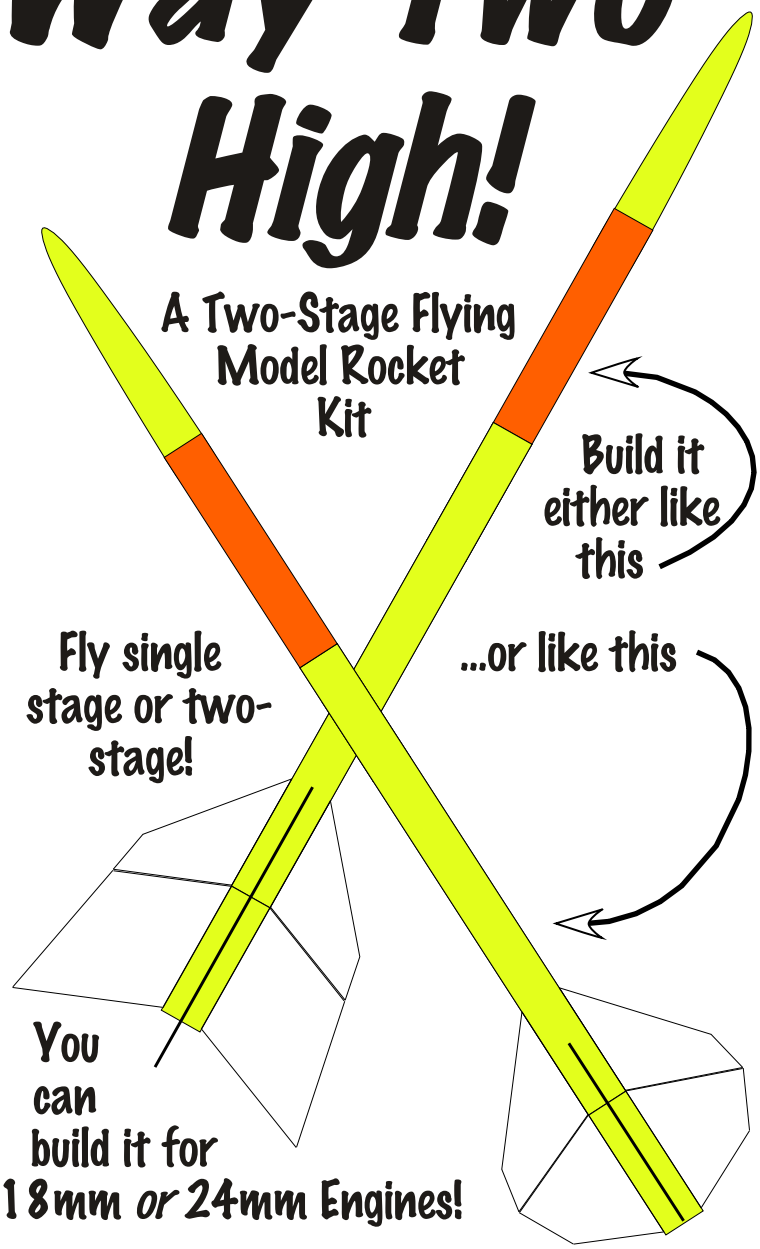
Way Two High!

A Two-Stage Flying Model Rocket Kit



Any way you build it - it flies *Way Two High!*

Specifications:
Length: 24.75"/62.87 cm **Dia.: .976"/24.8 mm**
Weight: 2 oz/57 gm **Streamer Recovery**
Skill Level: Beginner/Intermediate

This is a model rocket kit requiring construction. Tools, adhesives, finishing materials, launch equipment and engines are not supplied.

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KWTH-18/24

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About the *"Way Two High!"*

For safe, stable flight, the Center of Gravity (balance point of the model) should be at least 1.25" ahead of the Center of Pressure.

