Contents

Intro

Can I give you a complete rundown on the art of 3d modelling? Hell no. I can barely understand how to model a square.

However you might be an excellent modeller who is unsure how to get your model into the sim. That I can figure out.

You might also be looking to buy a model, or find a free one, and insert it into the sim which is what I do most of the time.

For some reason people automatically assume that I've made any 3d model that appears. This is weird.

This will be very narrow. You'll need to check other sources for most of the questions you have because I won't know. All I'm going to do here is detail what I do to get models ready to use.

There are other ways to do it and no doubt better ways too.

I also only use Blender so this will be useless for anyone with 3ds Max.

More than anything this is a reminder to myself as I have a bad habit of becoming an expert on my chosen subject within a week and then forgetting it all again.

There are six models I've included in the 3d model folder. Four are an aircraft hangar in various stages, from the original Sketchup file to a file that's ready to drop into MSFS.

Two are of an animated lighthouse beam, the original Blender file and the export that's ready to drop into MSFS with working rotation.

There are also other 3d models in the Heliport folder – two platforms, one visible, one invisible and solid. And a warship with a landable helipad.

Adding a ModelLib Asset Type

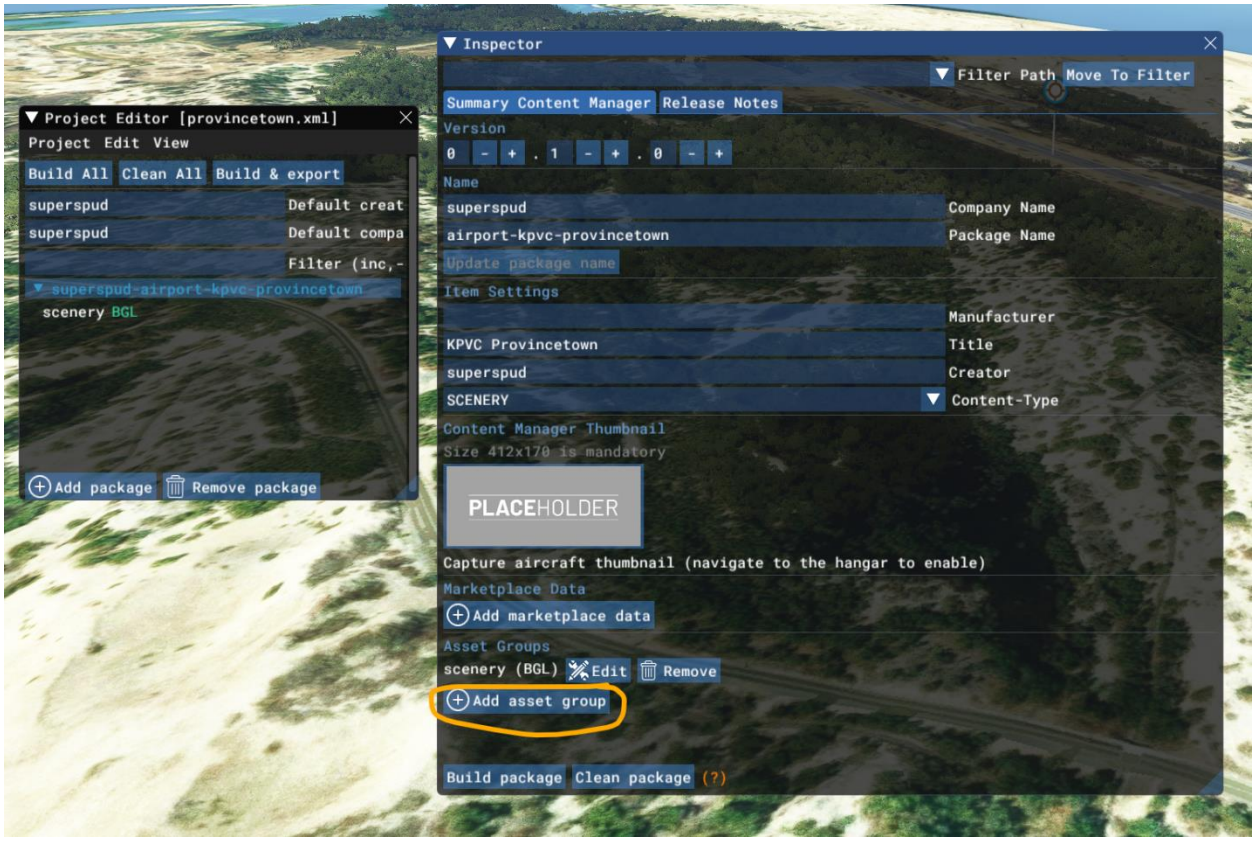
I will assume you've already built an airport or scenery project and done a few modifications to it. In the Project Editor window you have a 'scenery BGL' file which is the info contained in your project's XML file – where objects are placed, aprons, airport information etc.

You now need to add a modellib as a new asset group to the project.

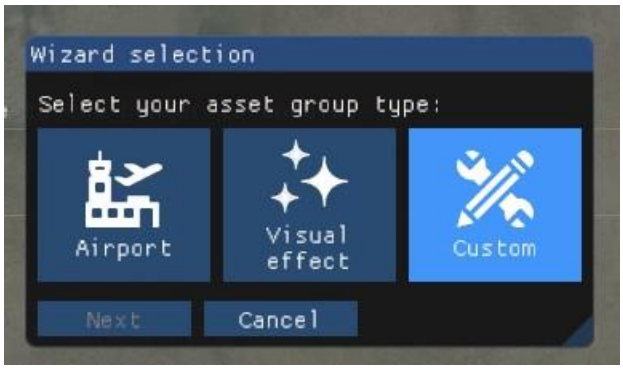
Asset Groups are the types of file that you use with the sim. Anything in the BGL section is basically internal to MSFS.

Something like a modellib is an external addition so you need to add this as a new modellib asset group for the SDK to use.

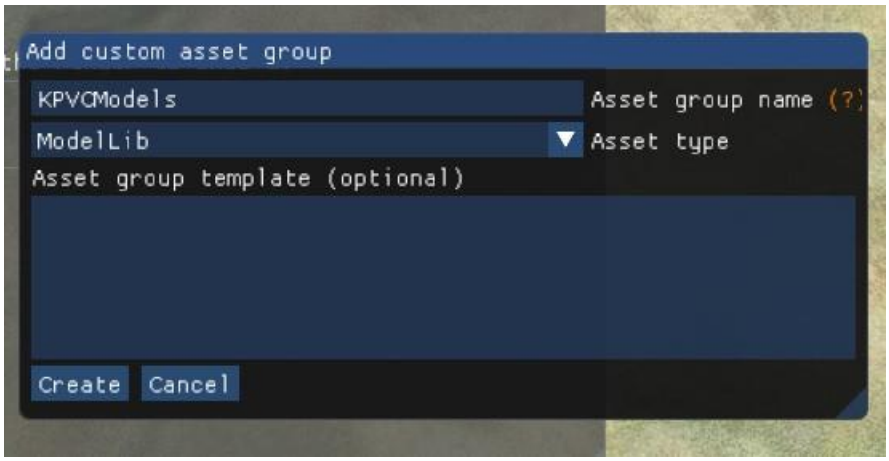
In the Inspector window click on '**Add asset group'**



In the next window click on '**Custom**' and '**Next**'



In the next window name your modellib and select ModelLib as an asset type in the '**Asset type'** dropdown menu.

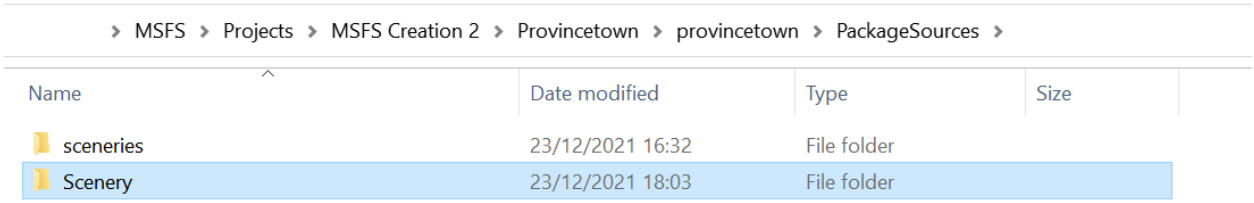


Then press '**Create**'

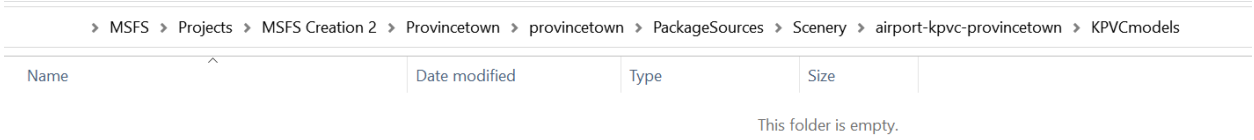
The inspector shows you the file path which is the 'Assetdir'

And when you look in your project folders you should now see a ModelLibs folder in the 'PackageSources' folder.

For some reason it now creates a second Scenery folder and the ModelLib is buried in there



Keep going until you're in this folder.

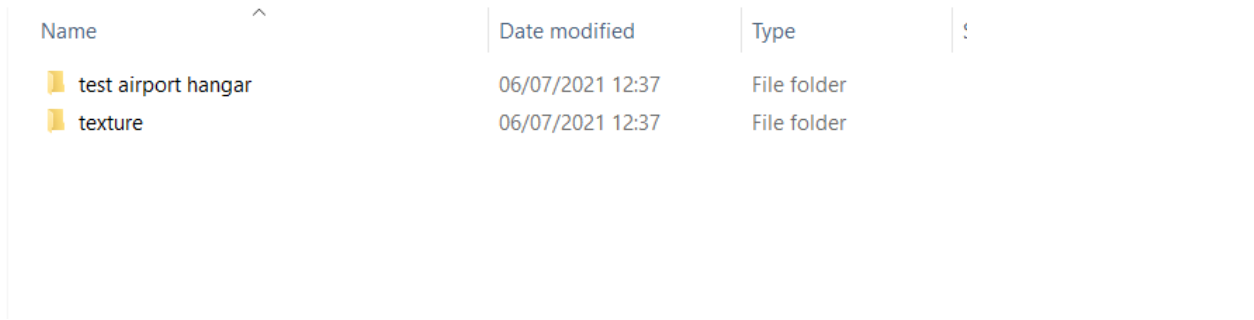


Inside this folder, KPVCmodels, is where you will need to manually place your model and texture folders.

