

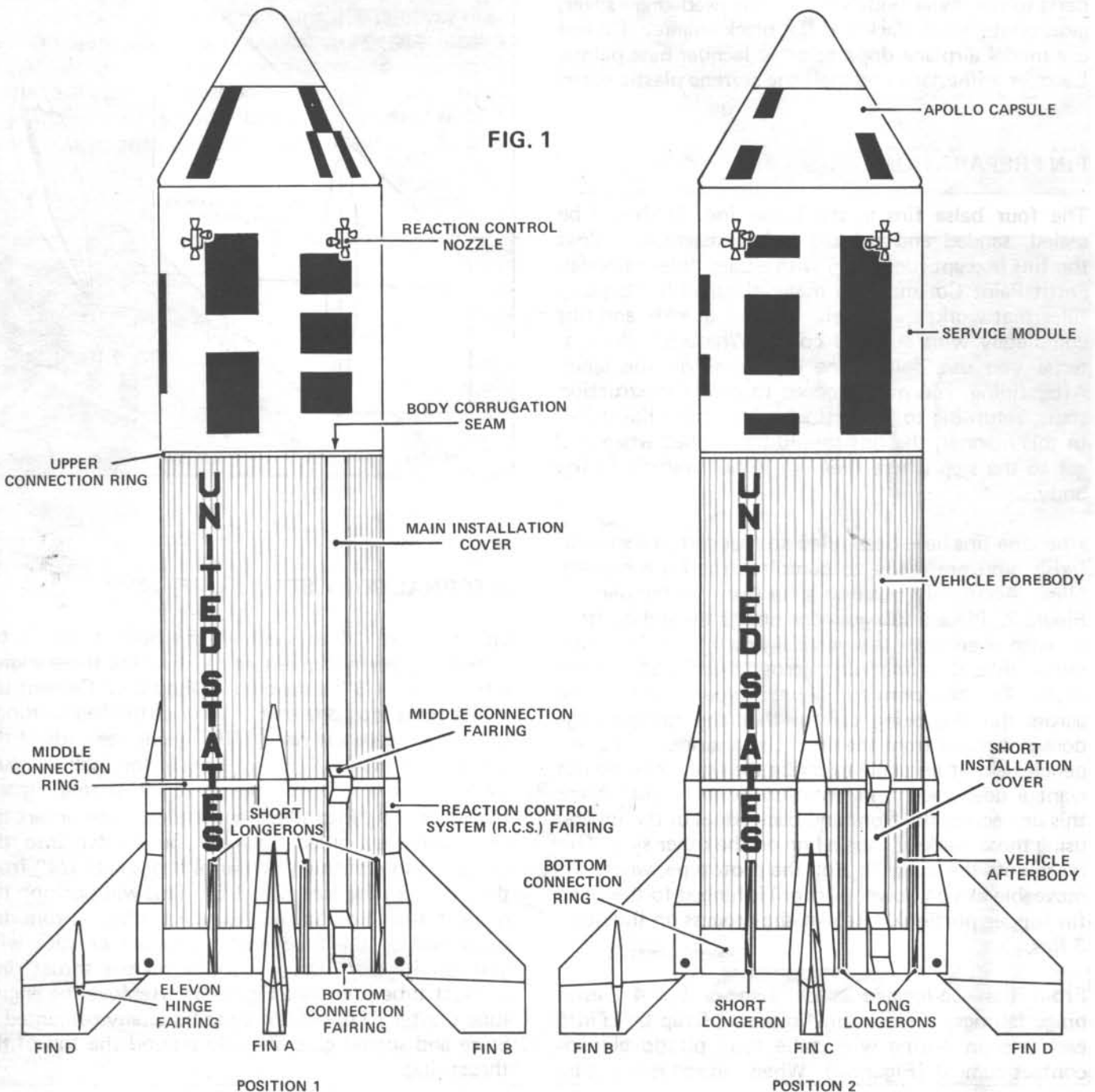
APOLLO LITTLE JOE II by *Centuri*

This kit is an exact scale model of Little Joe Mission A-004 with Apollo Spacecraft CSM 002, launched at White Sands, New Mexico on January 20, 1966. There were several Little Joe launches, each with a little different external configuration. We chose this particular version because it was the most refined vehicle of the series.

Centuri's 1/45 scale Apollo-Little Joe is one of the most complete scale model kits ever offered to the

growing hobby of Model Rocketry. A variety of materials and methods were used to put this kit together. A great deal of research went into the choice of these materials and production processes to provide you with a beautiful display model, as well as an excellent flying model rocket. We have simplified some of the most difficult construction problems, but this kit still requires time and patience on your part. Careful attention to the assembly instructions will reward you with a model of which you may be justly proud.

FIG. 1



TOOLS & MATERIALS

Tools needed for assembly of the Little Joe include a sharp knife (Xacto #1-st is recommended), several sharp blades (Xacto #11 blade is most useful), tweezers, sanding block and steel ruler/straight edge.

Materials needed include paint and glue. #320 and 400 grit sandpaper are included in kit. You will need several types of cement. For wood to cardboard parts you will need wood glue, such as Centuri Superbond, Franklin Titebond, Wilhold White Glue or Elmer's White Glue. We do not recommend regular model airplane glue for assembly of a flying model rocket. Plastic model cement is needed for the styrene parts and contact cement is necessary for cementing detail parts to the mylar body skin. Paints needed are silver, gloss white, gloss black and flat black enamel. Do not use model airplane dope or other lacquer base paints. Lacquer will attack and melt the styrene plastic parts.

FIN PREPARATION

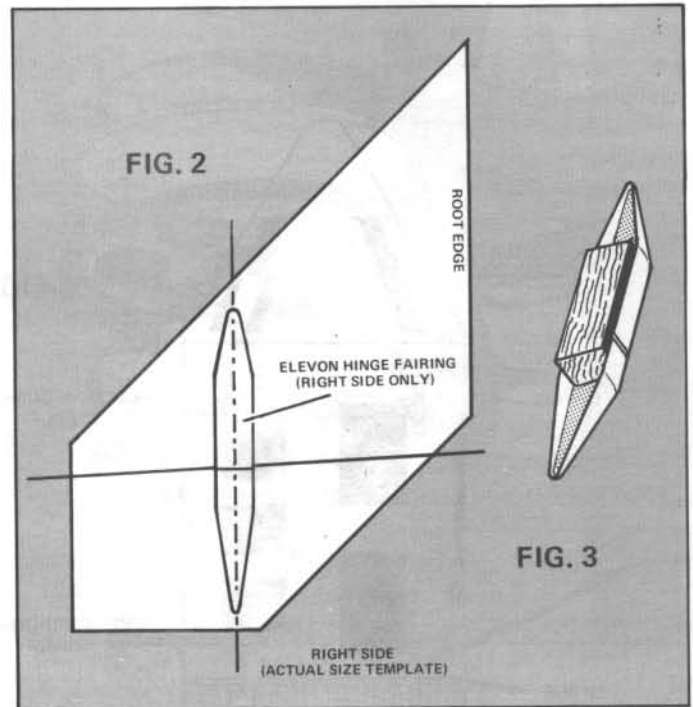
The four balsa fins in the Little Joe kit should be sealed, sanded and painted before assembly. Coat the fins (except root edge) with a balsa filler material. Pettit Paint Co. makes a material called hobbyoxy filler that works quite well. It dries quickly and fills completely with about 3 coats. Whatever filler material you use, follow the directions on the label. After filling, you may proceed to other construction steps, returning to the fins when the filler has dried. In this manner, the fins should be finished when you get to the step where they are to be attached to the body.

When the fins have been filled and sanded to a smooth finish, you are ready to complete the fin subassemblies. Accurately position a fin over the template in Figure 2. Place a straight edge on the fin and position its edge even with the vertical line on the template. (Note that this line runs across the fin at a slight angle. This conforms to the prototype). Scribe a line across the fin, being careful that the straight edge does not move from the line. Use a scribe or a sharp pencil held at an angle to scribe the line. You do not want a deep ragged indentation in the balsa. Mark this line across the front and back edges of the fin and using these marks, scribe a line on the other side. This represents the hinge line on the prototype, where the moveable elevon (lower portion) is hinged to the fixed fin (upper portion). Repeat the process on the other 3 fins.

From the vac-formed sheet, remove the 4 elevon hinge fairings. Glue a small piece of scrap balsa into each elevon fairing with tube type plastic glue or contact cement (Figure 3). When cement is dry, trim

block flush with bottom edge of elevon fairing. Now apply wood glue to the face of the balsa block and press assembly onto fin in position shown in Figure 2. Note: The elevon actuator fairings are all on the right-hand side of the fins (refer back to Figure 1).

It is best to paint the fins before assembly. If you spray the fins, use spray enamel such as Pactra, Testors or Krylon lacquerized enamel. If you brush paint the fins, Pactra Chrome Silver Enamel or Testors Pla Silver are recommended.



