STYRENE ROBOT BUILDING

Tools and Techniques

Introduction:

This document describes the tools and techniques to build from any of my styrene plans sets. On the cover is my first styrene droid in R5-K6 colours, and below is how it originally looked as R5-D4.

Styrene results in a strong and light robot that is easily repairable. I lift my droid with batteries in and out of a car by myself, and if I run into a child, the child will probably live.

I have plans available for an R5 head and I am working on an R4 head set. My R5 head is strong and has handled falling onto a marble floor and being dragged along behind the droid by a power cable. I have tried where possible to add strength and after 2 years of operation, my droid is still as good as ever. I have refined the design since then and made it even stronger.

I have done many repairs during that time though. Mainly they are due to devil children, but R5 has also suffered wounds from overacting sandpeople. Styrene droids are repaired very easily. My aluminium-coveting friends have even found themselves coming over to the light side as they are often concerned about letting the general public within range of their metal creations.

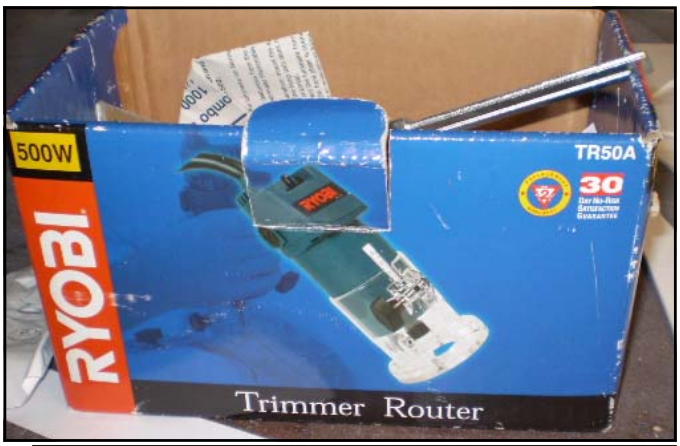
The best thing about a styrene droid build is it's speed of construction. With little more than hand tools and time, you can construct the majority of your droid.

In my first styrene droid, I took this to extremes. I have in my workshop a lathe, drill press and mill. I did not allow myself to use them. I even constructed my own casters for the centre foot from styrene and DuBro wheels. The only power tools I used was a dremel and a cordless drill. I used the dremel to cut all the circular parts. I wore out the

Tools

Here is the list of tools necessary to build a droid. You won't need to buy them all immediately, but they will eventually be needed. I've tried to group them into immediate and later categories. Once you have these tools, there is little you can't build. My 1st droid was also built on a single fold-up table that I packed away every day. Space is not really an issue until you get to the painting stage.

Immediate Tools



1. Trimmer Router and plunge bit. I bought a Ryobi 500 watt trimmer router and a 3mm plunge router bit to suit. I chose the Ryobi, because it had a support holder that I could screw under a piece of MDF that I use as my routing table. You can see the clear plastic support holder on the side of the box.
2. Olfa Utility knife with snapoff blades. I have found this superior to the Stanley knife as the blades cut plastic much better than Stanley.
3. Steel rulers. I recommend a 1m and 30cm ruler. I also have a 60cm and 150mm ruler, but the first 2 are used more than any other and are all you really need. The best seem to be the Toledo. I also have a Lufkin, but it is thin and warped after a few weeks use.
4. Set squares. You should have a decent metal set square, and if possible a couple of small ones. The small ones will come in handy when gluing 2 parts together that must be set at 90 degrees. The metal set square will also be used for truing some parts after gluing.
5. Styrene needle applicator bottle. This is for gluing and I have found it the best way to dispense glue right into the join between parts. Buy a tin of Weld-on No.3 glue. It's cheaper than buying it at a hobby store in bottles.
6. Drill bits, Countersinks. You'll need a 3mm drill bit, also at least 2 step drills 4-12mm and 12-20mm will be enough for now. A 3mm and 8mm countersink should be all you need
7. Digital vernier capilers. I got mine for $20 at Jaycar.