Single Stage Flights:

Recommended Engines: (18mm) A6-4 ; A8-3 ; B6-4; C6-5 or 7; (24mm) C11-7; D12-5 or 7; E9-6 or 8

Approximate Center of Pressure: 19.25" from tip of Nose Cone

Two Stage Flights:

Recommended Booster Engines: (18mm) B6-0; C6-0; (24mm) C11-0; D12-0

Recommended Upper Stage Engines: (18mm) A6-4; B6-6; C6-7; (24mm) C11-7; D12 - 7; E9 - 8.

Approximate Center of Pressure - Big Fin Version: 21.75" from tip of Nose Cone

Approximate Center of Pressure - Small Fin Version: 21" from tip of Nose Cone

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Please be sure to read the instructions thoroughly before beginning. Test fit all parts before applying adhesive.

Parts List - Be sure to check the following list to assure your kit is complete:
1 Long Body Tube (White), 1 Short (Booster) Body Tube (White), 1 Payload Tube (Red), 1 Tube Coupler/ Pusher Tube (Yellow), 2 Engine Tubes (Red), 1 Engine Block, 4 Centering Rings, 1 Spacer Tube (Green), 2 Sets of Balsa Fins, 1 Balsa Nose Cone, 1 Balsa Bulkhead, 1 Screw Eye, 1 Kevlar Shock Cord, 1 Launch Lug, 1 Yellow Plastic Streamer Material. Note that if you build the 24mm version you will not use all of the parts.

Tools & Materials - You will need the following to complete your model:
Required: Adhesive (A wood glue, such as Elmer's Carpenters Glue or Titebond can be used for all steps and is recommended.); sandpaper (medium - 220 or 280, fine - 320 or 400, & [optionally] extra fine - 500 or 600); pencil or ball point pen; scissors; cotton swab ("Q-Tip", or piece of scrap balsa wood); hobby knife with a sharp #11 blade; scotch tape; sanding sealer (or balsa fillercoat); thinner (appropriate type for the sanding sealer); small paint brush; paint (Spray paint, such as Krylon, Pactra or Testors is recommended. Be sure not to mix different types or brands of paint without testing.) - primer (optional), colors as desired & clear (optional).
Optional: filler material (such as Elmer's Fill & Finish, Elmer's Professional Carpenter's Wood Filler or interior spackling paste); sanding block; tack cloth.

Assembly Instructions

18mm Version:

1) Locate the two white body tubes. Very lightly sand the outside the of the tubes with medium or fine sandpaper until the surface just loses its' shine. This will allow the glue to penetrate the paper of the tube and the fins to stick to the tube better. Take the tube coupler (the yellow tube that fits inside the white tubes) and use it to hold the two pieces of white tube together while you mark the tubes (do not glue!) - see Figure A. Locate the Tube Marking Guide on page 7, and with your scissors, cut it out. Wrap the guide around the body tube - line up the marks on each end to align the guide (see Figure B). Use Scotch tape to hold the guide in place. With a sharp pencil (or pen), mark the body tube at the arrows at the end of each line for the fins and the launch lug. Remove the guide from the tubes. Using a drawer edge, door frame or a small length of metal angle, extend each mark the full length of the tubes (see Figure C). Separate the tubes and set the coupler aside.

2) Locate the two red engine tubes, the four centering rings (the larger ring shaped pieces that fit the outside of the engine tubes) and the engine block (the small ring shaped piece that fits inside the engine tube). Test fit the engine tubes into the centering rings. If the engine tubes do not fit smoothly, you may need to sand the inside of the rings or remove a layer or two of the paper wrap from the inside of the centering ring (use your knife to loosen an edge of the paper and carefully pull it out). Glue two rings to one of the tubes, 1/2" from the ends (as shown in Figure D) and allow to dry - this will be the engine mount for the booster stage.

