Budget Space Hulk: Papercraft and a Little Bit More by Todd Zircher

Okie dokie, a quick introduction: My son and his friends are getting into WH40K and I wanted to create some terrain to support their hobby. I started with some sand berms, ruined bunkers, vehicle wrecks, and a funky warp gate. Recently, Space Hulk has caught their eye and they wanted something like that for smaller kill team missions. So, I decided to try my hand at a set of modular terrain that would look nice, but not break the bank. The plan is to go with a combination of catwalks and cardstock rooms.

Phase 1, Cat Walks

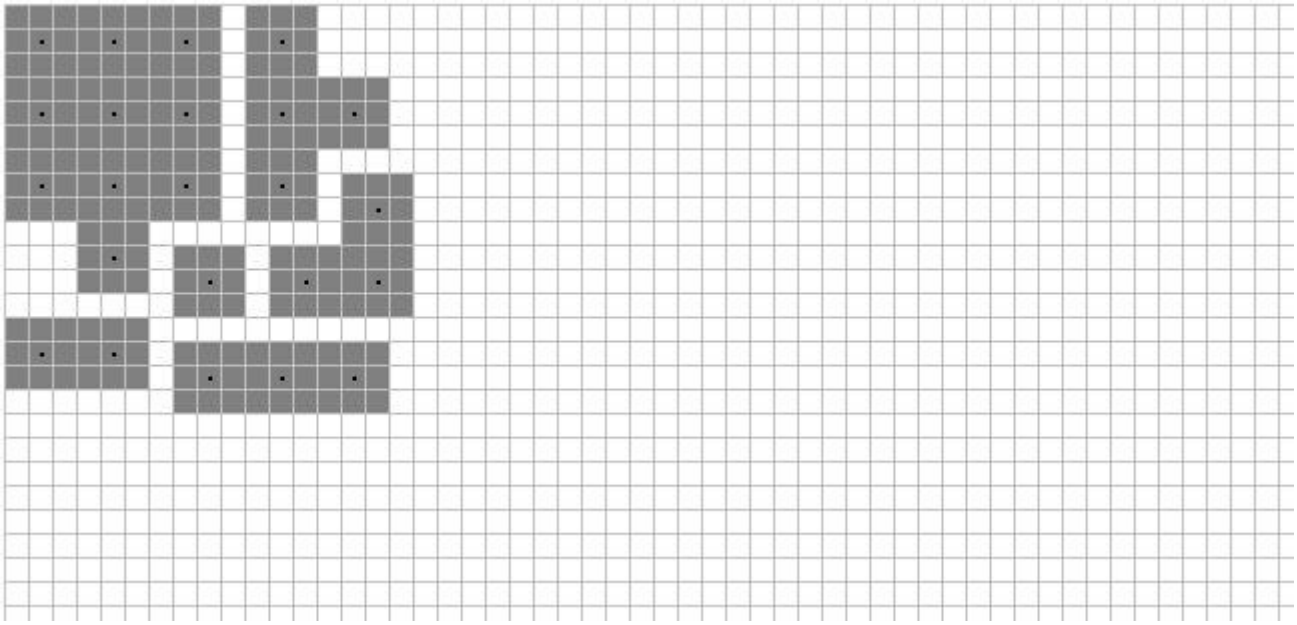
For those that are curious, the cat walks are sturdy and fairly easy to make.

Materials:
- 'egg crate' lighting panels (Home Depot, $10 each)
- a roll of black screen door fabric (Home Depot, $6)
- two cans of gray primer ($3 each)
- super glue

Tools:
- strong shears like tin snips, large diagonal cutters, or heavy duty scissors
- a full size flat file (at least 12mm or .5 inches in width)

The light panel I found is three squares per two inches. That's very handy for measuring purposes and fits 40mm and smaller bases just fine. Your typical four by two foot sheet is not enough to make a complete Space Hulk counter set, but is enough to create some good skirmish sized battles.
Catwalk construction:

Before starting to cut, you really need to plan your layout. Otherwise, you'll be prone to counting errors and wasted space. I fired up MS Paint and created a quick grid so I could plan out my cuts. Unlike cutting tiles out of paper, your catwalk pieces cannot share an edge. So, a one cell buffer space is needed. Here's an example...



Generally, a three by three group of cells is one square on a Space Hulk style map. So, most corridors will be three cells wide and rooms will be nine by nine cells in size. Space Hulk rooms always have one or more corridor entry points attached to the room. This is where doors are placed. Making it as one piece insures a nice solid base.

> I found a handy tool on the Space Hulk Yahoo Group. It's a visual editor for laying out the tiles, but it would also make for a great cutting guide when snipping out decks from your egg crate lighting panels. The program is a self extracting archive, the ZIP messages are in French, but it's pretty easy to figure out which button is used for browsing and which one is used for decompressing.
>
> http://games.groups.yahoo.com/group/Spacehulk/files/Spacehulk.exe
>
> As always, it's free to join any Yahoo group and this one looks to be spam free.

Cutting the lighting panel is pretty straight forward, if you have some heavy shears. The plastic used is brittle and snaps easily, expect little bits of plastic everywhere. Eyeglasses are sufficient protection, but the truly paranoid should wear goggles. Remember to count twice and cut once. I converted a couple of four way intersections into tee intersections by getting carried away with snipping.

After the bulk cutting is done, I went back to each piece and trimmed down the jagged connections with a pair of heavy scissors. I happened to like the rough sides and did not file them down smooth. However, where two corridor or room pieces meet, I filed those edges smooth so they would butt up against each other nicely. I don't have too many power tools, so I just used a wide flat file to grind them down. You'll want something a lot hardier and larger than a typical modeler’s file.