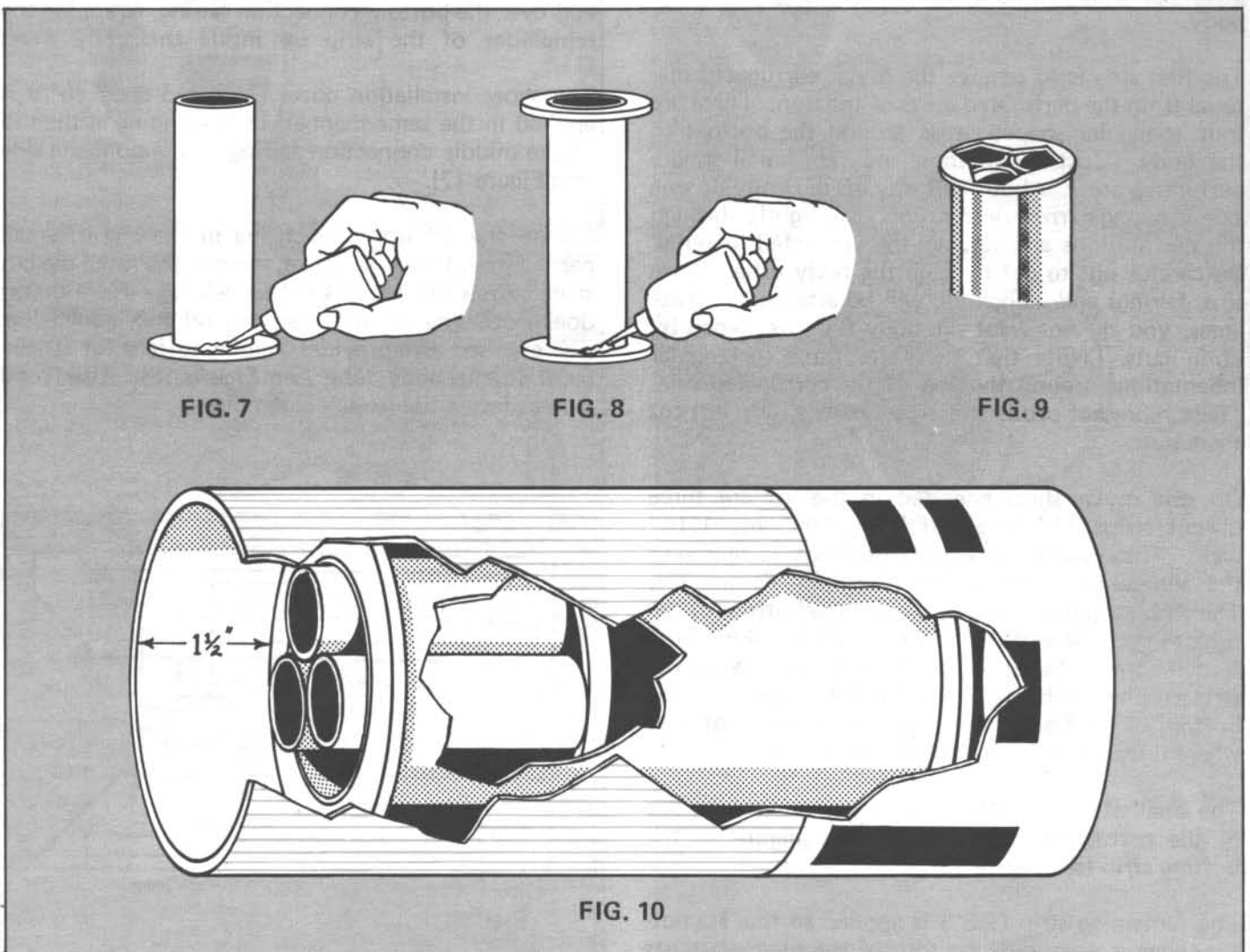
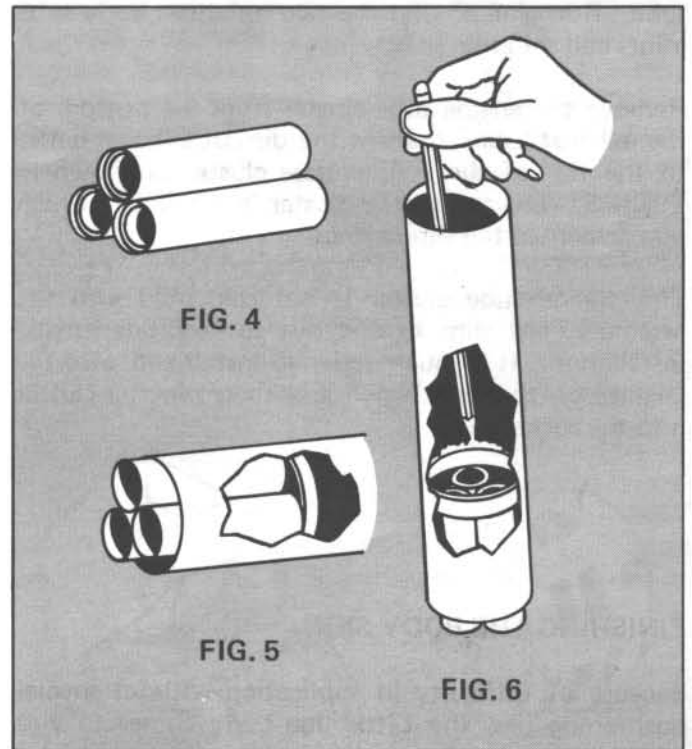
INTERNAL BODY STRUCTURE

Study Figure 10 to see how the body parts fit together. Begin by cementing together the three engine tubes ($3/4'' \times 3''$) as shown in Figure 4. Cement the thrust rings into one end of each of the engine tubes, recessing the thrust rings $1/16''$ inside the ends of the tubes. See Figure 4 again. Locate the main exhaust tube ($1 \ 5/8'' \times 8''$) and the large thrust ring. Insert the thrust ring into the exhaust tube. Now insert the previously assembled engine tube cluster into the exhaust tube, pushing it in until it projects $1/4''$ from the exhaust tube (see Figure 5). This will position the main thrust ring in the exhaust tube. From the other end of the tube, insert a pencil or stick with glue on its tip. Drop the glue on the thrust ring-exhaust tube joint (see Figure 6). Remove the engine tube cluster so it will not be accidentally cemented in place and spread glue liberally around the top of the thrust ring.

When the glue has dried, stand the exhaust tube on end and insert it into the hole in one of the balsa centering bulkheads (see Figure 7). Flow glue around the joint and let dry. Turn assembly up on other end, inserting into second balsa bulkhead, shown in Figure 8. Glue in the same manner.

From the bottom of the main body tube, measure inside $1\frac{1}{2}$ " and mark with a pencil. (Note: The bottom of the body tube is the end covered with the mylar corrugated skin). Insert the engine cluster into the exhaust tube again, pushing the cluster up against the main thrust ring.

Now insert the exhaust tube assembly into the body tube with the engine cluster extending out the bottom. Check your assembly against the cutaway drawing in Figure 10. It is very easy to put this together upside down, in which case you would have to use your Little Joe as a post hole digger. Push the exhaust assembly into the body tube until the bottom bulkhead is even with the mark you made inside the body



tube. Run glue around the two bulkhead-body tube joints and set aside to dry.

Remove the engine tube cluster from the bottom of the exhaust tube. Cement the die-cut exhaust baffle to the top of the engine tube cluster as shown in Figure 9. The top of the cluster is the end in which you cemented the thrust rings.

The engine tube cluster is not cemented into the assembly, but slips in and out to facilitate engine installation. It is much easier to install and wire the engines on the workbench and then slip the cluster into the rocket body.

FINISHING THE BODY SKIN

Because of difficulty in application without special positioning jigs, the Little Joe body comes to you with the corrugation and paint pattern already applied. The following steps will complete the basic body.

The first step is to remove the mylar corrugated material from the perforated areas of the skin. There are four triangular shaped areas around the bottom of the body. Just above these are four small square perforated areas. About half way up the body on one side is a long narrow perforation. Cut lightly through the perforations and remove the unwanted material. Be careful not to cut through the body tube. Since fins, fairings and launch lug will be attached in these areas, you do not want the body tube weakened by knife cuts. Note that there are three rectangular indentations around the top of the corrugated skin. These represent prototype access panels – do not cut them out.

On one mylar sheet enclosed in the kit are three die-cut strips 11" long and 5/8", 1/8" and 1/16" wide. These will wrap around the body to represent the subassembly connection rings (see Figure 11). The wide strip (5/8") wraps around the bottom of the tube. Press one end of the strip onto the skin at the seam in the corrugation (see Figure 12). Wrap the strip around the body, making sure it is even with the bottom of the body. Cut away the portions of strip where it laps over the triangular fin cutouts.

The smallest strip (1/16") is wrapped around the top of the corrugated skin in the same manner as the bottom strip (see Figure 13).