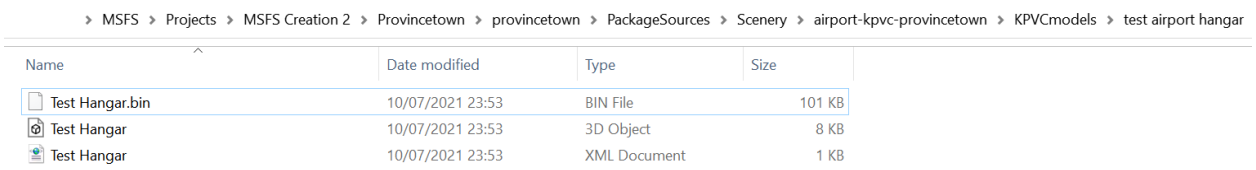
You may as well use the sample hangar model I've included in the 'Hangar Model - Blender Export MSFS Ready' folder. This one is ready to go.

Each 3d model has its own folder. All of the textures for all models are placed together in the single 'texture' folder.

This is what I've placed in the example project's folder.



MSFS uses the .gltf format for models. A model that is ready to go should consist of 3 files - .bin file, .gltf file and a .xml file.

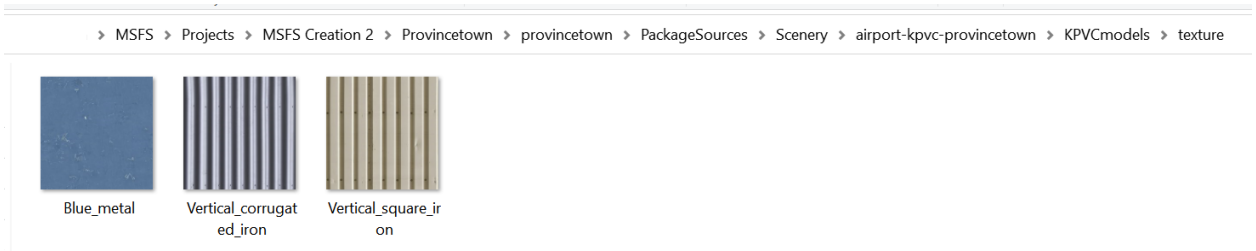


The .xml file is the only one you might need to edit. This contains the model's guid – the unique identifying code that each object needs to have so the sim can identify it – and it's also where you add animation information. If you have a static model correctly exported you shouldn't need to do anything else to this file.

Someone might give you a model ready to insert that's been prepared for MSFS with these files, if not you need to export it from another format.

If you find a .gltf somewhere else, it's a common format, you still need to add the .xml for MSFS to read it.

The texture folder should look like this

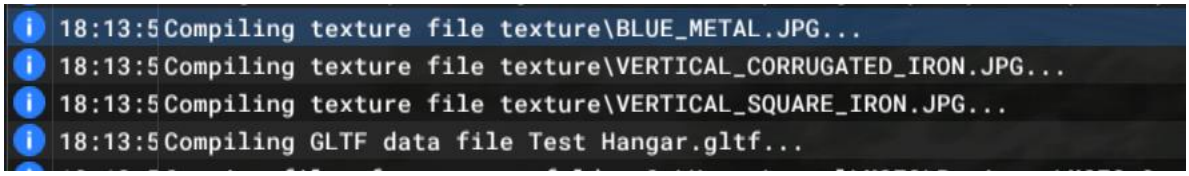


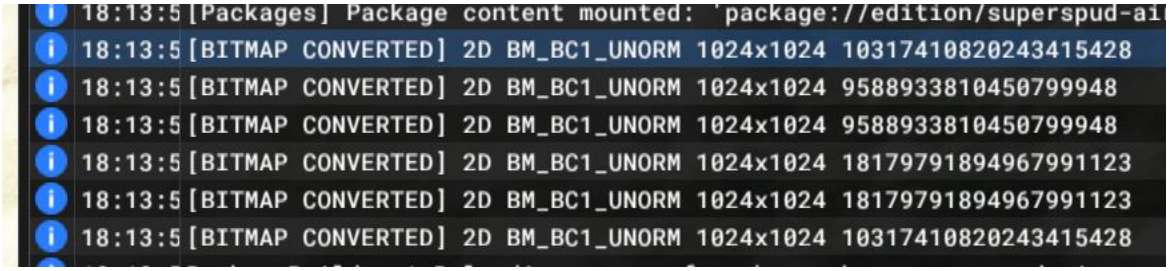
And as stated before all textures for all models go together in this one folder.

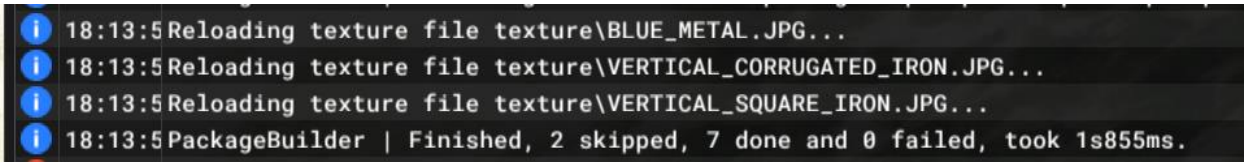
With the Modellib created and the 3d model and textures in the relevant folder you're now ready to build which will integrate the model into your project and package.

When you place the rebuilt package in the sim your model will be available to place when you've reentered the sim.

In the Console Window during the build you should be seeing messages like this as the SDK processes the models and textures while building.

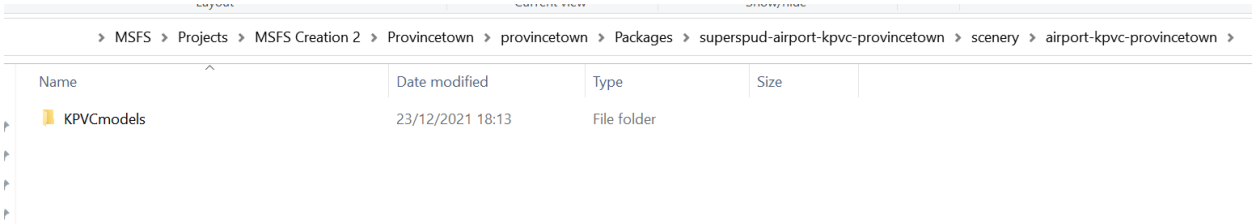




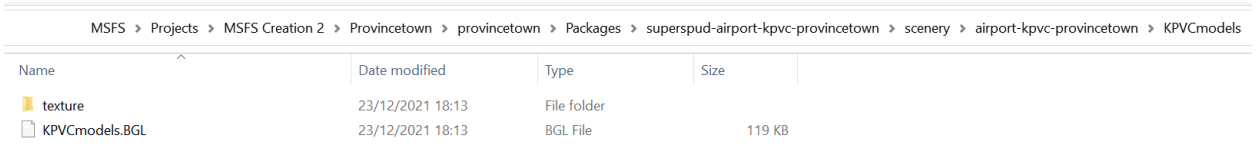


You'll probably also see lots of errors you don't understand, I don't understand them either. '0 failed' is what you want to see.

To double check go to your project folder and look in the 'Packages' folder.

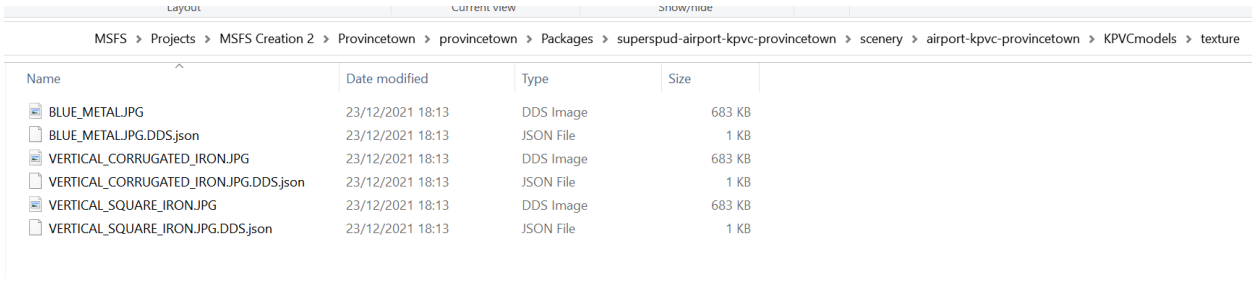


Click on 'KPVCModels' and you should see this.



The KPVCModels BGL file is all of your 3d models combined into one file.

Click on the 'texture' folder and you should see all of the textures processed ready for the sim.



This is a package that's now ready to insert back into your community folder. When you open up the project your model will appear in the object list of your package and you'll be able to place it and save it.

Since it's now an internal part of your package all of the users who download it will see it as well.

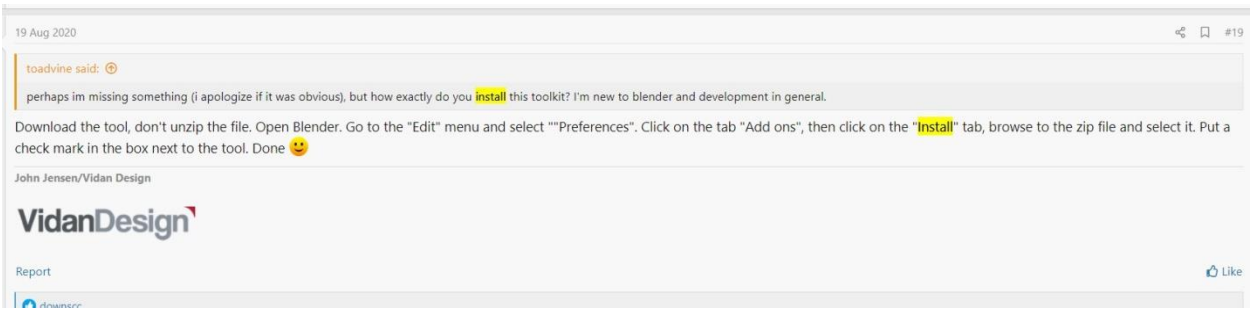
With this set up from now on all future models simply need to be exported into their own folder in the modellib, move their textures across to the 'texture' folder and build the project again. The next time you enter the sim the new model will be there and ready.