3) Refer to Figure E for this step. Locate the Kevlar shock cord (it looks like a heavy piece of thread) and firmly tie the shock cord around the remaining engine tube about 3/4" from one end. Thread the loose end of the shock cord through one of the remaining centering rings and slip the ring over the end of the tube and glue into place. Glue the last centering ring to the opposite end of the tube 1/2" from the end. Glue the engine

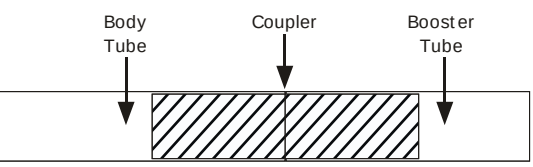


Figure A

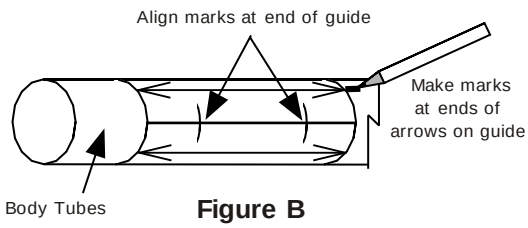


Figure B

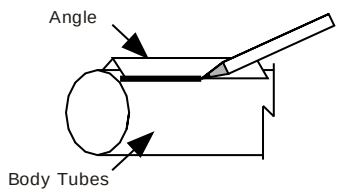


Figure C

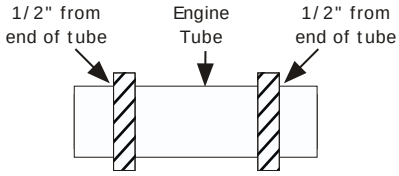


Figure D

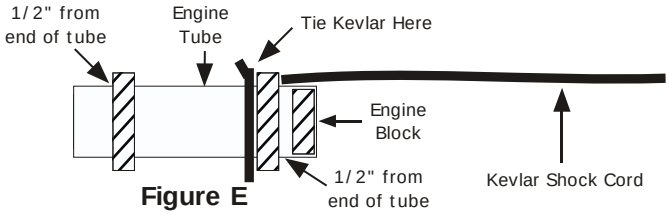


Figure E

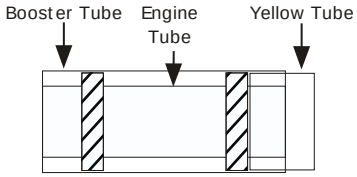


Figure F

block inside the engine tube end as shown in Figure E and allow the glue to dry - this will be the engine mount for the upper stage.

4) Take the engine mount for the booster (from step #2) and the short white booster tube. Test fit the mount and sand the centering rings if needed for a smooth, yet snug, fit. Using a Q - Tip, scrap piece of wood, etc., apply a thin layer of glue all around the **inside** of one both ends of the white tube about 1/2" to 3/4" up inside the tube and glue the mount into the tube so that the ends of the tubes are even. Take the yellow tube and carefully cut a piece about 3/4" long. Glue the yellow tube into the end of the booster tube so that about 1/4" extends out from the tube (see Figure F).

5) Locate the upper stage engine mount (from step #3) and the long white body tube. Test fit the mount and sand the centering rings if needed for a smooth, yet snug, fit. To avoid getting glue on the shock cord, thread it down through the top of the Engine Mount so that the shock cord hangs out the rear of the mount. Using a Q - Tip, scrap piece of wood, etc., apply a thin layer of glue all around the **inside** of one end of the white body tube about 1/2" to 1 1/2" up inside the tube. Insert the engine mount (engine block end first!) and smoothly insert into the body tube so that the bottom end of the engine tube is exactly even with the end of the body tube. After the glue is dry, thread the shock cord back through the engine mount so that the cord is inside the body tube.

