Chapter 4: Building Tools and Materials

In order to build good models, it is necessary to have the correct tools. The tools needed to build model rockets are inexpensive and few in number.

A "must" item is a modeling knife. Listed in the Centuri catalog are a number of knives and knife sets. These knives are specially designed for delicate model work. They use replaceable blades which can be discarded when they become dull. A word of caution: Always handle the knife carefully. Sharp blades will cut fingers as well as balsa. If you ever drop a modeling knife or if it rolls off the table, never—never try to catch it. This may sound funny, but it is a natural instinct to try to catch something when it falls. In this case, a natural reaction could produce a nasty cut on the hand.

A metal ruler which can be used for measuring and as a cutting straight edge is a necessary tool. A sanding block, tweezers, and scissors are also very handy to have on the work bench. Centuri's "Model Rocketeer's Tool Kit", Catalog No. XC-90, forms a very good basis for any rocketeer's tool collection. Once purchased, tools such as these almost never wear out — they are a lifetime investment.

Whether you are working at a workbench or the kitchen table, a cutting board is a standard item. Not only will it prevent marring of the table surface, but it will prolong the use life of the knife blade. A piece of heavy solid (not corrugated) cardboard makes an ideal cutting board. 12" x 18" is a good convenient size. Discarded "stand up" type signs such as the ones used in grocery stores are a good source for heavy cardboard.

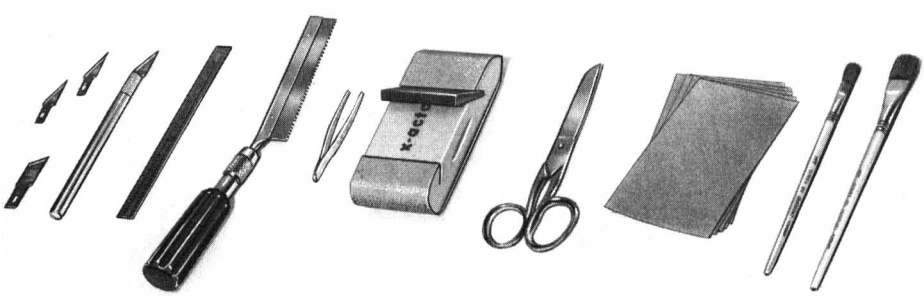
Sandpaper is required in a variety of grades. Sandpaper is graded by the "grit" or relative smoothness. Listed here are the different "grits" needed for various jobs:

150 & 220 GRIT SANDPAPER: Used for "shaping" and rough sanding of balsa part.

320 GRIT SANDPAPER: Used for interim sanding of balsa — between applications of fillercoat.

420 & 600 GRIT SANDPAPER: Used for final sanding. These are very fine grades of sandpaper and produce smooth, even finishes.

Additional materials such as paint, glue, brushes, tape, etc. will complete your "model rocket work bench". These materials are discussed more fully in Chapters 6 and 7.



Chapter 5: Custom Design Parts System

Centuri model rocket parts are number coded in a very simple and logical system. An understanding of this system will enable you to design custom rockets with a minimum of effort.

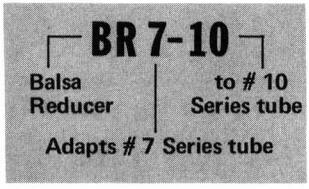
Basic rocket components are all numbered according to the seven different series of Centuri body tubes. These series are based on the diameters of the various tubes produced. They are listed below:

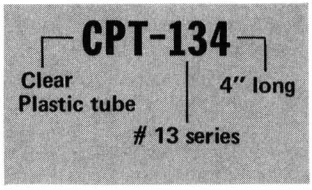
Series:	Nominal inside diameter of body tube:
# 5	.5"
# 7	.7"
# 8	.8"
# 10	1.0"
# 13	1.3"
# 16	1.6"
# 20	2.0"

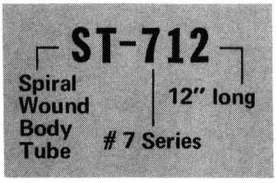
All parts are numbered in a combination of a letter prefix followed by a 2 to 4 digit number. The first digit (s) of the number always identify the series to which the part belongs. The last digit (s) provide identification of the specific part. The letter prefix gives a descriptive abbreviation of the part. Study the examples. They will clarify the system more fully.

