



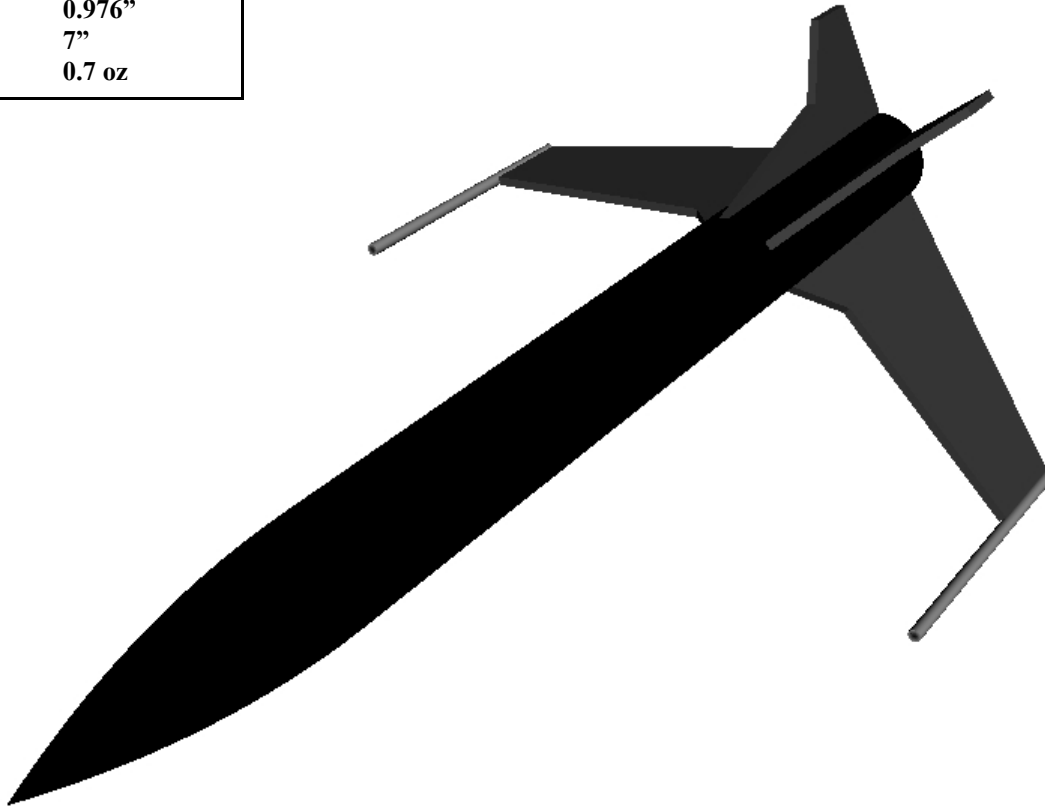
*Skill Level 1*

# Nightwing

*Original design by EVRocketry  
Model designed by C. P. McGraw*

*Revision Date: Sep 25, 2005*

Length	11.23"
Diameter	0.976"
Fin Span	7"
Weight	0.7 oz

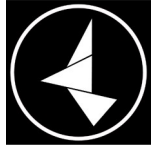


*Rendered with RockSim*

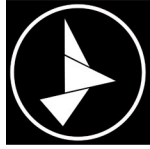
### *Main Parts List*

Nose Cone.....	[BMS] BNC-50K
Body Tube.....	BT-50 8.5"
Motor Tube.....	BT-5 2"
Centering Rings.....	[BMS] (2) CR-550
Thrust Block.....	[BMS] CR-35
Fin Stock.....	3/32" Sheet Stock
Tip Probes.....	(2) 3" x 1/8" Dowel Stock
Launch Lug.....	LL-225
Parachute.....	CPK-12
Shock Chord.....	SC-24
Shock Chord Mount.....	SCK-24
Screw Eye.....	SE-1
Snap Links.....	(2) #12

