# Assembly Notes and Instructions

I hope you enjoy building the DIRECT Jupiter-120 and Jupiter-232 models. I would like to thank a few people who contributed information, advice, technical drawings, and lots of help in putting these plans together. Without these great people, these plans would never have come to be. Ross Tierney, Chuck Longton and Stephen Metschan are the creators of the proposed Jupiter Launch Vehicle. Thanks to Paul Rogers, David Hanners, Tim Hinds, Niels Jahn Knudsen, Ton Noteboom, the great modelers on the Yahoo! Space-Paper-Models Forum, and all the Real Space modelers out there who enjoy this great hobby. Special thanks go out to all of those people who have built STS models from whom I asked advice and who also contributed to this project, even if they were unaware they were doing so. If I have left anyone out, it was completely inadvertent and I apologize. I'd also like to express my appreciation for the kind comments from the people who post to NSF who admired the photos posted on the DIRECT thread. Thank you.

These models are designed at 1/144 scale, which puts them in line with most other STS models out there, and will give people a chance to see how DIRECT's Jupiter Launch Vehicles compare to the existing STS stack, from which the STS replacement must be derived, according to the NASA Authorization Act of 2005. It is my hope that the Jupiter family becomes the Launch Vehicle System used by NASA in our great odyssey to continue manned exploration of space, to return to the Moon, and explore beyond. It is recommended that they be constructed out of at least 65 lb paper. I used ColorMates papers from http://www.thepapermillstore.com/ for my model, and also a textured paper for the External Tank from a scrapbooking store. You can find those papers in just about any craft or scrapbooking store. They come in 12" square sheets, and are made by different manufacturers, such as Canson and Strathmore. The actual brand of the paper isn't important, as long as the texture and weight are suitable, and that is best left up to the modeler. On the last page of these notes, is a listing of websites where you can find suitable modeling papers.

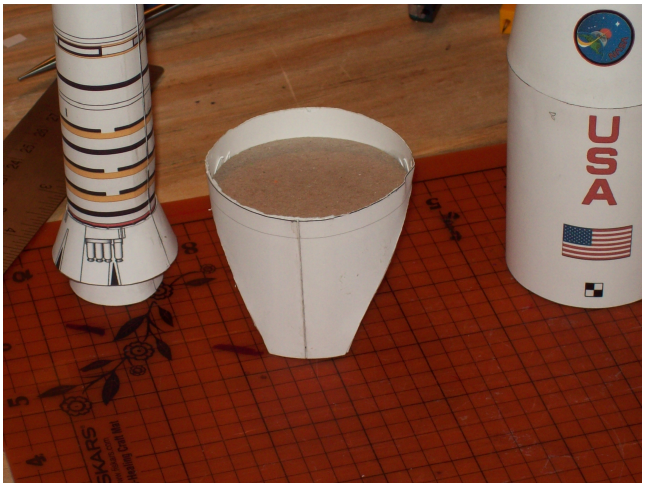
I want to make it perfectly clear, that I am not claiming in any way whatsoever, that I have designed and drawn every single part for this model. I viewed dozens of different models of the STS stack, all of them freely available on the Internet, and I selected bits and pieces from many of them to put this set of plans together. The parts that I did design, I do take full credit for. Those parts are clearly indicated as such where they are in the plans. Again, it is not now, nor was it ever, my intention to claim ownership of anyone else's model plans, and no parts were taken from any of the plans I borrowed from without significant changes being made. These plans for the Jupiter models are never to be commercially sold, and since no profit whatsoever will ever come from it, there can be no copyright violation, as it falls under Fair Use Adaptation, because I am not claiming authorship or creation credit for any of those pieces I did not design completely, nor am I intending to profit or gain anything from using any portion of them.

