

HOMEWORLD2

Innate Subsystem Design

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1 Innate Subsystem Overview

1.1 What are Innate Subsystems?

As you know, *Homeworld2* has support for regular subsystems like ability modules (cloak generators, hyperspace modules, etc.), sensors subsystems, and certain weapons systems (like the Hiigaran Battlecruiser's Ion Turrets). These all use separate, distinct meshes that are considered independent of the hull.

However, **Innate Subsystems** are slightly different. By necessity, these are subsystems that use part of the parent ship's mesh to represent themselves. Examples of Innate Subsystems include things like the Vaygr Battlecruiser's Heavy Fusion Missile Battery, all of the engines for ships in the game that are destroyer sized and up, and resource drop off points on motherships, shipyards, and carriers.

Making these Innate Subsystems isn't as simple as just making a subsystem mesh and hooking it up to a joint as it is in the case of regular subsystems. The creation process is a bit more convoluted although the result is the same. This is by necessity due to their nature:

1. Because they use part of the parent ship's mesh to visually "represent" it, it is invisible.
2. Furthermore, regular subsystems automatically glow green when you mouse over them. Innate subsystems, because they are not visible (as they are "represented" by the parent ship's mesh), require a "glow meshes" that are not normally visible but when moused over, their shapes glow like a regular subsystem.
3. Simple weapons effect collision meshes are required so that the innate subsystem can get hit and damaged.

1.2 Maya

Many things are done in Maya with the help of various custom Maya plugins. These are designed to enable a developer to add additional content to the base *Homeworld2* ship meshes. In this case, Maya is used in the creation of innate subsystems, specifically their glow meshes and their weapons effect collision meshes. Furthermore, Maya is used in the placement of joints that determine where the innate subsystem gets hooked up.

1.3 ShipTuning.xls, .ship, SubsystemTuning, and .subs Files

ShipTuning.xls is a critical file that gives *Homeworld 2* ships their properties and abilities. In the case of all subsystems, the ability to have them is defined as desired per ship within ShipTuning.xls and then exported to a .ship file. The actual properties of the subsystems themselves are defined within SubsystemTuning.xls and exported to a .subs file.

1.4 File Extensions and Directories (Folders)

There are a few general things that you must keep in mind regarding file extensions and directories (or folders in “Windows Speak”™) before you begin adding innate subsystems (or any sort of other customization process as well).

Ships in *Homeworld 2* begin as meshes saved as Maya ASCII files (.ma extension). These .ma files are stored in **Homeworld2/Datasrc/Ship/<name of ship>**, along with any associated textures (such as hull textures, badges, LOD textures, etc.). Exported files are exported into a file with a .hod extension, stored in **Homeworld2/Data/Ship/<name of ship>**.

With regards to adding innate subsystems to a ship, they must be defined in the appropriate places in **ShipTuning.xls** for the ship in question (found in **Homeworld2/Data/Ship**) and an appropriate .ship file (placed in **Homeworld2/Data/Ship/<name of ship>**) must be generated.

Furthermore, subsystem meshes are saved as Maya ASCII files (.ma) as well. These are stored in **Homeworld2/DataSrc/Subsystem/<name of subsystem>**, along with any associated textures. In the case of innate subsystems, a 1x1 pixel .tga is needed in this directory too. Exported files are exported into a file with a .hod extension, stored in **Homeworld2/Data/Subsystem/<name of subsystem>**.

Subsystems have their own version of ShipTuning, and in this case it is not surprisingly called **SubsystemTuning.xls**, which can be found in **Homeworld2/Data/Subsystem**. All subsystem properties, whether for regular and innate subsystems, are found here. Like its counterpart, SubsystemTuning.xls generates .subs files. These are stored in **Homeworld2/Data/Subsystem/<name of subsystem>**.