**Decal Images**  
(Full Size)



*Upper Port  
Lower Starboard  
(Make 2)*



*Upper Starboard  
Lower Port  
(Make 2)*

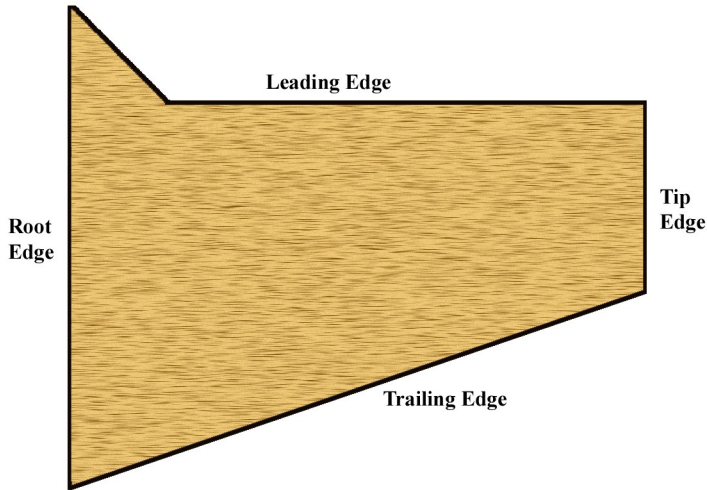


*V-Fin Port-Sides  
(Make 2)*

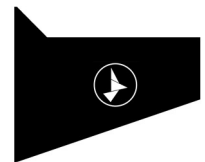
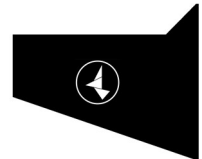


*V-Fin Starboard-Sides  
(Make 2)*

**Parts Patterns**  
(Full Size)

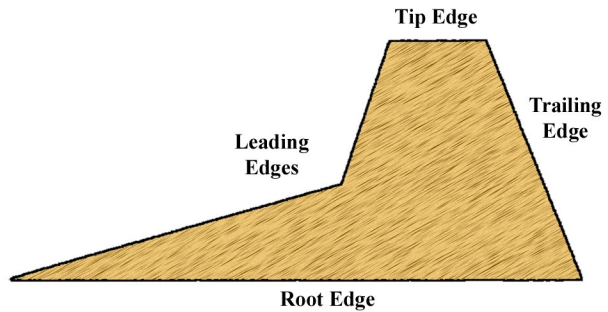


**Decal orientation  
and placement**  
(Top & Bottom)



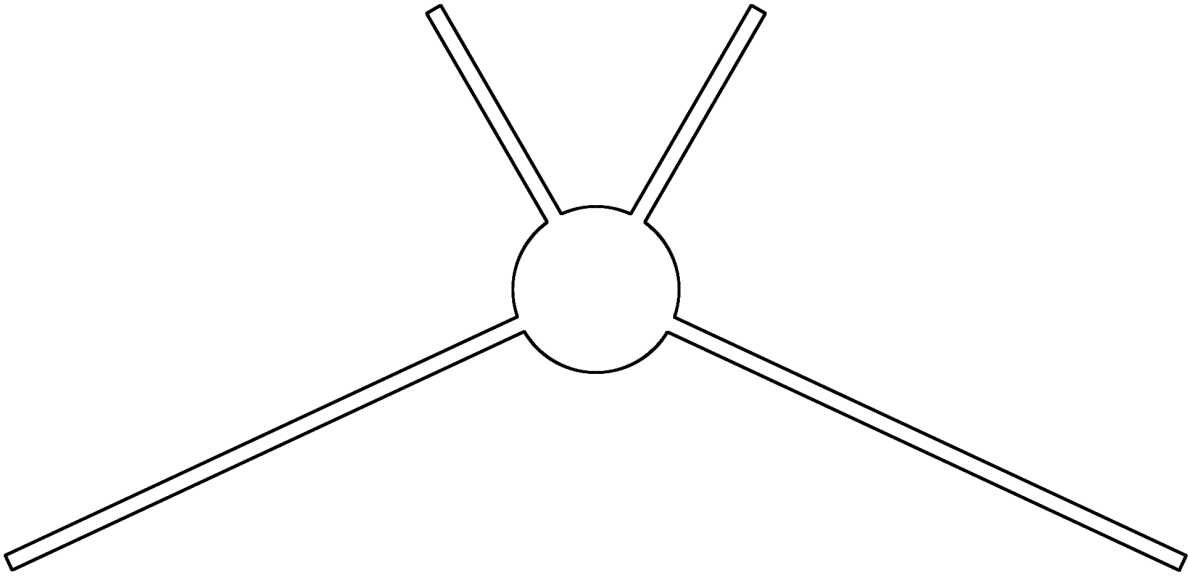
**Wing Panels**  
(Make 2)

