

Building the Estes Little Joe II

Many of us old-timer and BARs (Born Again Rocketeers) vividly remember lusting after the fabulous 1/45 scale Centuri Little Joe II kit from 1969. It had a great injection molded Apollo Spacecraft (the capsule and launch escape system) and RCS "quads," a body tube that was pre-covered with the SM roll pattern and a mylar wrap to simulate the bare aluminum booster (though the wrap was "chrome"), pre-formed balsa fins, vacuformed fin fairings, three engine power (three 18mm B or C motors), dual 'chute recovery, and...a hefty (for 1969) price tag of \$12.95 or just \$4.00 less than their 1/100 Saturn V (and \$3.00 MORE than the Estes 1/100 Saturn V!).

Fast Forward to 2016 and the introduction of the Estes 1/45 scale Little Joe II kit. We have a kit which uses the same injection molded parts as used in the Centuri kit. You even get a really nice reprint of the original Centuri history and data booklet that was in the original Centuri kit. That's it. Everything else is different.

From a scale model rocketry perspective, as good as the Centuri kit was for its day (phenomenally good), the Estes kit is even better. The kit utilizes an excellent (but strangely flawed...more later) full 3D vacuformed body wrap for the corrugated booster "skin" that has, count 'em, the correct number and spacing of "corrugations." Capitalizing on modern injection molding, the fins, along with their fairings, are outstanding thin, strong and precise. Going further with injection molding are six very nice scale nozzles that represent a configuration of an "all up" Little Joe II in its most powerful configuration...but which never flew in such a configuration. Also from the injection molding pool are a plethora of external details for the booster including the many various "stringers" and electrical systems covers as well as a pair of injection molded launch lugs. Finally, also in departure from the Centuri kit, are water slide decals for the SM section (pre-wrapped with a printed opaque Mylar "skin" on the Centuri kit) and water slide decals for the Apollo capsule and Launch Escape Motor (which were pre-printed Mylar wraps on the Centuri kit).

The "Oops" in the Estes Kit

Back to that marvelous vacuformed corrugated booster wrap... Yes, it has the proper number of "corrugations" and it also has formed-in non-corrugated bands like the real thing. It also incorporates raised areas to position and align the placement of the fins. BUT (and this only really tweaks at scale purists) the corrugations are one-half "pitch" off. That is, the centerline of the fins should fall in the valley between corrugations, but they don't. They fall over the peak of a corresponding corrugation. Picky, picky.

The second "oops" with the corrugated wrap is that it is formed what appears to be an ABS or similar plastic. All the other plastic parts in the kit are formed from polystyrene. What's the big deal? Well, ABS requires a significantly different glue for proper adhesion. Conventional tube glues for styrene, which is recommended in the instructions, just won't properly bond ABS. The recommended glue WILL bond all the injection molded parts in the kit but it will NOT properly glue the fins to the corrugated skin. The solution is to use a strong liquid cement intended for chemical resistant plastics. There are several that are readily available to the hobby market. Many builders opt for either of the two Plastruct liquid cements...Plastruct Plastic Weld or Plastruct Bondene, both are better on the corrugated skin than conventional styrene cements, but not the strongest...or for other even stronger cements that are based on Methylene Chloride such as Tenax 7s (...has been difficult to get for the past few years but is the

“standard” for Methylene Chloride cements), Micromark “Same Stuff” (as in, the ‘same stuff’ as Tenax 7s, or Flex-i-File “Plast-i-Weld.” These three are almost literally the “super glue” of plastics, surpassing even CA glues for plastic in strength and speed of bond. Hold the the parts in contact for about 10 seconds after applying adhesive. After about a minute the bond will be surprisingly strong.

But even getting the fins properly and strongly glued to the corrugated skin doesn’t overcome a significant “weakness” in the fin mounting. It has to do with the way the skins adhere to the body tube. Under relatively mild recover conditions the fins can literally rip off the model, taking a chunk of the corrugated skin with it. Not exactly desirable. It would have been great if the fins could be glued directly to the body tube...but such would create other production and building problems. So the compromise to glue the fin skin to the body and then glue the fins to the skin is the easiest way to go and just risk the occasional fin “rip off.” But there is a solution that is relatively easy. By incorporating a hardwood “spar” that runs about half the span of the fin, through the corrugated skin, through the body tube and ending at the engine tube, the chances of breaking a fin are tremendously reduced.