As you can imagine, quite a few files are affected. We will go into further detail about these files and their directories as we get to them, but to summarize:

Homeworld2/Datasrc/Ship/<name of ship>

- <name of ship>.ma
- associated textures

Homeworld2/Data/Ship

- ShipTuning.xls

Homeworld2/Data/Ship/<name of ship>

- <name of ship>.hod
- <name of ship>.ship

Homeworld2/DataSrc/Subsystem/<name of subsystem>

- <name of subsystem>.ma
- 1x1 .tga file (for glow mesh)

Homeworld2/Data/Subsystem

- **SubsystemTuning.xls**

Homeworld2/Data/Subsystem/<name of subsystem>

- **<name of ship>.hod**
- **<name of ship> .subs**

2 How To Add Innate Subsystems

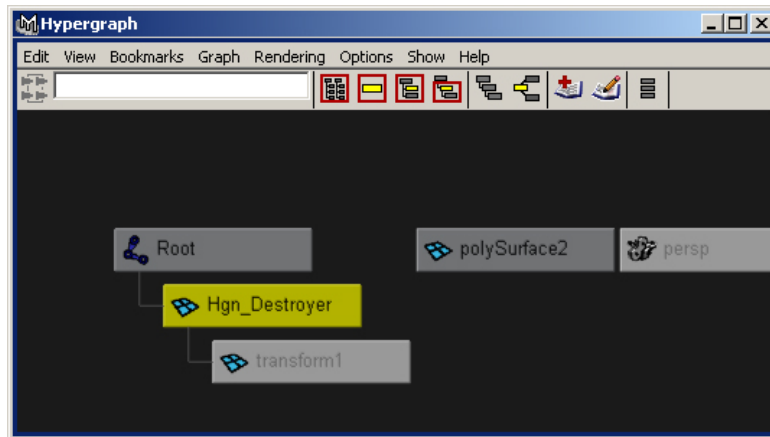
***Note:** This tutorial assumes that you know how to use Maya and Photoshop. If you need to, please familiarize yourself them before continuing. Furthermore, this tutorial assumes that you have the necessary plugins already installed. Also, you are warned ahead of time that this process is very complex and not for the faint of heart.*

2.1 Creating the Glow Mesh

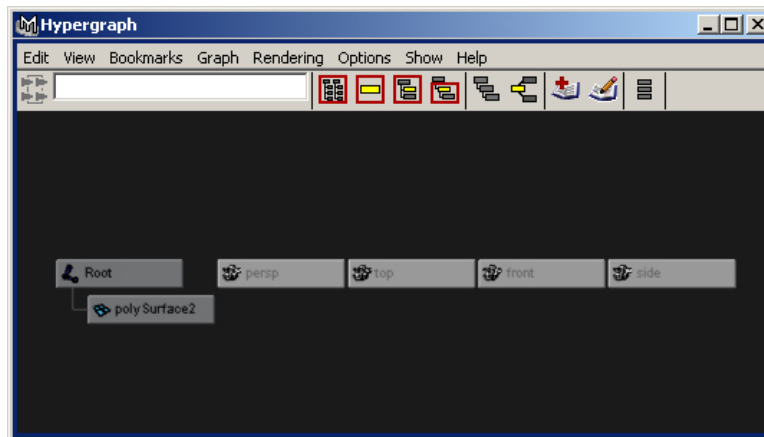
Let's pretend that you're making the engine of the Hiigaran Destroyer a targetable, damageable innate subsystem. First of all, we must fire up Maya and load up Hgn_Destroyer. Make a duplicate of this to work on. Call it something other than Hgn_Destroyer - like Hgn_Destroyer_Work for example.

1. In the top left corner of the screen, make sure that the drop box displays "Modeling". This means that you are in Modeling mode, which is what we want.
2. Examine the engine area of the Destroyer with faces in mind. We will select these faces and extract them for our use in the innate engine subsystem. We might have to split up a couple of polygons to get a clean "cut" so that the engine can be separated cleanly, without weird, uneven edges.
3. Shift-select all the faces (including new ones that you may have made from adding edges) that would make up the rear engine area of the Hiigaran Destroyer.
4. Select Edit Polygons -> Extract.
5. Select Edit Polygons -> Separate. This should split off your selection from the main mesh into a separate object.
6. Make sure that you have object selection turned on (press F8).
7. Select the engine object, and only the engine object, and then focus on its entry in Hypergraph.
8. Drag the object out of the root hierarchy.
9. With the object still selected, go to File -> Export Selection. Select the box beside the entry.
10. Make sure that the filetype is .ma and then click on the "Export Selection" button.
11. Give a name to this extracted file - Hgn_Des_Engine.ma. Make sure it's saved in **Homeworld2/DataSrc/Subsystem/Hgn_Des_Engine**.
12. Close this current duplicate of the destroyer that you are working on (i.e. Hgn_Destroyer_Work), and load up Hgn_Des_Engine.ma.
13. Go into the Camera Attribute Editor and change the far clip plane camera attribute to a high number like 10000. Your object should now show up properly after zooming in and out.