**Decal orientation  
and placement**  
(Port & Starboard)



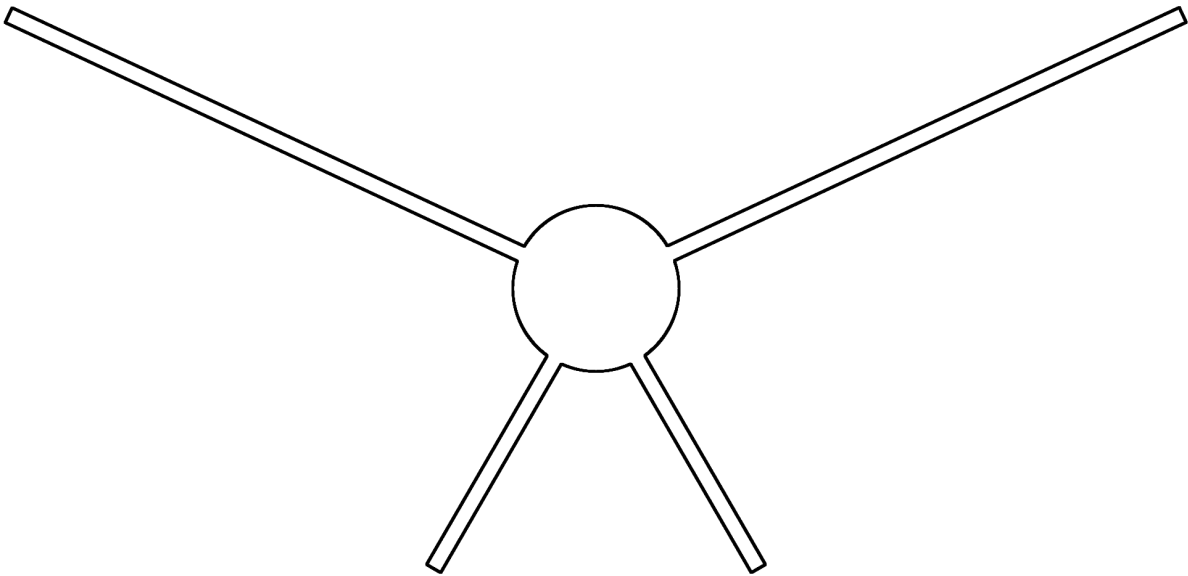
**Vertical Fin Panels**  
(Make 2)

*Fin Alignment Guide*

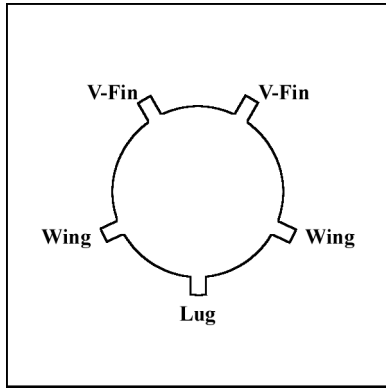


Fold Line

Fold Line



## Fin & Launch Lug Marking Guide



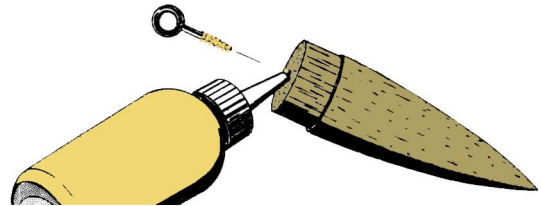
Print the Marking Guide and the Alignment Guide onto heavy cardstock. Glue both Guides to pieces of poster board to give them some additional thickness. Cut out the area inside the outlines with a sharp hobby knife and a steel ruler. Using the back of the knife blade, score the Alignment Guide along the two “Fold Lines”, then carefully bend each side 90 degrees along this line to form a “U” shaped holding tool. This tool will hold the wings and the vertical fins in their proper alignment while the glue dries.

## Main Instruction Sequence

### Balsa & Tube Preparation

- **Step 1** Cut out all of the fins from 3/32” thick balsa sheet. Square up the root edge of each fin, and the tip edges of the two vertical fins. Gently round over the remaining edges of all fins, and give their flat surfaces a light sanding with 220-grit to smooth out any raised grain.
- **Step 2** Apply a thinned layer of grain filler compound to the flat surfaces of the fins, to all of the rounded edges of the fins, and to the main area of the nose cone. Do not get filler compound on the root edges, the tip edges of the vertical fins, or the shoulder area of the nose cone. Apply the same filler compound to the spiral gap around the body tube. Set these aside to dry completely.