The third “oops” with the implementation of the corrugated skin has to do with two of those non-corrugated bands that I mentioned earlier. The bands are flush with the tops of the corrugations which means they do not rest against or glue to the body tube. Estes’ solution is to provide a short ring of body tube that you slit to fit around the aft end of the body tube. Supposedly, this ring takes up the gap between the band on the aft end of the corrugated wrap and the body. The problem is that the thickness of this ring is much too great and subsequently causes the wrap forward of the ring to not touch the body tube and therefore not be “bondable” to the body tube. The simple solution is to obtain a sheet of card stock or “cover” paper at an office supply and cut strips that are glued with white glue around the circumference of the aft end of the body tube. Two layers will do the trick.

The same problem exists with the narrow band at the fore end of the wrap. Estes doesn’t offer a solution for this end of the wrap which results in a gap that is visible if not filled. Again, two layers of card stock that are slightly narrower than the width of the band neatly fills the gap. I think Estes would have been far better off in providing a simple card stock sheet with the strips printed on them than the section of body tube that they do provide.

One last sort-of-oops applies to the corrugated skin. Estes doesn’t specify a specific adhesive for bonding the corrugated skin to the body tube. They simply ambiguously indicate to use a “spray adhesive.” You need to use something that is structurally strong. I specifically recommend either 3M Super 77 Multipurpose Adhesive or Loctite 200 High Performance Spray Adhesive. Both provide about the same strength and use properties and are easily sprayed in thin uniform coats without “stringing.” Avoid the “stronger” versions of the respective products as getting a thin uniform coat without random adhesive “strings” is next to impossible. I’ll cover applying these adhesives later.

The engine mount is another “oops” area. If built according to the instructions, the model will not rest flat on its fins because Estes’ engine retainer hooks with the silly “thumb tab” protrudes beyond the trailing edge plane of the fins. The simple solution is to take a pair of wire cutters and cut the majority of the thumb tab off and then “dress” the sharp cut edges with a file or sandpaper so they won’t poke your thumb when releasing the motor. That’s not all. The instructions indicate that the aft bulkhead is mounted $\frac{1}{2}$ ” forward of the end of the motor tube. Furthermore, the instructions indicate that the engine hook is positioned to allow $\frac{1}{2}$ ” of the motor to project beyond the end of the body tube. Finally, though the instructions do not provide a measurement, the illustrations imply that the engine mount is

glued into the main body with the aft bulkhead being flush with the aft end of the body tube. If you build the model accordingly, even without the engine hook thumb tab, the model won't quite sit square on a flat surface. Well, the aft bulkhead of the real Little Joe II IS NOT flush with the rear of the body, it's slightly recessed. Locating the engine mount so that the end of the engine tube is flush with the rear of the body tube takes care of this situation and mounting the aft bulkhead about 3/16" ahead of the end of the engine tube (or utilizing a removable rear bulkhead-and-nozzles as you will see later) eliminates the issue of the model "teetering" on the end of the engine retainer when resting on a flat surface.

Let's Get Started

Applying the Corrugated Skin Wrap

Wrap the corrugated skin around the body tube (no adhesive!) so that one end of the wrap is flush with one end of the body tube and hold it securely with one hand. With the other hand, use a pencil to mark completely around the body tube along the edge of the corrugated wrap that is not flush with the body tube end. Make note of which end was flush with the wrap (this is the aft end of the body).

Use a letter-sized sheet of card stock (65-pound is pretty much the standard "weight" you are looking for) to cut two 1/2" wide and 10 3/4" long strips. Also cut two 1/8" wide by 10 3/4" strips.

Using white glue, wrap and glue the 1/2" wide strips flush around the aft end of the body tube. It doesn't matter that the end-gaps don't completely come together. Glue the two 1/8" strips (two layers) along the pencil mark with the pencil mark being just barely visible toward the fore end of the body tube.