6) Locate the two sets of fins - the upper stage fins are the smaller ones (note there are four fins in that set of wood, but you will only use three of them). Carefully remove the fins from the laser cut sheets of wood. You may need to cut them out with your hobby knife. You may build the booster in either the "Big Fin" or "Small Fin" style - if you wish to make the "Small Fin" booster, you will need to carefully cut along the marked lines on the booster fins (use your sharp hobby knife and a metal straightedge held along the lines) and discard the excess wood. See Figure G.
If desired, you may round, or airfoil, the appropriate edges of the fins, this will make the fins more aerodynamic and allow you rocket to fly higher than it would if you just left the fin edges square. It is recommended that you round the leading edge of the upper stage fins, and the trailing edge of the booster fins. Keep all other edges square. See Figures H, I and J.
Using medium grit sandpaper, shape each fin as desired - a sanding block is highly recommended for this. If you don't have a sanding block, lay the sandpaper down on a flat surface and move the edges of the fin against the sandpaper. Be careful not too remove to much wood at one time - roughly shape one side then turn the fin over and do the same on the other side. Continue this procedure with the medium and then fine sandpaper to further shape and smooth the fins until you are satisfied with their appearance. Repeat with extra fine sandpaper if desired.

7) We will now attach the upper stage fins to the long body tube. One fin at a time, apply a thin layer of glue

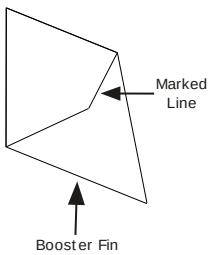


Figure G

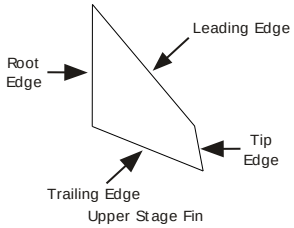


Figure H

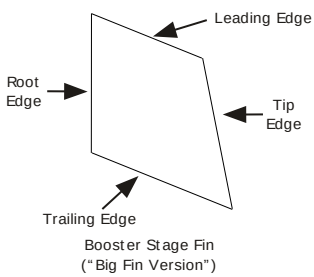


Figure I

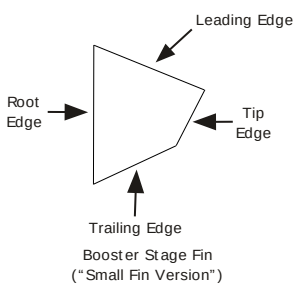


Figure J

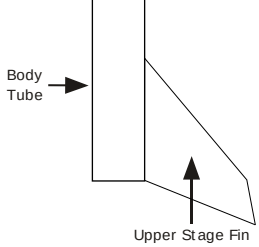


Figure K

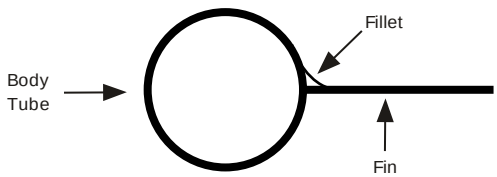


Figure L

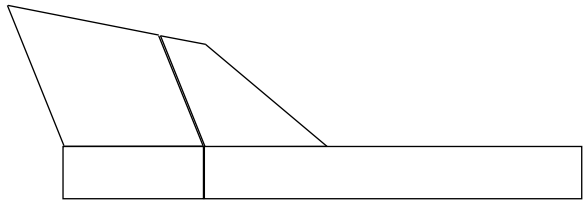


Figure M

to the root edge of each fin and to the body tube where the fins will be attached and allow the glue to dry. One fin at a time, apply another thin layer of glue to the root edge and firmly press the fin in place on the body tube. Note that the bottom of the root edge of each fin should be even with the bottom of the body tube (the end the engine mount is glued into, see Figure K). Use the fin alignment guide on page 7 to help you in aligning the fins. As the glue sets, be sure that the fin is straight out from and parallel to the tube. Repeat for the remaining fins. After the glue is completely dry, apply a small amount of glue to the joint between the root edge of the fin and the Body Tube. Smooth the glue with your finger to form a small, smooth fillet and remove any excess glue (see Figure L). Allow the model to rest horizontally while the glue dries on each set of fins. The fillets will strengthen the fin attachment.