The remaining strip (1/8") is applied so that its bottom edge is even with the tops of the square cutouts

in the skin. This strip requires a little different treatment from the other two. Note that there are two small black squares on the strip. Line up one black square with the bottom of the "T" in STATES (see Figure 14). Press the short end of the strip firmly onto the tube, then wrap the remainder of the strip around the tube. The second black square should fall at the bottom of the "T" on the opposite side of the skin.

From the length of 1/4" x 1/8" balsa included in the kit, cut four pieces to length and carve to final shape as shown on the templates in Figure 15. These are the body and umbilical connection fairings. Paint the sides of the fairings silver and cement to the body with contact cement. Study the main plan view (Figure 1) for exact placement of the fairings. Remove from the mylar sheet (Figure 11) the main installation cover (1/4" x 8 3/16"). Press this strip onto the body against the bottom of the top connection ring and directly over the seam in the corrugation (see Figure 16). Smooth the strip downward to the middle connection fairing. In applying the strip to the fairing, hold loosely and press the strip firmly into the joints. Now press the strip down the lower body and over the bottom connection fairing, wrapping the remainder of the strip up inside the body tube.

The short installation cover (1/4" x 3 5/16" strip) is applied in the same manner, but beginning at the top of the middle connection fairing on the opposite side (see Figure 17).

Locate the 2" long launch lug in the bag of small parts. From the mylar sheet, remove the small die-cut strip. Wrap this around the launch lug. Note that it does not wrap all the way around the launch lug. The exposed area provides a gluing surface for attachment to the body tube (see Figure 18). Use wood glue to fasten the launch lug in place.

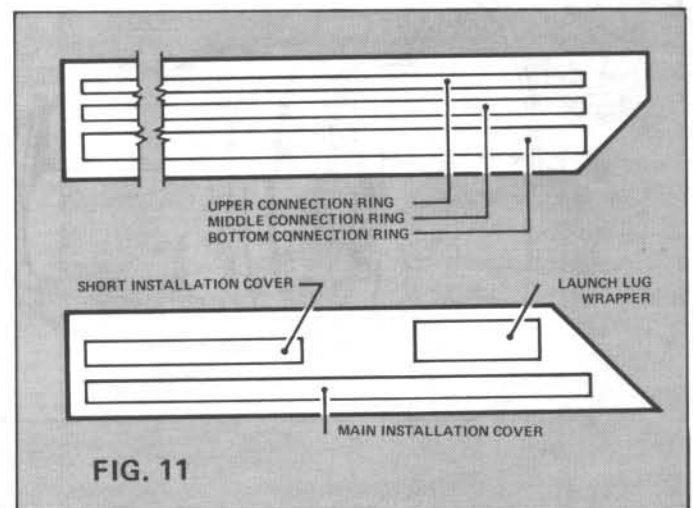
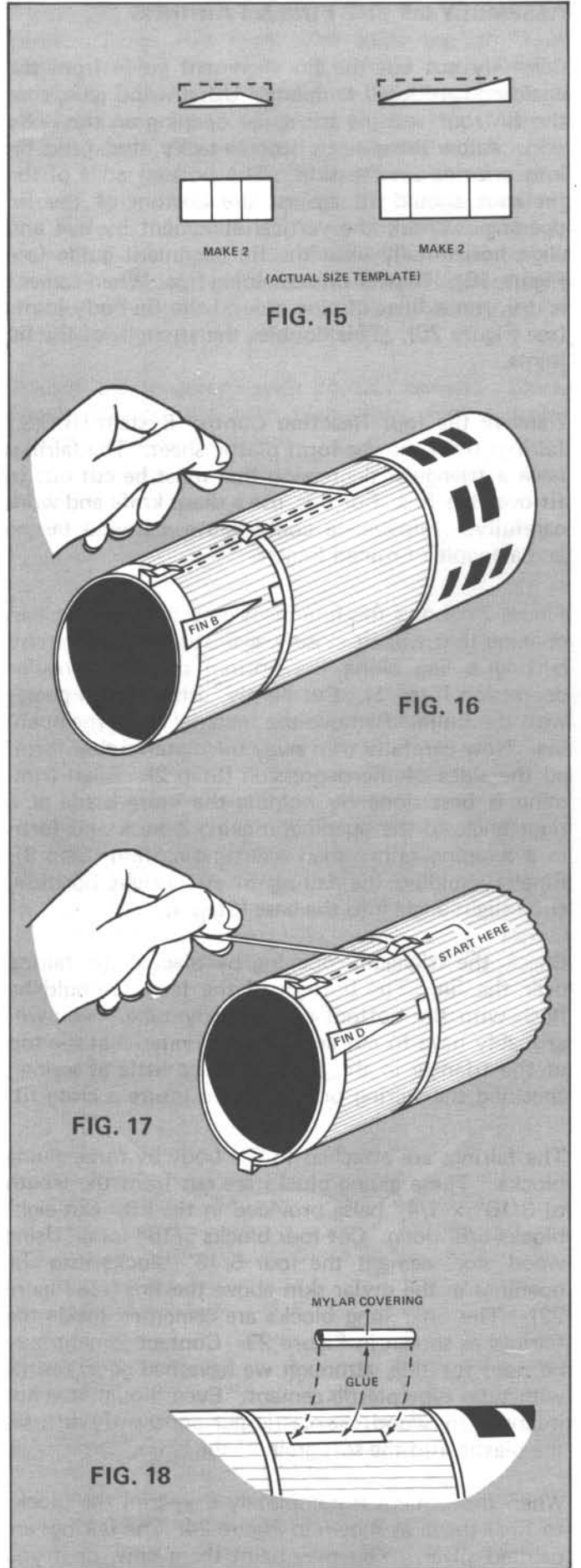
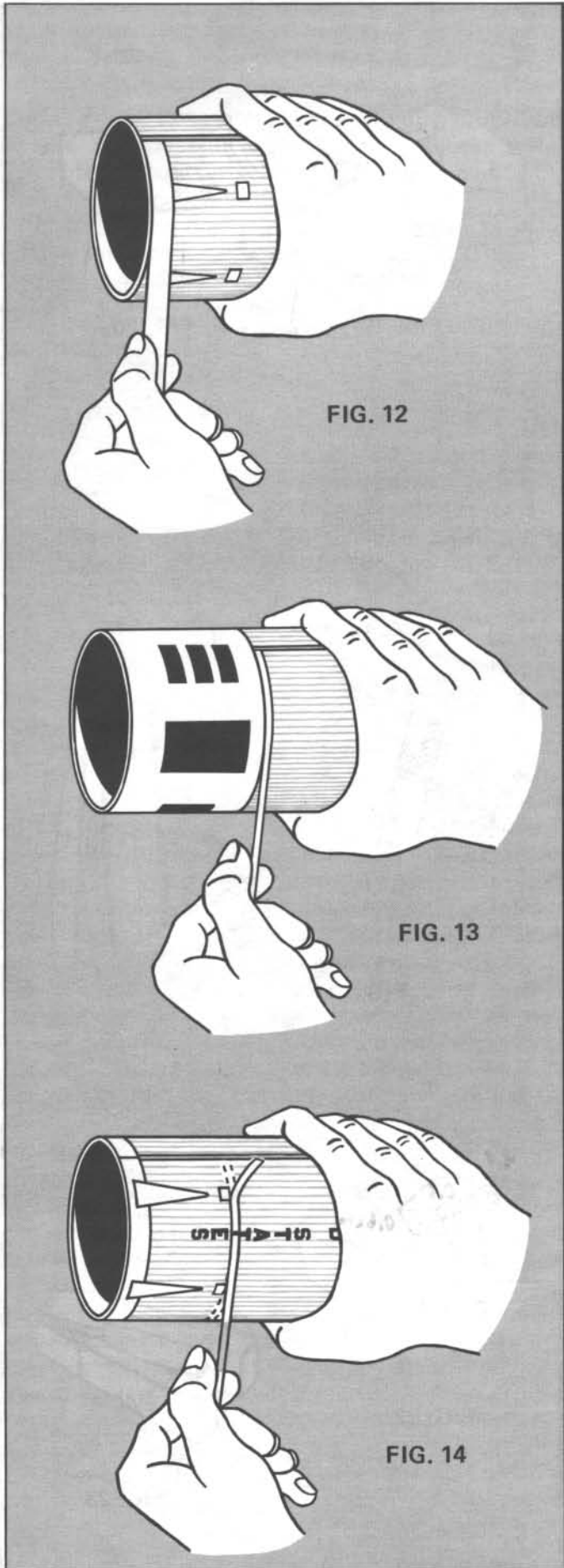


FIG. 11



ASSEMBLY OF THE FINS & FAIRINGS

Carefully cut out the fin alignment guide from the enclosed cardboard template. Using wood glue, coat the fin root and the triangular opening on the body skin. Allow the glue to become tacky, then press fin into opening on the skin. The bottom edge of the fin root should fit against the bottom of the fin opening. Check the vertical alignment by eye and align horizontally with the fin alignment guide (see Figure 19). Repeat on remaining fins. When cement is dry, run a fillet of glue around the fin-body joints (see Figure 20). This doubles the strength of the fin joints.

