Scratchbuilding Sci-Fi Models Tutorial: Part 1

Written by Johnny
Friday, 27 January 2006

I've been scratchbuilding/kitbashing original sci-fi model designs for years (triggered by Star Wars and a certain article I read by Clyde Jones and Verne Anderson in the August 1978 issue of Fantastic Films magazine, shown at left).

Later, I was majorly influenced by the imaginative work of Randy Cooper, whose pieces I first became acquainted with in the February 1987 issue of Fine Scale Modeler. Brilliant stuff.

My non sci-fi influences include Shep Paine, who got me started in armor modeling and diorama building, and Tony Greenland, one of the top true scratchbuilders around. His Panzer Modelling book still stands as a flagship for the art of scratchbuilding, regardless of whether you're doing tanks or spaceships.

This tutorial seeks to pass on some of the knowledge, tips, tricks and techniques that I've learned over the years in hopes that others might get the scratchbuilding/kitbashing bug as I did.

These same techniques can also be applied to computer-based 3D modeling, as the thought processes are quite similar.

Semantics

True scratchbuilding means you make EVERYTHING from scratch—nothing is bought off the shelf except raw materials (plastic, wood, metal, etc.).

Most of my ships are about 90% true scratchbuilt, but I'm concentrating here on using found objects as the basis of a form, rather than turning basic forms on a lathe.

I'm not a machinist, nor a carpenter (though I'm pretty handy in my wood shop when I need to be). I've used the lathe and other shop tools for years, but that's not what this article is about.

I've been sculpting for years, so I'm handy with clay, wire armatures, wood carving, plaster, resin casting, etc. In fact, I use quite a bit of resin casting in my models for repeating large detail sections.

I don't run a forge, I don't have an anvil, I don't mine minerals for smelting, so instead of making ALL my parts from scratch, I look to manufactured product containers for the basic shapes I need, then build on those with styrene sheet, tube and steal detail parts from kits (called kitbashing) to make the starship of my dreams.

This will bother some hardcore purist scratchbuilders. And I respect their opinion.

So, technically what we're doing here isn't true scratchbuilding. It's a combination of scratchbuilding and kitbashing. But that takes too long to type, so I'll just use the term scratchbuilding from now on to save time, even though I mean a combination of scratchbuilding and kitbashing.

To Scratchbuild Means to See the World in a Different Way.

When you go to the hardware store, or even the grocery store, force yourself to start looking for product containers that have interesting shapes. Don't look at them and think: "Oooo, only my spouse would buy a bottle like that." Instead look at it and think: "Wow-That deodorant stick case would make a great hand phaser with some additional parts."

Learning To See

Years ago, I learned in drawing classes that the most important part of learning to draw isn't what technique you develop or how cool it looks, but it's more important to learn to see.

By learning to see, they mean to look at something, break it down into recognizable shapes and negative space, be able to recognize what angle an arm comes out from the body that's resting on that knee, what is the true shape of the contour of that wine bottle, what is that person's nose really shaped like and how high is it in relation to the face, etc.

Learn to do that, and you will start to draw successfully. Hell, I'm a firm believer that if you can write your name, you have all the technique you need to draw—you just need to learn to see.

Until you can "see", you will struggle with drawing.

Learning to see as it relates to scratchbuilding models is a little different, but the desired outcome is the same—you will be more successful at it, if you can learn to look at objects not as bottles or containers, but as parts of a ship or prop.

Ergonomic Design
Manufacturing processes have changed a lot since I was in high school, due mainly to Computer Aided Design and Drafting and something called *nurbs*. In fact, nurbs have changed forever the way products are made and shaped.

Many bathroom products have very ergonomic, fantastic shapes that can look futuristic with the right amount of detail (called *numies*) and a good paint job.

Deodorant cases and Shampoo bottles make great phasers or starship engine nacelles or futuristic weapons.

Things like water bottles, fancy flashlight casings, etc. can be your best friend when you're scratchbuilding.

In the image below, train yourself to look at the objects and think "What part of a spaceship could that be?". Try not to think of them as just a water bottle, a flashlight casing, a fan casing, a hairspray cap, and a water bottle cap.