Exporting a 3d model into MSFS

For this I use Blender 2.83 LTS - https://www.blender.org/download/releases/2-83/

And to export into the sim you need to add this plugin to Blender - https://www.fsdeveloper.com/forum/resources/blender2msfs-toolkit.256/

To install the plugin this should do the job



Blender is a genuinely evil program that I have barely scratched the surface of. And I don't think I'm capable of describing everything I know about it, which isn't very much.

You're going to need someone else to teach you the proper ins and outs. I doubt I'll ever know 1% of what it can do.

What I will do is show the most common path most people take which is getting a free model from 3dwarehouse, which is probably the biggest source of free 3d models, export it from Sketchup which is the program everyone creates these models with, import it into Blender, and then export it to your modellib in a state that's ready to insert into the sim.

There are of course many other 3d modelling programs and many other 3d model formats.

You need Sketchup Pro for this which costs money, but you get a free 30 day trial so maybe you can pile up the models.

Find the model you like on 3dwarehouse, you need an account to download. Down load the SKP file. Open it in Sketchup Pro. Press File > Export > 3D Model and select 'OBJ FILE'.

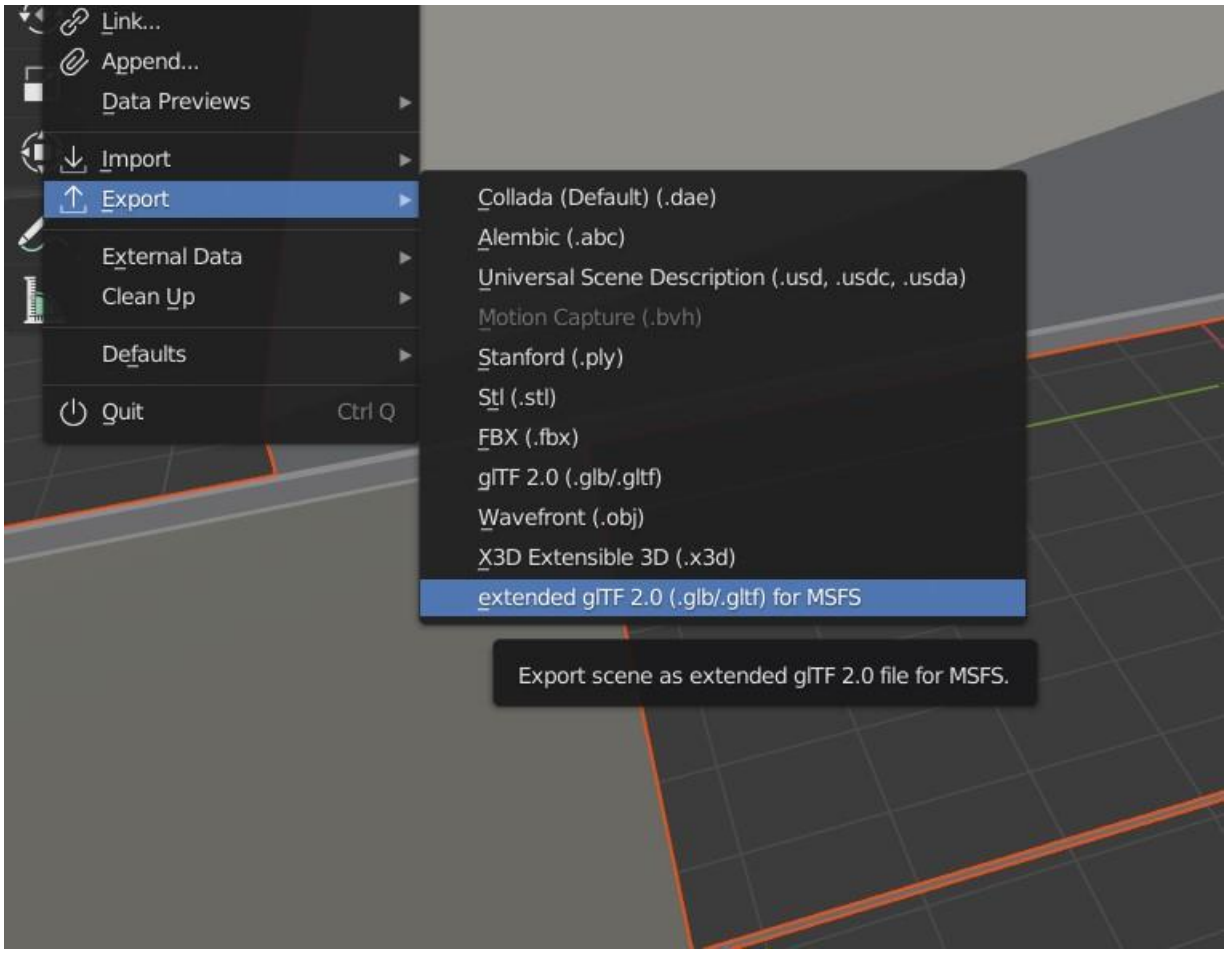
This will export the model with textures attached into a folder of your choice.

Open Blender and on the top left click on file > import > Wavefront (.obj)

Find your exported .obj

Press import.

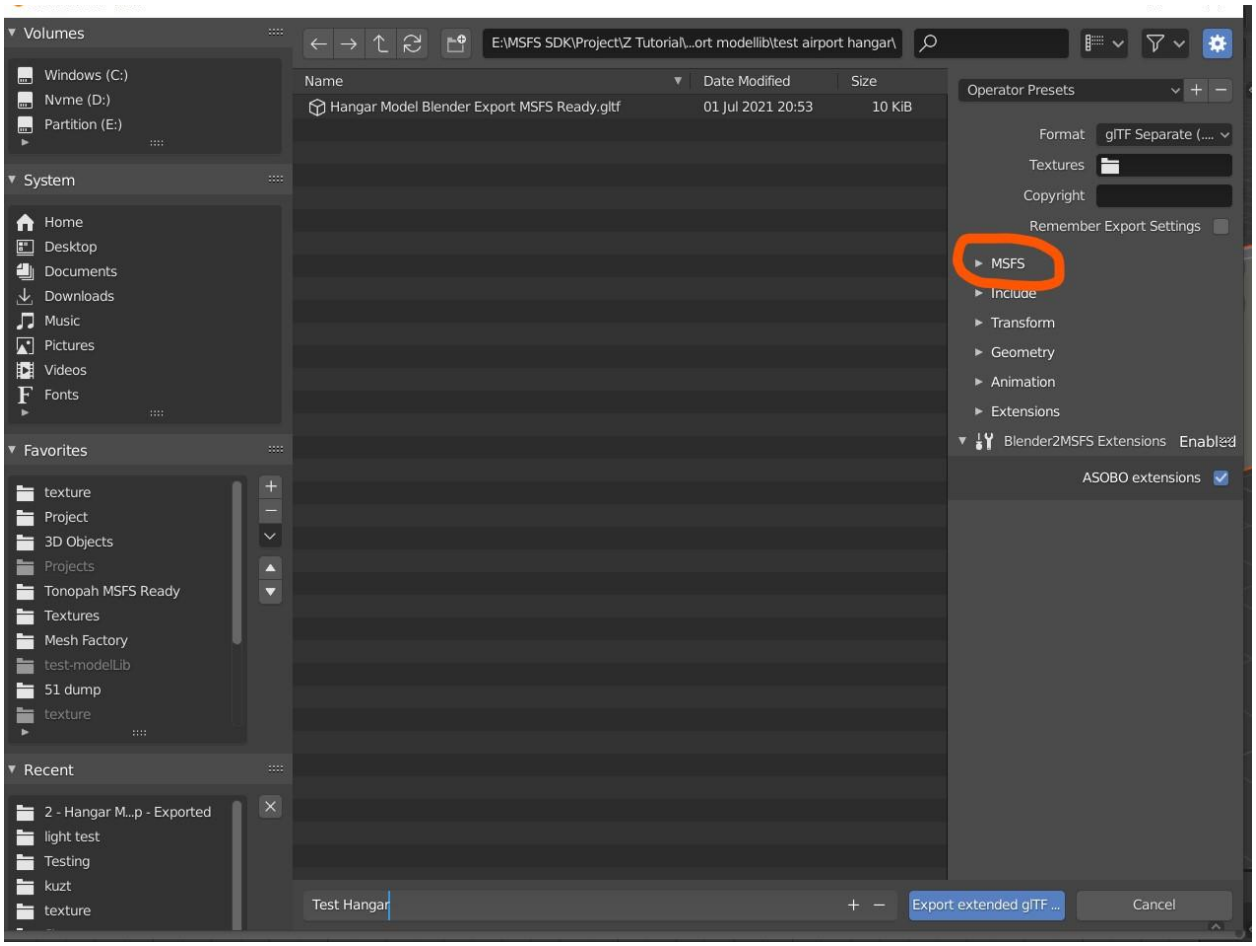
Then the model should appear in Blender with textures attached. Assuming everything is OK click on - file > export > _extended glTF 2.0 (glb/gltf) for MSFS