No alignment mark on the body tube is needed to properly and accurately adhere the corrugated skin to the body tube. In fact, it is very easy to get any marks you apply to the body tube just a "little off" that will lead to you applying the skin in not quite perfect alignment.

You will need one of the spray adhesives (or equivalent) mentioned above and you will also need a roll of 1"-2" wide painter's tape (such as Scotch Blue Painter's tape or equivalent)

First, prepare the corrugated skin by slicing two raised corrugations from one edge of the wrap...but you need to slice them from the proper edge. Lay the skin on a flat surface with the broad flat band toward you. Using a straight edge, slice/score through the 2nd "valley" from the left edge of the wrap. Why slice two corrugations away? One, the longer of the electrical tunnel covers completely covers these two corrugations. Two, by having a "gap", installation of the skin is made easier as you will see.

Using a sheet of paper and the blue tape, mask the portion of the body tube that is not to be covered by the wrap.

With the "visible side" of the corrugated wrap facing up, apply a strip of Blue Tape that extends the length of the wrap (and no more) parallel to the corrugations and so that about 5/16" to 3/8" of the tape overhangs the length of the corrugated skin. Rest the body tube squarely on end on your work surface. Stand the corrugated sheet on end squarely on your work surface and slide the body tube to the edge with the exposed tape. Carefully curl the corrugated skin around the body tube and seal the tape to the body tube. When the wrap goes completely around the body tube, the ends should perfectly align with one end secured to the tube with the tape. Burnish and secure the tape firmly to the body tube with the back of your thumbnail.

“Swing” the skin away from the body and back again, using the tape as a hinge, to make sure that it “automatically” aligns when wrapped around the tube. Swing the corrugated wrap away from the body tube and spray its inner surface with a light coat of spray adhesive. Also spray an equivalent coat of spray adhesive to the exposed body tube. Allow to “set” for 20 or 30 seconds and then smoothly swing the wrap back around the body tube allowing it to progressively contact the body tube. Using Blue Tape tightly wrap the entire length of the corrugated wrap and set aside overnight for the spray adhesive to completely bond.

After being wrapped overnight, carefully remove the blue tape and masking from the body and corrugated wrap, including the Blue Tape “hinge.” The tape hinge may extend under one edge of the corrugated wrap along the gap. That’s okay...just remove as much of the tape as you can.

Using your methylene chloride liquid cement, glue the long electrical cover over the corrugated skin gap with the edges of the cover being centered over the gap. Basically, the raised corrugation along each edge of the gap bonds to the edges of the cover. The forward edge of the long cover is flush with the forward edge of the corrugated wrap.

Count the corrugations from the fin centerline to the left of the cover. Glue the short electrical cover to the opposite side of the body using the same number of corrugations for proper positioning. The short tunnel protrudes beyond the aft end of the body by the same distance as the long cover.

Glue the various longerons to the body as indicated in the Estes instructions. Also glue the launch lugs in place.

The Fins

You will need about an 18” length of ¼”x1/4” basswood or spruce (I prefer bass as it bonds with CA glue better than spruce). You will also need both thin and thick CA glue and accelerator and one of the preferred liquid cements described earlier. A ruler and small drafting triangle will also be handy.

Glue the four sets of fin halves together and match the seams as perfectly as you can. Use the liquid cement to bond the halves together. Per your preference, smooth the seams as you see fit after allowing the cement to dry at least 10 minutes. Wrap a section of fine sandpaper around the SM portion of the body tube and then sand the “root edge” of the fins to the same curvature.

You will notice that there are several “raised” circular projections inside the fairings along the fin root edges. Trim or sand the four raised projections in the narrow end of the fairings flush with the inside fairing surface. You don’t need to do the same with the raised areas in the broad end of the fairings.