8) Slip the yellow tube that extends from the booster tube into the bottom of the upper stage (see Figure M) and align the fin lines with the upper stage fins. One at a time, attach the booster fins in the same manner as you did the upper stage fins. Carefully align the booster fins with the ones on the upper stage. Be very careful ***not*** to glue the two stages together while attaching the fins! When dry, remove the booster section and apply glue fillets as you did to the upper stage fins.

9) Locate the launch lug (the very small white tube), and cut it in half to make two short tubes. Make a mark on the Launch Lug line about 1 1/2" from the bottom of the body tube and another about 9" from the bottom of the tube. Using the same method as you used to attach the fins, glue the lugs to the body. The bottom edge of the lugs should be at the marks you made on the line. Be sure the lugs are parallel to the body and are in line with each other (you can slip a launch rod through the lugs as they dry to ensure that they are properly aligned). After the glue is dry, apply fillets to the lugs.

10) Locate the balsa nose cone, balsa bulkhead, the red payload tube and the metal screw eye. Test fit the shoulder of the nose cone into one end of the tube - sand the shoulder if needed for a snug fit. Be sure the cone is tight enough not to come loose during flight - you can wrap tape around the shoulder to make a snug fit if needed. Glue the bulkhead into the other end so that about 2/3rds of it is extending out from the tube. Gently thread the screw eye into the center of the bottom of the bulkhead. Remove the screw eye and put some glue into the hole. Thread the eye back into the hole and allow to dry. See Figure N.

11) Locate the yellow plastic streamer material - make two small slits (about 1/4" long, 1" or 2" from one end) as shown in Figure O. Take the loose end of the Kevlar cord and run it through the slits until the end of the cord is about 2" - 3" from the edge of the streamer. Take some tape and apply to both sides of the streamer as shown to hold it in place. Now firmly tie the loose end of the Kevlar to the screw eye at the end of the balsa bulkhead

24mm Version:

1) Complete step #1 as in the 18mm version.