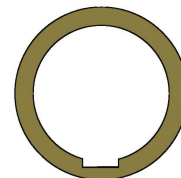
- **Step 3** When the grain filler compound is dry, sand the excess compound off with 220-grit, and finally 400-grit. Do not sand too deeply. Examine all the surfaces for blemishes and gouges, and repeat this sequence until the imperfections are no longer visible. Do not alter the shape of the balsa parts by over sanding.
- **Step 4** Apply a thinned bead of glue to the root edges of all four fins, and to the tip edges of the vertical fins. Set these aside to dry.



- **Step 5** Use the threads of the screw eye to cut a hole in the shoulder base of the nose cone. See the illustration above. Remove the screw eye and fill the hole with glue. Coat the threads with glue and re-thread the screw eye into the hole. Do not wipe away the excess glue. Allow the glue to dry completely, with the nose cone pointed downward.

### Engine Mount Assembly

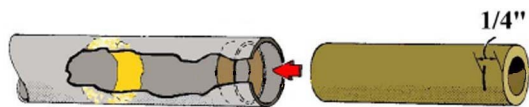
- **Step 6** Mark the motor tube 0.75” from one end. Slide one of the CR-550 rings over the motor tube from the far end and down until the ring touches this mark. Apply a bead of glue around the joint on both sides and allow to dry.



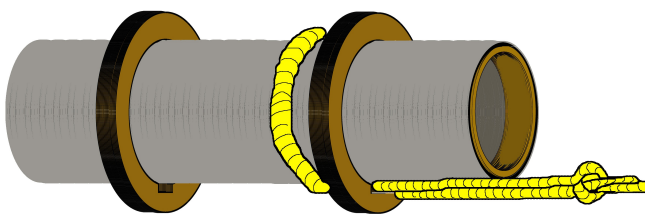
- **Step 7** Using a 1/8” wide sanding twig, sand a flat notch into the inside diameter of the second CR-550 ring, to a depth of about

1/16". See the illustration above.

- **Step 8** Slide the notched CR-550 ring down onto the top of the motor tube until it is one ring thickness below the edge of the tube (between 1/16" and 1/8"). Apply a bead of glue around the joint on both sides of the ring, but not to the notch area. Keep this notch open and clean. Allow the glue to dry.



- **Step 9** As illustrated above, use an expended 13mm motor casing to make a push tool. Mark the casing 1/4" from the nozzle end. This will be the depth gage target line.
- **Step 10** Apply a bead of glue to the top inside of the motor tube (the end with the notched ring) about 1/2" down. Insert the CR-35 ring into the bottom of the tube, and push forward with the marked motor casing, until the target line is even with the rear edge of the tube. Do not push the ring any farther. Remove the casing immediately, and allow the glue to dry.



- **Step 11** Use the illustration above as a guide to this sequence. Push one end of the Kevlar thread through the notch in the top ring from the front, and pull about 6" through. Wrap the thread around the tube and push the end back through the notch. Tie this short end of the thread around the long end with a slip knot, then pull out the slack carefully, pushing the loop against the back of the ring until all of the excess thread

has been removed from the loop. The knot should be aligned in the notch. Apply a bead of thinned glue to this knot, and around the joint between the thread and the ring. Allow to dry.