I found that Krylon Indoor/Outdoor Gray Primer took well to the plastic. Due to the cellular nature of the egg crate pattern, a LOT of primer is needed. You basically have to hit each piece from four directions not counting touch ups for spots you missed. One 4x2 sheet took two cans to completely cover the catwalks. Fortunately, the

dark gray primer looks so industrial; I didn't need to do any further painting.

After all the pieces have dried, you can start work on adding the mesh flooring to the substructure. I chose black fiberglass mesh for several reasons; it's cheap, lays flat better than aluminum mesh, is easy to cut, and the black color requires no painting. [Hey, budget project also means time spent as well as cash.]

You have a decision point here on how best to apply the screen door fabric to the plastic pieces. You can cut out individual sections and tack down the corners with a drop of super glue. That will optimize your materials, but you have to deal with some fabric curling (it comes in a roll.) So, you'll either need lots of little weights or patience to hold the mesh down until the super glue sets. Or, you can go for a more industrial route. Since I had lots of mesh (a 4x8 roll), I chose to cut out swaths about 12 x 24 inches and place as many pieces as I could under that before I glued them down. Curling is still a minor issue, but you only have to weigh down the corners and not every piece.

Given that the black mesh is easy to trim, I glued them down with plenty buffer space around the edges. One thing to note, it's rare to get a mesh glued down at a perfect 90 degree angle to the plastic base. The fabric tends to drift to the left or right. If you have the time you can stretch, pull, or otherwise finesse a section to be straighter, but I found that minor drifting does not adversely affect the end result.

That's pretty much for phase 1. Phase 2 will be creating walls and rooms with cheap computer software [Metasequoia LE (free/shareware) and Pepakura (shareware, registration optional)] and an inkjet printer using cardstock paper.

Here's a parting tip. I found that I had a number of 2x3 cell pieces of the lighting panel left over. Rather than pitching them, I sanded one of the long edges smooth, primed, and added mesh to them. These partial catwalk sections will become my dead end corridor pieces, torn up corridor sections, pitfalls, debris filled passages, etc.
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Cool, my son and his friends are getting psyched by the project as well. I've got a rather hefty list of accessories that they want to add to the basic corridor and room designs. That's one of the perks of paper modeling, if you can imagine it in 3D; it's fairly easy to convert it to paper with Pepakura.

Accessory wish list so far: stand pipes, vents, fans, switches (ala Incubation), cameras, xeno dissection table, specimen tanks, iris doors, cargo bay racks, cargo hatch (floor), cargo crane, torpedo bay, mess hall, galley, fuel tanks, steam valves, conveyor belts, astronomicon/navigation, computer terminals, barracks, chapel, armory, hanger bay, vehicle bay, vats, mixers, reactor cores, library, throne, inquisition chamber, bridge components, rubble, and hydroponic banks. Some of those require some artistic skill so that's why it's a wish list.

Accessories done so far: open door insert, closed door insert, support beams, archway, long pipes, crates, and barrels. They'll be included with the main archive file and I'll try to include images of most of these objects so you can see what they look like when assembled.

The goal is to make everything as modular as possible, but some of the parts will work best glued into place to customize a room.
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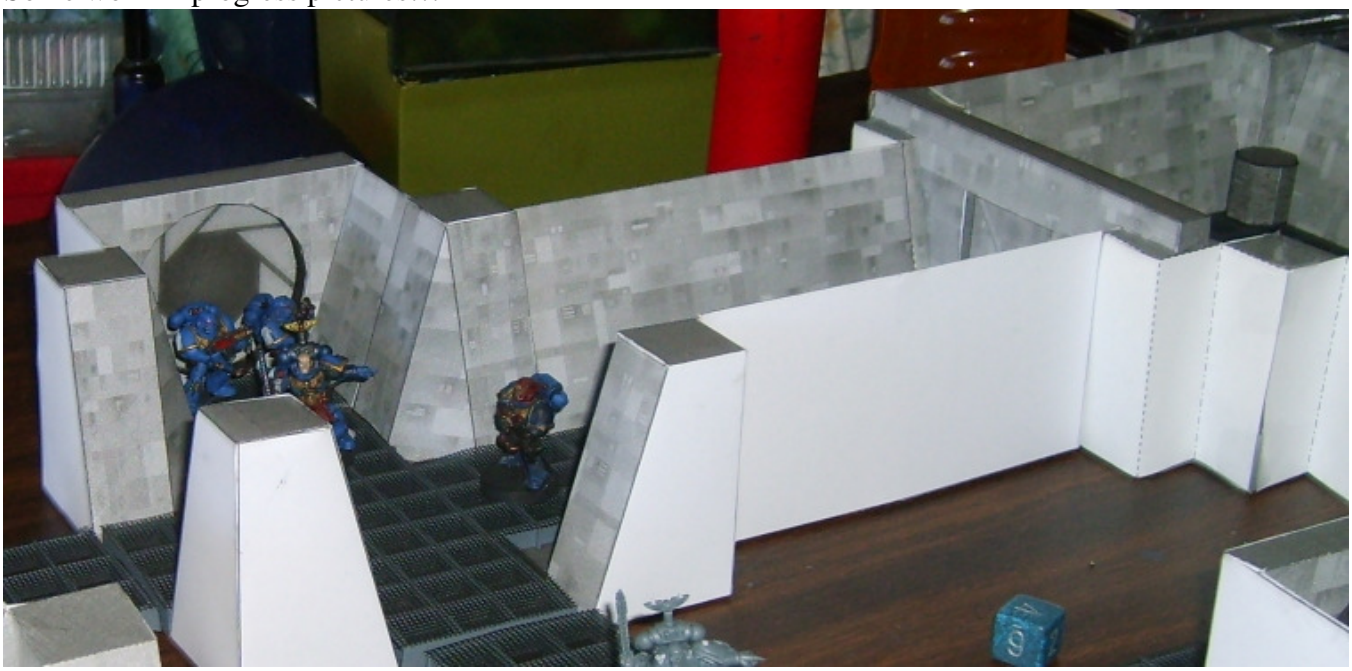
Some work in progress pictures…



Part of the plan is to use the mantel-like models for support braces, arches, open and closed doors, etc. They can either be glued down for support or swapped out to reflect the door status.