For more information on the DIRECT family of launch vehicles, go to
http://www.directlauncher.com

# Solid Rocket Boosters

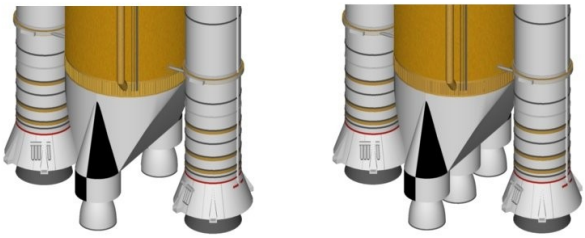
The SRBs of this model go together like pretty much every other SRB model out there. I viewed several different SRB designs from all over the Internet, and merged many pieces from many different models together, to make the design. I re-colored and adjusted the details of all of the parts, to make sure they went together smoothly and easily. Some pieces were redrawn entirely, and in most cases, only the outline of the shape of the part was used for the finished shape of the piece, and the rest of the part was redesigned by me.

I recommend purchasing a compass cutter from a craft or scrapbooking store, as it came in very handy for making certain parts. I used chipboard in the internal construction of the models, both for strength and for stiffness in many areas. I cut out lots of little chipboard circles and rings, and used them as inside support bulkheads. When you make a tube, such as the SRB, I strongly recommend putting these little chipboard circles inside, every few inches, for strength. That also goes for the Core, which are the parts converted from the ET structure. Here's a photo showing how the circles go inside the pieces:



# First Stage Core

The First Stage Core is derived straight from the STS External Tank, and is a common section (albeit with a few modifications) with the existing STS Stack. An “aft skirt” and the Engine Housing go on the bottom of the section to replace the lower end of the ET. On the Jupiter Launch Vehicles, this assembly houses the two engines intended for use in the Jupiter-120, and the three intended for use in the Jupiter-232. It is one of those pieces I designed and drafted out myself with a great deal of help from Paul Rogers, Ton Noteboom, and Ross Tierney. It is a cylindrical section, with sides that “taper” down to the flat bottom of the section. The engine bells for the two base engines of the Jupiter-120, and the three on the Jupiter-232 are mounted to this flat bottom piece.



There are also two aero-fairings to be added to this section of the aft skirt. The aero-fairings are the black and white cone-plus-cylinder parts shown above. This was a difficult set of parts to design as well, as I had no real idea how they were going to go together. I recommend building the two cone and cylinder assemblies before you build the Engine Housing. It doesn’t matter if you are building the Jupiter-120 or the Jupiter-232, you will only need two. For the third engine on the Jupiter-232 however, on the plans there is a pair of white cylindrical fairings with pale grey lines on them. This is the fairing to be used on the center engine of the Jupiter-232 first stage. This fairing does not get a cone, because it is mounted in the center of the flat bottom of the Engine Housing.

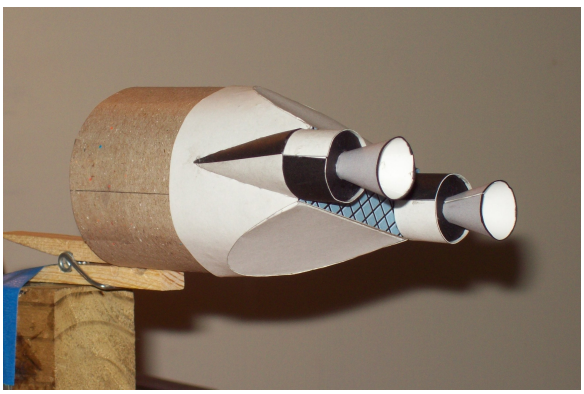
When building the two cones, glue the cylinders to them, with the black roll pattern opposing like a checkerboard. Cut out two chipboard circles to fit snugly inside the cylinder. Glue these to the top and bottom ends of the cylinder. Let these completely dry; preferably overnight, as you will need some strength and rigidity in these parts. Once dry, cut down the center of the black and white sections, on either side of the seam in the cone, to vertically halve the cone, and leave the entire cylinder intact. There is a pale grey line down the center of both the white and black sections. Cut carefully on this line. You should end up with what then looks like a half a cone on top of a full cylinder. Glue the engine bell to the inside of the chipboard circle in the bottom end of the cylinder, and then set aside. If you’re building the Jupiter-232, make the cylinder for the center engine fairing as well.

