

Shuttle Solid Rocket Booster's and External Tank



Why make these after all this time, well I made the model of the Shuttle by Raimondo Fortezza <http://www.marscenter.it/eng/modellisimo.htm> and I was so impressed I wanted to make a complete stack. A search on the internet only found the SRB's and External Tank on Jon Leslie's site, <http://www.lhcc.com/egiftshop/giftshop05.htm> and as Jon said these were something he cobbled together with the intention of doing a better job later. So maybe I'll save him a job if he thinks these are good enough.

As Raimondo's shuttle was based on mission STS88 I did the same and I hope have got the details right, I'm sure somebody will be kind enough to point my errors or omissions. I always thought the SRB's were the same, it was not until I started to look at pictures of them that I realised they were all different. That led to a lot of searching for detailed info which in the most was fruitless, it seems all the detailed info from NASA as been removed from the Internet for some reason.

One last bit before we get on to the important stuff, **ME**. This is the first time I have ever designed anything as complex as this, but by the standards of some of the models that are available on the Internet this is basic, so I hope you like what I have done, it is freeware so if you do like it make a donation to guide dogs for the blind or whatever you have like that in your country. I'm really a very trusting sort of person, I know you will do it. BTW sorry for the rough sketches.

Safety First.

Before we begin lets get the usual safety points out of the way.

By necessity sharp implements are needed, so keeps fingers behind the cutting edge, especially small fingers.

If you have to work on the dinning table a few sheets of newspaper will save a lot hassle from your Mother/Wife.

Always replace the top on your glue pot/tube after use, saves the hassle from above.

Work in good light or the best that you can get.

Make sure you tidy your bits away safely when you finish for the day, you don't want the kids/dog eating them.

There are more, but I think you get the gist, play safe and use common sense, nobody died from an overdose of common sense, just a lack of it !.

Some points to note before you begin.

To make this model I used 240gsm card and 80 gsm paper. If you do use a different weight of card then some parts that are measured by thickness are not going to be the same as mine, adjust accordingly.

To print I used 1440 x 720 dpi.

The paper was set up as 'letter' in the drawing program with all the parts inside a 7 x 10 inch box on the page. I found no problem printing with the paper set to A4 in the printer properties and with A4 in the feeder. Set to print at 100 % in the centre of the page but **do not** select 'fit to page' and the model will print out at 1:100 scale (ish).

Read through these instructions before you begin and during building.

Have fun and enjoy.

Construction.

Start by cutting out and forming the nose section from sheet 1 and joining it together with the nose joiner. Form the tip into a rounded section, the use of a 6mm $\frac{1}{4}$ dia sphere inside will help to make it rounded.

Cut out and form four of the separation motor nozzles which are on the paper parts sheet. (there are more than you need of these, each circle contains two, they are so small and accidents do happen) Insert the nozzles into the nose section so they look something like **figure 1**.

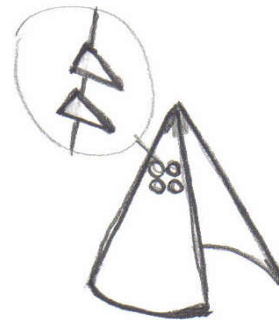


Figure 1

Form the body top tube and join with the joiner. Insert the nose to body joiner into the top of the body and then fit the nose onto the body, making sure the seams are aligned **180 deg** apart. Fit the upper channel to the side of the top tube and the tube 2 tube joiner at the bottom. Cut out and assemble the top attachment point as per **figure 2**

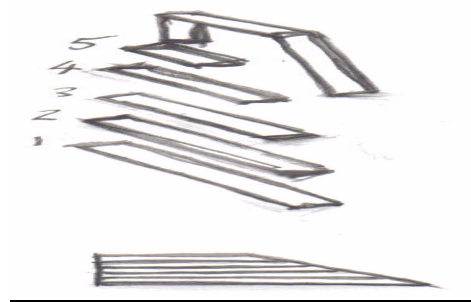


Figure 2

Form the bottom body tube and join with the joiner. You can fit the bottom tube to the top tube at this stage or wait until you have made, and got the lower attachment point to fit.