Phase 2, Paper Models

I've always been of fan of low polygon modeling tools and this project is right in line with that kind of detail. As a general rule, 3d models are made from infinitely thin polygons. The same can't be said for paper or card stock. That means the more complex the model the greater the drift or margin of error. For the design I wanted sloped walls for several reasons. It's consistent with original Space Hulk artwork, it allows for a little more room for big models, I can hang accessories off the edge, and the wider base will give the models more stability.

For the design phase, I went with Metasequoia LE. There are free and shareware versions of this modeling tool. While it is not as powerful as say Blender, its MQO format is natively understood by Pepakura and less features means that it is easier to learn. I'm using Meta R2.4 for this project.

http://www.metaseq.net/english/index.html

Pepakura Designer is a tool that takes 3D models and unfolds them. It does an okay job on its own, but you can help it by designating where to separate model edges. This can lead to more efficient templates that are easier to cut and assemble. Unfortunately, Pepakura has no free version. The shareware version works for our purposes, but it does not allow you to save your preferences unless you register it.

http://www.tamasoft.co.jp/pepakura-en/download/designer.html

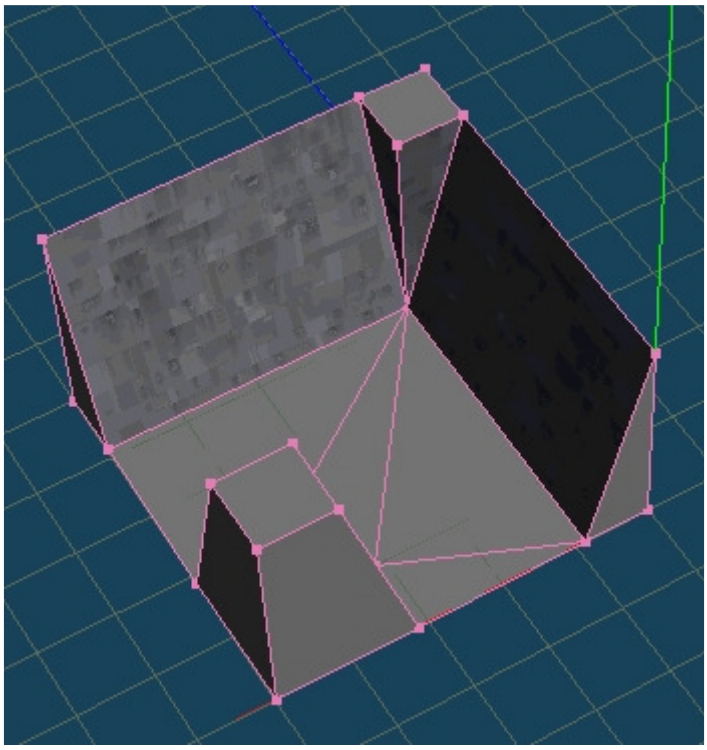
Once I get a complete set of models done, I'll probably post the MQO files on the DoGA CGA Yahoo Group. DoGA CGA is another free/shareware modeling tool that you can also use in conjunction with Metasequoia.

Tools:
- A computer capable of running Meta and Pepakura. (Windows XP)
- An ink jet printer (set to grayscale, black ink only - budget, remember?)

Materials:
- Cardstock paper. (I'm using Xerox 65 lb Bright White Card Stock, $15 USD at Office Depot.)

Metasequoia is a 3D editor that uses a single window for viewing. You can create points, lines, triangles, and quads. To those you can add images as textures and project the textures on to select faces. A full Metasequoia tutorial is beyond the scope of this thread, but you can always pick my brain on the DoGA CGA Yahoo group if you’re interesting in learning more.

What I did for this project was set a working scale of 40 units equaling one inch. Forty is a good number since it can be easily divided into halves, quarters, and eights. The default grid size is 50, so I changed that to 40 as well. The general rule for most of my models is that they are 3 inches (120 units) tall. It's important to be consistent or at least know when you’re working outside of that restriction since we'll need to set a scaling factor in Pepakura.



With two inch wide cat walk squares, I set the corridor width to 2.25 inches in order to account for rough edges and overlapping mesh. If you count out the squares, you'll see that this model's base is 5x5 inches.