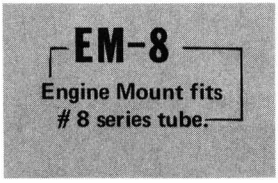
Body tubes are availalbe in a variety of lengths. 12" and 18" lengths are, however, the most economical purchases. You can cut from these longer tubes the exact lengths that you need. The #7 series tube is a glove fit for a model rocket engine. Since the #5 series tubes are too small in diameter to contain an engine, they are used only as supplemental tubes or dummy upper "stages" on a rocket. (See rocket plans.) The balsa and paper reducers can be used to combine the different series, offering an unlimited variety of possible rocket shapes. The example shown here is somewhat exaggerated in design, but does demonstrate the variety of possible combinations.

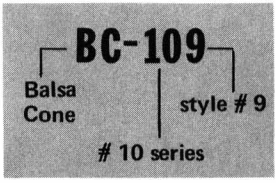
CENTURI PARTS NUMBER EXAMPLES

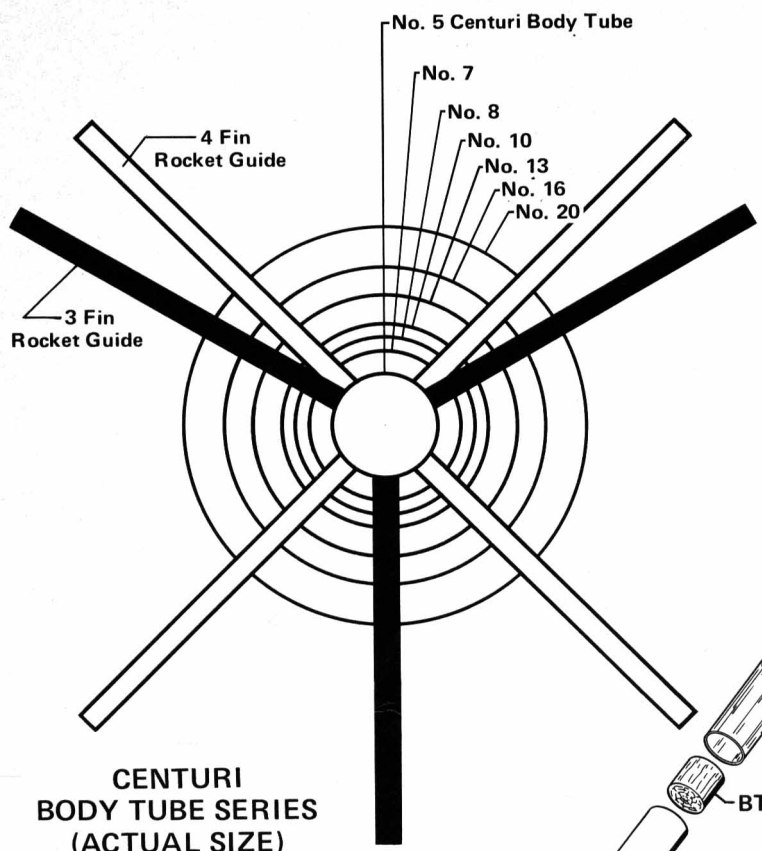




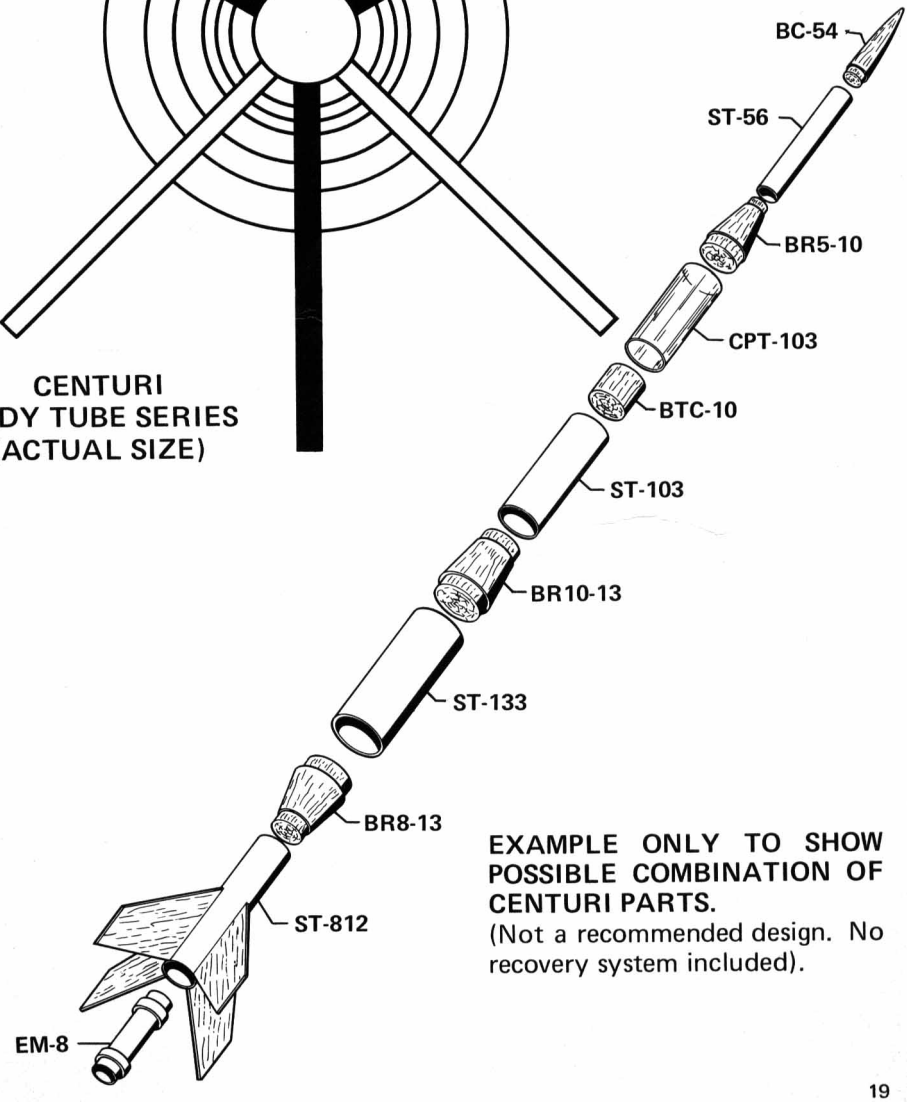








CENTURI
BODY TUBE SERIES
(ACTUAL SIZE)



EXAMPLE ONLY TO SHOW POSSIBLE COMBINATION OF CENTURI PARTS.
(Not a recommended design. No recovery system included).

Chapter 6: Construction Techniques

CUTTING BODY TUBES:

The simplest method of cutting a body tube is to wrap a piece of paper around the tube where the cut is to be made. Place a pencil against the edge of the paper and draw a line around the tube. Lay the tube on a flat surface and rotate slowly, cutting along the pencil line with a sharp knife. Use light pressure and do not try to cut through the tube on the first pass. Once the tube is cut, dress down the end by sanding on a flat piece of fine sandpaper.