In game, the target centre of an innate subsystem is where its root joint joins onto the subsystem joint it is assigned on the target ship. Note that in our case, the root joint is far away from where the innate subsystem glow mesh is. We will change this shortly. Examine the Hypergraph. It should look something like this:

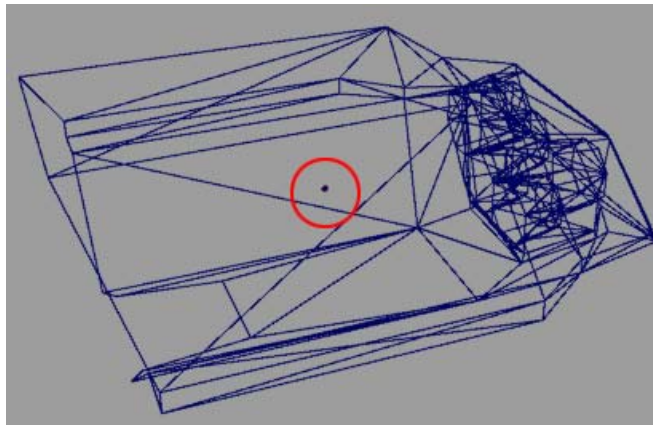


14. Do you see the highlighted Hgn_Destroyer object? Drag it out. Now, drag the object labeled “polySurface2” in the picture and drag it into Root. Delete the now separated “Hgn_Destroyer” and its child, “transform1”. You’ll notice that Hypergraph should look like this:



15. “polysurface2” will be our innate subsystem glow mesh. You can rename it to “select_Hgn_Des_Engine”.
16. You would also note that the mesh will now look transparent. No matter... Create a new HW2 shader by pressing the “Create HW2 Material” button (the sphere with HW2 in it, in the Relic Tools Shelf). Open up Hypershade and call the material whatever you like.

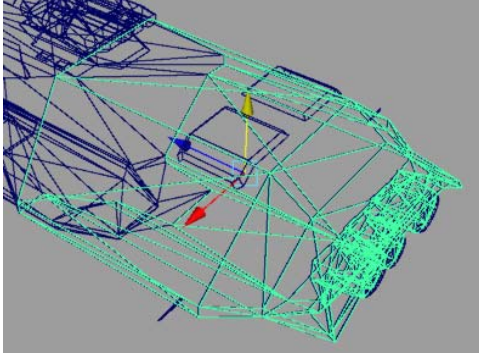
17. Open up the new material's Attribute Editor and assign a 1x1 .tga of a single white pixel to it via the button at the right side of the Color slider. This .tga can be named anything you want, but we called it "white.tga" because we made it a white 1x1 pixel.
18. Go to HW2 Shader Attributes in the Attribute Editor for the same material, and assign it "innateSS.st" from the list of shaders.
19. Delete all unused shaders from Hypershade. Furthermore, go into Window -> Rendering Editors... -> Multilister... and then from there, Edit -> Delete Unused shaders. This will delete any extraneous shaders that are not used in this mesh.
20. Assign this new material to select_Hgn_Des_Engine. It should now appear as a solid color in Maya.
21. Make sure that select_Hgn_Des_Engine is selected. Activate the Move Tool.
22. Use the command "Center Pivot" (we've assigned ALT-C as the hotkey for it, although you may have a different assignment) to center it on select_Hgn_Des_Engine.
23. We will now use the command "Snap to Point" (we've assigned "v" as the hotkey for it, although you may have a different assignment) to snap Hgn_Des_Engine onto the root node. To do this, make sure select_Hgn_Des_Engine is selected, hold down "v" (or your own hotkey) and then hold down the middle mouse button at the same time. Drag the pointer over the root joint and Maya will snap the innate subsystem to where the root node is. This is what the result should look like in wireframe display (the circle indicates the root node):



24. Click on Modify -> Freeze Transformations.
25. Simplify the mesh for the innate subsystem, while retaining as much of the overall profile as much as possible. Nooks and crannies can be eliminated however, because when they are rendered in game, they will be bad looking bright spots caused by overlapping, redundant faces. Since no edges will be visible, we will aim for as flat of a surface as possible without changing the shape of the engine too much. As usual, manipulating/merging vertices and deleting edges are your best bet towards this. Make sure to triangular questionable faces on your mesh or else they will not render properly in game.
26. Save your work as
Homeworld2/DataSrc/Subsystem/Hgn_Des_Engine/Hgn_Des_Engine.ma!!