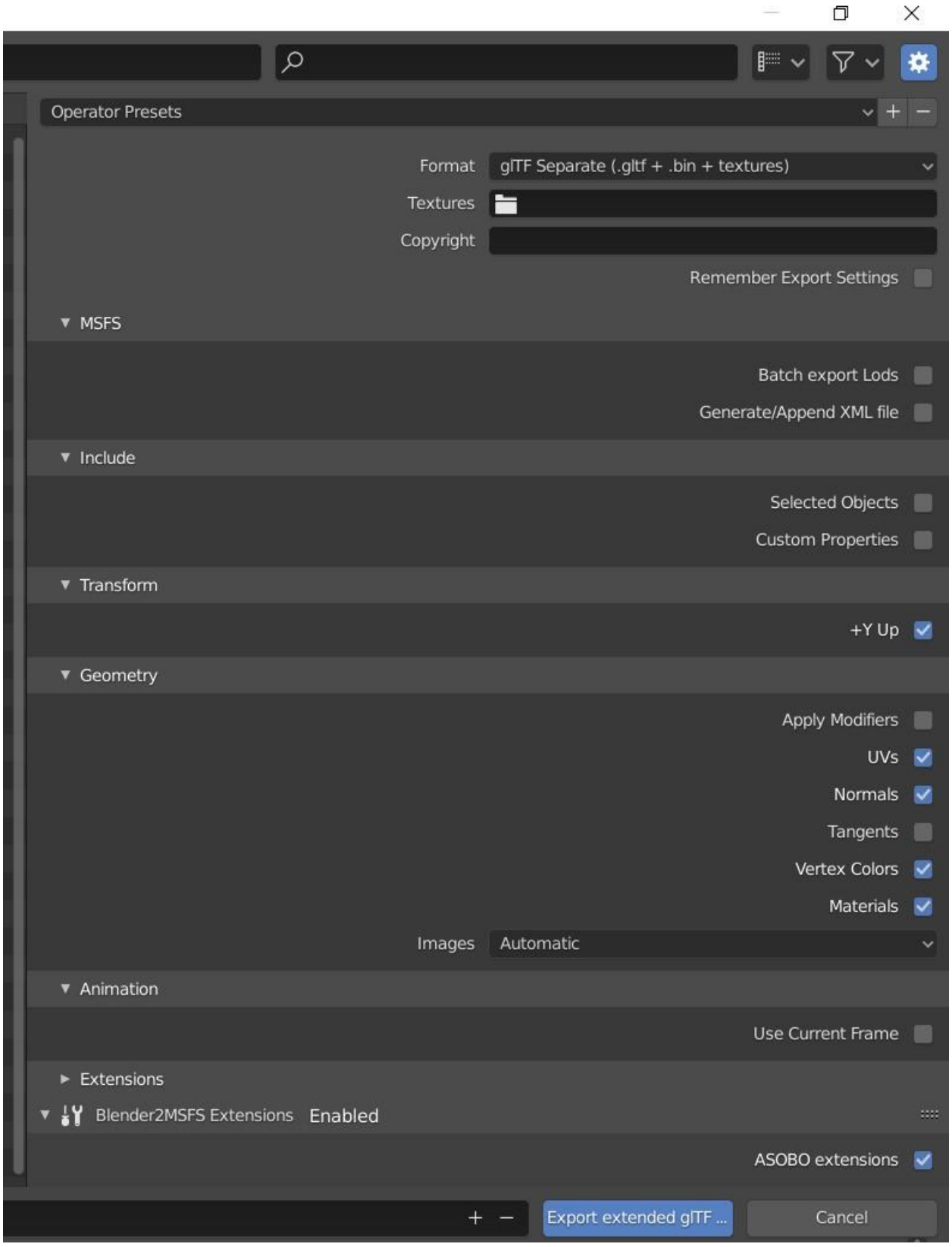
You will then see the folder select screen.

Navigate to your project's modellib. If there isn't a folder for your new model then create one.

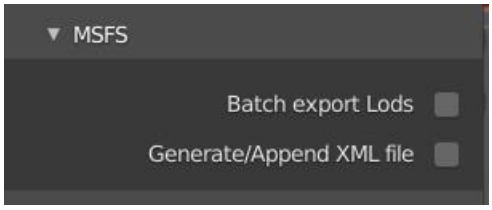
On the right side of the Blender export window you will see this



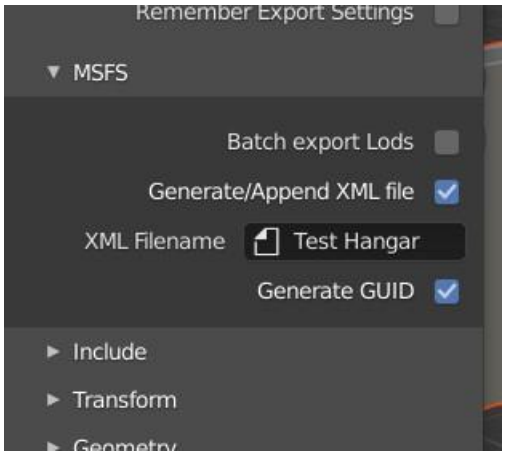
As as aside, these are my complete settings for the exporter so you might as well match them as it works



Click on ‘MSFS’ highlighted in orange to get this dropdown menu.



Tick the ‘Generate/Append XML’ file box which will open up the XML Filename box. Give the XML the same name as the model and also tick ‘Generate GUID’



Press ‘Export extended glTF’

And the model should be exported successfully into your modellib folder. There should be all of the textures if there are any, and the .bin, .gltf and .xml file.

The import and export process is the same for other file formats such as FBX, glTF, dae. Some formats will not import with the textures attached like stl.

Before you move the textures into the ‘texture’ folder and build the model, you need to check the texture sizes.

MSFS will only process textures that are on the 4/8/16/32/64/128/256/512/1024/2048/4096/8192 scale. If they’re not this size it won’t process them. You will need to resize any textures that don’t fit.

You can change the texture size without changing the appearance of the built model in the sim. I don’t know why. It might look badly distorted in your texture folder after changing it, but it should be fine in the sim.

To give a practical example Sketchup has some stock textures that are 530x530 pixels. I change these to 512x512.

You might have a texture that is 887x 1800. I would change that to 1024x2048. Just choose the closest number on that scale for each measurement.

Move the textures and leave the 3 model files in their own folder. You’re now ready to build the model with the SDK.

If the model fails to build the console will give you an error message. This isn’t very informative as it often won’t tell you what the actual error is.

You could try building with the fspackagetool which should give you more error information.

The most common error I make is giving the .xml file a different name to the .bin and .gltf files so check that. There can also be a space I haven’t noticed so it might be ‘model .gltf’ whereas the xml is ‘model.xml’

The next one is forgetting to create the xml at all. Another one is having a xml file I forgot to delete lurking somewhere else in the folder structure.

There are many other potential errors. Some I never solved so gave up on the model. Some can be cured by simply copy and pasting the model into a new Blender window and exporting again.

If the model is built and shows up without any textures or missing textures the chances are one of your textures still has the wrong dimensions so check all of them again.

Another common problem, especially with Sketchup models, is reversed faces that might only show themselves in MSFS. These might appear as darker than the others or without any texture if the other side of the face is untextured. You will need to re enter Blender and flip the normals in question in edit mode.

Animation

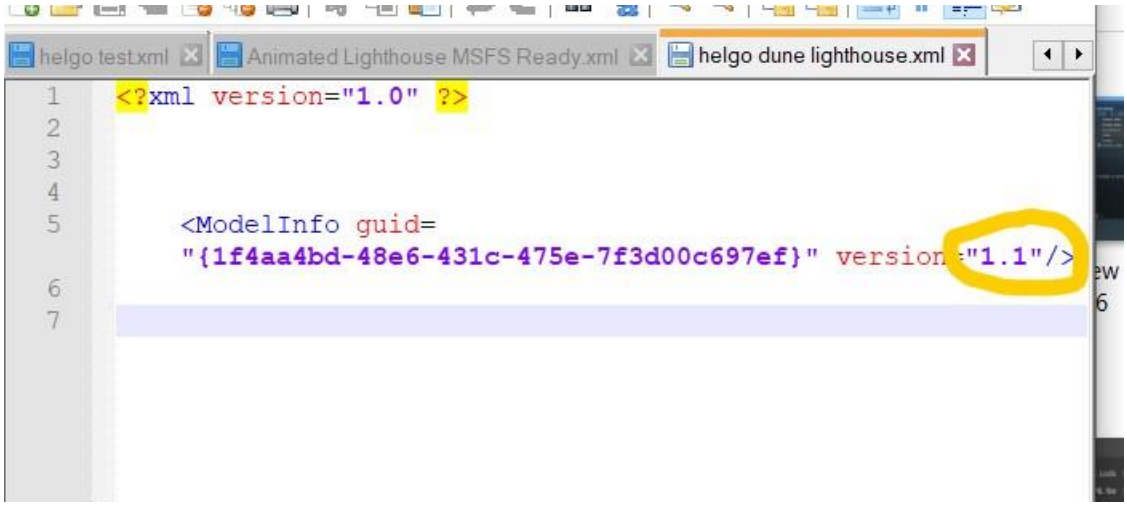
I haven't got the brain power to explain how to animate, I only do rotation so far anyway.

This is the best video with a basic explanation and it covers much of the same ground - https://www.youtube.com/watch?v=MIqc8liASCw&list=PL_Up4sAmkCfXIOqIRzS9OpQEJRyW-rnoq&index=21

For this bit check the two lighthouse models included which is what I'll be referring to.

Assuming you have a model that is animated and working in Blender, export into its folder in the modellib folder in the same way as previously described. All you need to change to get the animation to work in MSFS is the model's XML file which tells MSFS there is animation present which it will run.

This is a standard, static model's xml file with no animation.



An animated model's xml file looks like this

```
<?xml version="1.0" ?>


    <ModelInfo guid=
    "{3be8b8b0-7b67-4864-abe5-a994888ca225}" version="1.1">

        <Animation guid=
        "e6a1344c-411d-4f5c-aaf4-71ced6995511" name=
        "lightAction" type="Standard" typeParam="Autoplay"/>

        <Animation guid=
        "8c1a8388-3589-4274-bd9a-23f4b74a24a0" name=
        "light.001Action" type="Standard" typeParam=
        "Autoplay"/>

    </ModelInfo>
```

The number one mistake you are likely to make is forgetting to remove the forward slash from the line in the first xml image highlighted in orange so do that first if you plan to edit the xml yourself.