Sand a tapered wedge to one end of the ¼ x ¼ bass/spruce strip. This taper should closely match the inside taper of the fin when the strip is inserted as far aft of the fin as possible. The taper should also allow the strip to extend at least half of the span of the inside of the fin. Cut the tapered end of the strip so that about a 4” long spar results. Insert the spar as deep into the fin as possible (without deforming the fin). The spar should be perpendicular to the root of the fin. Use the small drafting triangle (or 90-degree equivalent) to assure a 90-degree angle. Once the spar is positioned, apply a bit of thin CA to the spar where it touches the inside of the fin. Capillary action will “wick” the thin CA to bond it to the inside of the fin. After a few seconds, apply a liberal amount of thick CA around the exposed spar-to-fin joints

inside the fin and “set” with CA accelerator (if desired). Finally, trim the spar so that 1- $\frac{1}{4}$ ” (or a bit more) protrudes from the root of the fin assembly. Repeat this process for the other three fin assemblies.

The Engine Mount

Assemble the two forward bulkhead rings together inserting the engine tube through the both of them before gluing to assure concentricity (allow about $\frac{1}{4}$ ” of the engine tube to protrude through). Square up the bulkhead with the engine tube and apply a generous white or yellow glue fillet to both sides of the bulkhead/engine tube joint.

Mark, slit, and install the engine retainer (after cutting the thumb tab off with strong wire cutters) according the Estes instructions.

Mark the engine tube $\frac{1}{2}$ ” from the engine end. Install, square up and glue ONE of the aft bulkhead rings at the $\frac{1}{2}$ ” mark. Fillet on the forward side of the ring. Be sure the engine retainer notch is centered over the engine retainer. Install the shock cord through the fore bulkhead of the engine mount and set the assembly aside.

Using a sharp #11 blade, cut a $\frac{1}{4}$ ” square hole that is located $\frac{5}{32}$ ” from the aft edge of the body and centered between the molded-in fin alignment lugs on the corrugated wrap. This hole goes through both the wrap and the body tube. Mark each hole 1 through 4. Mark each fin (on the aft edge of the fin spar is a good place) with 1 through 4.

Insert the engine mount without gluing it in place so that the rear bulkhead is about $\frac{1}{2}$ ” inside the body. Insert the fin spar through the first $\frac{1}{4}$ ” hole. Trim and sand the spar so that the fin assembly firmly touches the corrugated wrap along all edges and seats squarely while the end of the spar just barely touches the engine tube. You may need to file or trim the fore and aft edges of the $\frac{1}{4}$ ” hole to get the aft edge of the fin assembly to properly seat over the alignment lugs and also rest firmly against the rear of the corrugated wrap. Repeat this process with the other 3 fins.

Install each fin assembly into its corresponding position on the body. Use your liquid cement to securely glue the assembly to the corrugated wrap around the perimeter of the fin assembly. Hold tightly in place for a minute or two after applying the cement. Repeat this for the other three fins.

If you removed the engine mount before installing the fins, slide it into the body from the forward end so that the aft engine mount bulkhead ring is against the fin spars. Rotate the engine mount so that each of the six engine nozzle holes aligns with the six main longerons (there are two long and four short longerons equally spaced around the body). Use thick CA or white/yellow glue to glue the aft bulkhead snugly against the forward edges of the spars. Also glue the spars to the engine tube where they contact it making sure not to accidentally glue the engine retainer. Rest the body tube vertically on its forward end while the glue dries. Finally, with the body still resting vertically on its forward end, drip white/yellow glue onto the forward bulkhead through the nozzles holes of the aft bulkhead and use a dowel or long-stick swab to spread the glue around the bulkhead/main body tube joint. When dry, flip the assembly over and apply glue to the front side of the bulkhead/main body joint.

Assembled the six scale nozzle halves together and paint. Use white paint to paint one side of the remaining nozzle bulkhead. Install the nozzles from the painted side and glue them into place. The aft bulkhead/nozzle assembly should install cleanly with a moderately snug fit. Sand the circumference of

the bulkhead as needed to achieve this fit. Don't glue this assembly in place if you want it to be removable from flight. Removing it for flight improves model stability, reduces its weight and, most importantly, protects the scale nozzles from any heat damage or soot deposits caused by delay backflow or reflection of the engine exhaust from the launcher blast deflector.

Make sure all the plastic glue joints are good. You may want to flow a bit more liquid cement to all the joints.