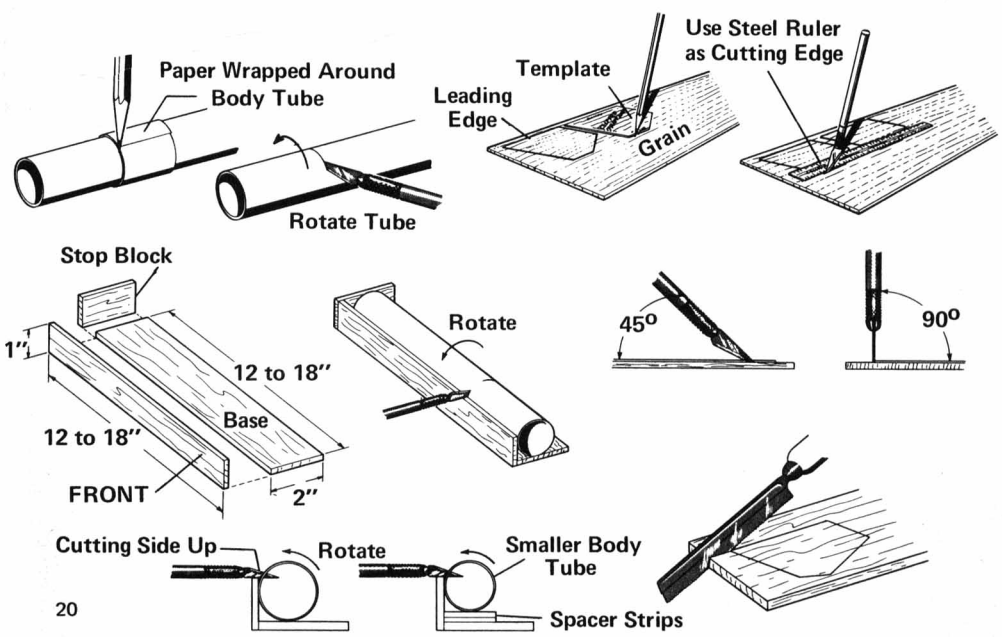
A faster and neater method for cutting body tubes involves building a simple but efficient cutting jig. Make the jig from any available wood to the approximate dimensions shown. To use, place the body tube in the jig, position the knife, blade up, on the edge of the jig at the desired cut off point. Rotate the tube slowly, keeping the knife point pressed against it. If you hold the knife firmly in place and hold the tube firmly against the stop plate, you should come out with a perfect cut every time. To cut different diameters of tubes, modify the jig by placing flat pieces of wood on the base plate to serve as spacers.

MAKING FINS:

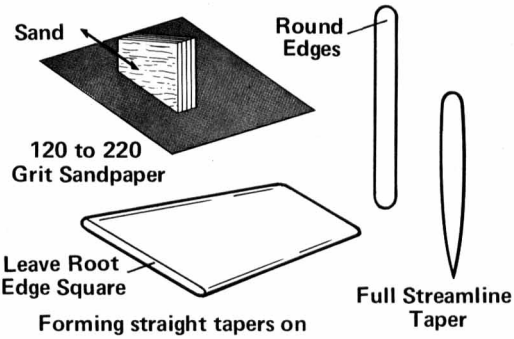
Once a fin shape has been decided upon, a card stock template must be made. (PFC-15 Fin Guide Pack has pre-cut templates). Using a soft lead pencil, trace the outline of the template onto a balsa sheet. Remember – the leading edge (top) of the fin should always be parallel with the grain of the balsa.

Balsa is soft and easy to cut, but a few basic rules must be followed to produce consistently good results. Always use a metal straight edge as a cutting guide and always use a sharp knife. When cutting out fins, place the straight edge so the knife blade cuts to the outside of the fin. If the knife slips, you will only nick the scrap balsa, not the fin. Hold the knife straight and cut in several light passes, This results in a neater cut with less dulling of the blade.

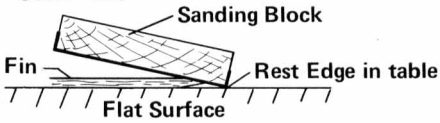
If you are cutting very heavy balsa, a razor saw is better than a knife. Razor saws have a very thin blade and very small teeth, making them perfect for this type of work.