Once you've opened your mind to thinking like a scratchbuilder, almost *everything* will put ideas in your head and get you thinking creatively!

Take a look at this weapon I made out of household items...

Did you recognize any of the items? You probably have several of them in your bathroom right now! Here's a detail shot of the middle. Recognize the big object in the middle?
Figure it out yet? Here's two of that very same object connected together:

If it's not immediately obvious, don't feel bad. That's the idea—take ordinary objects, add some detail parts and voila! Instant sci-fi weapon!

The 2 objects connected together are the 2 aspirin bottles:

What about the front of the weapon:
Recognize anything? Well unless you've had a Nestle Quick chocolate drink or changed your toilet paper lately, you may not recognize these objects:

Here's a shot of most of the parts used in making the weapon (except the little bottle between the 2 big ones).

The blue thing in front is the 2 chocolate drink caps glued together. The long white tube is the spine of the whole weapon, almost completely covered.
in the final design. The half-tube "cage" is half of the toilet paper roll holder. The small cap looking object on the front left is a floor bolt cover from a commode (don't worry, I bought it new).

The smaller tubes and styrene strips make up a lot of the detail surrounding the aspirin bottles, drink caps, etc.

Here's a shot showing some of the detail made with these tubes and strips:

The capsule looking object is 2 of the commode bolt covers glued end to end.

[hr] Finishing Up

That concludes part 1 of this tutorial. Next, we'll look at putting the pieces together. Future tutorials will talk about building details, using styrene sheet and strip, etc.,

I'll leave you with shots of 3 guns made out of styrene tubes and strip. On the first one, I used a gun from a tank model to give it a little extra detail (this is the kitbashing part because I took a part from a model kit).

Here's the styrene raw material:
And here's the 1st gun, a finished cannon, ready to be sanded and painted. Note the weapon can rotate 360 degrees, as well as tilt up and down. This is where most of the work went into this model:

And here's the 2nd gun, suitable for mounting on your favorite ship or mech, made from styrene tubes, sheet stock, and a long version of the commode bolt cover:

Below is my projectile tube launcher, in desperate need of filling and sanding.

Again, most of the work in this model went towards making it functional—the weapon can rotate 360 degrees, as well as tilt up and down:
This is Part 2 of my series, *Scratchbuilding Sci-Fi Models*.

In Part 1, we looked at a finished model, then discussed what was used to create that model.

Here's part of that finished model from Part 1:

![Part 1 finished model](image)

and some of the items used to create it:

![Items used to create the model](image)

(Warning: This tutorial has a LOT of images. While they are small and optimized, you may experience long download times if you are on a slow connection)

In Part 1 of my tutorial, we looked at some of the pieces and parts of a sci-fi model (a weapon for a large scale spaceship), and how you could use everyday household items as the basis of your model's main construction. We used aspirin bottles, toilet bolt caps, chocolate milk caps, toilet paper dispenser tubes, etc.

Basically, we're using manufactured cylindrical shapes (also known as aspirin and vitamin bottles) to create a form that might normally be tooled on a lathe in your wood shop, but instead of a huge machine, long pieces of wood and lots of mess, we're using plastic bottles to give us our basic form.

Those bottles are all centered on and attached to a piece of plastic pipe which forms the backbone of the model. In order to get the bottles onto the
pipe, you'll have to carefully drill centered holes in the caps and bottoms of the bottles the size of the pipe, then slide the pieces onto the pipe. After settling on placement of each piece, glue them in place with epoxy or super glue.

That's really all there is to the basic form, but if you take another look at that model, you'll notice that what really makes it feel like a "real object" as opposed to a bunch of aspirin bottles stuck together is the detailing—in other words, all the little pieces stuck to the surface of those aspirin bottles. Most of that detailing consists of styrene strip, rod and tube (henceforth called "numies") that you can buy at your local hobby shop or from online hobby shops.

Here's another closeup of the finished model we made in Part 1:

![Model closeup](image)

**REMOVING THE LABEL**

Before we can begin construction, we need to remove the label from any plastic bottles we will use.