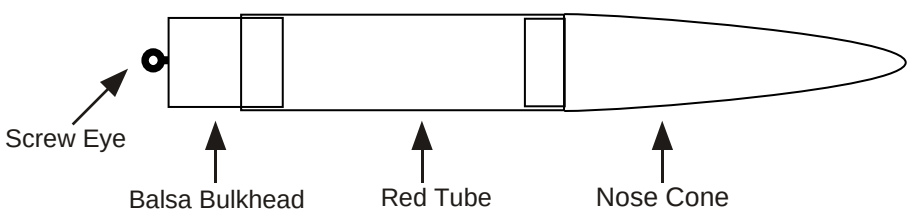


Figure N

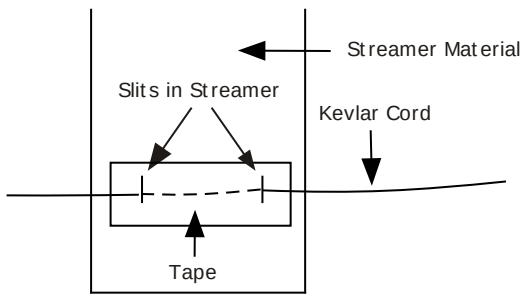


Figure O

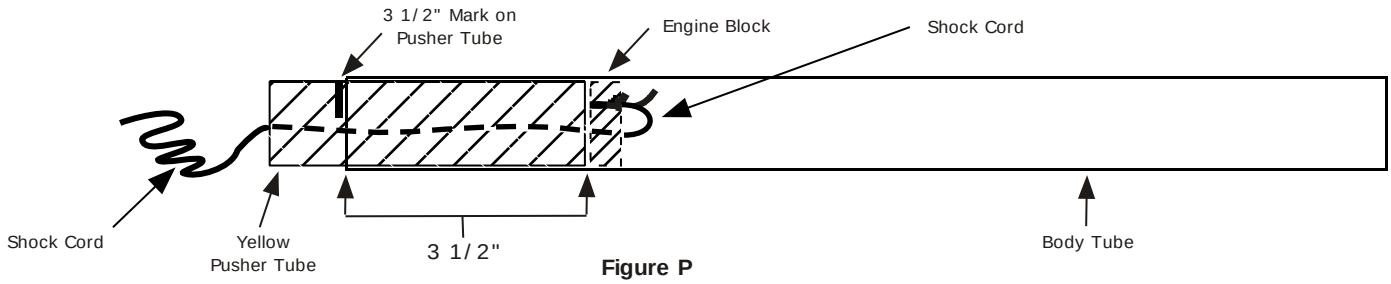


Figure P

2) See Figure P as needed for Step #2. Locate the Kevlar shock cord (it looks like a heavy piece of thread), one the centering rings (there are four identical rings that fit inside the white body tube, this one will now be your engine block), the yellow tube and the long white tube. First very firmly tie one end of the shock cord tightly around the engine block. Make a mark 3 1/2" from one end of the yellow tube. To avoid getting glue on the shock cord, set the engine block on top of the yellow tube, then thread the cord through the engine block, and also out the end of the yellow tube. Using a Q - Tip, scrap piece of wood, etc., apply a thin layer of glue all around the **inside** of one end of the white body tube about 3 1/4" to 3 1/2" up inside the tube. Insert the the engine block into the tube. Use the yellow tube to push the engine block into place (up to the mark on the yellow tube) as shown in Figure P. Quickly remove the yellow tube and set it aside. Allow the glue to dry.

3) Complete steps #6 and #7 as in the 18mm version.

4) Use the yellow tube to hold the upper stage and booster tube together and complete step #8 as in the 18mm version.

5) Complete steps #9 through #11 as in the 18mm version.

Finishing/ Decorating - the model may be decorated and/ or painted in many ways, depending on how you want it to look and how much time you wish to put into it. The following instructions refer to a full finishing of the model including filling the wood grain. Be sure to do all balsa filling, painting, etc. in a well ventilated area. Alternately you may simply decorate the model with any colors of felt tip markers, decals/ stickers, etc. If you decide not to fully finish the model as described below, skip on to the Flight Preparation and Launching section.

1) Prior to beginning this step, be sure to read any instructions on the brand of sanding sealer you are using - follow the manufacturers directions if they vary from those below. Be sure to use the thinner recommended by the manufacturer to clean your brush. Using fine sandpaper (then extra fine, if desired) go over all the wood parts to ensure they are smooth. If there are any dents or "dings" in any of the wood parts, apply one of the recommended filler materials to the area and allow to dry. Sand the area until smooth and repeat if necessary. Wrap a single layer of scotch tape (or masking tape) around the shoulder of the nose cone (the part that goes into the body tube) - this will prevent building up the thickness of the shoulder while painting. Insert the nose cone shoulder into the top of the body tube. Next apply a coat of sanding sealer to all wood parts (the nose cone and fins)- it is not necessary to seal the nose cone shoulder. Allow the sealer to dry then apply a second coat. After the second coat is dry, sand with medium or fine sandpaper until the surfaces are smooth. Continue with single coats of sealer, sanding in between each coat, as needed until the wood grain is completely filled and the surface is smooth.

2) You will need to use something such as a dowel or a section of newspaper rolled into a tight cone inserted into the base of your model to hold it while painting. If desired, lightly go over the model with a tack cloth to remove any excess dust or other particles which could mar the finish. It is a good idea to do this before applying each coat of primer and paint. Be sure to read the instructions on the brand of paint you are using - follow the manufacturers directions carefully. Be sure **not** to mix different types or brands of paint without testing. It is recommended (but not absolutely necessary) that you apply one or more coats of primer before the color coats of paint - this will give a much smoother surface to your model and allow the paint to adhere better. If using primer, sand with fine and/ or extra fine sandpaper after each coat is completely dry. Use as many coats as needed to get a smooth finish before proceeding to the color coats.