Thoroughly clean the exposed plastic parts with a good cleaner such as mineral spirits thinner or Bestine (hard to get) or even "Goo Gone". This will remove any oils or adhesive residue from the masking process and/or handling. Wipe down everything with window cleaner as a final step.

Paint all the exposed booster body starting with the fore end of the corrugated wrap with silver paint. After trying several brands and types I have settled on Model Master spray silver as most approximating the aluminum color of the Little Joe. It may have a tad more silver sheen than real aluminum, but you can solve that problem with the proper clear coat.

Paint the SM portion of the booster with gloss white. Mask as needed before painting.

After painting the body you will clear coat it with Pledge Furniture Polish. You can either spray direct from the bottle with an airbrush or use a high quality open cell foam 1" artists brush. Yes, you can very successfully and very easily brush the Pledge. I use the brush technique frequently because it is very fast, has very little waste, and with just a little practice will produce a finish that is indistinguishable from a sprayed finish. This is especially true of the corrugated wrap where the linear corrugations effectively mask any brushing imperfections.

Brushing Technique

"Prime" the foam brush with warm water immediately before using it with the Pledge. Fully saturate it in warm water and then dry it as completely as possible by squeezing it flat against two folded sheets of good paper towel. Be careful not to break the core strip that is inside the foam brush...it properly rigidizes the foam brush and also helps "meter" the flow of paint.

Squirt about an ounce of Pledge into a cup saucer and then saturate the foam brush with Pledge. You want to "load" the brush as much as possible without the Pledge dripping out. Using uniform, steady speed single strokes, brush the length of the silver body (which should be held horizontally). Rotate the body a bit and apply another stroke, keeping the overlap of adjoining brush strokes as small as possible. It's actually better to NOT overlap than to overlap too much. Work all the way around the body. Avoid drips and runs. You might need to go back and "clean up" runs with a small brush dipped in water. Allow this first pass to dry about 5 minutes then repeat the process. If you had any small gaps between strokes they will likely be covered in this second pass. Be sure to cover the fins, too. Allow to dry for at least an hour.

After this first coat of Pledge has dried, you will likely notice that it has "whitened" the silver Model Master a bit (I don't know if this happens with other silver paints). It now looks more like bare aluminum than "silver" paint.

Apply the "UNITED STATES" decals down each side of the body that is between the fins that have no electrical tunnel between them. The lower most "T" in "STATES" aligns with the lower edge of the

narrow middle ring. The centerline of "UNITED STATES" aligns along the raised corrugation that aligns with the center longeron at the aft end of the body.

The decals provided with the kit will nestle quite nicely between the corrugations with only a little effort and generous water applied to the decal area BEFORE sliding the decal in place. Support the model horizontally while sliding the decal in place. Once in position, rest horizontally but slightly nose down. Just resting the model sideways on two fins works nicely. Use a ¼" soft brush or foam "dabbing" brush to gently "dab" the decal down into the valleys between corrugations. Be sure to keep the decal centered and work from the rear of the decal to the forward end, pushing the water under the decal toward the front end of each valley. Use a good paper towel (such as Viva) to "suck away" any excess water as you work along the decal. Just lightly touching a dry area of the paper towel to the water you want to remove will do the trick. Do not apply pressure to the decal.

Once the decal on one side is in place and dabbed in place, lift and support (sounds like a bra commercial) the front end of the body so the model is again horizontal. Use a good decal setting solution such as Solva Set and apply liberally over the top of the decal without disturbing the decal. Let dry (it only takes about an hour or less). You will find that the setting solution "draws" the decal over irregularities like the corrugation peaks and valleys as it dries. If you have found that there are areas that have not been drawn completely in place, go back and liberally apply setting solution over the entire decal. Repeat as necessary. Repeat this process with the second "UNITED STATES" decal.

You may notice that the Pledge "fogs" just a bit when you apply the decals. Don't worry as the fogging will disappear as the decals dry.

After the decal dry you might want to apply a coat of Pledge over the decals and the silver painted body to protect the decals.