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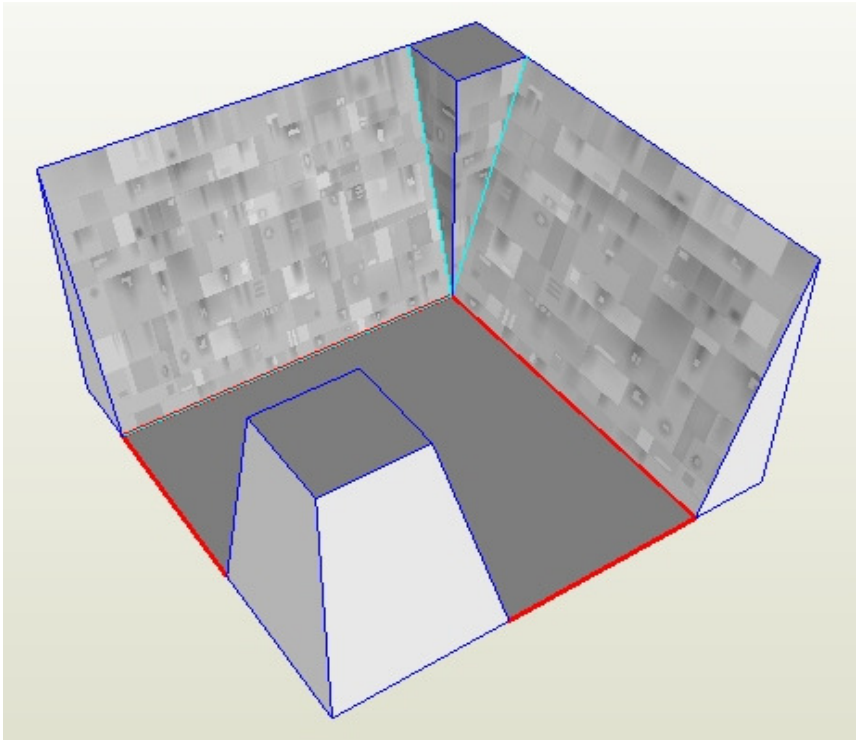
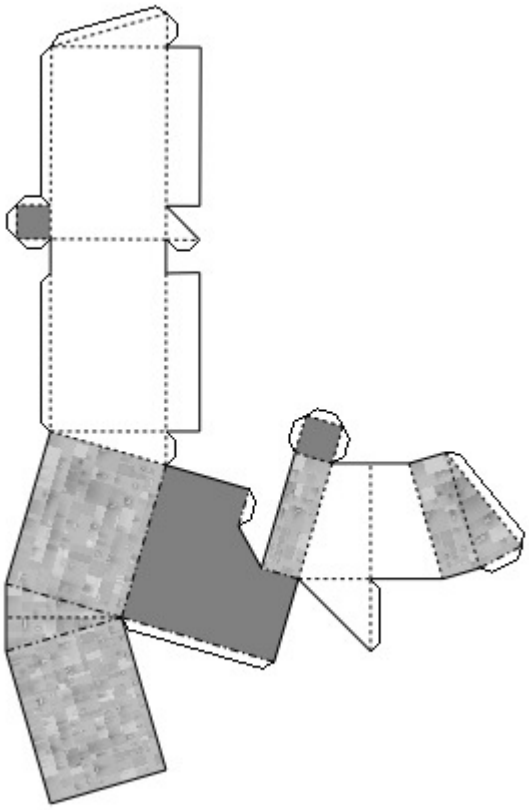
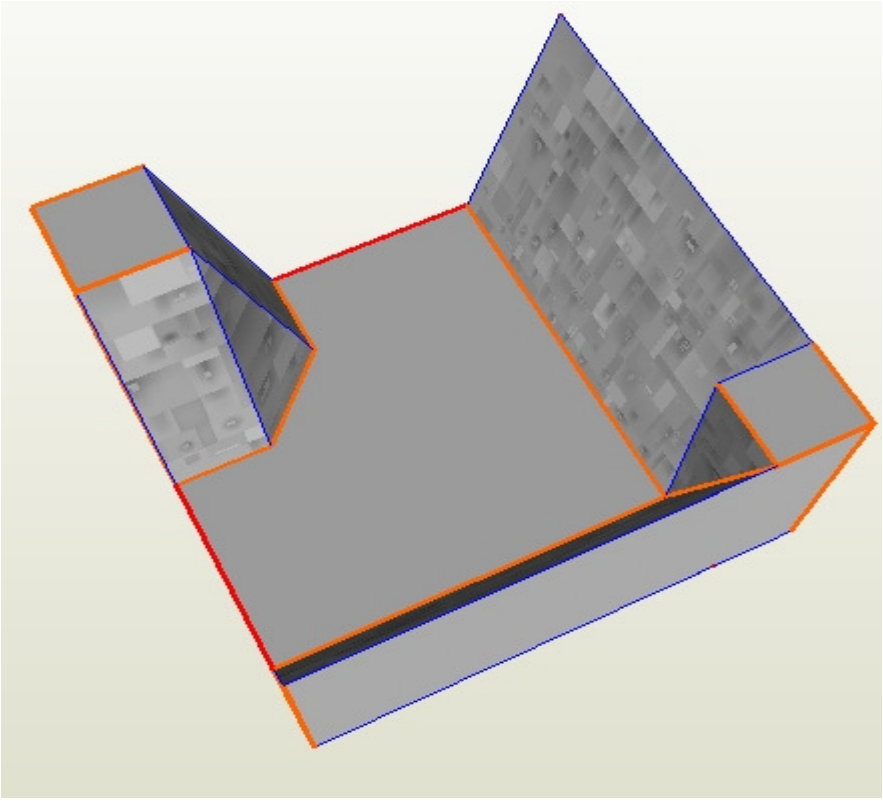
Pepakura and similar tools (I've been told that Blender has an unfolding script) are what make this project possible. If you're using Metasequoia, you can load in the 3d files directly into Pepakura Designer. Below is a corner hallway piece. The red edges are mandatory cuts or hard edges. Blue lines represent mountain or valley folds.