The lower attachment point consists of two parts, upper and lower rings, these are used to sandwich thicker pieces of card to make up a thickness of 6mm (a little under 1/4 inch). Also a paper part, the side wall. When cutting out the upper and lower parts from the card sheet, cut out the inner hole, then roughly cut the part from the sheet leaving as large a margin as you can **figure 3**. Glue the thicker card to the top or bottom part and once the glue has dried on a laminated part cut out the inner hole then cut the external shape to size. Keep cutting and gluing until you have made sufficient parts to give the correct thickness. Glue the attachment side wall (paper part) to hide all the laminations. *As an aide to keep things aligned while you are gluing the laminations together use a scrap of card from the end of the sheet where you cut the tube body from and form it into a tube.*

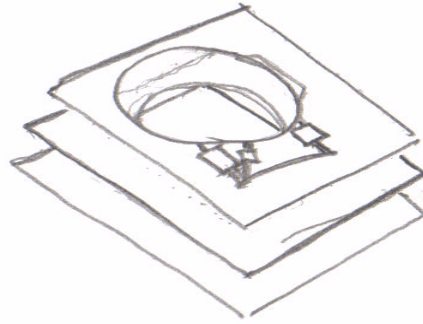


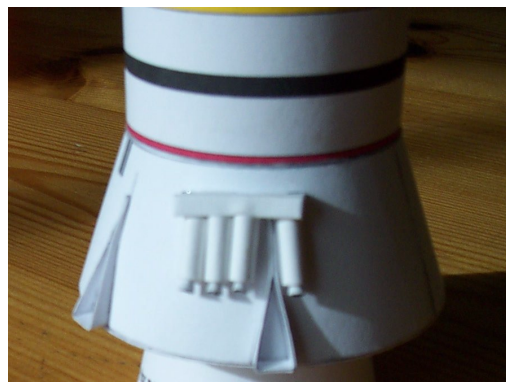
Figure 3

If not already done fit the bottom tube to the top tube and fit the middle channel to the lower tube. Fit the lower attachment point to the lower body tube so it covers the wide gray band and it should butt up against the middle channel previously fitted. Orientate the lower attachment point so the large radius (bit were it fits to the ET) is 180 deg from the body seam. On the left booster the body seam is to your left and the large radius is to your right then the block on the side of the attachment point will be towards you. On the other Booster the seam will be to your right and the large radius to your left. Picture (inset) shows left booster aft attachment point.



Fit the booster body to aft fairing joiner into the bottom of the bottom tube. Glue the inner ring inside the bottom tube resting on the joiner previously fitted. This forms one of the locators for the Nozzle fitted later. Draw a line on the inside of the Aft fairing two card thicknesses (???) from the bottom edge (large radius). This is to align the aft fairing to outer ring joiner the right distance inside the fairing. Form the aft fairing and make the join with the joiner. Fit the aft fairing to outer ring joiner so the bent tabs are aligned with the line drawn previously.

Cut out and bend to shape the separation motor block from the paper parts sheet. Once dry fit it to the aft fairing over the thin oblong shape. Roll 4 separation motor bodies by wrapping them around



a straightened paper clip. Glue the motor bodies to the block, **note** one of these motor bodies needs to be chamfered at the top so it does not hit the tie down bolt bracket. Cut out and fit the four nozzles for the separation motors. The nozzles are fitted so the side of the nozzle nearest the fairing is parallel to it

Cut out and bend the tie down bolts brackets to shape (picture above) and fit them to the four positions on the fairing.

Fit the aft fairing to the lower booster body aligning the small square with the channel guide.