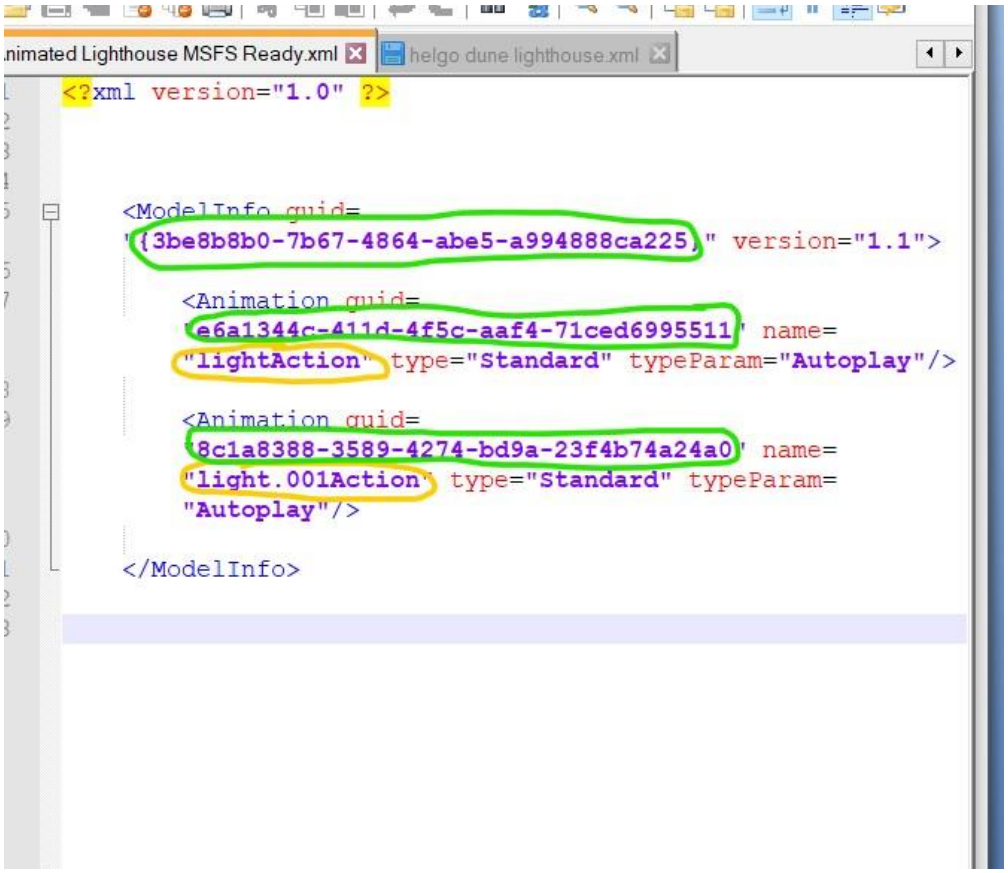
Alternatively copy and paste everything from my xml to yours and the changes you need to make are described on the next page.

You can see new xml entries. These are for the animated elements in the Blender file.

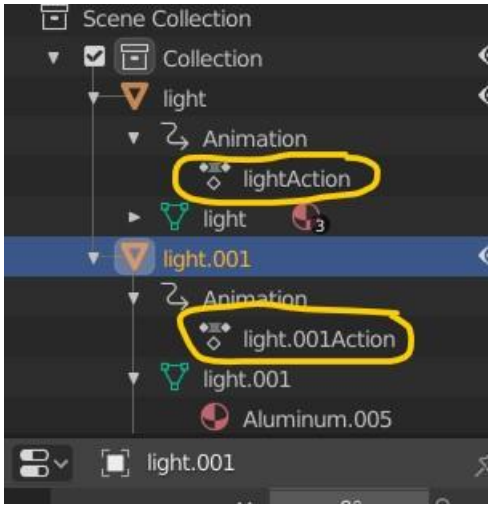
With the provided lighthouse file there are two animations present. One is the physical lamp that rotates. The second is the rotation of the light created in Blender.

Each animation needs its own entry with a unique guid and name just as the model itself does.

The guids are in the green boxes, the animation names are in the orange boxes.



As you can see here the animation names you add to the xml file need to be the same as they are in the Blender file.



For a model with your own animation you should simply be able open your exported xml, delete everything, and copy and paste the provided xml's text into it. All you'll need to replace are the guids, you can generate new ones here - https://www.guidgenerator.com/online-guid-generator.aspx and the names of your animations in the relevant spaces. Make sure you retain the speech marks and brackets.

Solid Surfaces

To make a solid surface for a 3d model you need to use the Blender2MSFS plugin again.

It doesn't seem possible to make a 3d model fully collidable – as in something you crash into and are guaranteed to bounce off like you can with the in SDK hangar models.

I have managed to them collidable sometimes, but only at certain speeds and from certain angles. When I test it again it's no longer collidable. I've given up and people can fly through them instead.

You can make solid surfaces that an aircraft can land and taxi on.

The first thing to note is that a landable surface must be completely unbroken. If there's a hole or break in the surface anywhere the aircraft will find it and usually go mad even if it's absolutely tiny.

Because of this I prefer to make my solid surfaces an invisible separate plane in Blender placed on the 3d model so I know for sure it's unbroken. With your own 3d model there might be areas you haven't spotted that the aircraft will find.

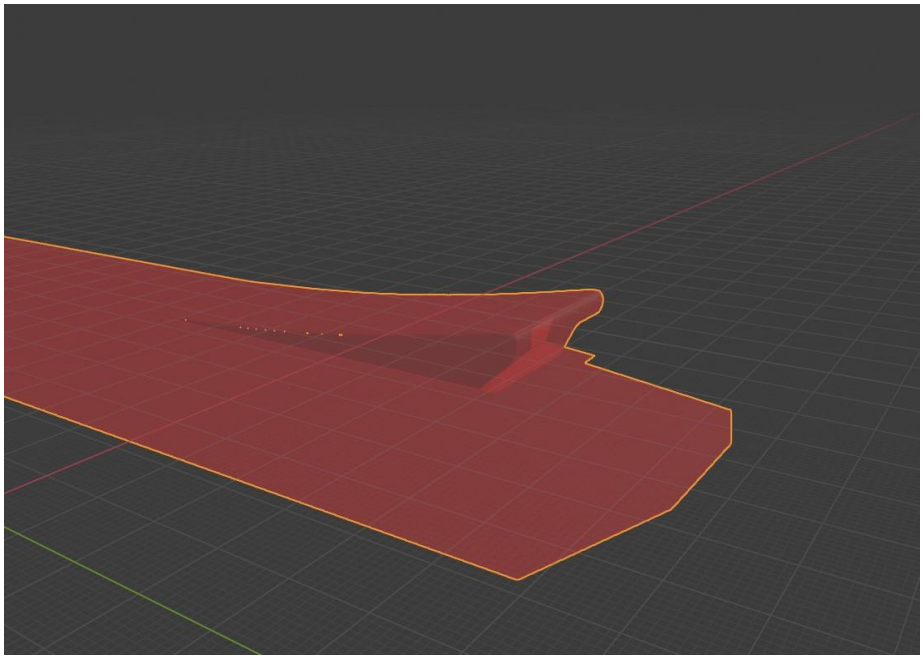
You can see this in the 'Test Ship' Blender file in the Heliport folder.

You may prefer to start with a surface on your own model. I had the hole problem so many times I gave up.

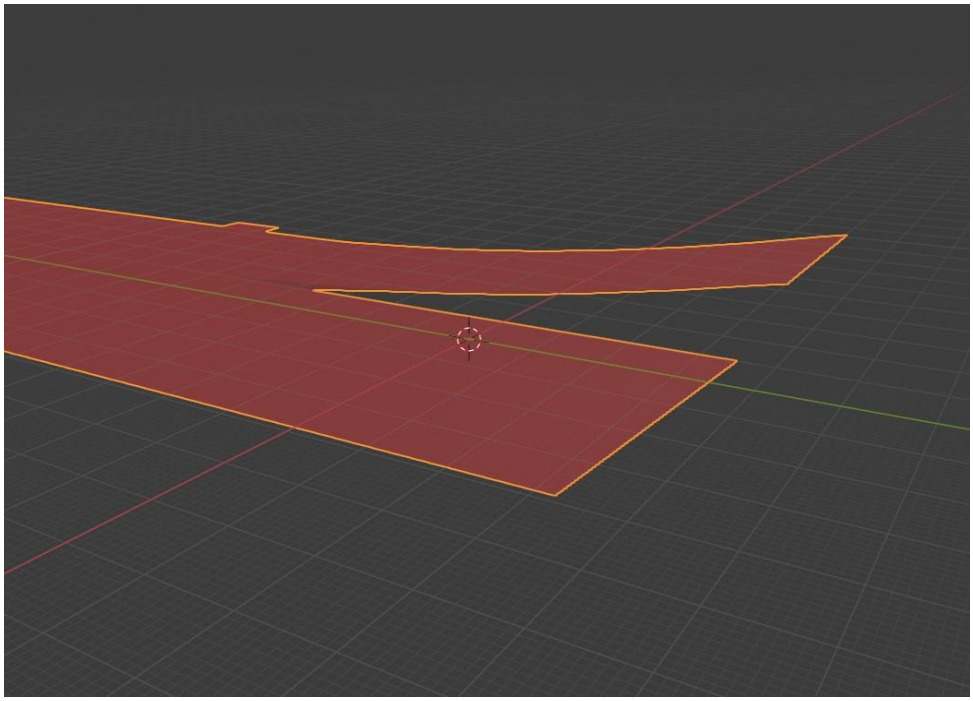
There are also some other strange behaviours that I've learnt to ignore and work around.

For example with the aircraft carrier mod I made certain carrier decks were eating certain planes when they reached the end of the ramp to take off.