Set Square

Digital Vernier Calipers

Other tools you will need

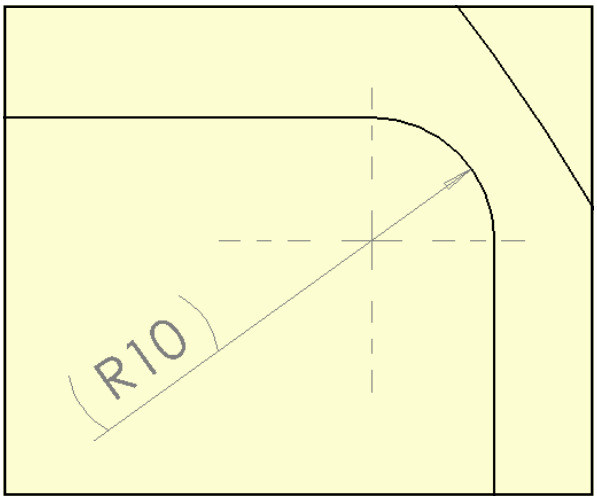
1. 8mm Tap and tapping handle. Make the tap an Inter tap as it will be easier to use.
2. 17/64 drill bit. Used to drill the pilot hole for the 8mm tap.
3. Drill Press. You will greatly benefit from a small desktop drill press. I bought mine for less than $100.
4. Long nose pliers
5. Hand hacksaw and blade
6. Bastard file. You'll need this for chamfering parts.

Reading the plans

The parts are not laid out in any special order. I have simply tried to fit them to each sheet as well as I can. I have attempted to minimize cuts by butting parts up against each other. I've also tried to group parts of the same height together. This makes it easier to get uniform heights during construction.

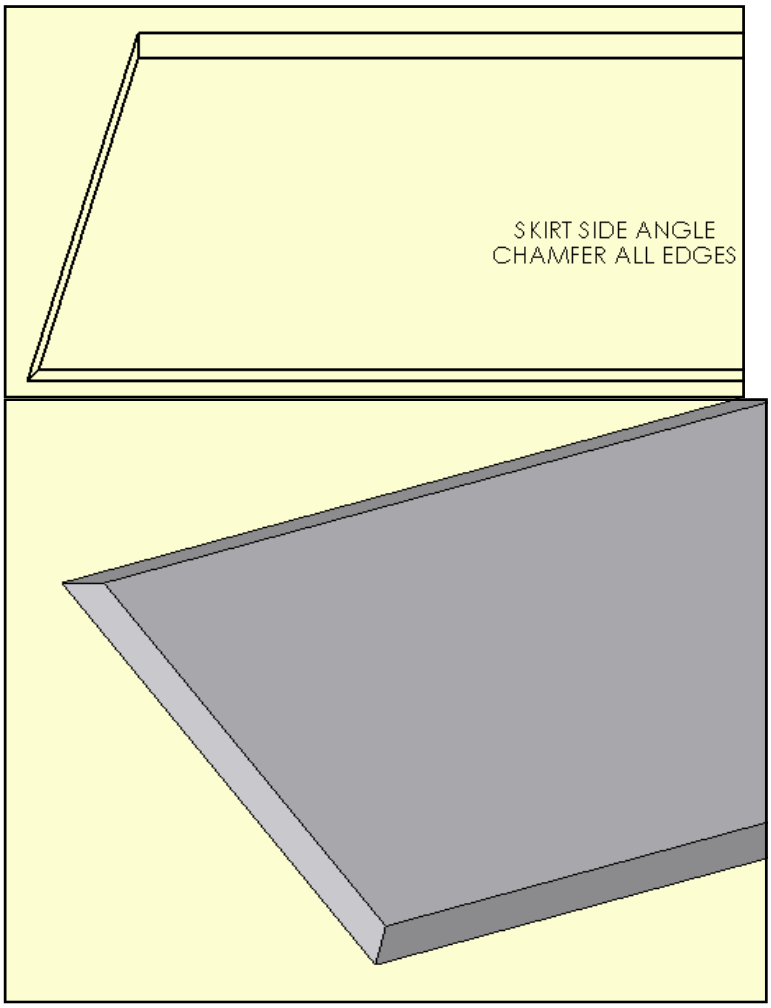
All parts are 3mm thick unless otherwise specified.