The fins must be sanded smooth before being attached to the rocket. Square up all edges with a sanding block. Lightly sand the surface of the fins and round the leading and trailing edges. If you wish to have a streamlined fin shape or if you are building a scale model with fins of a particular cross section, then sand to finished shape at this time. Chapter 7 deals with finishing and painting the rocket. The normal practice is to prepare the balsa fins for painting after they are attached to the rocket. If, however, you are using fins that have compound angles and special shapes, it would be more practical to completely "pre-finish" the fins before proceeding to the next step.

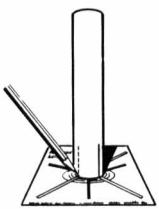


Forming straight tapers on a "Scale" fin.



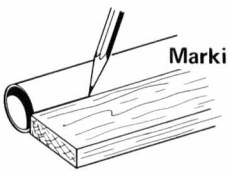
ATTACHING FINS TO THE BODY:

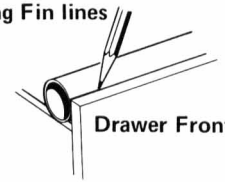
The first step in attaching the fins is to mark the fin locations on the body tube. All Centuri kits come with fin location and alignment guides. When you build a kit, save these guides for future custom building use. As an alternative, use the body tube chart in Chapter 5 to mark the tube. To extend parallel lines along the tube, place the body tube against the lip of a drawer, a flat piece of wood or other material which has parallel sides and a thickness of approximately ½ the body tube diameter.

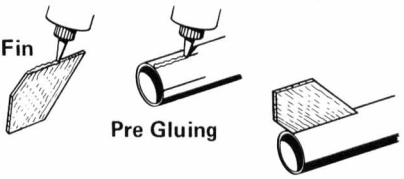


Body Tube - Fin Guide on Page 19

For gluing the fins to the body, we highly recommend the use of Centuri Superbond. This glue is specially formulated and is the strongest glue available for this purpose. White glue takes longer to dry, but will work as a substitute. Model airplane type cements are NOT recommended for use on flying model rockets.

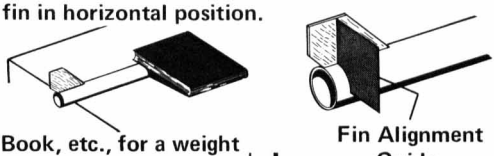


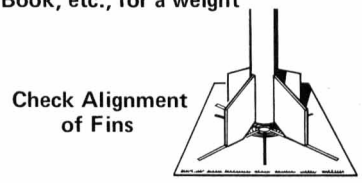




Pre-gluing will provide the strongest joints. It is done in the following manner: Sand the root edge of the fin to remove any filler material (if you pre-finished the fins). Run a light bead of Superbond along the root edge and on the pre-marked line on the body tube. Allow the glue to become almost dry. Run another bead of Superbond along the fin root edge and press in place on the body tube. Check the alignment of the fin with the alignment guide, or with the body tube guide in Chapter 5. (If the fins extend below the end of the body tube, the guide in Chapter 5 does not work very well. If you have an "accurate eye" you can 'sight align' the fin with reasonable results. When you are satisfied the fin is properly aligned, set aside to dry.

Allow glue to dry with fin in horizontal position.





After the glue has thoroughly set, repeat this process with the remaining fins, one at a time.

The fin joints can be greatly strengthened by adding fillets of glue. This is to be done only after the original glue joints are completely dry. Run a bead of glue along both sides of each fin-body tube joint. Smooth the glue into even fillets with your finger. Set the rocket aside in a horizontal position and allow the glue to dry. Note: If you stand the rocket vertically, the fillets may sag and look unsightly.