If you search online, you'll find a dozen ways to remove labels from plastic bottles. I used a combination of applying dish soap to the bottle label overnight, then put hot water inside the bottle, with the bottle sitting in a pan of hot water (not on the stove of course!). Eventually, I had to use a scrubby to get the remaining residue off the bottle.

Let the bottle dry completely before moving on to the next step.

**INCOMPATIBLE SURFACES**

In most cases, those manufactured aspirin bottles are made of a plastic that isn't compatible with your normal, everyday plastic modeling glue—stuff will just slide right off the bottle if you use regular modeling glue.

In order to get our numies (small details on the surface of the model) to stick to an incompatible surface like an aspirin bottle, we have to lay down a compatible surface that they can adhere to. The simplest way to do this is to attach a sheet of thin styrene (.010 or .020 should be thick enough) to the aspirin bottle first (using epoxy or super glue), then, you can use standard modeling glue to attach the numies to the styrene.

By the way, numies are also known as "greebles" in some cultures. In fact, there's an aboriginal tribe that uses the term "greebers" when they scratchbuild/kitbash sci-fi models.

Not really.

**NOTE:** Make sure if you use epoxy, that you spread it on thin and cover the area well where the styrene will wrap around, because if you put the epoxy on in thick lines, those lines might show thru your thin styrene wrap-around.

Here's the basic steps:

To get started, I usually super glue the very first edge of the sheet to the bottle to anchor it, but it absolutely must be perfectly straight before you do this. Until you're comfortable keeping the sheet completely straight, you might skip that part since once you superglue the edge down, there's no fixing any crookedness.

Measure and test fit a sheet of styrene that, when wrapped around the bottle, ends right where you began (it's okay if there's a small gap between the beginning and end—you can cover that with numies)

How do you test fit a sheet? You could use complex math formulas to calculate the circumference based on the diameter, but instead, simply roll the
sheet around the bottle before you use any glue. Where the sheet comes back around to the first edge you put down, mark the sheet, and using a framing square or other right angle tool, cut the sheet off at the mark.

After test fitting, apply epoxy to the bottle (or to the back of the sheet) and start wrapping the sheet around the bottle. Make sure the sheet edges are perfectly vertical as you wrap it:
To really pull this tight around the bottle and give it a good fit, I use what I call a masking tape clamp. The idea is to wrap the styrene sheet around the bottle, then, while the epoxy is still wet, attach a piece of masking tape to the trailing edge which came around the bottle, pull it very tight (don't break the tape, though!), and tape it to the leading edge of the sheet that you started with. This provides a nice tight fit while the glue sets up.
Make sure when you apply the tape that the sheet doesn't become crooked. If it's off a bit, you still have time while the epoxy is wet to make adjustments.

Wait for the recommended time for the glue to completely cure before handling the bottle.

Here's a few of the actual bottles I'm using, with styrene wrap-arounds already in place:
Here's most of the basic form parts ready to be detailed:
And here's a few variations on positioning the bottles:

The cool thing about building the model this way as opposed to one big piece of wood on a lathe is that you can always change your mind about positioning of shapes up til the moment you glue them in place.
If you're into smooth, sleek starships with no surface detail other than panel lines, you might want to skip this section, because, ever since Star Wars, I've been a "guts on the outside" kind of guy, and every ship I build has LOTS of texture all over it.

To some extent, my interest in modeling tanks contributes to my love of surface detail as well.

If you ever study a tank (or tank model), they always have these "things" stuck to the hull, either out of necessity or convenience. Things such as gas cans, tarps, sleeping bags, tents, equipment crates, tools, spare wheels, spare track, etc., and it's these "things" that help give a tank its personality (well, for me anyway), as well as to help create a great surface texture.

Now, it'd be kind of silly to slap a sleeping bag on the outside of a spaceship (unless you were making a statement, a joke, or perhaps creating a futuristic tank), but we can add texture to a sci-fi model using nurnies.

Nurnies are small details on a model that help add texture and interest. These small details sometimes look as if they serve some purpose, but often they're just there to create texture.