Although I have listed hole sizes throughout, generally, I recommend drilling to 3mm first as a guide for drilling out to the final size. Often the 3mm hole is used for construction. I tend to list hole dimensions by radius. In the photo on the right, you see a hole listed as R10, that means the drill must have a radius of 10mm or a diameter of 20mm.



Dashed lines usually indicate an alignment mark that should be lightly cut into the plastic. Other parts are glued against these alignment marks to ensure the construction is accurate.

Dotted lines usually indicate that a chamfer must be made on the opposite side. Since the paper plans only show one side, I use this method to differentiate between chamfering sides. For chamfers on the same side as the drawing, you will see a 2nd set of lines just within the edge boundary as shown on the right. Chamfers go from the inner line all the way to the outside boundary.



Using the plans

The plans get stuck to sheets of styrene using a removable spray glue. I have been using Fuller's removable spray bond. I have also had excellent results with Micador brand removable spray adhesive.

The removable part is crucial. Paper glued hard to styrene is very hard to remove and leaves a residue that must be cleaned off before painting. I have found the Micador product leaves very little residue.

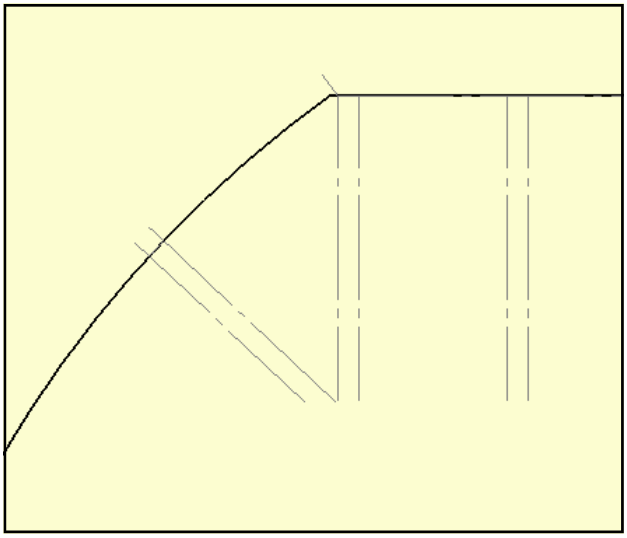
The paper will only just be stuck to the plastic. I find I can peel it off and reposition if necessary.

Often, I will cut the paper parts up first and position for maximum styrene efficiency. If you do this, don't cut right up to the line of the part or you will find it difficult to cut the plastic through the paper and to get the steel ruler to sit flat and solidly on the work.

With the plans stuck to the styrene sheet. Lay a ruler against the lines of the pieces. Hold the ruler firmly down, if it moves you'll find it difficult to correct the cut later.

Start with a light cut, the knife blade running against the ruler really just cutting through the paper. Repeat to lightly score the plastic and score it again. Now you can apply a little more pressure for the next 3 or 4 cuts. Remember if you press too hard the blade will not cut any better. Because of the blade shape and the way the plastic moves out of the way, pressing harder just makes the blade stick against the sides of the cut groove.

Keep cutting until the groove is about halfway through the plastic, then pick up the sheet and flex it back and forth along the groove until the plastic snaps apart.



You'll find your cuts do not necessarily produce a squared cut. The edge may have a slight angle to it. Don't worry, this is just how it comes out and for the most part will not affect anything.