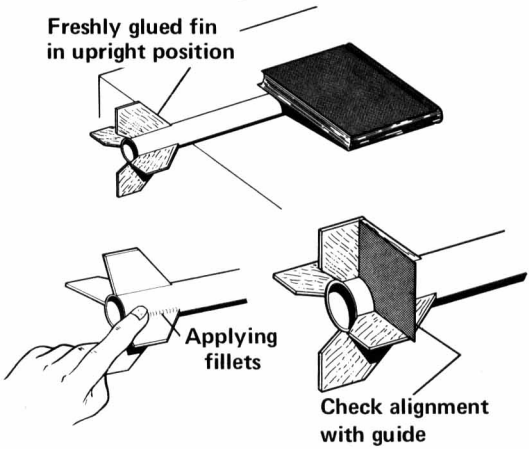
INSTALLING ENGINE MOUNTS:

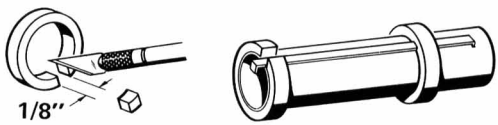
All Centuri custom engine mounts come complete with assembly instructions, so we will not go into that here. Just remember to glue the engine mount in securely; the thrust of the engine against the mount can produce considerable force. If you wish to add an engine lock to the mount, it is a very simple process. Concealed engine locks will normally work only on # 10 through 20 series body tubes. The # 8 series tube does not have enough clearance for the spring action of the lock to function. An engine lock can be installed on a rocket which is built from the # 7 series tube, but the engine lock will be exposed. The engine lock is secured by simply cutting a slit in the mount at the base of the thrust ring, inserting one end of the lock into the slit and securing in place with the mylar lock ring. (Centuri Engine Locks EL-1 include mylar lock rings.) It will be necessary to cut clearance slots in the engine mounts as shown. If you wish to use an engine lock on a # 7 tube rocket, it must be installed BEFORE the fins are attached.

The engine mount is normally positioned with the aft end of the mount even with the aft end of the body. In some instances, especially with larger body tubes, you may wish to recess the mount into the body for a short distance to provide an added stability margin. (See Chapter 3.)

ATTACHING THE LAUNCH LUG:

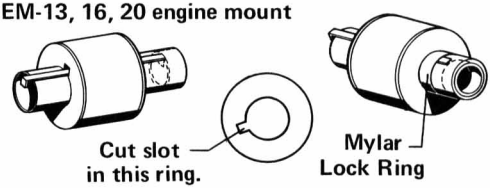
In the case of a straight single diameter rocket, the launch lug is simply glued right to the body tube. The lug should be attached at the approximate CG of the rocket. After the lug is positioned on the body, sight along the launch lug to insure it is parallel with the body tube. Once the glue is dry, you may wish to run a small fillet of glue along the launch lug-body joint for added strength.
(See Illustration Page 23.)



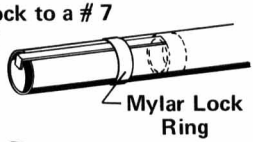


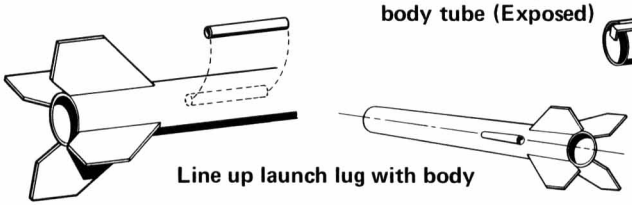
Adapting an engine lock to an EM-10A engine mount

Adapting an engine lock to an EM-13, 16, 20 engine mount



Adapting an engine lock to a # 7 body tube (Exposed)





If the rocket has an enlarged payload capsule, the launch lug must be mounted on a balsa "stand-off". The stand-off must be wide enough so the launching rod will not rub against the payload section. If a rocket is quite long, it may require two launch lugs. These are glued in place near the top and bottom of the rocket body. Use a launching rod to align the lugs and keep them in alignment while the glue is drying.