Remove the four Reaction Control System (R.C.S.) fairings from the vac-form plastic sheet. The fairings have a triangular depression that must be cut out to fit over the fins. For this, use a sharp knife and work carefully. Impatience could cause a ruined fairing and a couple of ruined fingers.

Figure 21 shows the four steps used to obtain a clean opening that will fit closely against the fin. Begin by cutting a line along the bottom of the triangular depression (Step 1). Cut lightly, using several passes with the knife. Remove the material from the opening. Now carefully trim away the material that formed the sides of the depression (Step 2). Final trimming is best done by holding the knife blade at a right angle to the opening, moving it back and forth in a scraping rather than a cutting motion (Step 3). Finally, holding the fairing in an upright position, cut a slight angle into the base (Step 4).

Check the triangular opening by placing the fairing over the fin. The bottom of the fairing should be flush with the bottom of the body tube. You will probably have to cut away a little material at the top of the triangle in the fairing. Cut a little at a time, checking the fairing on the fin to insure a close fit.

The fairings are attached to the body by three gluing blocks. These gluing blocks are cut from the length of $\frac{3}{16}$ " x $\frac{1}{4}$ " balsa provided in the kit. Cut eight blocks $\frac{5}{8}$ " long. Cut four blocks $\frac{5}{16}$ " long. Using wood glue, cement the four $\frac{5}{16}$ " blocks into the openings in the mylar skin above the fins (see Figure 22). The $\frac{5}{8}$ " long blocks are cemented inside the fairings as shown in Figure 23. Contact cement may be used for this, although we have had good results with tube type plastic cement. Even though it is not intended for wood, the plastic glue apparently diffuses the plastic into the soft grain of the balsa.

When the cement is completely dry, trim the blocks to final shape as shown in Figure 24. The fairings are painted silver. You may paint them now, or if you

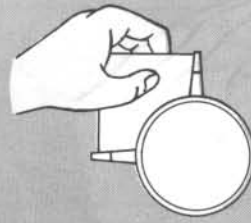
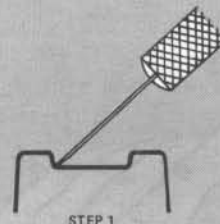


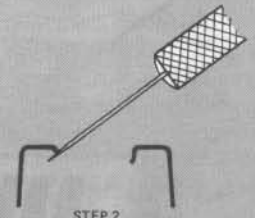
FIG. 19



FIG. 20



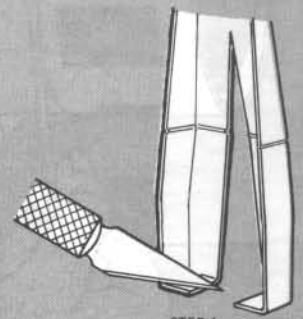
STEP 1



STEP 2



STEP 3



STEP 4

FIG. 21

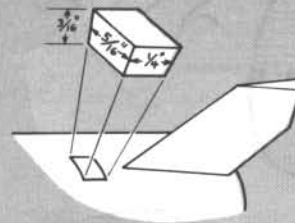


FIG. 22

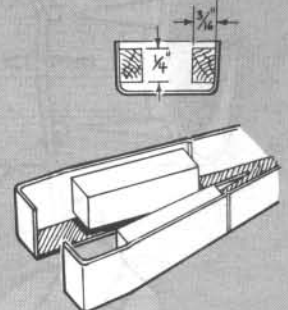
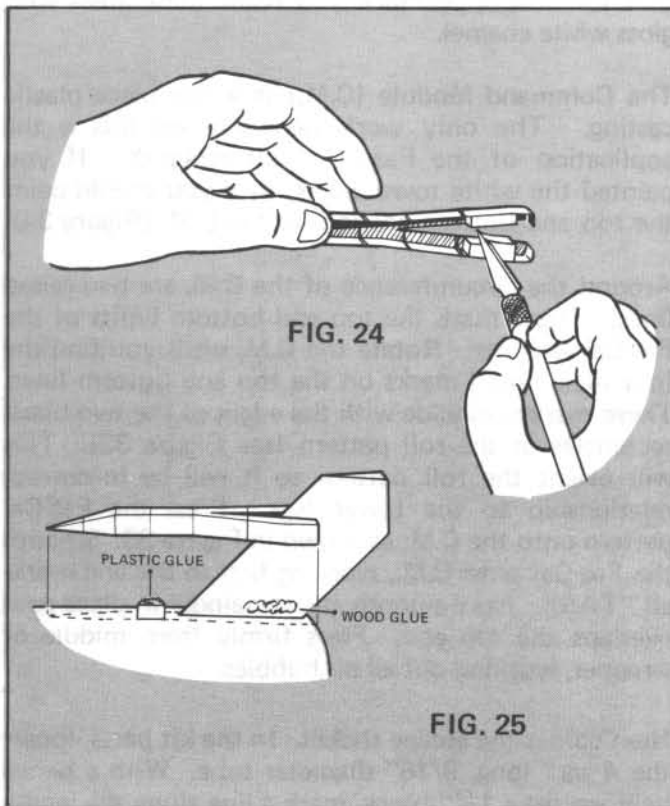


FIG. 23

are steady with a brush, they may be painted after final assembly.

To attach the fairings, first apply wood glue to the fin in the area where the two side gluing blocks will attach. Do not put any glue on the blocks themselves (see Figure 25). Next apply plastic glue to the top gluing block previously attached to the body. Slide the fairing down on the fin. Press down and in at the three contact points. Hold in place until the cement begins to set. Repeat on all fins and set rocket aside to dry. The last bit of detail on the fairings is the application of the high altitude nozzle openings. The nozzle openings are small black die-cut dots on the Fas-Cal sheet. These dots are pressed onto both sides of the fairings. See the plan view (Figure 1) for placement of the dots.

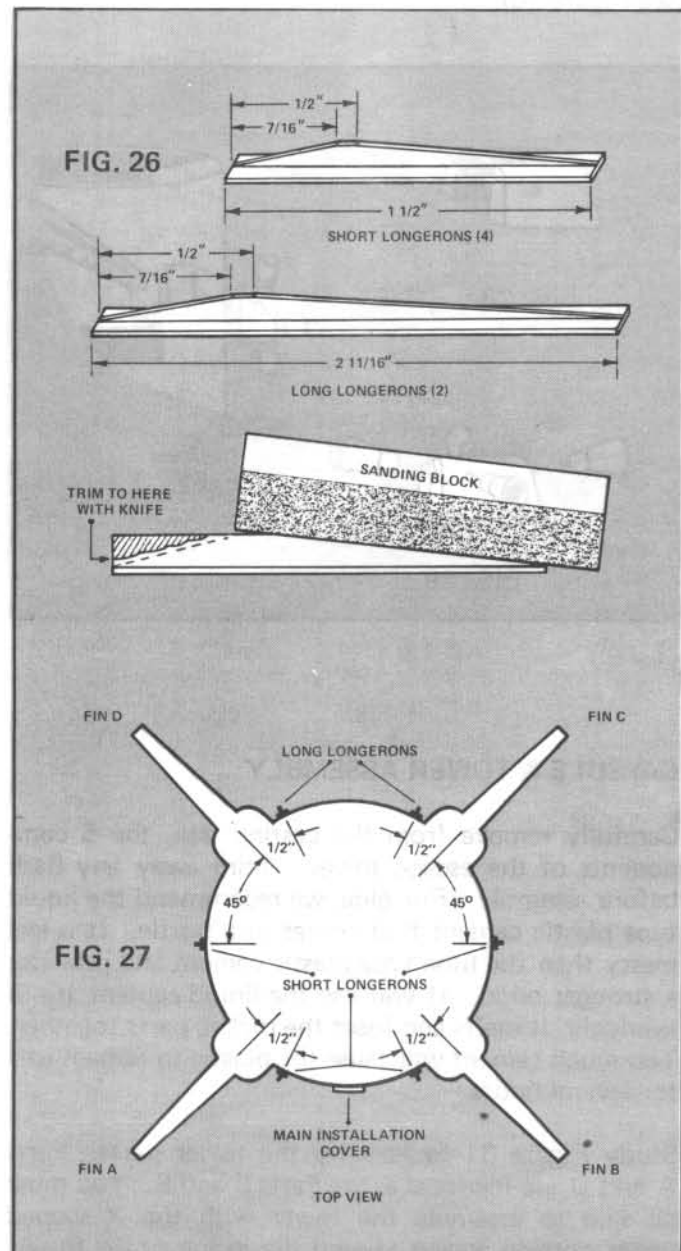


LONGERONS

From the 12" piece of "Tee" section wood enclosed in the kit, cut two pieces, each 2 11/16" long. From the remainder of the strip, cut four pieces, each 1 1/2" long. Use a sharp blade and cut with a light pressure to avoid breaking the delicate "Tee" section (refer to

Figure 26). Measure in 7/16" from one end of each piece. From this mark trim away top of "Tee" angling toward the short end. Shave material away carefully. Don't try to cut to final taper. Use a sanding block for this (refer to Figure 26). Measure in 1/2" from the end you just tapered. From this mark, taper the long portion in the same manner as above. When finished, run the sanding block along the surfaces of the longeron to obtain a completely smooth finish. Paint the finished parts silver. A piece of masking tape doubled over and pressed onto a piece of wood or cardboard makes a handy jig for holding the longerons while painting.