If the drawing shows a dashed line, that line should be scored lightly into the plastic as an alignment for other parts.

Making a router table for cutting circular parts

Cutting accurate circular parts is crucial to constructing the body frame, skirt, shoulders and battery boxes. I toyed with a few ideas before screwing the router attachment for my Dremel onto a sheet of MDF and drilling holes in the wood at the correct distances to cut the parts. This worked out great, but ended up ruining the bearings in the Dremel. I constructed a new table using a trimmer router and so far 8 droids have been made on it with no sign of wear.

The construction is very simple. I started with a sheet of 16mm MDF, the size was around 1200 x 600mm. I took the clear plastic router guide and screwed it to the underside of the sheet of MDF and put a 3mm plunge router bit in the router.

In the next section you'll find a table of Radii for cutting all the components that are circular. Drill a 3mm hole at the correct place, do the same in the styrene sheet, hold them together with an M3 screw and rotate the styrene against the cutting blade to cut the circle.

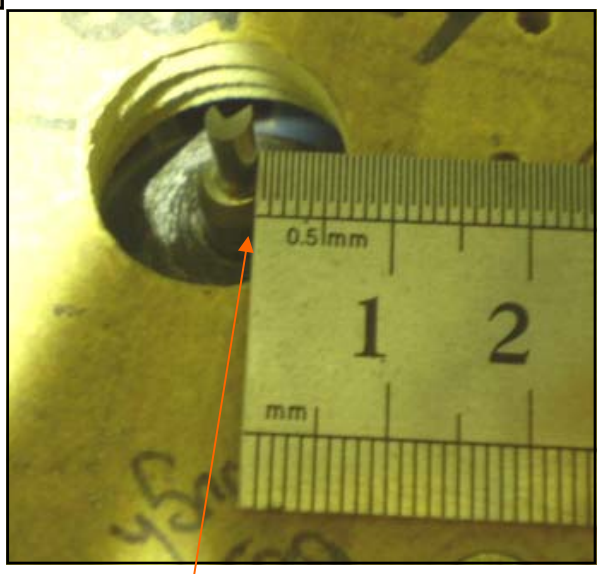
You will need a rough cut position and a final cut position to get the best results. This is because your initial cut has the cutter cutting material on the inside and outside of the circle. This causes the cutter bit to vibrate slightly which affects the finish of the edge. Once the rough cut is made, the loose piece of styrene on the outside can be removed and the piece repositioned into the final cut hole. Now the cutter bit is only cutting about 0.5-1mm of material on one edge only and the result will be a very smooth finish.

Please remember, if the part is to be a ring, like some of the body frame pieces, then the middle should be cut last as this is what you are rotating the piece of styrene on.