To create the cool details (nurnies) on the surface of the bottle, I use a combination of small rectangles of styrene sheet, chunks of styrene strip, and parts from old model kits. Well, actually, the kits aren't really THAT old—I'm guilty of going out and buying new tank, plane and ship models and using parts from those. But if I HAD old models just laying around, I'd use those first. Really.

Now you'd drive yourself insane if you tried to cut hundreds (or in the case of my scratchbuilt/kitbashed 40” explorer ship, thousands!) of small rectangles of styrene using an X-Acto knife and straight edge, so let me fill you in on a little secret for mass cutting of tiny plastic rectangles:

Buy a Chopper!!!

The Chopper is hands down, my #1 tool for creating surface detail. Here's a picture of my poor worn out little Chopper:

What's it do? It's like a small paper cutter for styrene strip. You put your strip up against the ruler, determine the length of the piece you want, then pull the handle down and it chops the little piece off the strip. Slide the strip down a bit, chop off another piece. The ruler makes it incredibly easy to create duplicate rectangles, and repetition of pieces helps add to the convincing nature of the surface of a model. Sometimes, you have to slightly clean up the edge of the piece a bit, but usually it's a pretty accurate cut (a sharp blade helps here). I can't believe how much time this tool saves me.

Here's a sample of surface detail created with lots of little Chopper-cut rectangles:
And a few more examples:
If you like lots of surface detail and texture, the Chopper is your friend.

**SURFACE DETAIL BUILD-UP**

Okay, we have our aspirin bottle with a styrene sheet glued tightly to it, we have lots of spare model parts from expensive WW2 German armor kits (I'm also an avid armor modeling fan), and we have our styrene strip cut to size with the Chopper or an X-Acto knife. We're ready to lay stuff down.

At this point, you can use regular modeling glue to attach the styrene pieces since we wrapped the styrene sheet around the bottle first.

Begin by gluing thin smaller sheets of styrene partially around the bottle to create raised panels on the sheet that's already there. Vary the thickness, length and width of the pieces (1 or 2 inches long and a half inch or so wide), and offset the pieces so the edges don't line up:
Next, add a 2nd layer of smaller panels on top of SOME of the other panels (don't overdo this—you just need a few additional panels on top of the previous ones):
Now, using either the Chopper or the trusty ol' X-Acto knife and a square, start cutting a bunch of short rectangular pieces from your styrene strip, and place those on the panels. Again, don't overdo it, just a few pieces to bring out some detail. This is also a good time to introduce interesting shapes from your old Panzer kits (they'll have to be small pieces since you gluing flat shapes onto a curved bottle).
Notice in the illustrations above that I use rounded panels quite a bit (and sometimes rounded rectangles on top of the panels). I think rounded rectangles and squares have a nicer finished look than sharp corners. And it's quite easy to create rounded corners in styrene:

First, using a sprue cutter, X-Acto knife or scissors (if the sheet is thin enough), cut off the corners at a 45 degree angle:

Next, using 320 or 240 grit sandpaper, sand the sharp corners left behind from the previous step until you get the desired roundness. On thicker stock or strip, use a rougher sandpaper (80 or 100 grit).
MORE INTERESTING DETAIL

Stacked panels and strip boxes are great at basic detail, but what if you want more "interesting" texture? Well, using a tool called a Nibbler, you can create some really cool details and panels beyond the basic square with rounded corners (though you can also round the corners here as well).

What's a Nibbler?

The Nibbler is primarily used to cut designs into sheet metal by PC Case modders. But I've discovered a better use for it—I use it to make perfect rectangular cuts in thin sheet plastic.

Online, you can find them at:

xoxide.com
You use it like this:

Place the sheet plastic under the cutting head and squeeze the handle to make the first cut:

Continue cutting around the edge to get the pattern you want:

The nibbler will only cut a small amount into the edge of the plastic, but if you keep pushing it forward, you can make your cuts deeper with each squeeze of the handle. The end result are panels that look very much like the panels on the Millennium Falcon (I always wondered how they did those—except they probably didn't have Nibblers in 1977).

**UPDATE:** According to OldTimer Bob in our forums, there WAS a nibbler tool in 1977! Thanks O.B.!
It would take months to cut those with an X-Acto, and you'd have a difficult time making accurate square cuts that way.