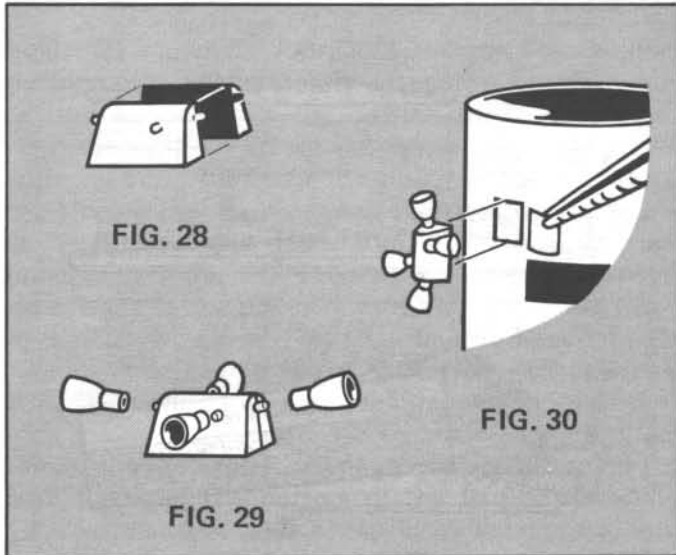
Attach the longerons with contact cement. Study Figure 27 and the main plan views, Figure 1, for placement of the longerons.



REACTION CONTROL SYSTEM (R.C.S.) ROCKETS

Spaced equidistant around the upper portion of the rocket body are four small black outlines, approximately $3/16'' \times 1/4''$ in size. These outlines locate the position of the R.C.S. rockets. Cut lightly around the outlines and remove the Fas-Cal covering, exposing the body tube (Figure 30). The tube will provide a better gluing surface than the slick Fas-Cal material.

Carefully remove the eight R.C.S. housing halves and the sixteen R.C.S. nozzles from the casting sprue. Using plastic glue, cement the housing halves together (Figure 28). Cement the nozzles over the locator pins on the housings (Figure 29). When glue has dried, paint the R.C.S. rockets gloss white. Paint the inside of the nozzle openings flat black. When paint is dry, attach the rockets to the body with contact cement (see Figure 30).



CAPSULE & TOWER ASSEMBLY

Carefully remove from the casting tree, the 5 components of the escape tower. Trim away any flash before assembly. For glue, we recommend the liquid type plastic cement that comes in a bottle. It is less messy than the tube type plastic cement and provides a stronger bond. If you use the liquid cement, use it sparingly. It melts and fuses the plastic parts together. Too much cement will cause the plastic to remain soft for several hours.

Study Figure 31 to identify the tower parts. Parts A and D are identical as are Parts B and E. You must be sure to assemble the tower with the X shaped upper portion angled toward the inside of the tower.

Begin tower assembly by cementing Part A to Part B. Use the locator pins and dimples to align the parts. The structural ring, Part C, is now cemented in place as shown in Figure 31. Allow glue to dry, then attach Parts D and E.

The escape rocket nozzles are assembled from the four pieces as shown in Figure 32. Cement Part F to Part G and Part H to Part I. When the assemblies are dry, press Parts H—I up into the slot of Parts F—G. Put a drop of cement on the completed assembly. Cement this assembly into the socket in the tower skirt making sure that the nozzles are turned to an angle of 45° with the dimples for tower legs (see Figure 32).

Figure 34 shows the paint colors for these parts. You may elect not to paint the white areas since the plastic is white in color. We recommend however, that for best appearance you paint these areas with gloss white enamel.

The Command Module (C.M.) is a one piece plastic casting. The only work necessary on this is the application of the Fas-Cal paint wrapper. If you painted the white tower parts, then you should paint the top and bottom portions of the C.M. (Figure 34).

Around the circumference of the C.M. are two raised lines. These mark the top and bottom limits of the Fas-Cal wrapper. Rotate the C.M. until you find the four little raised marks on the top and bottom lines. These marks coincide with the edges of the two black rectangles of the roll pattern (see Figure 33). This will orient the roll pattern so it will be in correct relationship to the tower legs. Press the Fas-Cal pattern onto the C.M. as shown in Figure 33. Smooth the Fas-Cal onto C.M., working first to the end marked "TAB". Now smooth the remainder in place so it overlaps the tab end. Press firmly from middle of wrapper, working out all air bubbles.

Next comes the escape rocket. In the kit parts, locate the $4 \frac{3}{8}''$ long, $9/16''$ diameter tube. With a pencil held against a $1/4''$ block, mark a line along the length of this tube. Remove the escape rocket paint pattern from the Fas-Cal sheet. Apply this to tube by placing side marked "TAB" exactly on the line you had drawn on the tube. Now carefully roll the Fas-Cal around the tube, smoothing out any air bubbles with your fingers.

Figure 34 shows how the assembly is completed. The C.M., escape tower and rocket skirt are cemented together with plastic glue. The nose cone is pressed into end of escape rocket body and this is pressed onto rocket skirt. Rotate the escape rocket so the paint pattern lines up with that of the C.M. as in Figure 34.

