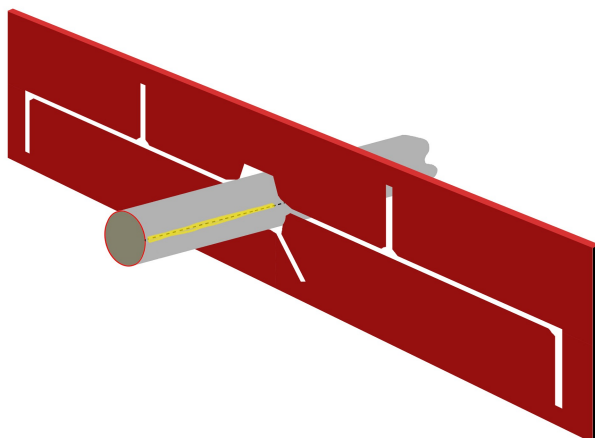
Figure 3

- **Step 5** Using the patterns from one of the cardstock fin sheets, cut out all of the fins from the 1/16" sheet of balsa. Square up the **root edges** of all the fins by placing each pair of matching fins together and carefully sanding them against a piece of 220-grit paper taped or tack-glued to a flat surface, as shown in Fig. 3.
- **Step 6** Lay out a piece of wax paper over the second fin pattern sheet, and align the three pieces of the main fin together over the wax paper. Mark the larger fin piece where the two strakes come in contact. Apply glue where the pieces touch, and assemble, using a metal straightedge to keep the root edges aligned with each other. Weight or clamp these pieces down firmly for about 20 minutes to dry. Repeat this sequence for the other main fin.
- **Step 7** Use the Hump Shaping Template to carve and shape the Engineering Hump from the piece of 1/2" x 3/8" x 6" balsa stock. Start by shaping the **top-down** view to get the front curve. Ignore the notch-out at the tip – this is a result of the shaping

done in the next step. Next, look at the **rear view** of the hump to sand the correct bevel along the sides of the hump. Finally, use the **side profile** to sand down the **top** of the windscreen area to the correct shape – the bottom of the hump will be taken care of in the next step.

- **Step 8** Wrap a piece of 220-grit paper around the body tube and secure this with clamps or tape. Place the engineering hump on top of the sandpaper and contour-shape the **bottom** of the hump to match the cylindrical shape of the tube. When the shape matches and the hump fits cleanly on top of the tube, glue the hump to the tube, as shown in the full cover profile. The rear edge of the hump is even with the rear edge of the tube. Slide the three alignment guides over the tube down over the engineering hump, separated by about 1.75” between them. Let the glue dry at least 20 minutes.

- **Step 9** As shown in Fig. 4, with the three alignment guides still over the tube, mark the tube for the main fins, the sub fins, and the launch lug, according to the cutout edges.



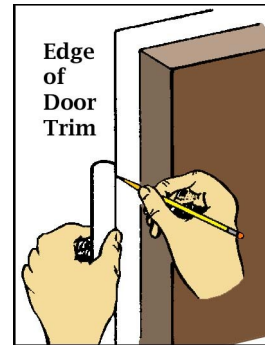
**Figure 4**  
(Some details omitted)

- **Step 10** Remove the guide. Using the trim around a door, as shown in Fig. 5, or a length of brass angle stock as a pencil guide,

extend the alignment lines forward from the rear edge of the tube as follows:

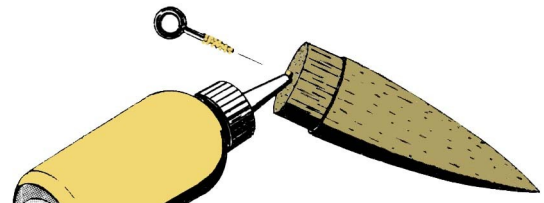
- Sub Fins: 3”
- Main Fins: 5”
- Launch Lug: 4.5”

Place marks on the launch lug line at 4.5” from the rear of the tube, and 2.25” aft of this mark.



**Figure 5**

- **Step 11** Apply a layer of thinned glue to the body tube along all of the fin lines and the launch lug line, and to all of the root edges of the fins. Give these about 20 minutes to dry.