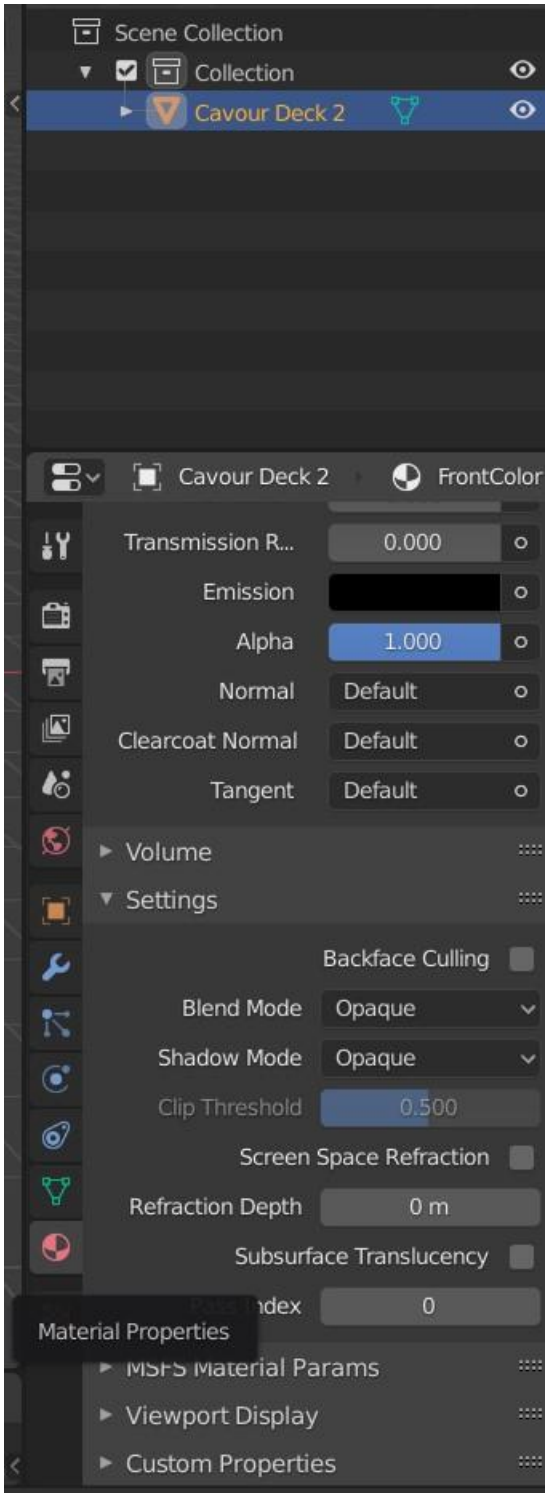
Changing the invisible and solidified deck from this shape



To this stopped it. No idea why.

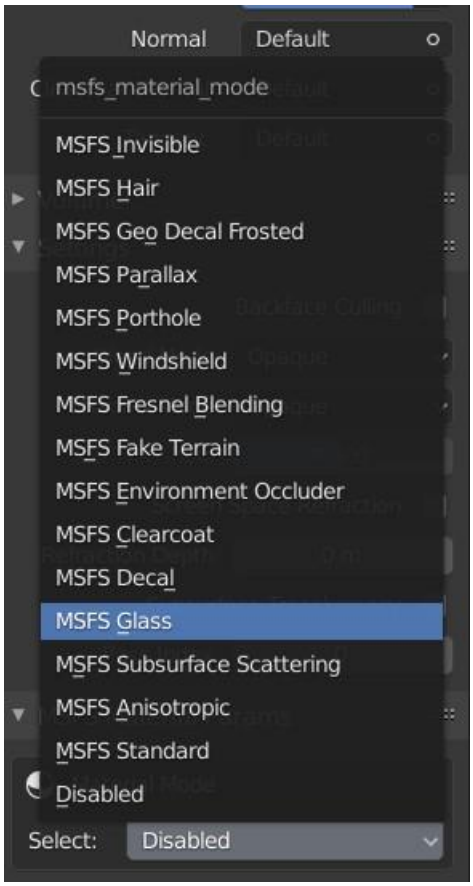


To make your surface solid you want to select its material and go to the Material Properties section in Blender.



Near the bottom you'll see the 'MSFS Material Params' dropdown menu. This gives you various options for your material's behaviour in MSFS.

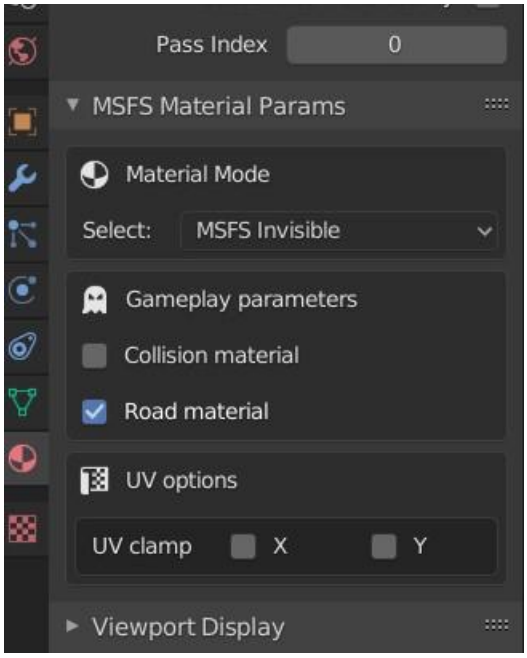
Click on it to see them.



I'll cover glass shortly, but for this I will select 'MSFS_Invisible' for my invisible plane. If you want to try your own model's surface with its original texture first select 'MSFS Standard' here instead.

If you select 'MSFS Standard' your own model's texture will disappear at this point so you'll need to reapply it.

Once your material category is selected look at the section below and tick ‘Road material’ which will make it solid.



Some people say this makes cars drive all over their surfaces. I’ve never seen this myself but most of my surfaces are miles out to sea.

I never bother ticking ‘Collision material’ myself. As far as I can tell it’s broken for this plugin.

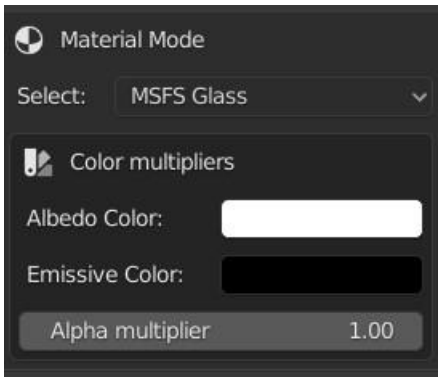
And that’s it. Once exported into the sim your chosen surface should be solid and landable.

To test it quickly I place it from the Objects tool window. In its properties I uncheck ‘**Snap to ground’,** put it beneath an aircraft and bring it up from below. The aircraft should react as the model touches its wheels.

Glass

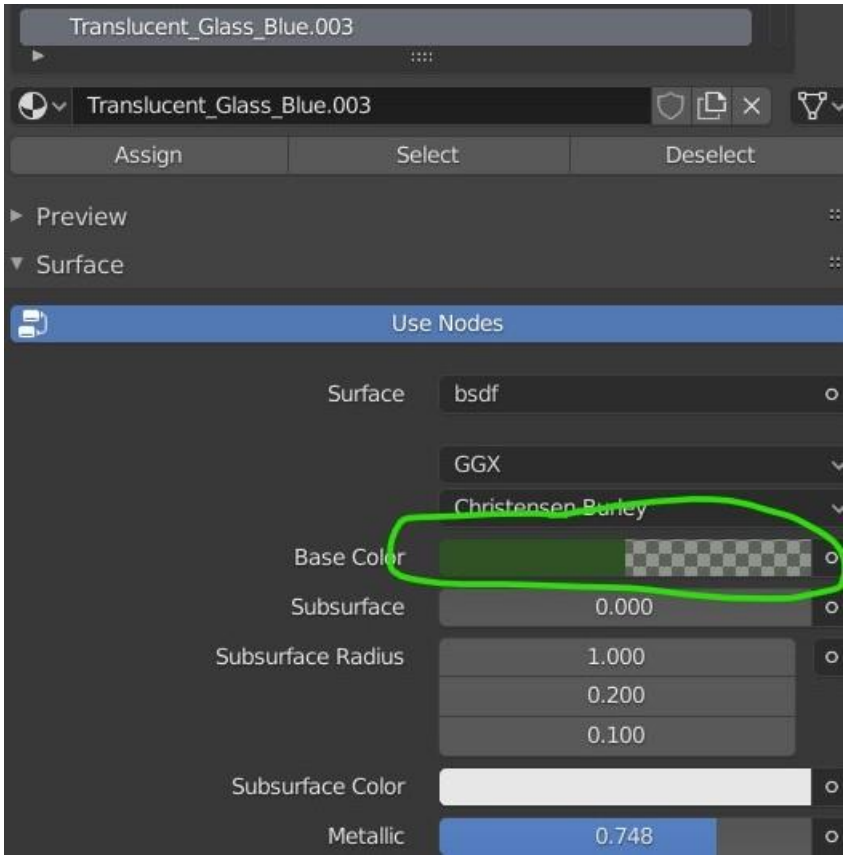
It's the same process for material selection and the same plugin section. In this case you select 'MSFS Glass' to make your material transparent. The plugin will do the work for you to make it transparent.

You need to change the 'Alpha multiplier' number or it'll be cloudy or fully opaque in the sim.



I usually go for 0.03-0.05.

You can change the tint of the glass with the color wheel here and reduce the roughness to make it more shiny. I normally choose around 0.25.



How to Increase Your Model's Draw Distance

Quite often you might find your model only appears in front of you when you get very close to it. Sometimes this is because it's tiny, other times it's because there's something else weird going on with your model.

The first thing to check is the model's scale in Blender but sometimes correcting that that makes no difference.

In both cases it should be curable with a simple addition in Blender.

If you open up the 'Animated Lighthouse Blender Model' file that I've included you'll see it has an enormous invisible plane added to the lighthouse lamp's mesh.

That's all you need to do. Adding that will force the sim to reassess your item's size and give it the according draw distance. Making the added plane invisible means it doesn't matter how huge or silly it needs to be.

Making your newly created plane invisible is the same method I've described in the Solid Surfaces section – selecting 'MSFS_Invisible' in the 'MSFS Material Params' menu. All you need to do first is assign a material after creating the plane so that material can be made invisible.

The plane also needs to be an integral part of your object's mesh, so press Ctrl-J to integrate it into your object's mesh.