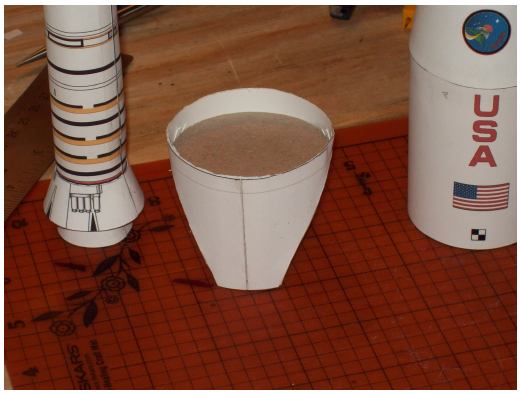
The finished engine cone/bell housing assembly for the Jupiter-120 looks like this:

The brown chipboard cylinder is just to hold the top in a cylindrical shape.

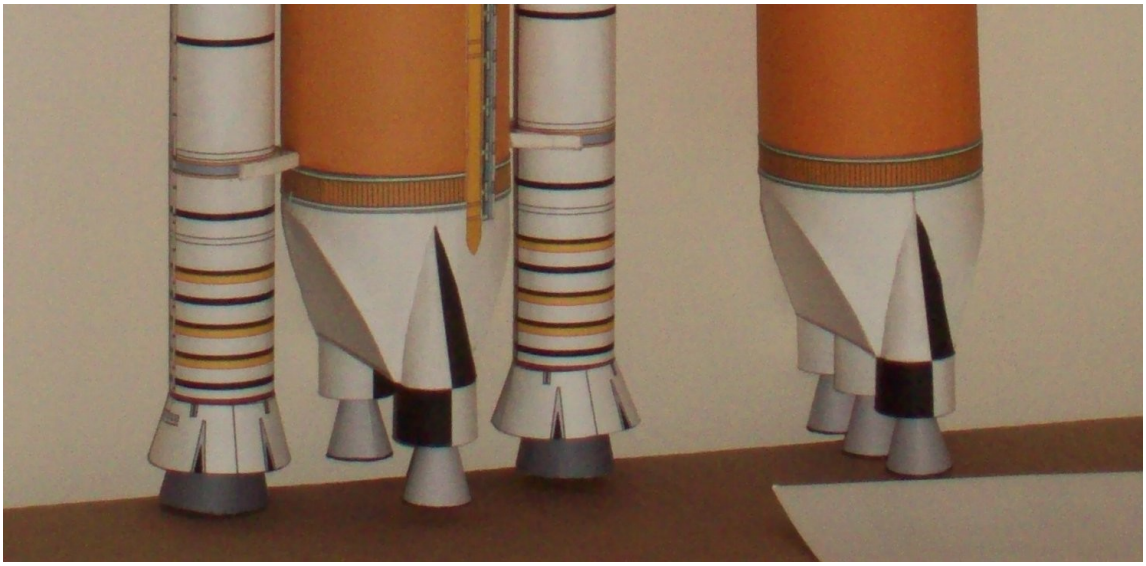
When you build the engine housing, (that's the part with the two parabolic cut outs in the sides) you must first assemble the piece into the cylinder shape, and then very sparingly glue a chipboard circle near the top of it for rigidity. You will have to eventually take this piece out, so only put a tiny drop of glue at four places around the inside. Also glue one of the circles into the very bottom to hold the two ends on either side of the parabolic cutouts in the cylinder shape. You also may want to cut the straight sides on that bottom piece (when it dries), in line with the two edges of the parabolic cutouts. This will allow you more room in which to work, when you're attaching the flat sides.

Cut out the flat parabolic shaped sides, and glue only ONE of them in place. It helps if you fold and glue the bottom tab to the flat circle first, and then glue the very top pointed tab to the inside of the housing cylinder. Move down the sides, making sure the edge of the cylinder cut out is flush with the flat side piece. When you've finished the first flat side, let that dry for a day before putting the other flat side in. You'll have to remove the chipboard circle you put at the top before you put the second flat piece in. Once that second flat piece is in, you can then trim to the top black line in the middle of the housing. Before you attach the engine fairings, cut out two pieces of the grey grid to fit over the bottom piece on the housing. This is the bottom of the engine housing and it is the piece to which you mount the engine fairings. It will look something like this, if you've built it correctly:





If you are building the Jupiter-120, attach one each of the engine bell/fairing assemblies to the ends of the engine compartment housing, with the flat edges of the cones along the sides of the engine housing, and the cone centered in the flat bottom at the edge, as in the photo below. If you're building the Jupiter-232, put the center engine (that's the one with the white cylinder only) in the center of the flat bottom. Here are pictures of what the finished assembly should look like.