3) First give a base coat of the lightest color you will be using on the model - several light coats are preferable to one or two heavy coats (this will be true for **all** the colors you will be using). Apply as many coats as needed to get a nice even color. Allow to dry thoroughly.

4) If applying other colors, use masking tape to cover up the areas of the model you do not wish to paint with the second color. Apply the second color as you did the first and allow to dry. Continue this process if other colors are desired. After the paint has dried carefully remove the masking.

5) At this time you may apply any decals, stickers, trim tape, etc. if desired. To protect the paint and other decorations, apply one or more coats of clear paint (such as Krylon Crystal Clear or similar) and allow to dry.

Flight Preparation & Launching

Single Stage Flights:

Remove the payload section and streamer from the body tube and loosely insert some flame - proof recovery wadding (such as that made by Quest or Estes) into the top of the lower body tube. Use enough wadding to fill the tube to a depth of at least two body diameters. Use a pencil or dowel to lightly tamp the wadding down towards the top of the engine mount.

Fold the streamer in half lengthwise. Fold in half again two or three more times then roll the streamer into a small cylinder. Next wrap some of the shock cord around the streamer to hold the streamer into a cylinder. Insert the shock cord then the streamer into the body tube - if the streamer doesn't fit easily, rewrap tighter until the cylinder fits smoothly. Slide the payload section into the body tube. Be sure to check the fit of the bulkhead - if too tight, sand the shoulder down - if too loose, wrap with tape. The payload section should be loose enough to slip out easily, but tight enough so that you can turn the model upside down without it falling out.

Select an engine from the list of recommended engines. Test fit the engine into the rear of the body tube - push it up until it meets the engine block - about 1/4" of the engine should be sticking out (Note that if you built the 24mm version, the engine block is glued in to allow the use of the longer Estes E motors, if flying with a 24mm C11 or D12, insert the green spacer tube ahead of the engine). Remove and wrap enough masking tape around the engine until it fits snugly into the body. The engine should fit tightly enough so that you cannot pull it out easily with your fingers. Insert the igniter according to the manufacturers directions.

Be sure to check the center of gravity (see "About the Way Two High") - add weight to the paylaod section if needed.

Place the rocket on the launcher by sliding the launch lugs over the launch rod. Attach the micro - clips to the igniter. Move back to a safe distance & be sure the launch area is clear. Check for low - flying aircraft, give the countdown & launch!

Two Stage Flights:

Add the wadding and prep the streamer as in the instructions for single stage flights above.

Select a booster engine and an upper stage engine from the list of recommended engines. Butt the nozzle end up the upper stage motor to the top end of the booster motor and hold together with a single wrap of scotch tape (see Figure Q). Test fit the upper stage engine into the rear of the upper stage - push it up until it meets the engine block (Note that if you built the 24mm version, the engine block is glued in to allow the use of the longer Estes E motors, if flying with a 24mm C11 or D12, insert the green spacer tube ahead of the engine). Remove and wrap enough masking tape around the upper engine as shown in Figure Q until it fits snugly into the body. The engine should fit tightly enough so that you cannot pull it out easily with your fingers. Wrap tape around the top end of the booster engine as shown. Slide the booster section over the engine and align the fins. Insert the igniter into the booster engine according to the manufacturers directions.

Be sure to check the center of gravity (see "About the Way Two High") - add weight to the paylaod section if needed.

Place the rocket on the launcher by sliding the launch lugs over the launch rod. Attach the micro - clips to the igniter. Move back to a safe distance & be sure the launch area is clear. Check for low - flying aircraft, give the countdown & launch!