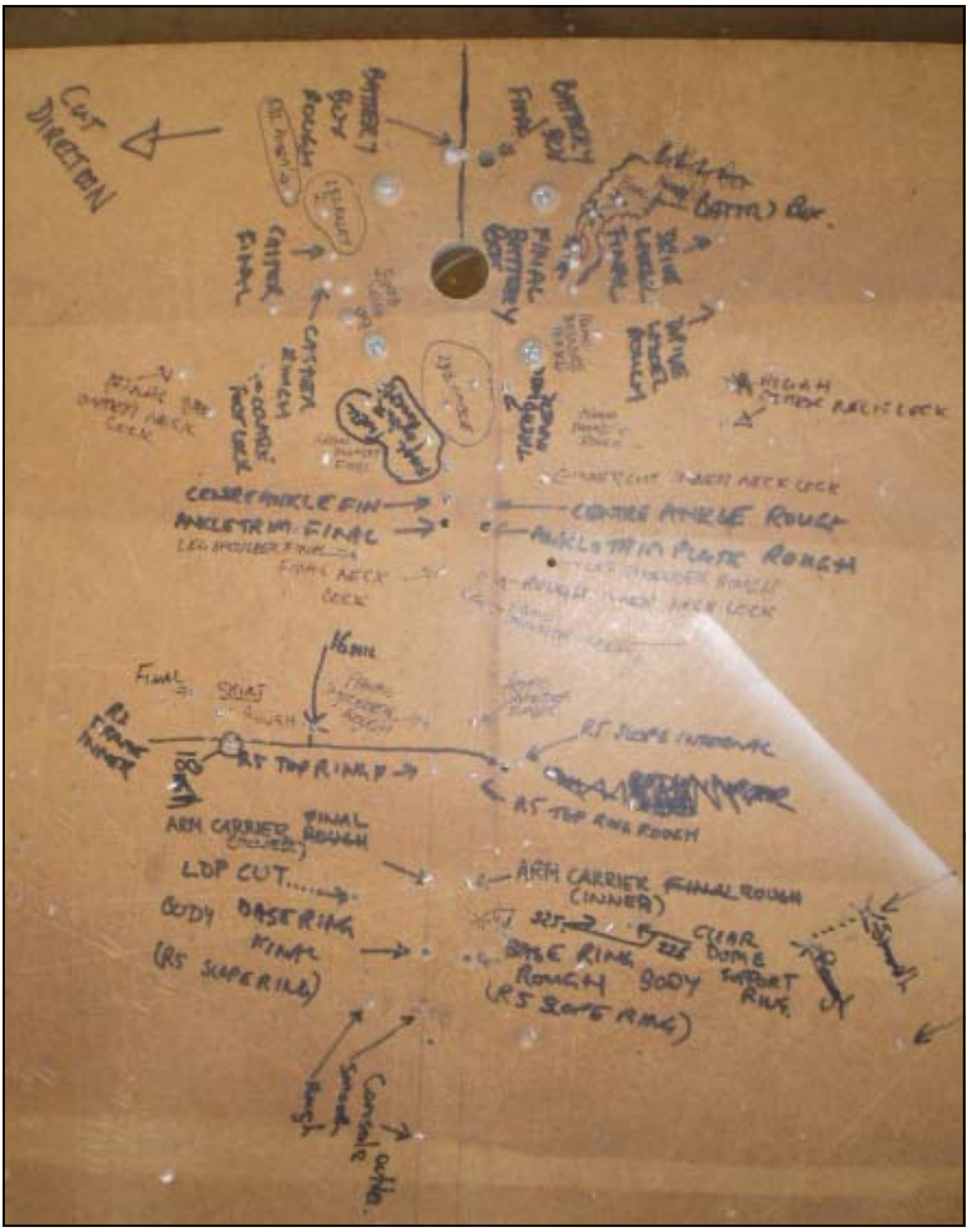
Your rough cut should be the radius plus 1mm. The final cut should be the exact radius. Note that both measurements are made from the outside edge of the cutter bit, not the centre of the bit.

I use a steel ruler and digital calipers to find the radius centre. First I place the steel ruler against the cutter bit with the router in the table. The radius for the body frame outer rings is 228.8mm so for the rough cut, I would want a hole in the table at 229.8mm. I first mark 229mm using the ruler as outlined above, and draw a short line from that mark, continuing in the same direction. I then use the digital calipers set to 0.8mm to mark on that line the final position. Drill a 3mm hole with a cordless drill and I'm ready to make the rough cut for the body ring. I'd repeat to drill a FINAL cut hole at exactly 228.8mm.

For inside cuts, like the centre of the body ring, I must subtract the cutter diameter from my required radius. For example, the inner ring radius for the body rings is about 169mm. I would subtract the cutter width (in my case 3mm) to get 166mm. Now I can use the same technique to drill a radius centre cutting hole as before.



Measure from the outside of the cutter, not the centre line.



Here's my current table, littered with cutting hole positions.

If you have questions place them in the appropriate forum. I'm always happy to answer and incorporate new ideas.

Dave Everett