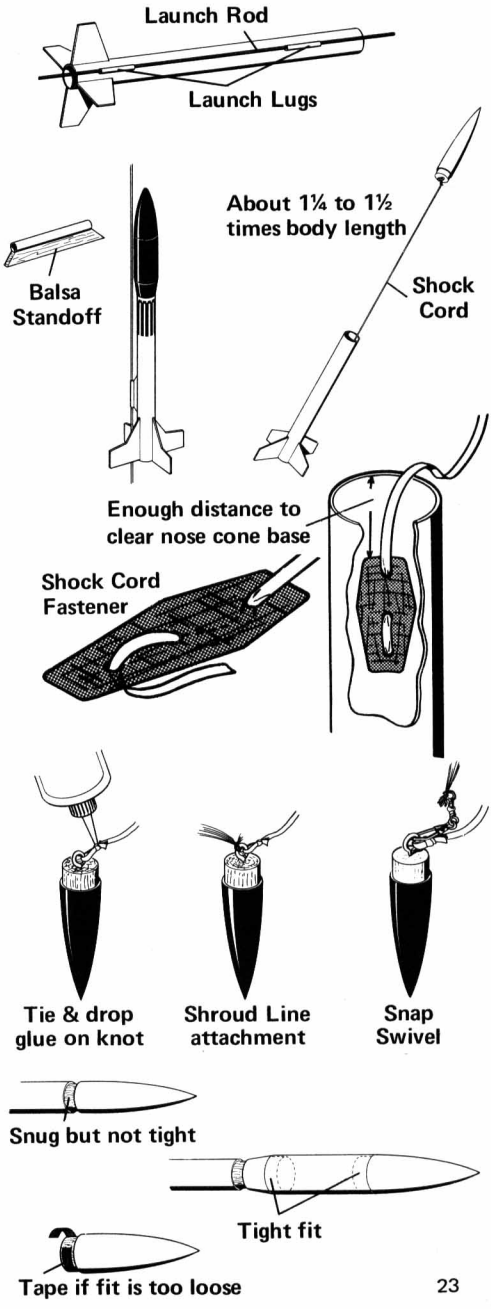
SHOCK CORD AND PARACHUTE ATTACHMENT:

By far the best and easiest way to attach a shock cord to your rocket is by using Centuri's Shock Cord Fasteners, Cat. No. SCF-1 These fasteners are very strong; they are heat resistant and have a permanent pressure sensitive backing. To install, simply remove the backing material, loop the shock cord through the holes as shown, and press the Fastener in place inside the body tube. Make sure the Fastener is far enough inside the body tube to clear the nose cone base when it is set in place on the rocket. The shock cord is secured to a balsa nose cone by means of a screw eye. The screw eye is inserted into the base of the cone and turned until it is seated all the way into the balsa. The screw eye is then removed, glue is squirted into the hole and the screw eye is replaced. This insures permanent anchoring against ejection shock. This shock cord is tied to the screw eye in a firm, triple knot. Smear a little glue on the knot to prevent it from loosening. With Centuri plastic nose cones, an attachment lug is cast into the base. Simply tie and glue shock cord to attachment lug.

Parachutes may be attached in two ways: The shroud lines may be tied to the screw eye or nose cone lug, or they may be tied to the eye of a snap swivel. The snap swivel can then be attached to the nose cone. The snap swivel not only keeps the shroud lines from becoming tangled, but allows quick interchange of parachutes from different models.