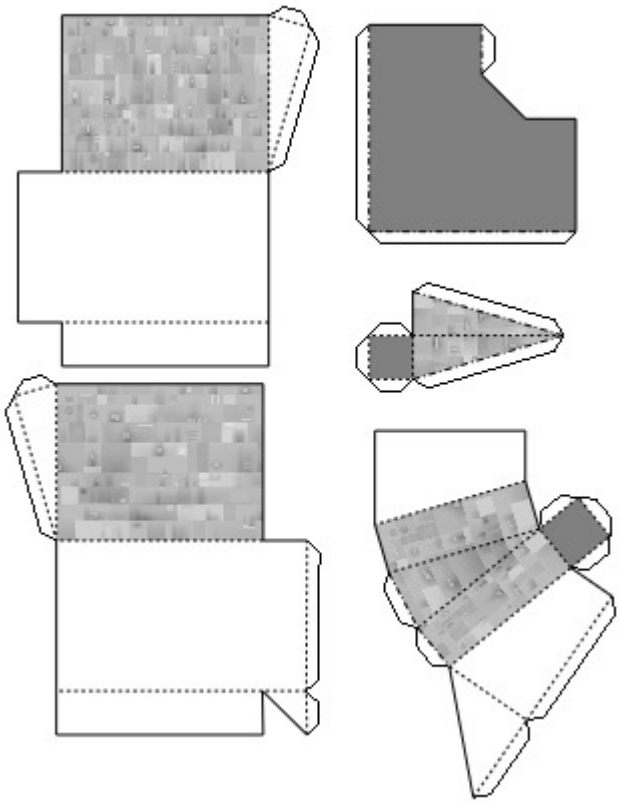
The problem with accepting the default unfolding is that you can get a huge piece that will not fit on to a single piece of paper once it is set to our 3 inch high scale.



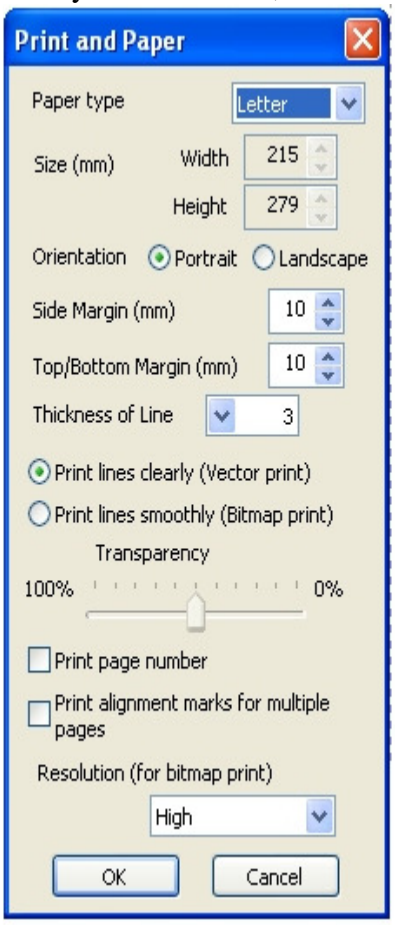
Fortunately, Pepakura allows you to select your own edges (orange.)

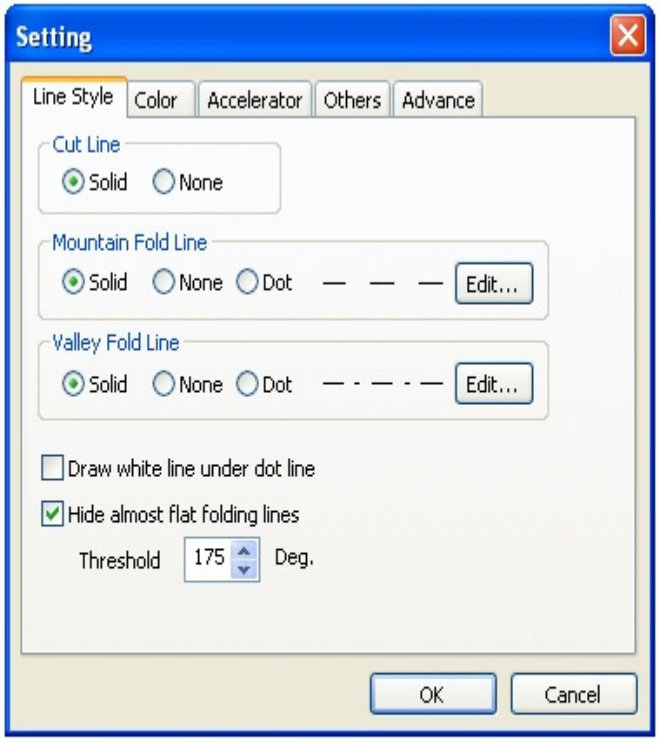


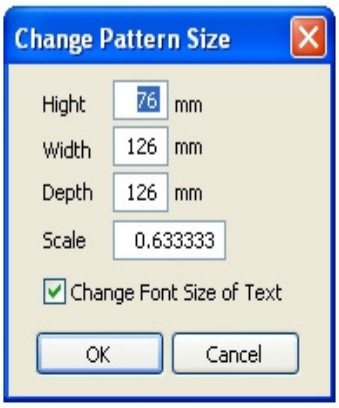
This forces Pepakura to unfold into easier to position parts that will fit on the other pages.



Of course, to be useful you have to tell Pepakura three things: What kind of paper you're using, what style of lines you want to use, and the actual scaling factor for covering the 3D model into real world values.