2.2 Hooking Up the Glow Mesh

It's time to "fit" it onto the ship it's intended for.



1. Make sure you have Hgn_Des_Engine.ma saved. Load up your duplicate of the Hiigaran Destroyer (i.e. Hgn_Destroyer_Work from Section 2.1).
2. Select File -> Import... and pick Hgn_Des_Engine.ma.
3. You'll notice that select_Hgn_Des_Engine will appear in the scene.
4. Use the Move Tool and drag select_Hgn_Des_Engine so that it fits over the engine of the destroyer. **Make a note of the XYZ coordinates in the Channel Box.** These coordinates are what you will use to place the subsystem joint (to position the innate subsystem in game). The picture to the left is an example of it should look like in Maya in wireframe display (for clarity).
5. Close the duplicate Destroyer mesh.
6. Load up Hgn_Destroyer.ma. We will now add a subsystem hookup joint for the Destroyer engine. Make sure you enable Show -> Joints in the view that you are using.
7. In the top left corner of the screen, make sure that the drop box displays "Animation". This means that you are in Animation mode, which is what we want.
8. Click on Skeleton -> Joint Tool. Now click on anywhere in the display near the mesh.
9. Switch to Move Tool and select the joint. Duplicate this joint and then move it negatively along the Z-axis.
10. Duplicate the original again and move it up along the Y-axis.
11. In Hypergraph, join both of these to the original joint.
12. Rename the root of this joint "Hardpoint_Engine_Position". Rename the joint placed down the Z-axis "Hardpoint_Engine_Direction". Rename the joint placed along the Y-axis as "Hardpoint_Engine_Rest".
13. Enter the coordinates that you copied down in Step 4. The point should move to where the center point of the innate subsystem would be in game.
14. Select Edit -> Delete All By Type -> History.
15. Save in **Homeworld2/DataSrc/Ship/Hgn_Destroyer**.
16. Click on the box beside File -> Export All. This will open the "Export All Options" window.
17. Beside where it says "File Type," there should be a drop box. Click on it, and select "hod" from the list.
18. Make sure that the "Ship" radio button is selected in the "Export Type" section.
19. Make sure that "DXT5(rgba)" is selected in "Texture Options."

20. Make sure that in the “Optimization Options” that Triangle List is selected and Merge is selected.
21. Once this is done, click on the “Export All” button.
22. Select the directory the .hod is going into. In the case of our Hiigaran Destroyer, we will place its **Hgn_Destroyer.hod** in **Homeworld2/Data/Ship/Hgn_Destroyer**.
23. Close the file.

2.3 Finishing the Innate Subsystem Mesh

Now that you have your joint placed on the main ship, it's time to finish Hgn_Des_Engine.

1. Reload Hgn_Des_Engine.ma.
2. You might want to scale up select_Hgn_Des_Engine at your discretion. It needs to be slightly bigger than the engine on the parent ship. Use your judgment as to how to go about this. You might also find that you will have to come back and adjust other parts of the mesh to make it fit better.
3. With the select_Hgn_Des_Engine mesh still selected, enter “90” in Rotate X in the Channel Box. This will rotate the subsystem to its proper orientation in the game. It will align itself to the joint placed in Hgn_Destroyer.
4. Duplicate this mesh. This will be your weapons effect collision mesh. Rename it to “CM_Hgn_Des_Engine”. It is highly recommended that this geometry be simplified if possible. This mesh won't be seen at all, and is only used to determine where weapons hit and their effects get spawned.
5. Select Edit -> Delete All By Type -> History.
6. Save.
7. Click on the box beside File -> Export All. This will open the “Export All Options” window.
8. Beside where it says “File Type,” there should be a drop box. Click on it, and select “**hod**” from the list.
9. Make sure that the “**Ship**” radio button is selected in the “Export Type” section.
10. Make sure that “DXT5(rgba)” is selected in “Texture Options.”
11. Make sure that in the “Optimization Options” that Triangle List is selected and Merge is selected.
12. Once this is done, click on the “Export All” button.
13. Select the directory the .hod is going into. In the case of our Hiigaran Destroyer Engine, we will place its **Hgn_DesEngine.hod** in **Homeworld2/Data/Subsystem/Hgn_Des_Engine**.
14. Close the file.