Making a PNG Texture Background Transparent in Blender

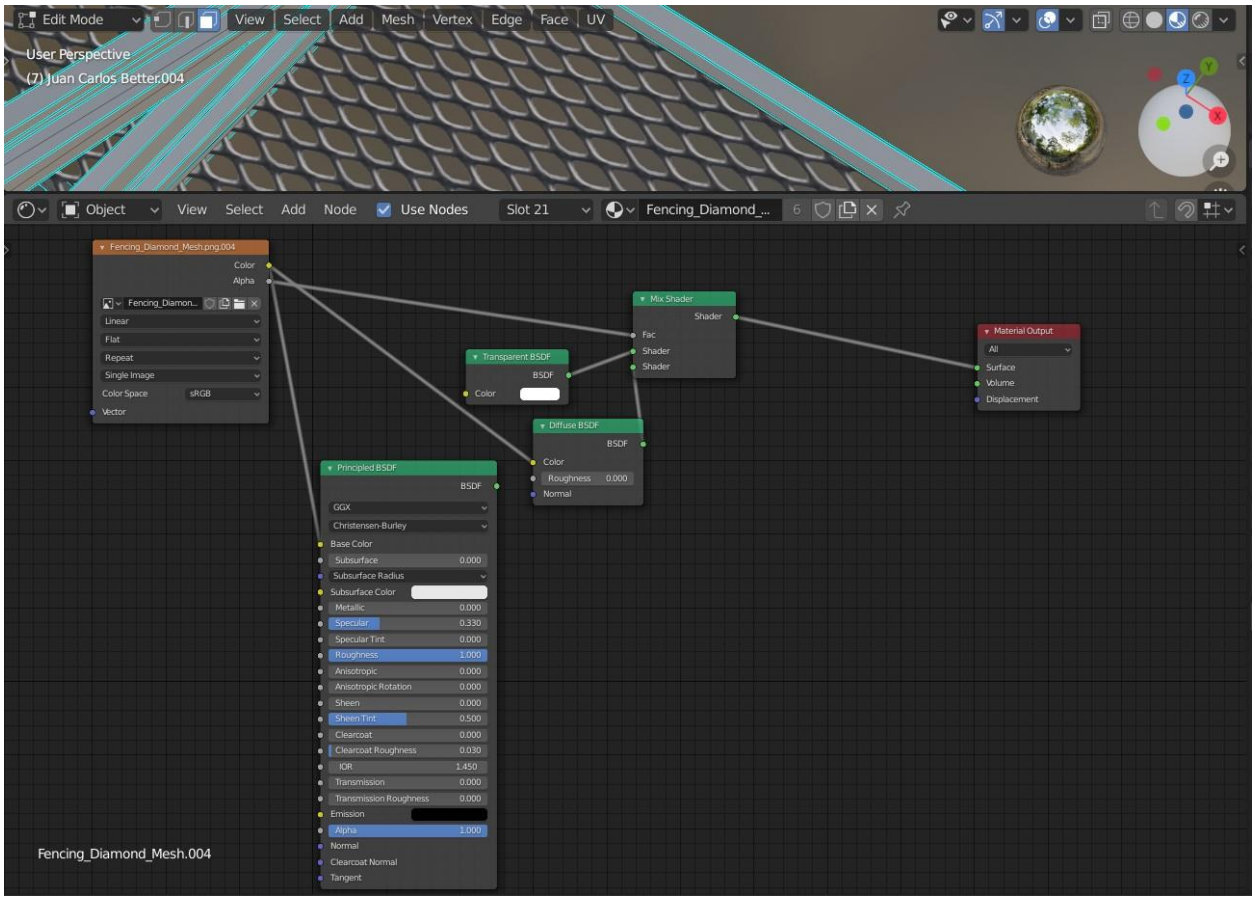
Another reminder for me more than anything. This took me a long time to figure out. I'm sure experienced Blender users are rolling their eyes by this point. I wish I was you.

Transparent PNGs are very useful. They can save a lot of polygons for items like fences for instance. Instead of physically creating the fence in 3d, a PNG with a fence pattern will be one face.

It's also used a lot for numbers and other markings.

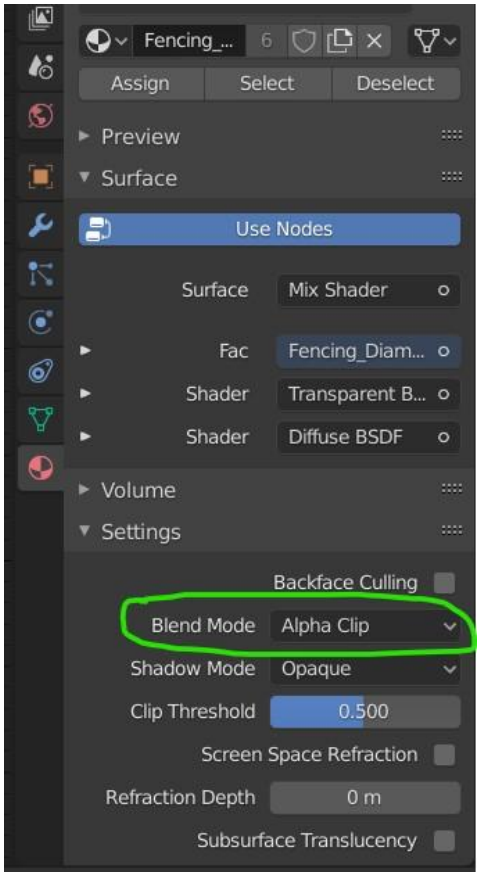
However when you import into Blender from Sketchup for instance Blender won't show the transparency of the PNG's background. It'll show up as black.

This is the node set up you need in Blender's shading section. You might need to zoom in to see it.



The three extras tools you need to add are – Mix Shader, Transparent BDSF, Diffuse BDSF.

Once that has been created there's one more setting to change which is this one. Switch 'Opaque' to 'Alpha Clip'



Polygon/ Tri Count

The polygon count, in Blender it names them ‘tris’, is the measure of the complexity of your model’s construction.

The more polygons there are, the more work a graphics card has to do to render the model.

This is what the SDK documentation has to say about Polygon count for complex models.

Poly Count

This is a high level guide to how many triangles you can spend on a plane asset. The ideal level is currently undefined. | Plane Size | Plane Description | Triangle Count Exterior | Triangle Count Interior |—|—|—|— Large plane | Jumbo Jet | 500,000 tris | 400,000 tris Medium plane | Small Passenger Jet | 200,000 tris | 200,000 tris Small plane | Single/Double Seater | 150,000 tris | 150,000 tris

I have absolutely no idea where the limit for this is, but it must exist somewhere.

So far I haven’t created anything that I noticed had an effect on my performance but keeping polygon counts down is something I try to be conscious of anyway. I’d feel bad if your computer was still rendering a 50,000 tri moustache when you are 10 miles away.

Also the more polygons there are the greater the size of the model is in megabytes and my internet is so slow every kilobyte counts for uploading.

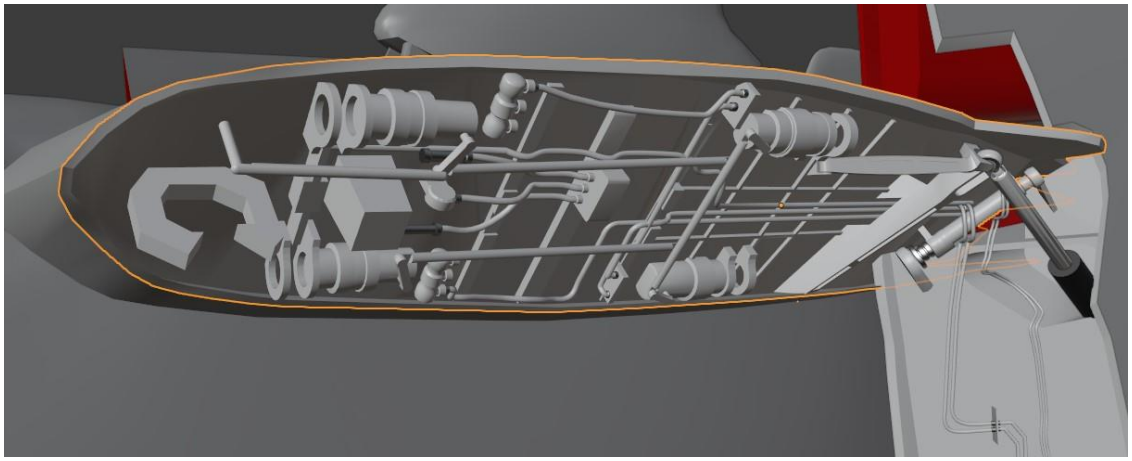
Most of the models I use have needed their polygon counts reduced, sometimes massively.

The quickest way to do it is to remove parts of the model.

It’s often the smaller items that have the most polygons. One fire truck I downloaded had 600,000 tris in the light bar, and the whole rest of the truck was 10,000 tris.

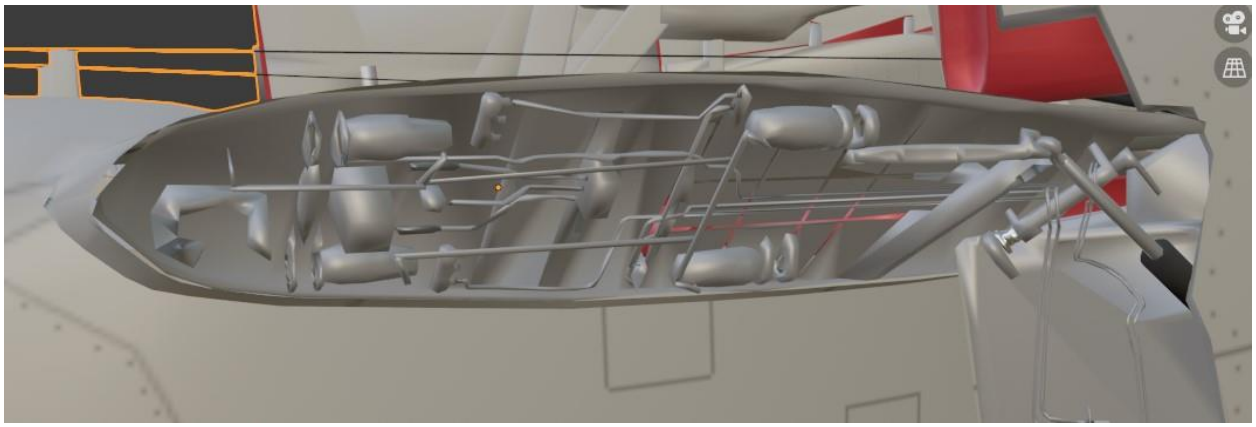
Wheels, especially tyres with tread patterns, and small but complex mechanisms are usually the worst for this so I replace them with simpler items from another model or get rid of them completely.