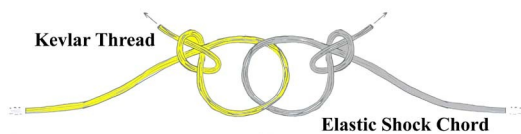
**Figure 6**

- **Step 12** Use the threads of the screw eye to cut a matching hole in the base of the nose cone. Reverse the screw eye back out, then force glue into the hole and coat the threads, as shown in Fig. 6. Re-thread the screw eye into the hole, but do not wipe away the excess glue. Let dry.

- **Step 13** Assemble the parachute kit according to the SEMROC instruction sheet,

then attach the barrel end of one of the snap links to the shroud lines.

- **Step 14** Pull the Kevlar thread back through the body tube and out the top end. As shown in Fig. 7, tie a slip knot in the free end of the Kevlar, then push one end of the elastic shock chord through the loop and tie a slip knot in that end of it, around the Kevlar thread. Pull the excess length of the lines out of the loops and firmly tighten the knots against each other. Secure the knots with a layer of thinned glue. Tie the opposite end of the elastic chord to the barrel end of the remaining snap link.



*Figure 7*

- **Step 15** Apply a bead of full-strength glue to the root edge of one of the main fins, and to the body tube along one of the main fin alignment lines. Press the fin onto the body tube, keeping the root edge parallel to the line or directly on top of it. Remember that the main fins are not perpendicular to the body. They have a slight droop in their alignment to the tube, but the main fins are parallel to each other. Hold this fin in place for about 12 seconds before releasing it. Use a soft-bristle artists' brush, moistened, to smooth out the glue that squeezes from the joint into a fillet. Slide all three alignment guides over the tube and down over the fin, separating the guides by about an inch. Adjust the fin carefully as you do this, nudging the fin into its proper alignment relative to the body tube. Allow about 30 minutes for this fin to dry, then remove the guides and repeat this sequence for the other main fin, and for each of the two subfins.
- **Step 16** Using two alignment guides, mark the **top of the main fins** in the

locations for the vertical fins, and draw lines between these marks using a pencil and a straightedge. Attach the vertical fins to the tops of the main fins along these lines in the same manner as step 15, and use the alignment guides to hold the fins in their proper places until the glue dries.

- **Step 17** Attach the main fin tip lower vertical fins to the main fin tips in lime manner, using the guides to maintain the fins in place until the glue dries.
- **Step 18** Attach the launch lug to the body tube along the lug alignment line, between the mark at 4.5" and the mark 2.25" aft of that mark. Allow to dry.
- **Step 19** When all of the glue from the previous steps has dried for a full day, apply a bead of full-strength glue along the root-edge joints with the body tube. Using your finger, form a heavier fillet with the glue along these joints, wiping away only the excess. Do not push your finger into the joint too deeply, or you will remove too much glue. The glue will shrink as it dries, so all you want to do is smooth the glue out for the full length of the joint. Allow to dry.
- **Step 20** Apply a lightweight filler to all exposed balsa surfaces to fill the grain. We recommend [Elmer's Fill-N-Finish](#), thinned with water to a cream soup consistency, and brushed onto the balsa with a wide (1/4" to 3/8") hobby brush. Coat both sides of the fins in the same step to reduce the warping that will occur from expansion and swelling. Allow a full day for this to dry before sanding smooth with 220-grit paper. Inspect the surface, and retouch any areas that have become bare. Sand again when dry, and re-inspect, repeating this process until all of the balsa has been hidden and any gouges from sanding have been eliminated. Tack-rag the model thoroughly to remove sanding dust.

- **Step 21** The illustration in Fig. 8 shows the correct technique for spraying primer, paint, and gloss coat onto your model, regardless of the equipment used. Always spray from the top downward – never from bottom-to-top, or side-to-side.