2.4 Adding Values to SubsystemTuning.xls

Your innate subsystem won't work unless it exists as a subsystem as defined by SubsystemTuning.xls.

1. Load up SubsystemTuning.xls
2. It is highly advised to make a duplicate of an engine type as a foundation to work on. Highlight the Hiigaran Carrier Engine column and duplicate it. Rename the new column Hiigaran Des_Engine.
3. Under Basic Subsystem Stats, find the row called "TypeString" and rename it to DestEngine.
4. Click on where it says "Hiigaran Des_Engine"
5. Click on the "Create/Update/Export Subsystem Data" button.
6. This will export a .subs file called **Hgn_Des_Engine.subs** into **Homeworld2/Data/Subsystem/Hgn_Des_Engine**.
7. Save and exit.

2.5 Adding Values to ShipTuning.xls

Now that your innate subsystem has been defined in SubsystemTuning.xls, you can call them in ShipTuning.xls...

1. Load up ShipTuning.xls.
2. Go to the column named "Hiigaran Destroyer".
3. Scroll down to "Hardpoints".
4. Take the first unoccupied spot (usually Hardpoint0) and make sure you enter the following values, ignoring the rest:
 - a. Name Of the Hardpoint: **Engine**
 - b. JointName: **Hardpoint_Engine**
 - c. Type: **System**
 - d. Family: **Innate**
 - e. Healthtype: **Damageable**
 - f. DefaultSubsystem: **Hgn_Des_Engine**

HARDPOINTS		function StartShipHard			
HardPoint 0		Name Of the Hardpoint	Quoted	hardPointName	Engine
		jointName	Quoted	jointName	Hardpoint_Engine
		type	Quoted	type	System
		family	Quoted	family	Innate
		healthType	Quoted	healthType	Damageable
		defaultSubSystem	Quoted	defaultSubSystem	Hgn_Des_Engine

5. The end result should look like the illustration above.
8. Click on where it says “Hiigaran Destroyer”
9. Click on the “Create/Update/Export Ship Data” button.
10. This will export a .subs file called **Hgn_Destroyer.ship** into **Homeworld2/Data/Ship/Hgn_Destroyer**.
6. Save and exit.

And that is how you add an Innate Subsystem to a ship. Go ahead and test the placement. You may find that you have to adjust your mesh as necessary. If the innate subsystem is mis-aligned, go back and fix it by changing whatever is necessary (i.e. corrections to rotation, and location... Sometimes try freezing the transformations of the select_mesh too).

Our example showed how to do this for a Hgn_Destroyer and should be taken as a guideline. However, treat each ship as a different case. Sometimes you will find that you will only need to build a simple box shape to cover sections of the hull (as in the Hiigaran Shipyard resource pad). It all depends on the case and the ship in question. Use your judgment.

2.6 Summary

Making Innate Subsystems is a fairly labor intensive process.

1. Make a duplicate mesh of the ship you want an innate subsystem on.
2. Select the faces of the place where you want an innate subsystem to be.
3. Extract and separate these, and export them to a separate file.
4. Hook up desired mesh to root, delete extraneous stuff including unused shaders (use Multilister and Hypershade for the shaders).
5. Rename mesh to select_<whatever> and then reduce polys if necessary.
6. Make a new material with a 1x1 pixel .tga as its texture, and assign it an "innateSS.st" shader.
7. Save mesh and go to main ship's mesh. Import the mesh of the innate subsystem and try to get the XYZ coordinates of where it fits best at the desired location. Close the duplicate mesh.
8. Load up the real target ship mesh, and make a subsystem placement joint with the XYZ coordinates taken from step 5 and export.
9. Go back to the innate subsystem mesh, rotate the mesh 90 degrees and create a weapons effect collision mesh. Save and export.
10. Add an entry in SubsystemTuning.xls and export.
11. In ShipTuning, enter values so that the ship you want the innate subsystem for gets assigned the innate subsystem you just made. Export.
12. Test in game. Fix any errors.