For instance this is the folding mechanism on a E2C Hawkeye.



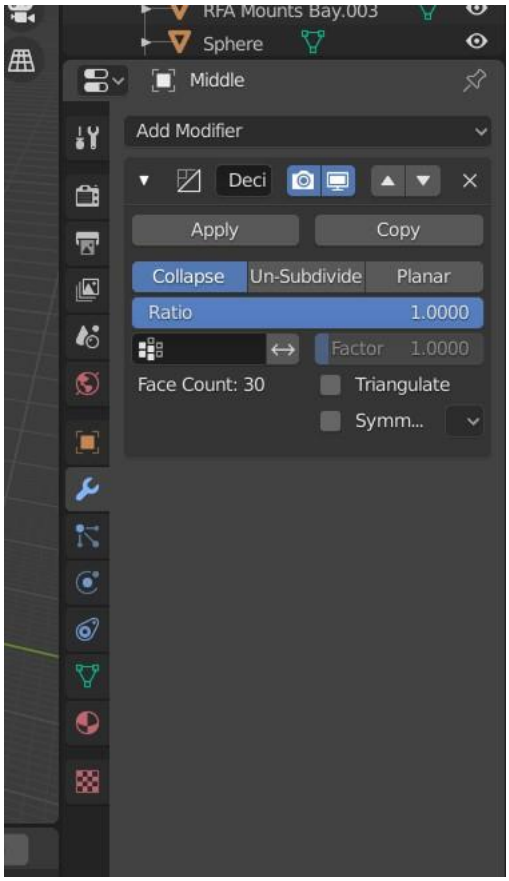
This is 20,000 tris. There's another on the other side so that's 40,000 tris alone for something most people may never even notice.

I mangled it until it still looked vaguely the same but was much smaller.



The quickest way to reduce an item's tri count in Blender is to select the relevant faces in edit mode. Press X and select 'limited dissolve'. It might work great, it might break everything. You can change the amount of degrees.

Another more effective way is to use the decimate modifier on the model while in Object mode.



1.0000 is the initial value. Try reducing it gradually and see how bad the model gets. Some fall apart at 0.95. Some look fine right down to 0.1, which should be a much lower tri count.

Press ‘Apply’ once you’re satisfied. If the model is still intact but its lighting looks distorted or weird then try applying the ‘Edge Split’ modifier which should sort that out.

The rest of the time I cheat and use a commercial polygon reduction program. Using that, limited dissolve, the decimate modifier and discarding parts, the entire E2C’s tri count is now 26,000, less than those components in the photo.

Other things you can do are replacing modelled sections with a texture.

For instance the 3d model I use of the USS Dwight D Eisenhower individually 3d modelled every single deck tie.

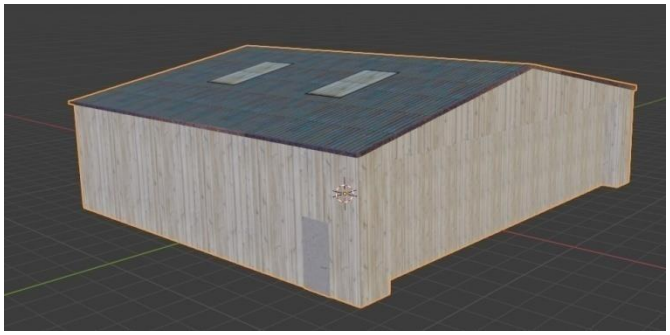
Which meant the deck alone was 450,000 tris.

Instead I added fairly bad jpegs of them to the original deck texture.

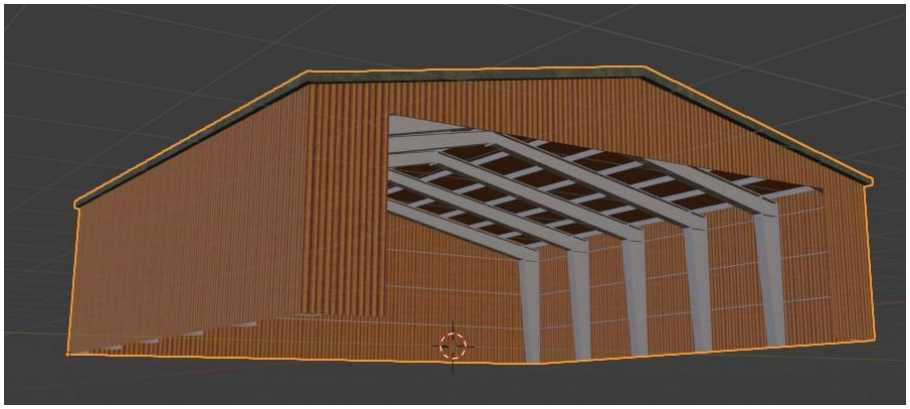
And now the whole deck section is less than 500 tris.

These are some example tri counts. If they're much higher in a seemingly simple item like a building without an interior then it's worth doing some investigating.

Hangar with a door – 548 tris



Open hangar with a detailed metal structure – 1748 tris

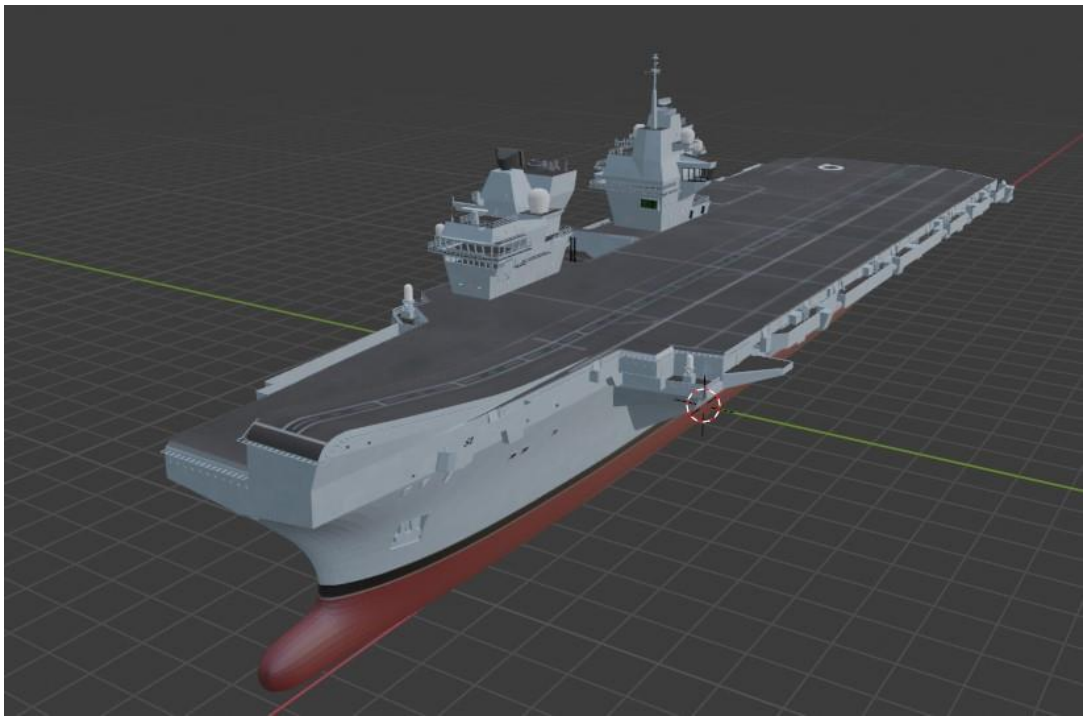


A complete airport terminal with detailed interior – 200,000 tris

Again it's the small details that add up – seats, food, antennas, cups. As an empty building it's less than 10,000.

A decent quality Harrier model – 35,000 tris. I reduced this from 240,000 by changing various parts like the wheels and squashing irrelevant details like the throttle handle which was 9000 tris on its own.

HMS Queen Elizabeth – 178,000 tris.



The original model was 3.2 million tris. How did I reduce it so much and keep it looking the same? I got someone else to do it, that's how.

A complete aircraft carrier group with 4-5 carriers, 5-10 aircraft models per carrier, 5-10 support ship models and all the other ground support equipment probably adds up to about 2-2.5 million tris in total.

I never bother with LODs. Does this make me a bad person? Probably.

If you're not familiar with the term, a model with LODs means the item you're seeing is made of several different models that are swapped the further or closer you get to them. The further away you are, the simpler the model version that is shown to you to save your graphics resources.

At the moment LODs are not mandatory for PC, but they may be in future which means your single model that doesn't have different LOD versions will vanish after a few metres.

If you can be bothered it's best to do LODs now. In my case I will probably just delete the projects because I well and truly can't be arsed to make thousands of new LOD models.

Free 3d model sources

There are loads but these are the main ones I check.

https://3dwarehouse.sketchup.com Probably the daddy. There's a lot of crap on here but also some very good stuff too and it covers a huge range of subjects.

https://sketchfab.com – this is particularly convenient as most free downloads are either Blender files already or correctly exported FBX or glTF 3d model files that you can drop straight into Blender. Most other sites output FBX files Blender won't like.

https://open3dmodel.com – some models here can be great, others total junk. Many are 3ds Max files which will require 3ds Max to open. That costs.

https://grabcad.com – this is more for 3d printing but there are still some useful models on here.

https://3dexport.com https://www.cgtrader.com and https://www.turbosquid.com are all commercial sites but offer free models too.