When you're done cutting the piece, use sandpaper to round the corners if you prefer.

Here's just a few pieces of the hundreds I've created with the Nibbler. I keep them in my details box, ready to apply to my next project. In fact, I often sit and make these while watching TV or when I'm just relaxing and not building models.

Here's a detail piece using all the techniques we've done so far—stacked panels, rounded corners, repetition of rectangular shapes, etc.:
Here's a closeup of my 24” Drop Ship showing the technique described above. Note all the little rectangles providing texture and interest to the surface. Also note that due to the scale of this ship (1/35), the sheets are relatively thin, whereas on my huge explorer ship, I went with thicker pieces:

And another part of the ship (man, I hate when colors don't match between 2 pictures–back to Photoshop...):
REPETITION IS A GOOD THING

Once you've got 1 bottle built up, it's time to create a few more. I can't stress enough how repetition adds to a model's personality and sense of realism. Repetition of not only the small details (like rectangles), but also repetition of the larger form, like multiple bottles.

Here's the concept for the piece I'm creating:
Here's a closeup of the middle section:

Note the box used to create the extension with the small bottle. This was easily made with pieces of sheet styrene shaped and glued together:
Need a spacer? Make it by cutting out 2 bigger circles the diameter of the spacer you need, then cut holes in the middle of them (using either a compass with 2 metal points instead of a pencil, or a tool specifically designed to cut holes in styrene). Make sure the holes fit the diameter of the pipe that runs down the center of all your objects. Next, cut out a strip the height of the spacer and bend and glue it between the 2 circles.
How do you bend styrene in a circle? Place the styrene strip on the edge of a table, letting it overlap just enough to grip it. Put one of your hands on top of the strip right where it crosses the edge of the table. Grip the overlapping bit and pull the styrene straight down while using your other hand to push down on the strip. Repeat as many times as necessary to get the proper curve.

CONCLUSION

That's it for Part 2. Keep checking back here for Part 3. I'll leave you with a few more nurnie shots to hopefully give you ideas.
Here's a good shot showing the use of styrene tubes. You bend the tubes by holding them over a candle (not too close!) until they start to "fall", then lay the pipe on a grid, such as on a cutting mat, to form them into a right angle:

Here's a sensor array, made with styrene circles and a ping pong ball, plus a few parts from a kit:
Here's another sensor array made entirely from sheet styrene (white), except for a few model parts (colored parts):
In this installment, we'll look at a detail subsection and how it's constructed. The Chopper comes in real handy for doing this quickly, but you can also do it with an X-Acto knife and straightedge, it just takes a bit longer.

Here's the detail piece we're going to deconstruct:

Here's an exploded view illustration of the piece with all the parts roughly in place:
Everything here except the tank wheels (brownish objects which came from a model kit) is made from styrene strip, rod and sheet, bought from a hobby store. The piece is about 3 inches long, so you don't need much material to create something like this.

When it's together, it looks pretty simple, but as you can see, it's made up of quite a few pieces.

Here's an illustration of all the pieces laid out:

**SUB-ASSEMBLIES**

Here's a view of the main sub-assemblies of the piece:
Here's the first sub-assembly. I took 13 pieces of styrene rod, carefully measured and cut, and glued them together on the back rectangle right up against each other. A square or other right angle tool helps keep them parallel with the base edges.
And here's all the tubes in place:

Next, we need to build a box around the tubes so it looks like the tubes are down in a subsurface. Here's all the pieces of the box:
And here's the box together with the tube sub-assembly:

Next we add a little detail to help step it up to the front detail piece, sort of helping to blend the front sub-assembly and back sub-assembly together:
Next is the big wedge piece on the front sub-assembly. Here's the pieces:

And the extra detail that goes on the sides of the wedge. Note the sanded rounded corners:
And finally we add the tank wheels from the model kit, a throwback to the early days of kitbashing and sort of my ongoing tribute to that era:

That's it for part 3. Stay tuned for part 4...

John

[Read Part 1] | [Read Part 2]

[COMMENTS?]

Last Updated ( Saturday, 11 February 2006 )