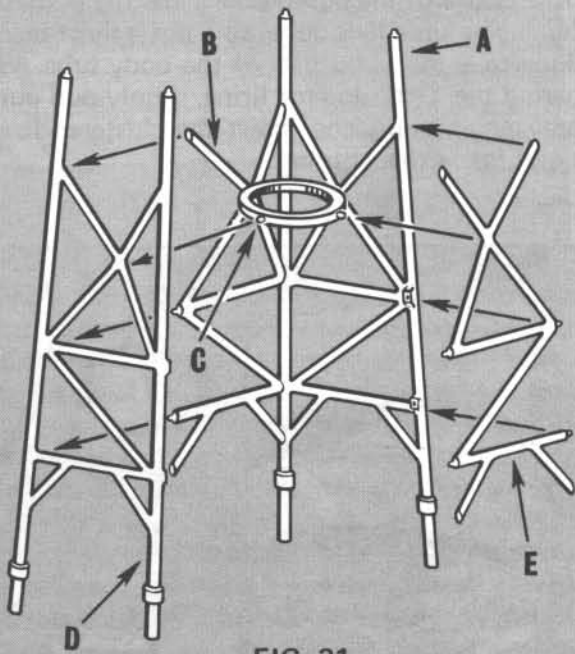


FIG. 31

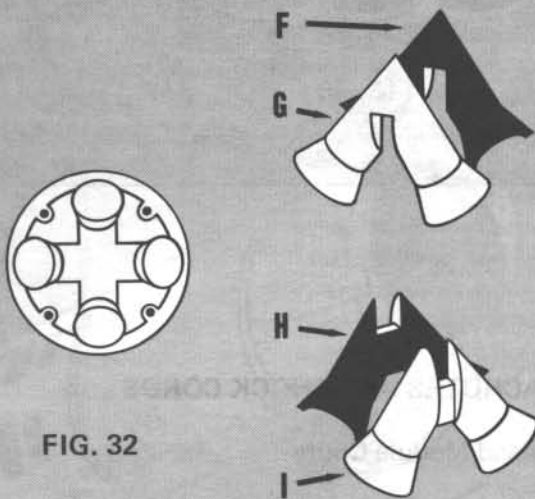


FIG. 32

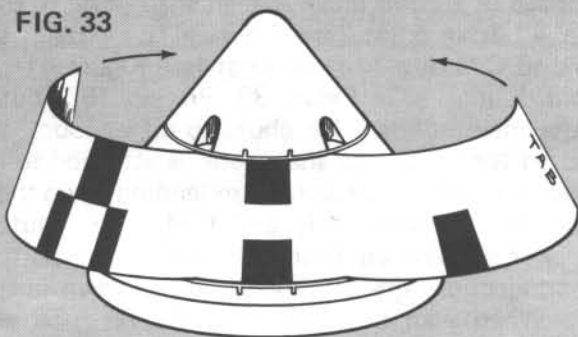
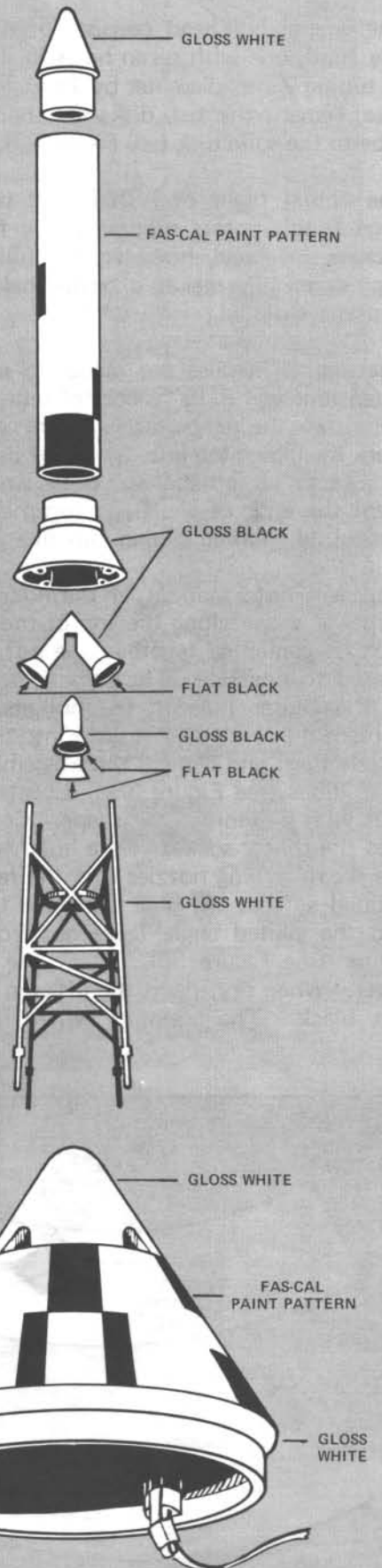


FIG. 33

FIG. 34



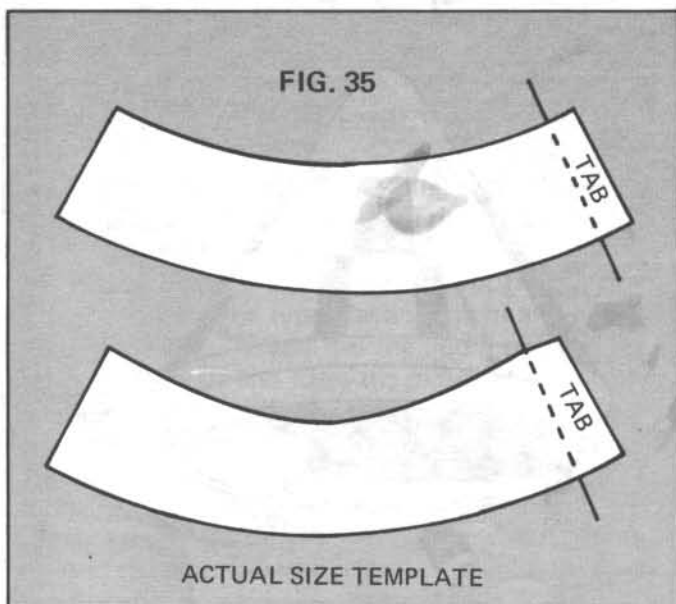
NOZZLE ASSEMBLY

The engine bulkhead consists of two die-cut disks, one solid, one with seven holes in it, and one length of tubing 2 3/4" diameter by 1 3/8" long. Using wood glue, cement the two disks together and cement the tube to the solid disk (see Figure 36).

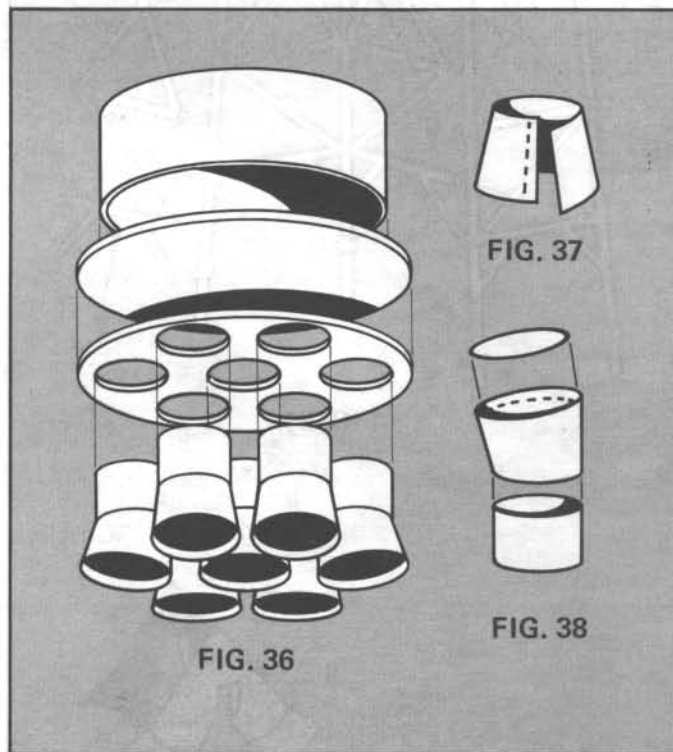
The actual flight of A-004 used only four of the large Algol motors supplanted by five small recruit rockets. We feel, however, the full complement of engine nozzles makes a better balanced and more impressive model.

The engine nozzles are made up of die-cut flaired extensions and 5/16" pieces of tube. Lay the die-cut flairs over the templates in Figure 35 and accurately mark the gluing tab line. Now curl the nozzles around an Xacto knife handle or other small cylinder. Cement the ends of the flairs together exactly on the previously marked gluing tab line (see Figure 37).

You will note that six of the nozzle flairs have an elliptical shape along the top of the flair. When the tabs are cemented together, the nozzles appear to be canted to one side. The seventh nozzle, which goes in the center hole in the bulkhead is cylindrical. Cement the seven die-cut disks into the bottom of the nozzle flairs and cement these assemblies to the short base tubes (see Figure 38). Locate the one nozzle unit with a symmetrical shape. Cement this nozzle into the center socket in the bulkhead. Now cement the six remaining nozzles into the remaining sockets, rotated so that the glue tab faces the center nozzle and the canted angle faces out from the bulkhead center (see Figure 36). Paint the entire assembly silver. When dry, paint the disks in the nozzle flairs flat black. The assembly, when inserted into the



bottom of the rocket, should stay in place from the slight pressure of the bulkhead against the body tube. If the engine unit falls out easily, put a short piece of masking tape inside bottom of the body tube. When preparing the Little Joe for firing, simply pull out the dummy engine unit and insert the clustered live engine unit into exhaust tube.



PARACHUTES AND SHOCK CORDS

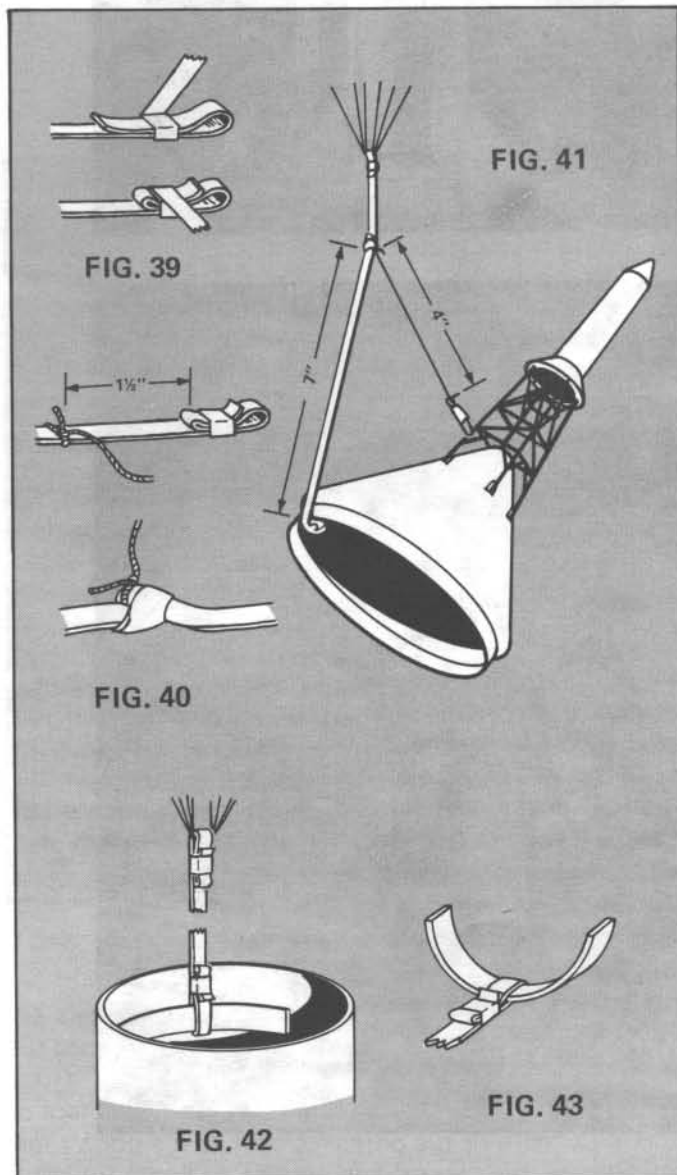
Command Module Chute

Form a loop in the end of rubber shock cord as shown in Figure 39. Tie an 8" piece of shroud line (white thread) around rubber shock cord as in Figure 40. Now tie knot in shock cord to prevent slippage of shroud line. Attach snap hook to shroud line 4" from knot (see Figure 41). Attach shock cord to C.M. lug 7" from knot (see Figure 41). Use same tie loop as in Figure 39. Prepare 16" chute per chute instructions. Tie chute to upper loop. When packed for flight, the snap hook is attached to lower tower leg with the shroud line extending down through slip joint between body and C.M. The chute and shock cord are all inside the chute compartment. Upon ejection, the chute deploys as shown in Figure 41. When your Little Joe is on display, you simply detach the snap hook from the tower and all non-scale paraphernalia is hidden inside.