Fit the bottom channel from the lower attachment point to the aft fairing followed by the channel bottoms. Number 1 on the fairing, 2 on top of 1 and 3 on top of 2

Cut out the outer ring and 24 of the booster nozzle gimble parts (paper parts). Don't discard the circle from the inside of the outer ring just yet you may need it later. I would recommend that you make the nozzle at this stage so you can check that it will fit through the hole in the outer ring and fit into the hole in the inner ring, if not trim the hole in the outer ring as necessary. Once you are happy the nozzle will fit, form the gimbal paper parts. Start with the printed side up and the large wedge towards you. Bend the small wedge down and the large wedge up at the lines nearest the edges. Put a slight bend in the middle as this will help when you come to fit the part to the outer ring. Fit the gimble to one of the sectors by gluing the small wedge to the outer ring between the lines, near the inner hole, then glue the large wedge to the outer ring outside edge, the middle will bend upwards as you glue the large wedge to the outer ring **figure 4**. Continue doing this until all the sectors on the outer ring are covered. Cut out and fit the thin outer ring to the inner ring aligning the lines (**photo**). If you have positioned the fairing to outer ring joiner correctly the thin outer ring will be flush with the edge of the fairing.

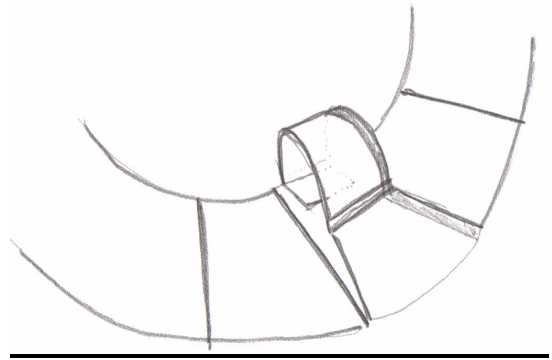


Figure 4



Form the nozzle by gluing the inner and out parts together. A scrap of paper glued to the inner face of the outer nozzle will hold it in shape until you fit the inner nozzle. Fit the nozzle into the hole in the outer ring and you should find that the top of the nozzle fits into the hole in the inner ring fitted previously, you did check before didn't you.

You will have noticed that there is a large hole at the top of the nozzle, if you do not want this then use the disc saved from the inside of the outer circle to fit inside the nozzle to close the hole colour black as reqd. An alternative, if you want the mount the model in an upright position, use a couple of pieces of dowel, that pass up to the top of the booster bodies and fit them into a suitable base. If you don't want to use thick dowel use thinner dowel but use the disc's mentioned before and fit them onto the dowels so they resemble ski poles **figure 5**.

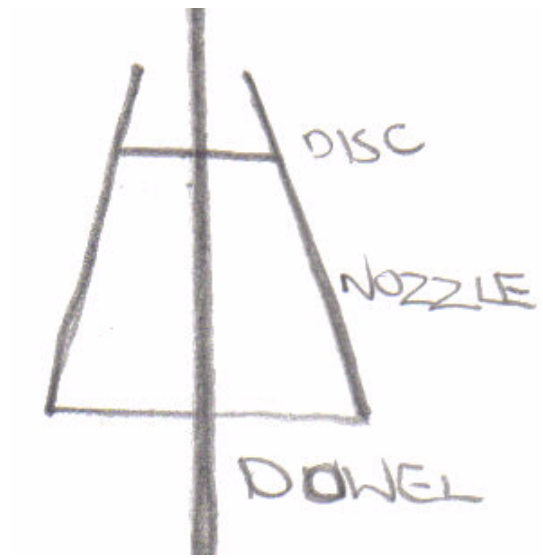


Figure 5

The other Booster is constructed in the same manner but the nose, aft fairing and lower attachment point will be the opposite way round.

If you need to get in touch with me then e-mail me at bill516@ntlworld.com and make the subject line Shuttle SRB's. I am less likely to delete your mail by accident with my mail washer this way.

Bill Spencer.