Be sure to read & follow the NAR Safety Code before flying this or any other model rocket!
(Note: the NAR Safety Code is normally included with each package of Model Rocket Engines)

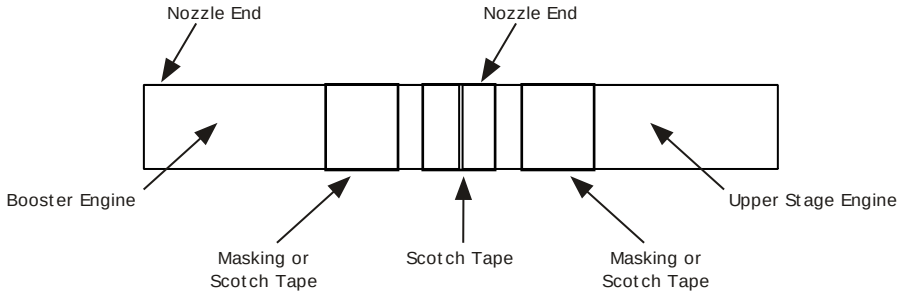
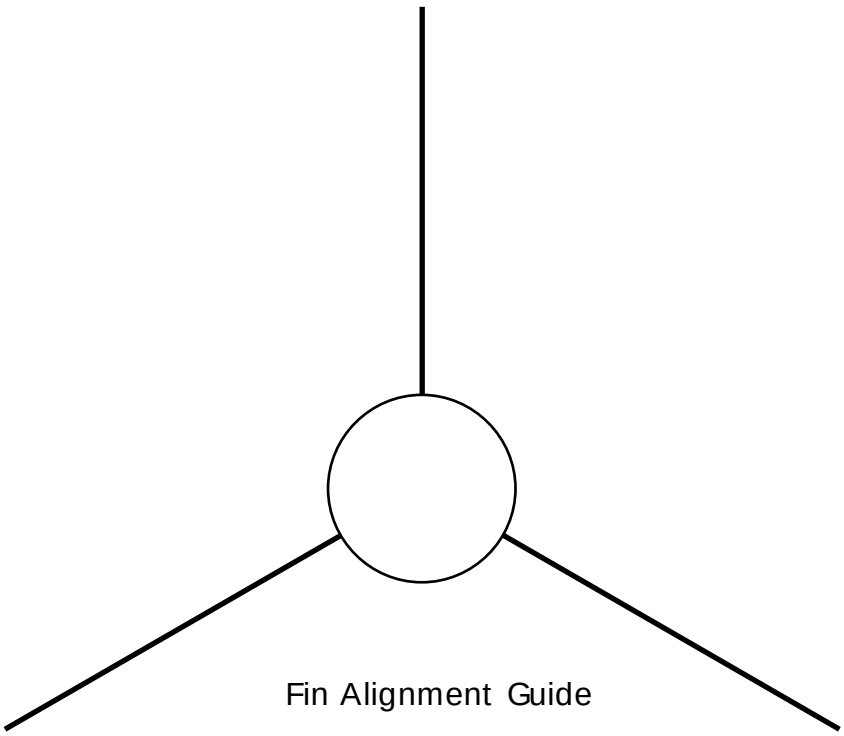
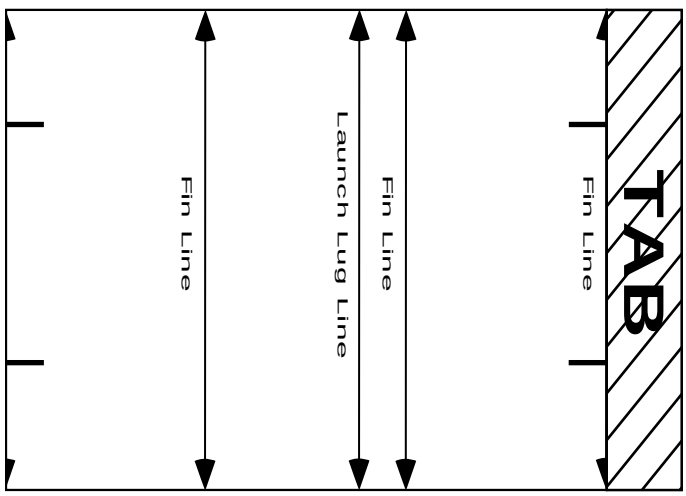


Figure Q



Fin Alignment Guide



Tube Marking Guide