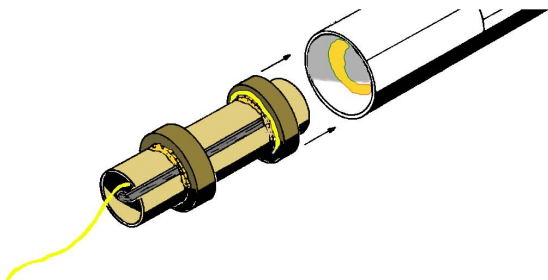
#### Fin & Launch Lug Attachment

- **Step 12** Mark the main body tube using the Fin & Launch Lug Alignment Marking Tool, found at the beginning of these instructions. Using a piece of outside corner trim, or the trim around a door, extend these marks upward from the rear of the tube for a distance of 4".
- **Step 13** Mark the two vertical fin lines at 3" from the rear edge of the tube. Mark the two main wing lines at 2.5" from the rear edge of the tube. Mark the launch lug line 3.25" and 1" from the rear edge of the tube.
- **Step 14** Apply a bead of thinned glue to the body tube along the fin alignment lines, between the edge of the tube and the forward marks. Apply glue to the launch lug alignment line between the two marks. Keep the width of the glue to less than 3/16" if possible. Allow the glue to dry.
- **Step 15** Apply a generous bead of glue to the root edge of one of the vertical fins. Carefully place the root edge against the body tube, with the trailing edge of the fin even with the edge of the tube, then quickly remove the fin. Pause for about half a second, then reattach the fin in place and hold with your fingers until the glue tacks up. Take a moist hobby brush and wipe away any of the glue that squeezes out from the joint, forming a shallow fillet with the remaining glue. Carefully slide the two Fin Alignment Tools down from the top of the tube to hold each fin in its correct position while the glue dries. Repeat this step for the remaining vertical fin and the two main fins.
- **Step 16** Shape or otherwise dress one end of each of the 3" long pieces of 1/8" dowel stock. This will become their front ends. Mark both dowels 1" from their non-tapered

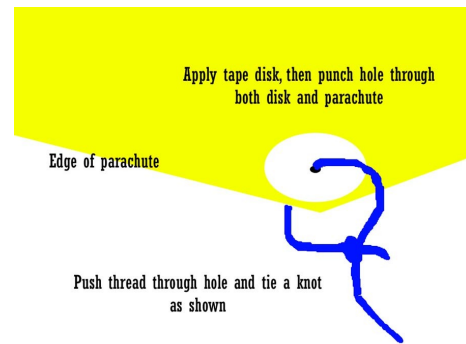
ends, and apply a layer of thinned glue to one side of both dowels in this area. Allow the glue to dry.

- **Step 17** In a similar manner to the fin attachment procedure of Step 15, apply a bead of glue to the tip edge of one of the main wings, then press one of the tip probes against the fin between the rear edge and the mark on top of the glue layer, pull the probe free, then reattach the probe in its proper place and hold it with your fingers until the glue tacks up. Wipe away the excess glue with the moist hobby brush, and allow to dry. Repeat this step for the other tip probe.
- **Step 18** Apply a layer of thinned glue to the launch lug and allow to dry. Using the procedure in Step 15, attach the lug to the body tube between the two marks on the lug line and allow to dry.

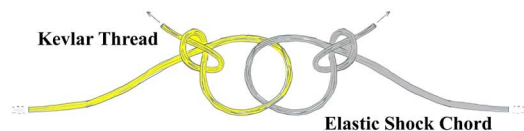
#### Final Assembly Steps



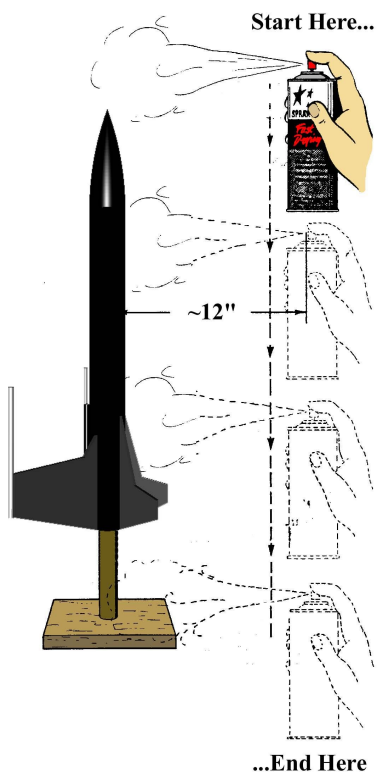
- **Step 19** Run the Kevlar thread down through the engine mount from the top, pulling all of the thread out the bottom. Notice the illustration above. Spread a generous layer of glue around the inside of the main body tube, about 1" from the rear edge, and about 1" wide, using the brush. Insert the motor mount notched-ring-first into the bottom of the main body tube, and up through the glue until the rear edge of the motor tube is even with the rear edge of the body tube. Do not pause while pushing the mount into the tube, or the glue will "freeze" the mount in the wrong place. Set this assembly onto a rack to hold it in an upright attitude while the glue dries.