Main Chute

Prepare the 24" chute per instructions included in chute pack. This chute is attached by means of an elastic shock cord. Begin by making a loop in the elastic cord using the method shown in Figure 39.

Locate the half section piece of body tube. This serves as an anchor ring. Loop the other end of the elastic shock cord around this and tie as shown in Figure 42. Place a generous amount of glue on the back side of the anchor ring and shock cord and glue into body tube 1" from top (see Figure 43). Run a bead of cement all around joint for added strength. Tie the chute to the top loop. When packing the chutes for flight, make sure you don't cross the shroud lines and shock cords. Place a large piece of flameproof wadding in the bottom of the chute compartment to keep the hot ejection gases from coming in contact with the parachutes.



LAUNCHING THE LITTLE JOE

The technical report enclosed with this kit will give you a complete run down on cluster ignition firing. Read this prior to firing preparation.

Recommended engines for the Little Joe are listed on the following chart:

| OLD DESIGNATION | NEW METRIC DESIGNATION |
|-----------------|----------------------------------|
| three A.8-3's | three A8-3's |
| three B.8-2's | three B4-2's, B4-4's |
| three B.8-4's | three B6-4's, or three C6-5's |

When the engine cluster is ready for firing, insert into exhaust tube. If it does not fit tightly, wrap a short piece of masking tape around the cluster unit. Keep adding short pieces of tape until you have a tight fit. This is important since the ejection charge is supposed to eject the C.M. and chutes. If the engine unit ejects instead, your Little Joe will have problems when it reaches terra firma.

To guarantee a stable flight, you should verify the balance point of the model before firing. With the model in firing condition (including engines, chutes, wadding) the balance point should be 6 1/4" from the bottom of the rocket body. If it balances at a figure less than this, add weight to the nose (Escape Tower) until the safe balance point is reached.

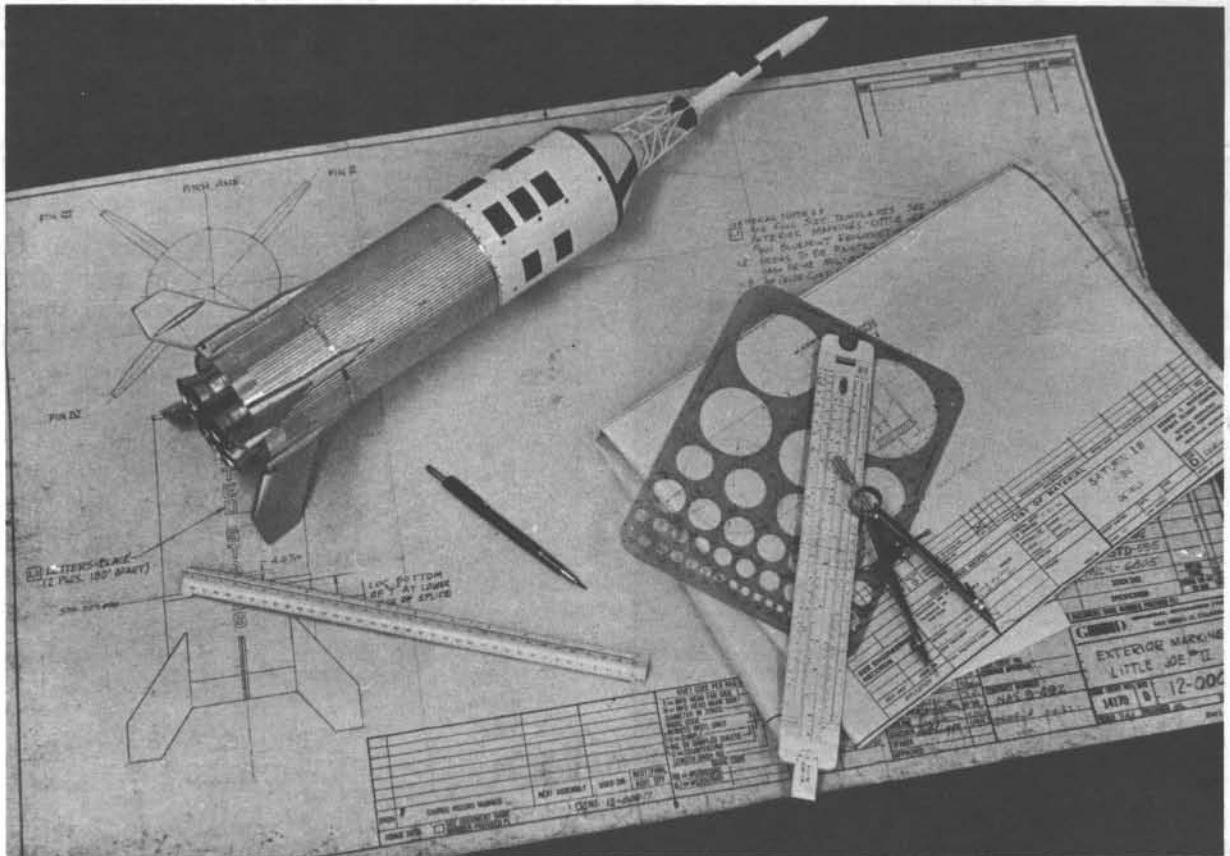
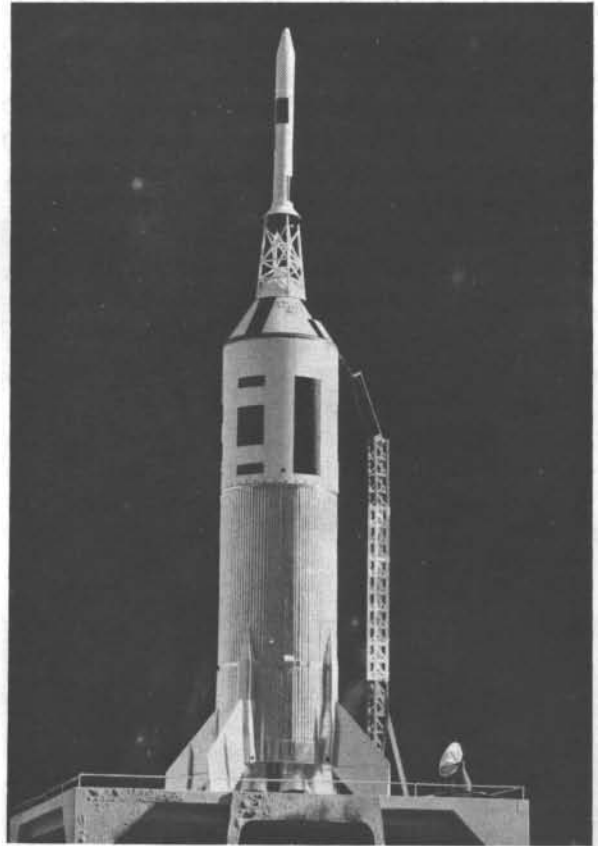
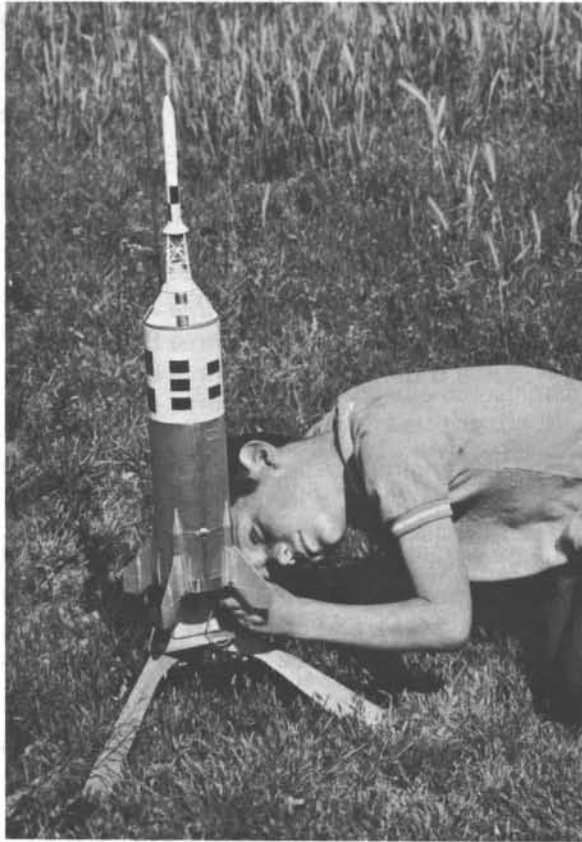
Launch the Little Joe from a 1/8" x 36" steel launch rod in the middle of a field at a safe distance from any home, street or power line.