FITTING NOSE CONES AND PAYLOAD CAPSULES

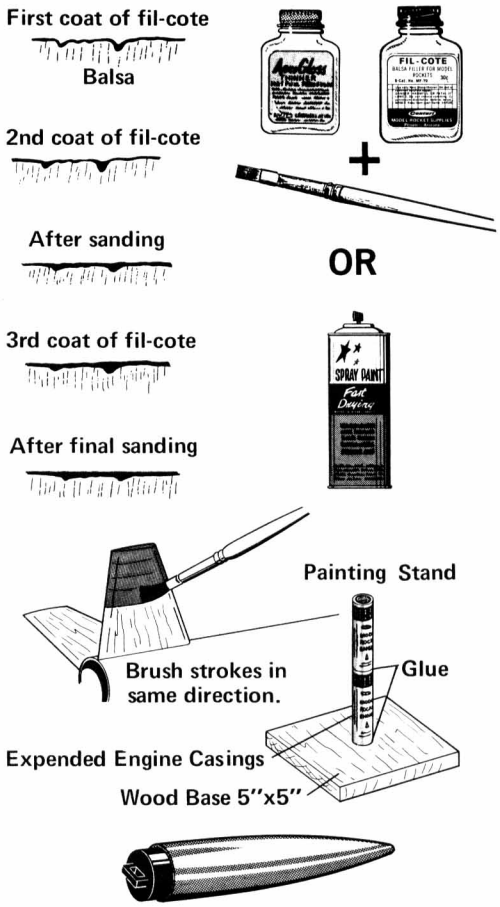
Nose cone and payload capsule bases should be checked to insure a perfect fit. The bases should fit snugly but not tightly into the body tube. A tight fit may cause malfunction of the recovery system. A fit that is extremely loose may allow the cone to come off during the thrusting phase. If the fit is too tight, a little sanding will take care of the problem. If the fit is too loose, wrap a turn or two of tape around the base. In the case of payload capsules, all fits except the one that sockets into the body tube must be tight to prevent the capsule from coming apart during the "snap back" of the shock cord.



Chapter 7: Finishing the Rocket

In order to have a smooth finished appearance after having been painted, balsa wood must be filled and sanded before painting. The following steps are absolutely necessary if you wish to have a really good looking model. Since you have sanded the fins to shape prior to attachment to the body, it is only necessary to lightly sand the surface with very fine sandpaper. Next, the fins are painted with a special filler preparation (Centuri Fil-Cote). This preparation fills the grain lines in the balsa and dries hard in 30 minutes. Apply two coats of filler at intervals of 15 minutes. After 30-45 minutes have elapsed, sand the fins with medium fine sandpaper. After sanding, apply another coat of filler, let dry and sand lightly to a smooth glassy finish. If the balsa is very porous it may be necessary to apply more filler to obtain the desired finish. If you are using a balsa nose cone, it must be prepared in the same manner as the fins.

Centuri body tubes need no preparation and should not be sanded. They have a polyglassine coating which is very smooth yet accepts all types of paint easily. The choice of paint is up to the model builder. Model airplane dope will work well. It brushes easily and dries hard in 15 to 20 minutes. Enamel is usually thicker and heavier and takes much longer to dry. It is generally, however, more durable than dope. A word of caution: Do not paint any plastic parts with dope or lacquer base paints. Chemicals in these paints will cause the plastic to soften, krinkle, and in some cases, actually melt. Use only enamels on plastic parts. In painting with dope or enamel use a good quality flat brush. Run the brush strokes in one direction and do not go back over an area which has just been painted. Figure at least three coats of dope to produce a good finish, two coats of enamel. Allow the paint to dry between each coat. A faster and better way to finish a model involves the use of spray paint which comes in aerosol cans. Spray paint produces a very smooth finish, but must be done correctly to avoid runs and sags. Before spraying, you will need to build something on which to stand the rocket during painting. A very simple holder can be made by gluing two expended engine casings end to end and gluing these to a wooden base. The rocket is slipped onto the top engine case and is held firmly in place in an upright position. Select a clean well ventilated area in which to paint. Spray the model with even passes of the can. Do not start or stop spraying when the spray is directly on the model. Spray a light mist coat and STOP – Allow the paint to dry. This is of the greatest importance. Do not try to finish the painting in one spraying. Chances are 10 to 1 you will ruin the finish. The first mist coat will leave the model with a lightly colored appearance. After this coat dries, another mist coat is sprayed on. After the second mist coat dries, the model is ready for final spraying.



NOTE: Plastic nose cones do not have to be painted. Vigorous rubbing with a soft cloth will produce a hi-gloss finish to the pre-colored plastic.