

# *Beginning Scale: Scale Bash: Bear Skins and Stone Knives*

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Sometimes scale model rocketry is presented as an elite or even elitist branch of hobby rocketry. This is nonsense. While scale models can be the most finely crafted objects in hobby rocketry, building a rocket shaped and painted like a “real” prototype doesn’t have to be any harder than building a three-fins-and-a-nosecone sport model. In fact, with the right fin pattern and the right body tube length, there is no reason not to make your next sport model a scale replica.

## Definitions

Scale: A model that looks like a real rocket.

Prototype: The real rocket that your model looks like (not necessarily the first one built).

Scale Data: Drawings and photos of a real prototype.

Scale Plan: Patterns and building instructions for a particular scale model.

Precision Scale: The modeler is proud of his or her effort.

Semi-Scale: Kit whose design was compromised for ease of construction or safe flight.

Fun Scale: The modeler built it without becoming obsessive.

Scale-Like or Pseudo Scale: It looks like what a real rocket would look like if a real rocket looked like that.

FAI Scale and Scale Altitude: American beginners won’t encounter these rules.

NAR Scale: This is the measured scale event in the US. The modeler must provide length, diameters, nose cone length, transition lengths, fin chord and fin span, as well as a photograph and color data for all sides of the prototype. Judges inspect the model closely and measure a few dimensions.

NAR Scale Altitude: NAR Scale score plus altitude in meters.

NAR Super Scale: NAR Scale plus a launcher.

NAR Sport Scale: Modeler provides some sort of illustration of the prototype—Photo, drawing, or painting. Judges examine accuracy from one meter away, but judge craftsmanship up close.

NAR Giant Scale: Sport Scale for big models (defined by Pink Book).

NAR Peanut scale: Sport Scale for small models (defined by Pink Book).

NAR Future/Fiction Scale: Sport Scale for models of proposed or fictional rockets.

Remember that the difference between NAR Scale and NAR Sport Scale is just the judging method, not a quality standard. Your model is always ranked against the other entries. NAR Scale scares off other entrants, so your chances are better.

## Kits vs. Scratchbuilt

There are some nice scale kits available. Unfortunately, there are just as many kits, especially in the high power and large model rocket market that are not really accurate.

## Choosing a Prototype

Pick a subject that grabs you! If you have good enough photos or drawings to inspire you, you’ve probably got enough to build it. But plan ahead for difficulties—you don’t want to run into a dead end halfway through. Be willing to compromise on difficult parts by painting on details or approximating shapes. If a simple subject grabs you, you’re in luck.

## Scaling Your Model

Scale your model for easily available parts. If you are building a four-fins-and-a-nosecone design, find a nosecone that approximates the shape of the prototype’s nose. I compiled the booklet *Scale Bash* to simplify this approach. If you’re building a two-diameter prototype, search for tubes whose diameters have the same ratio as prototype’s tubes. I’ve put together a table of tube diameter ratios as a quick reference.

## Scale Data

Scale data means drawings and photos of your prototype. You need these both to build your model and to enter it in a contest. If you are building a kit for a contest, get the data first and build to the data. I've sunk a lot of effort in gathering data on a couple hundred rockets—so buy my books!

## Construction

There are some absolutely essential techniques you need to learn that most kits won't teach you:

**Cutting tubes:** Use paper to mark a straight line, and support the tube inside with a tube coupler or expended engine. Make the cut in several passes with your hobby knife. Sand the cut end of the tube against very fine finishing sandpaper (240-400 grit) on the table top, while supporting the tub inside with the tub coupler or expended engine.

**Cutting fins:** Cut out a paper pattern, trace outline onto the wood with wood grain along leading edge, and sand fins together. Sanding in a scale airfoil is nice, but not essential.

**Paper shrouds:** Here are the formulas:

You will need three numbers to calculate the dimensions for a tapered shroud. These are: shroud height H, small diameter  $D_1$ , and large diameter  $D_2$ . From these, you can calculate the inner and outer radii  $R_1$  and  $R_2$  to lay out on the shroud.

$$R_1 = \sqrt{(D_1/2)^2 + (HD_1/(D_2-D_1))^2}$$

$$R_2 = \sqrt{(D_2/2)^2 + (HD_2/(D_2-D_1))^2}$$

Finally, calculate the angle  $\theta$  to lay out for the shroud:

$$\theta = 180^\circ \times D_2/R_2$$

Cut out shroud, including a glue tap, and roll into a cone. Support the large end with a tube coupler inside the tube.

**Turning nosecones and transitions:** Use a small hobby lathe, a drill press, or an electric drill clamped to work surface. If you use a drill, attach the wood with a dowel. Or just order the things from BMS.

**Assembly:** I like to use Titebond or similar carpenter's yellow wood glue, except when gluing plastics.

**Surface preparation:** Sanding and sealing balsa is boring, but critical to final appearances. I use titebond to seal wood grain so that I can sand and seal before assembly. Basswood fills much more easily than balsa.

**Finishing:** Avoid brush painting—use spray paint. Multiple thin coats are best.

**Masking:** Start with light base coat, then progressively darker colors. Metallics go on last. I mask with Scotch Magic tape and get good results, but others prefer actual masking tape. Always press down edges of tape for good seal. I find this impossible with masking tape, others find it impossible with Scotch. Go figure.

**Decals:** Save decals from kits, use vinyl lettering, dry transfer lettering, or computer printout on adhesive material. Tango Papa, Jim Z, and others can make water transfer decals for you.

**Contest flying:** Almost all contests are Sport Scale. Craftsmanship is the most important judging category, with 300 points. Remember that all the judge sees is the paint, so the finish should be smooth and clean. You need good, crisp construction, smooth surfaces under the paint, and smooth, opaque paint with sharp masking and straight decals without film showing. Document with scale data that matches your model. You should look at your data before you build, especially if you build a kit. You really don't need more than one or two photocopies. Remember to list difficult assemblies.