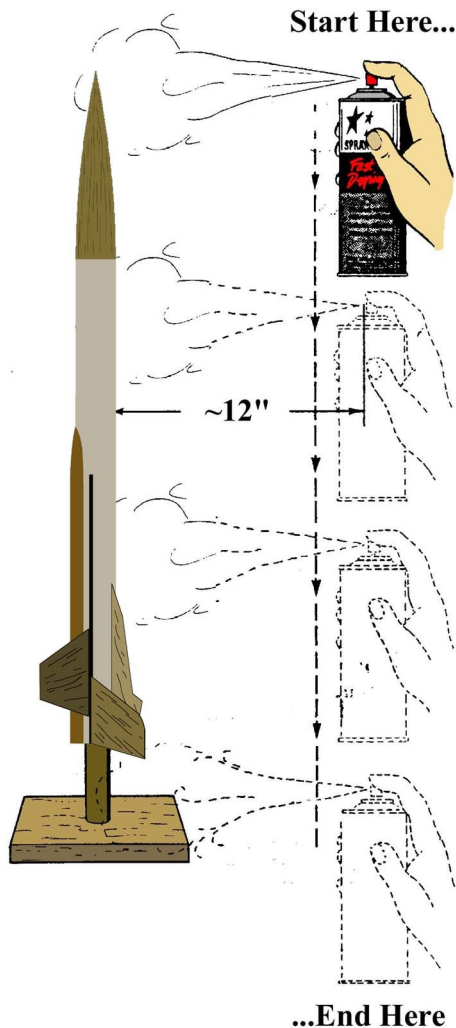


Figure 8

- **Step 22** Apply at least two full coats of primer to the model, allowing a day between coats, before sanding with 220-grit paper. We recommend **Rust-O-Leum White Clean Bare Metal Primer**. Tack-rag the model after sanding and apply another coat of primer, allow to dry, sand, and inspect. Repeat this sequence as often as needed to achieve a good, smooth, fully-primered surface with no gouges or blemishes, such as the spiral wrap line in the tube. When

satisfied, give the model one final prime coat, let dry, then sand with 400-grit paper for a polished look. Do not handle the surface of the model with your fingers after this step, to reduce the chances of a ruined finish.

- **Step 23** Tack-rag the model to remove dust, then apply a base color of white to the entire model. Make sure the paint you choose is compatible with the primer you've used before trying to apply it to the model. We suggest a bright red or metallic copper for the nose cone color, and your choice of matching trim. Allow each of these color coats two days drying time, or until the solvent smell dissipates, before masking for each successive color.
- **Step 24** When the color coats have fully dried, apply a coat of gloss clear Acrylic to the entire model, to prepare it for any decals you may wish to apply. We have used formulas from **Krylon** and **Valspar** with equal success. When the decals have dried, wipe the surface carefully to remove any decal residue, using a soft cloth. Finally, seal the decals with a second coat of the Acrylic.

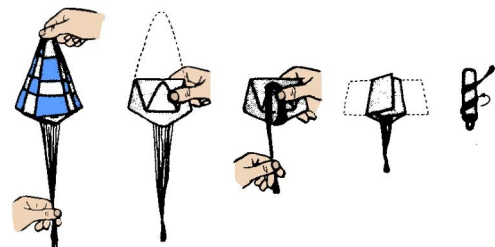
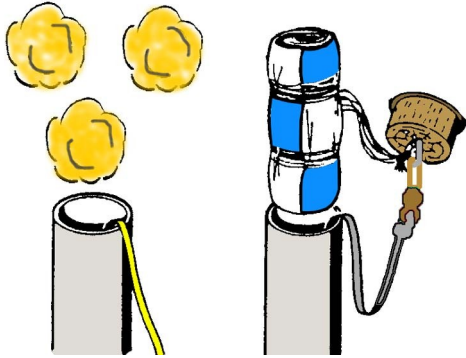


Figure 9

- **Step 25** Study the illustrations in Fig. 9 to see the correct method for folding your parachute prior to launch. Only do this before the flight – never fold or store the parachute in the model between sessions. Leave the parachute out of the body, opened. In almost every climate throughout the year, you will find it helpful to lightly dust the parachute with talcum powder

before flight, to reduce the chances of a recovery failure.



*Figure 10*

- **Step 26** Attach the snap links on the parachute and the shock chord to the screw eye in the base of the nose cone. As shown in Fig. 10, crumple at least three sheets of recovery wadding (may require more), or use at least 2" of shredded cellulose insulation, to protect the parachute from the deployment charge in the engine. Do not pack this material tightly, as it must be ejected for the parachute to come out. Next, insert the recovery lines, followed by the parachute itself. Insert the nose cone into the top of the body.
- **Step 27** We recommend either the A8-3 or the A8-5 engine for your first flights. The -3 engine should deploy at or just before apogee, and the -5 will deploy after apogee. Fly with this engine until you are comfortable with how the model flies.

*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
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