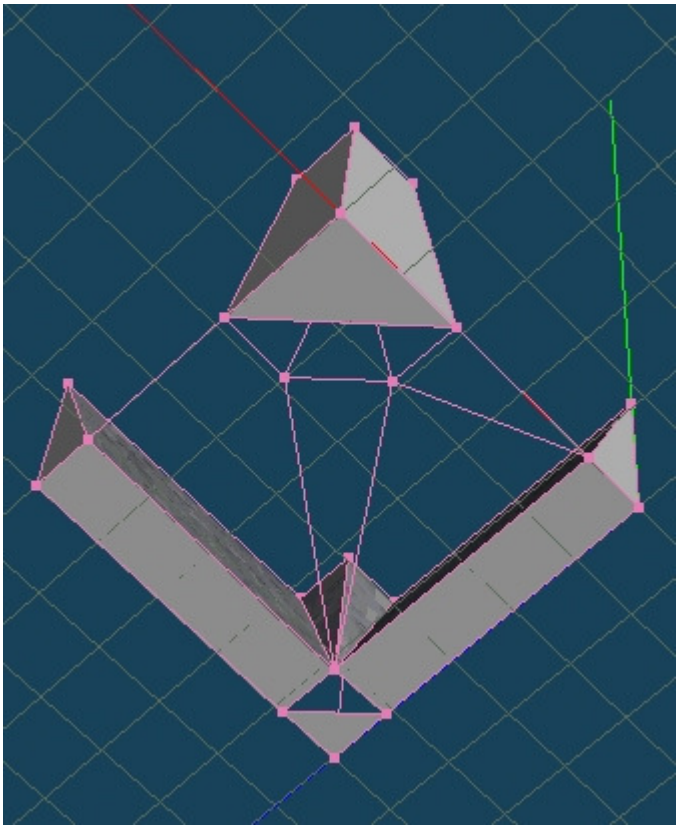


The Print and Paper dialog box is accessed from the File menu. The three settings to pay attention to are paper type (US machines use Letter), margins (I use 8-10mm), and line print style (I prefer vector.)

The Setting dialog box under the Setting -> Other Settings lets you choose the line type. I prefer solid lines for everything, but you could also use None for the mountain and valley lines if you have a good idea where these should go on the paper template.

The last and most important setting is the Change Pattern Size box. You can only access it from the 2DPatternWindow menu after you have unfolded a model. Click on the Change the Scale and Specify the Scale sub menus. Remember how I talked about setting a consistent height in Metasequoia? That pays off here. You can set 'Hight' to 76mm or you can set the scaling factor to .633333. This will insure that your assembled models are the right size. Pepakura's default behavior is to re-scale everything so it fits on one page.

Finally, Ctrl-R (rotate) is an important key, it toggles on and off red handles that allows you to rotate and move the 2D patterns so that more of them can fit on a single page.



Of course, we're designing for paper and not a video game. So, it's important to think about the underside of the model and place flaps and corner reinforcing tabs so that the model will sit square on its own.
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Assembling paper models...

Depending on your sense of geometry, assembling the patterns Pepakura makes can be a piece of cake or a sticky headache of glue and tape. What I do is cut out the majority of the template using a nice comfortable pair of scissors. Precision is more important than speed. The black solid lines are thin and you really want to hit the center of them so that the model will come together with a minimum of deviation. For tight spots, I'll use a Xacto knife and a cutting board.

After the patterns are cut out, I go over all the fold lines and lightly score them with a metal ruler/straight edge and a letter opener or the back of the Xacto knife. That greatly improves the accuracy and ease of folding the paper or cardstock. Once scored, I pre-fold all the mountain and valley edges to make the assembly easier.

There is really no right or wrong place to start gluing down the tabs. I just use regular white glue (also known as PVA glue) and a little patience. One thing that you do want to keep an eye on is accessibility of your fingers since you will need to press down on both sides of any glued surfaces. On corner pieces I like to start at the top, get it solid/dry and then work on the reinforcing corners at the bottom.

Now that I've gone from prototypes to 'mass production', several tips have surfaced.

Since the unregistered version of Pepakura dies not save your work, perform print runs in batches. Print out four or five of the same model at one time. When I get the time to convert these to PDO format, that should hopefully not be an issue.
All your pages have margins, if a tab extends into a margin and does not get completely printed, it is not a disaster. This might allow you to place more patterns on a single page and save cardstock. I'm already half-way through 250 sheets since I had a lot of prototyping to do.

Cardstock is stiffer than paper. So, it's good to trim to within a half inch or so on all your patterns. This enables you to cut for longer runs without the excess cardstock getting in the way. It only takes a few seconds to trim around each pattern.

It's important to cut faces accurately, but you can - and should be- more flexible with cutting tabs. I tend to cut the tabs a touch smaller (on the inside of the lines) since they sometimes butt up against each other. In the virtual world two 45 degree angles is 90 degrees. With paper and cardstock, 45 degrees plus print lines can create difficult to assemble parts such as end caps on a column. Trimming tabs gives you a little bit more space when gluing down tabs in tight spaces. Also, it is fairly common for two tabs on opposite sides of a model to overlap when the model is folded together. Trimming the tabs to be a shorter and sitting flush is better than gluing one down on top of the other.