Skimming the Little Joe

You can apply the kit's water slide decals to the SM and Apollo spacecraft if you like. However, by "skinning" the SM and the Apollo in a manner similar to that first used with the original Centuri kit you can achieve a great result. One of the disadvantages of decals is that they tend to yellow with age (you will really notice the decal outlines), they are delicate over time, and large decals aren't the easiest thing to apply and get perfect alignment.

The Little Joe II Skin Kit from Accur8 Spacemodels will give you near instant results that strengthen and toughen the surface of the model while adding detail that is in perfect alignment.

Apply the SM skin according to instructions with the skins. Alignment and applications it is easy. No measuring or marking is required and the skins are self-adhesive.

Once the SM skin is in place, cut out the four small squares where the RCS quads mount (assemble and paint each quad while glue on other parts of the model dries). Also cut through the painted layer of body tube and remove it so that bare "raw" body tube is exposed. Use a "dot" of thick CA to secure each quad in place.

As a final step for the booster, apply 2 or 3 more coats of Pledge.

The Apollo Spacecraft

Assembling the LES tower. Assembling the tower is not difficult. Just use your liquid cement in generous quantity at each glue joint.

Remove the LES tower parts from their sprues and scrap, sand, or otherwise clean up any flash or mold lines. Also remove the four little equally spaced “zits” that are on the circumference of the small ring that goes in the middle of the tower near its fore end. They only get in the way and the ring’s assembly into the tower is made surprisingly easy by their removal.

Lay one of the “full sides” of the LES tower on a flat surface with the alignment holes for the tower middle sides facing up. Using the brush in the liquid cement’s bottle just barely touch each of the areas with holes with the cement-loaded brush. You want to leave a “bead” of cement. Work quickly. Position the middle side piece, aligning the holes on the full side with the pins on the middle side. Hold in place for at least 20-30 seconds. Release and observe the joints. You may need to use a thin end of your hobby knife or tweezers to reposition the joints as needed. Make sure the middle side is at right angles to the full side...or tilting slightly toward the centerline of the tower. Allow this step in the assembly to dry for about 15 minutes and then glue the opposite middle side in place.

Next, glue the ring (from which you removed the locator “zits”) in place. Simply insert it between the three “V” trusses. It will stay in place of its own accord. Apply a dot of liquid cement to each of the three locations where the ring touches the tower. Allow to dry then assemble the remaining full side in place using the same glue technique and allow to dry.

Keep an eye on keeping the tower “square” while assembling. Going by “eye” is adequate.

Once the whole tower is dry, go back and check all the joints and do a second application of cement to all the joints.

The Apollo Capsule and LES Tower Installation.

There’s not much to the capsule. Paint white if desired and apply the decal or wrap using the alignment marks to center the “triad” roll pattern segment. You may also want to push the remaining noseweight clay into the nosecone per Estes instructions at this point.

Install the four legs of the LES tower through the openings in the capsule and glue from the inside using thick CA or tube type plastic cement.

Assemble the LES motor nozzles and glue them into the LES skirt. Paint the nozzles and skirt black. Don’t get paint on the shoulder of the skirt over which the LES motor tube will be glued. Glue the skirt to the LES Tower using tube type glue or thick CA.

LES Motor

Glue the plastic nose of the LES motor into one end of the LES motor tube. Pack clay into this assembly per Estes instructions. Paint the assembly white and apply the decals or Accur8 skin per instructions. Apply several coats of Pledge to seal and protect the decals or skins. Using the point of your #11 knife to make a very small (smaller than a pin hole...) slit through the aft end of the LES motor tube. Position the slit near the forward end of the lowermost roll pattern rectangle. This hole will keep air from getting trapped inside the LES body when gluing it to the LES Skirt and pushing the LES body off the skirt...believe me, it happens almost every time.

Finally, use tube type cement to glue the LES body to the skirt. Make sure the lowermost LES body roll pattern rectangle aligns over the roll pattern "triad" on the capsule as shown in the Estes instructions.

Apply 3-4 coats of Pledge to the entire Apollo/LES assembly.

I'll leave recovery system installation up to you. I do recommend recovering the nosecone with its own parachute like the original Centuri kit.