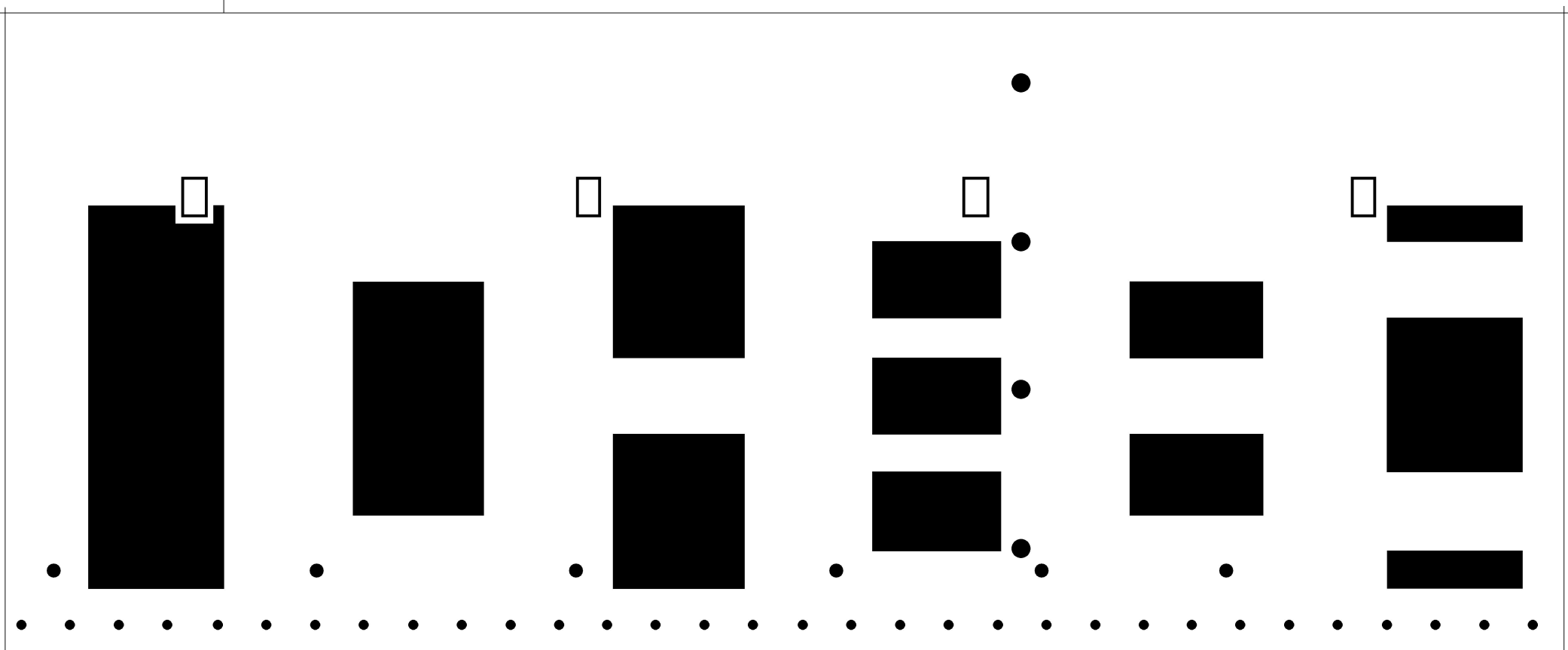
The Little Joe is designed to give you countless flights and will bring oohs and aaahs from your friends when reposing on your display shelf. Read the historical booklet enclosed in the kit. A better understanding of the prototype will give you more enjoyment in your model.

WATCH FOR
MORE NEW



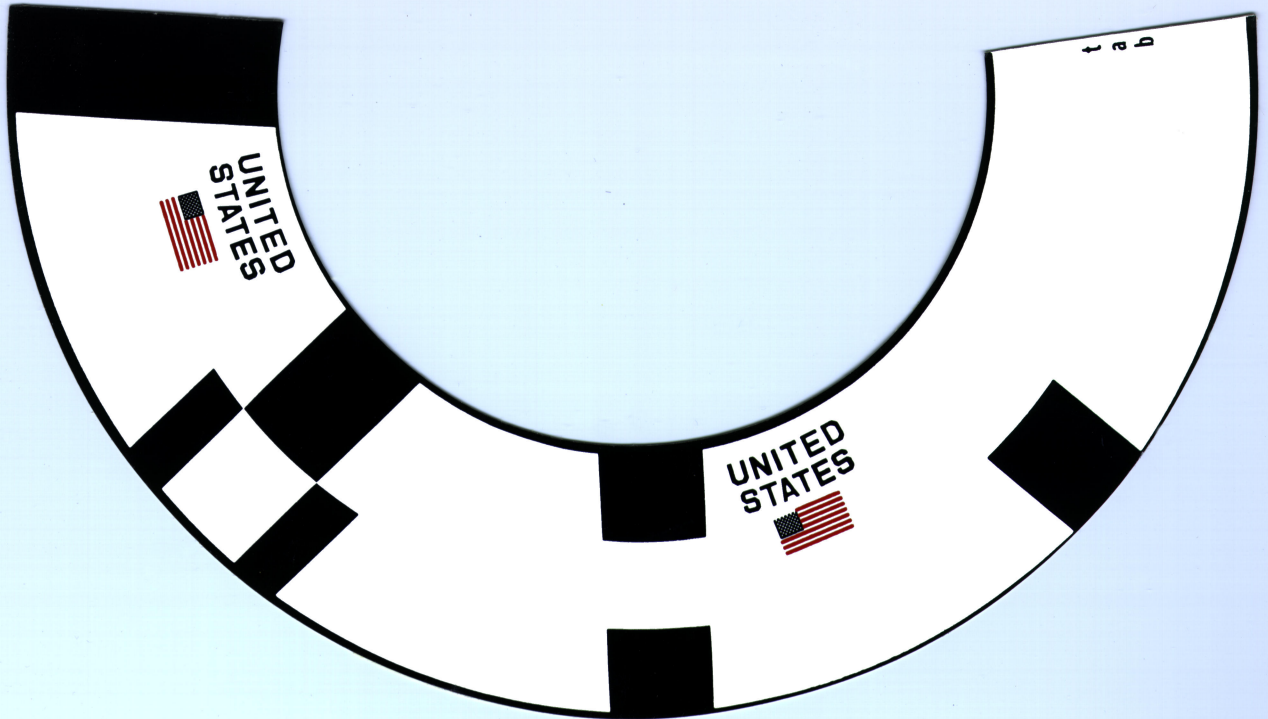
SUPER SCALE
MODELS

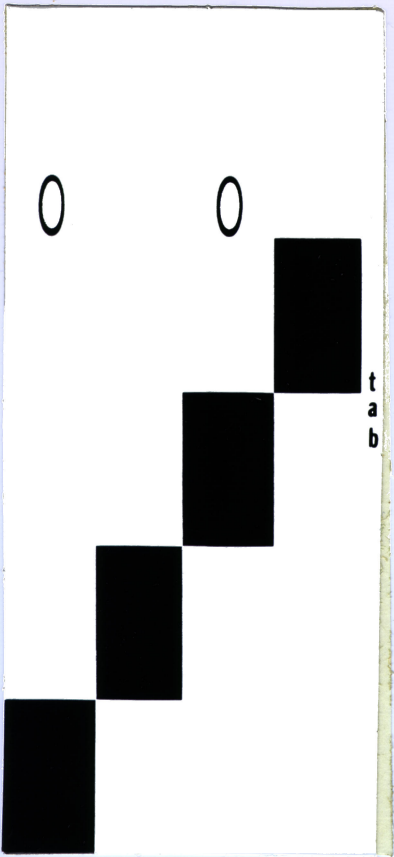




Upper wrapper for the Apollo Little Joe II by Centuri Kit # KS-8
Image 6506 x 3170, 600 DPI

1 inch (25,4 mm)





Centuri Little Joe II Escape Tower Shroud

01/2005 www.leo.nutz.de

Centuri Little Joe II Fin