- **Step 20** Assemble the parachute as shown in the SEMROC instructions, with the modification described in the illustration above. Apply the tape disks to the outlined places at the points of the parachute, then punch a small hole through the center of the each disk and through the parachute film just large enough for the shroud line to pass through. Push the ends of the shroud lines through these holes and tie them with a slip knot, then pull the loops up against the parachute, but not too tightly. Apply a very tiny, thinned drop of glue to these knots. You want just enough to secure the knot, but not enough to interfere with the function of the parachute. Gather the shroud lines as you normally would, and attach the lines to one of the two snap swivels.



- **Step 21** Tie the free end of the Kevlar thread to one end of the elastic shock chord, using a double slip loop knot as illustrated above. Pull the knots together tightly. Attach the remaining snap swivel to the opposite end of the shock chord and apply a tiny drop of thinned glue to all of these knots. Allow to dry.
- **Step 22** Sand the body tube around the fins to remove any excess glue, then tack rag the pieces to remove the dust.

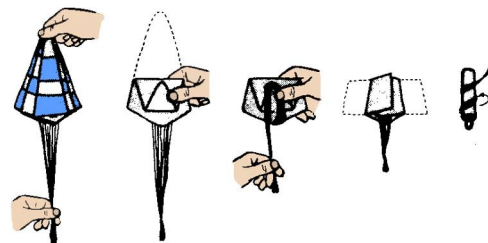


- **Step 23** Run the shock chord back up the model and out the top end. Attach the snap link on the shock chord to the screw eye, then push all of the chord back into the body tube. Insert the nose cone into the body, and place the model on a holding spike. Prime the entire model with at least two full coats of primer, allowing each coat to dry thoroughly (about a full day each coat) before sanding with 220-grit. Spray the model from top to bottom, as illustrated above, to reduce the chances of having runs in either the primer, the paint, or the gloss coat finish. Inspect the model for excess scratches or blemishes. Spray the model with follow-up coats as needed, sanding between coats until the visible blemishes have disappeared. Use progressively finer grits to achieve a “catalog finish” with the color coat.
- **Step 24** Tack rag the model after the final prime-and-sand cycle, then spray the entire model gloss black. Allow at least two full days for the paint to dry (or until there is no trace of solvent remaining in the paint).

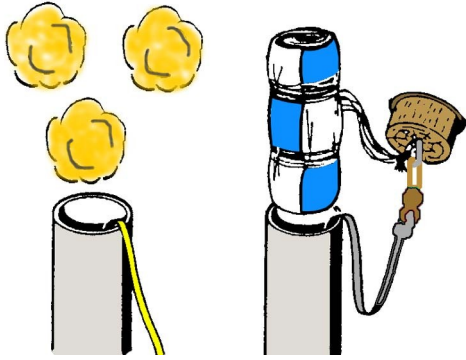
- **Step 25** Apply at least one coat of Future Acrylic finish to the model and allow to completely dry. We recommend spraying this finish. The product is thinned with ammonia, so do all of this outdoors!
- **Step 26** Apply the decals to the model, following the placement illustration at the front of this instruction manual. When these are dry, gently wipe away any adhesive residue with a soft cloth.
- **Step 27** Apply a second coat of Future over the decals to seal and protect them.

#### Flight Preparation Sequence

- **Step 28** Attach the parachute snap link to the screw eye at this time. Also, make sure the shock chord snap link is attached as well.



- **Step 29** Fold the parachute as shown above only when you are about to fly. Do not store the parachute in the model between sessions. You might find it helpful to give the parachute a light dusting of talcum powder in cold climates, and during winter months, to prevent the parachute from opening properly.



- **Step 30** Insert about 2" or 3" of shredded cellulose wadding, or about three wadding sheets, into the body tube. See the illustration, above. Use a pencil or a dowel to gently tamp this material down to the bottom of the parachute compartment. Do not pack the wadding tightly! The function of this material is to provide a protective gas seal between the motor and the recovery items. The wadding must be loose enough to blow out the top of the tube completely at deployment. An overly-tight packing will prevent this from happening, and your model will be damaged. Insert the shock chord next, followed by the parachute, then insert the nose cone.
- **Step 31** We only recommend one engine for this model – the Estes A3-4T. There is no engine clip in this model, so the engine must be held in place with a good friction fit. Wrap masking tape around the engine casing to make the fit as snug as possible without damaging the model. Insert an igniter and go fly!

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

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by EchoVictor Rocketry**

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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