# Payload Section: Jupiter-120

The payload section of the Jupiter-120 is another of the sections of the model I designed myself. It consists of an interstage, the Instrumentation Unit ring, the payload fairing, the BPC for the Orion Spacecraft, and the Launch Abort System tower. Some of these pieces are fairly small, and I had to build several versions before I was satisfied with the fit and finish. They go together just like they look, and the photo of the finished section shows where all the pieces go. Just take care to line up all the opposing edges, and run the seams down the back side of the model, and it will be fine. Be sure to put chipboard circles in the top and bottom of the payload fairing, about 1/2" from the ends, and also one near the top of the adapter cone between the fairing cylinder and the BPC.

Here is a photo of one of the first test builds, so ignore the written numbers on the parts and all the seams and such.


Here is a photo of the first prototype model. It shows the LAS tower, the BPC, the Payload Fairing and adapter, the IU ring and interstage, and the top of the Core First Stage section.

## Upper Stage + Payload Section: Jupiter-232

**T**he payload section of the Jupiter-120 is another of the sections of the model I designed, and it was a pretty challenging set of parts to come up with, especially if you have as little experience designing model parts as I do. ☺

The upper stage is where we see the first major difference occur between the Jupiter-120 and the Jupiter-232. Aside from having one extra engine in the center, the two Cores are identical, which is one of the more interesting facets of the design of the real rocket.

Beginning with the top of the external tank, which is the First Stage Core, we find the first difference to be that the IU ring is not at the top of the tank. It has been replaced by a white Interstage cylinder. This piece has the “corrugation” on the part. We then have the upper stage itself, which is the tall white cylinder without corrugations. Then the IU ring, and the nosecone. There is also a fuel line on the model in the upper stage, as you see here:


All these parts are straightforward, and I’ve included two sets of plans for the nosecone. One set of parts is for a more complex attempt at building a true ogive shape, and the other is less complex. Which one you use is up to you. From the top ring on the tank/core, all these parts were designed by me. Just be careful to line up the seams, and make sure that for just this section of the model, that these seams are at the back of the model, rotated 90° from the seam on the tank, which should be hidden by one of the SRBs.

## Assembly Notes

When I assembled the first prototype models, I thought of ways that I could make the model look as real as I could (which is what we all do!) so I cut up some very thin pieces of heavy 90 lb card stock to use as attachment points between the First Stage Core and the SRBs. For the lower attachments, I cut strips the same width as the attachment band on the SRB, and laminated five of them together. I then bent them into a teardrop shape before the glue dried, so they would dry in that way. I cut up the pieces to make a curved support. The top attachments were merely 5 little rectangles that were also laminated together. You can attach the SRBs any way you like, keeping in mind that the First Stage Core is pretty much identical to the STS stack, except the fittings for the attachment of the orbiter are no longer there.

One of the great things about paper modeling is that the builder is an artist of sorts. Each builder can customize, enhance, and improve the basic model to make it as realistic and detailed as that builder wishes to make it. I hope that these plans give you that opportunity. A few examples of what could be customized, might be changing the fuel lines to make them three-dimensional tubes, or putting the cooling structure on the engine bells like the SSMEs have, or building the Core and Intertank out of a textured paper to simulate foam. This is what card modeling is all about. So have some fun!

If you have any questions or comments, you can email me at: lancer525@yahoo.com (please put “DIRECT Model”) in the subject line) and I’ll try to answer your questions.

## Sources for Paper

http://www.thepapermillstore.com

http://www.paperworks.com/

http://www.discountcardstock.com/

http://www.createforless.com/

http://www.michaels.com/