It's better to do things in batches, trimming, cutting, and assembly. While one part is drying (white glue is your friend), you can work on other parts.
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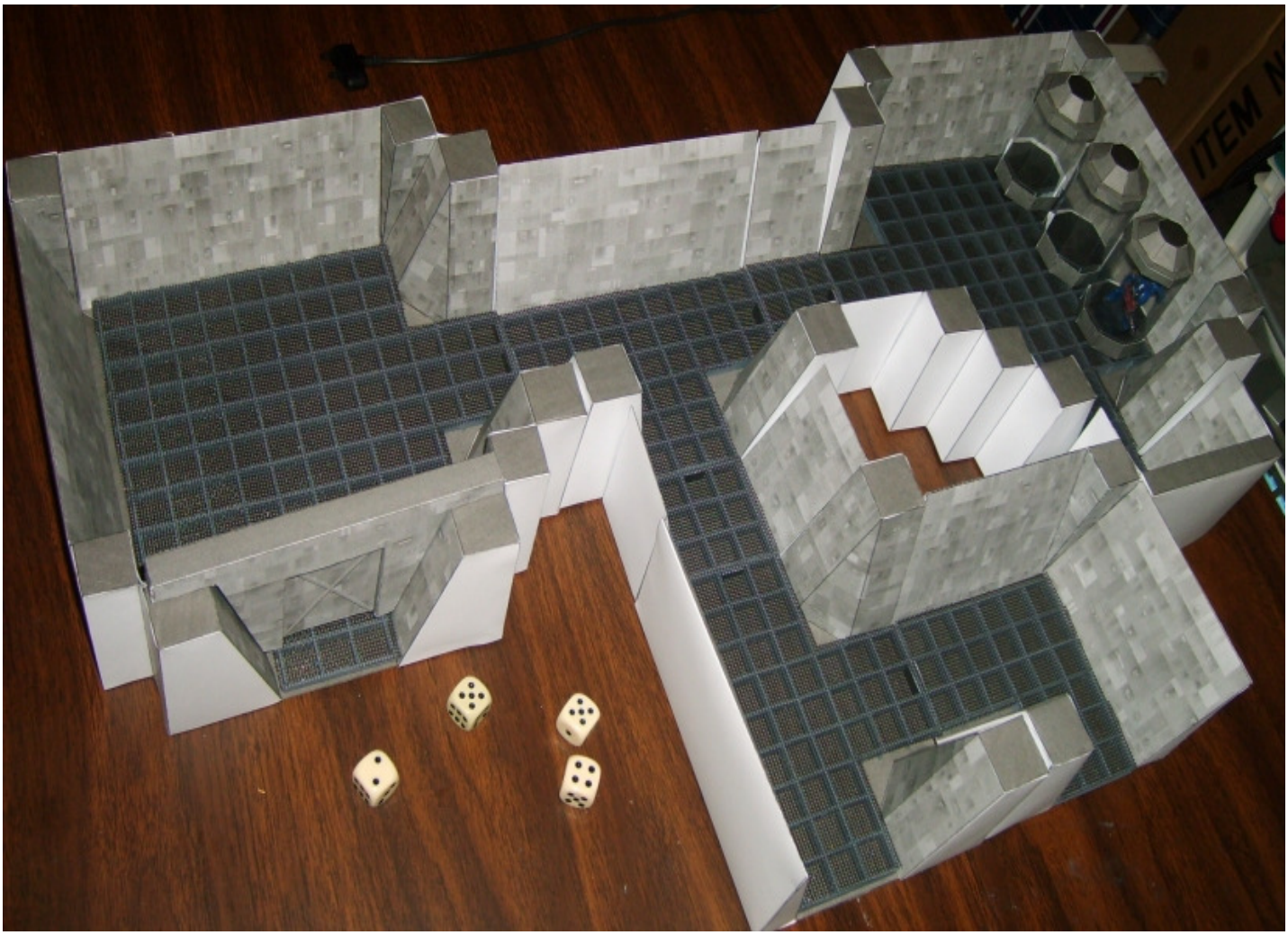
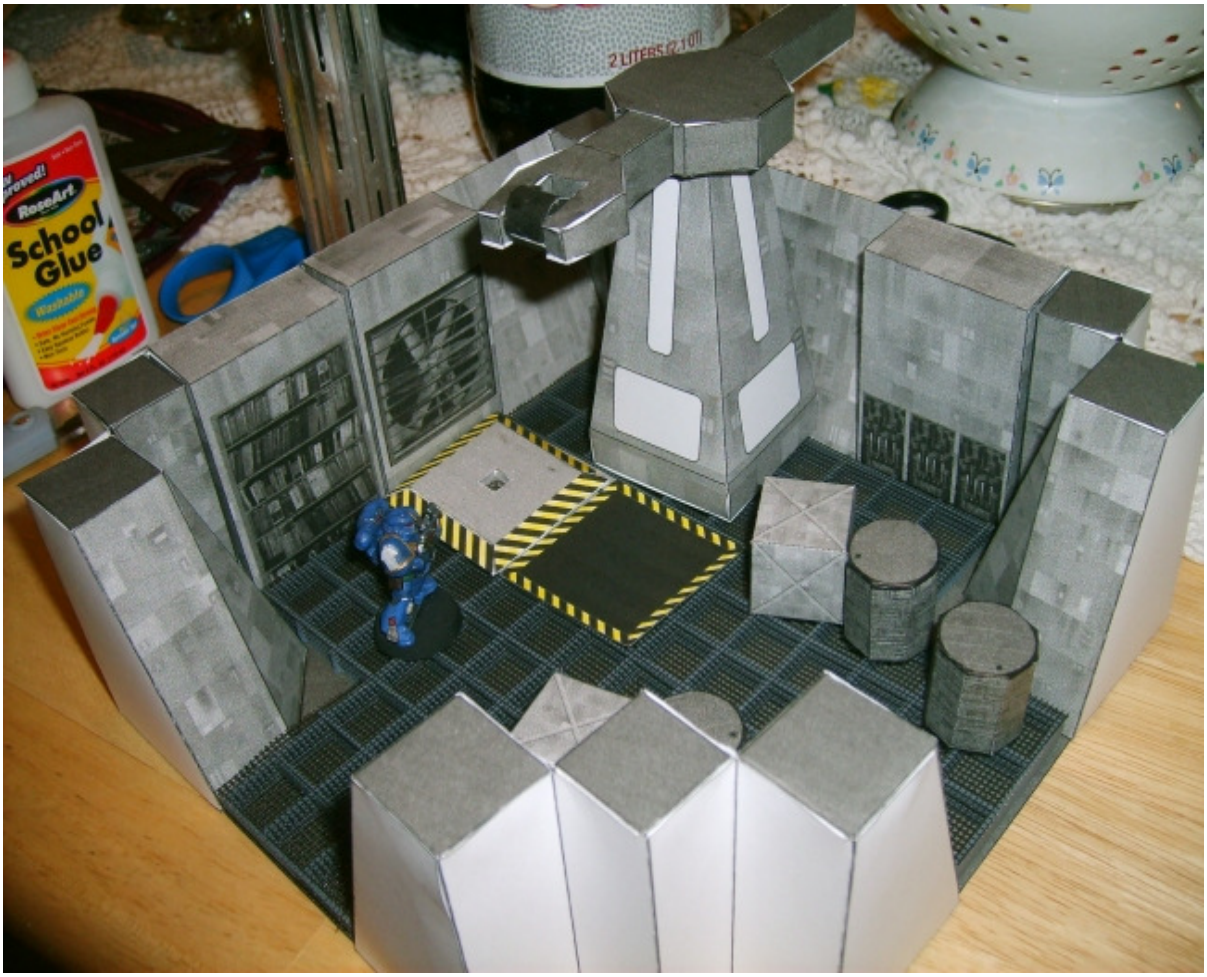
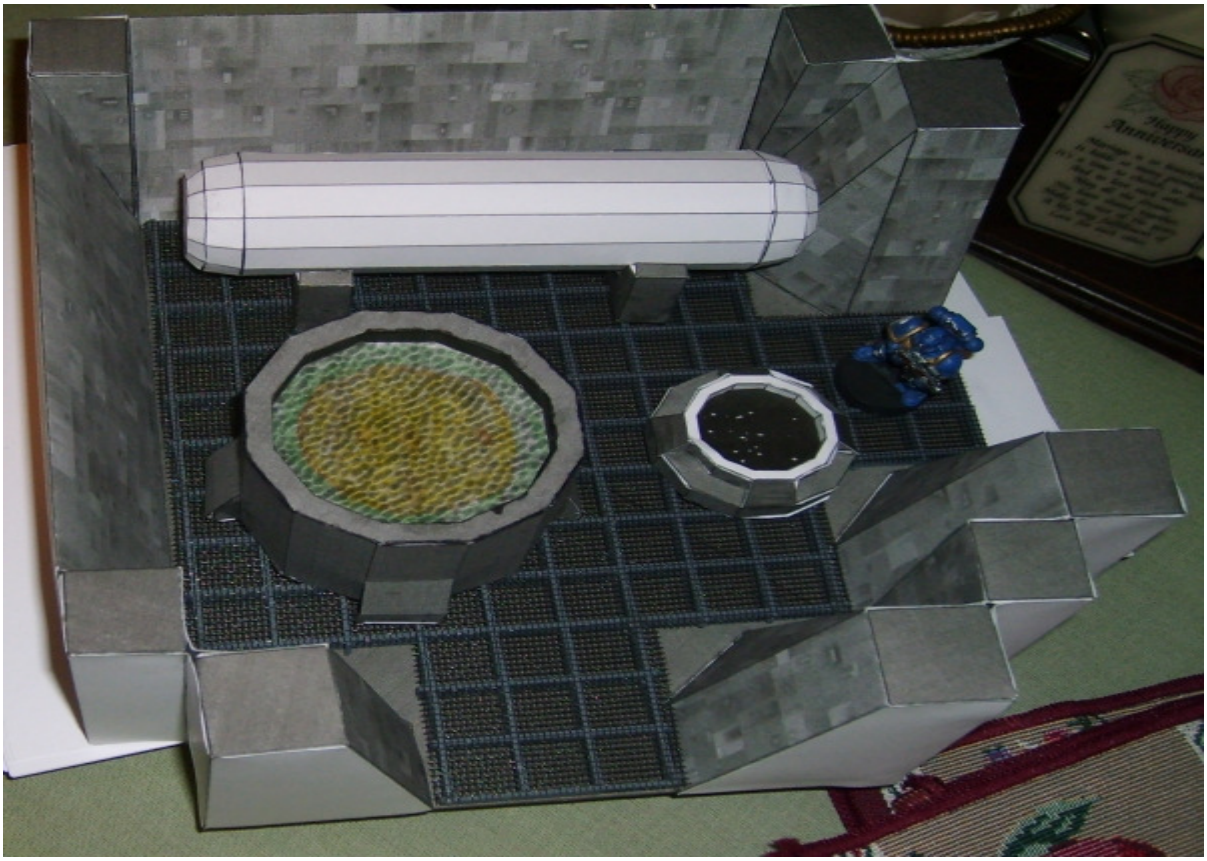
Built some more hallways, made a slew of plastic clips, and spent way too much time on specimen tanks. The clips worked out brilliantly. Not only do they hold the catwalk into place, they help to push the paper models together to make them fit nicer and slouch less.



Another work in progress picture mainly of accessories: a cargo hatch (which can be positioned to show an open or closed status), a cargo crane, and three wall hangers (control panels, books, and a ventilation fan.)



A chemical vat, a fuel or toxic gas tank, and a navigation/holo-tank console.



I can see some minor tweaks are need in the design of the head on the cargo boom. And, I need to double the height of the lockers. I'll include those updates in the archive.
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Thanks! I updated the Metasequoia model file archive for those that are interested.

http://groups.yahoo.com/group/dogacga/files/TAZ/space_hulk_MQO.zip

I also plan to include them in the PDO archive as source files as well.
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TAZ