NEBULA SPACESHIP SCENE
3D Optimization 2019

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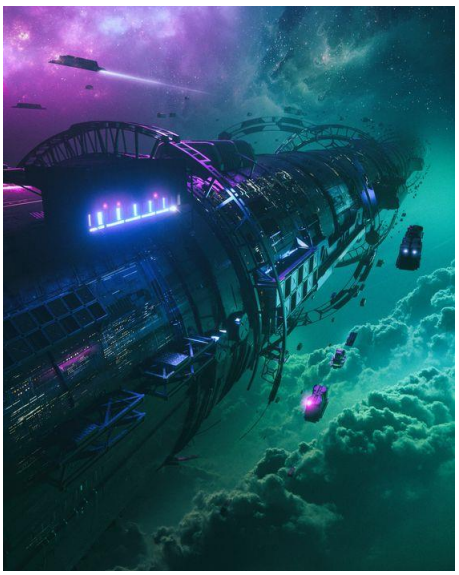
Introduction

A thousand years into the future, humanity is a spacefaring species. A capital ship travels the universe, in transit through a nebula cloud, in search of new habitable worlds.



The colourful lights emitted from the massive clouds of space dust, and the ongoing chemical reactions happening in the gas clusters as new stars are born, brighten up the ships as they transit to new worlds.

Inspired by space scenes from classic sci fi, as well as the colourful space environments of No Man's sky, my aim was to design an exterior environment scene of a futuristic capital spaceship navigating through a nebula cloud.

I aimed to learn and explore new interesting optimization techniques to produce a visually striking nebula cloud based on volumetric effects, and a complex, yet efficient hard surface asset with the spaceship.

Pre-production

I started by creating a Pinterest board and looking at pictures and inspiration for the spaceship and detailing the classic sci fi themes. I found the picture above that set the tone for the entire scene in terms of colour and mood. I also looked at the best way to render a nebula cloud, and researched how to use volumetrics to generate the effect, as this would be an interesting challenge to create an efficient material that completely enveloped the scene.

After I had a good set of images of spaceships and nebulas I created a concept of the spaceship that I would be modelling using kitbashing in photoshop from the references gathered before:

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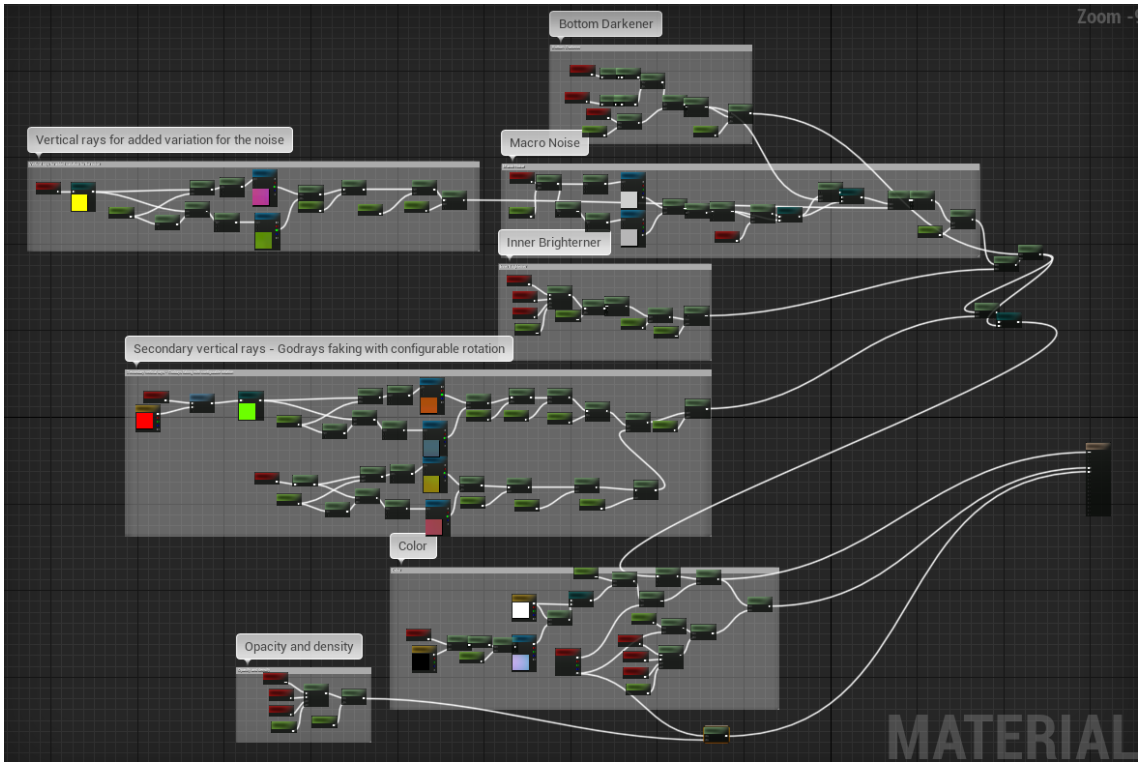
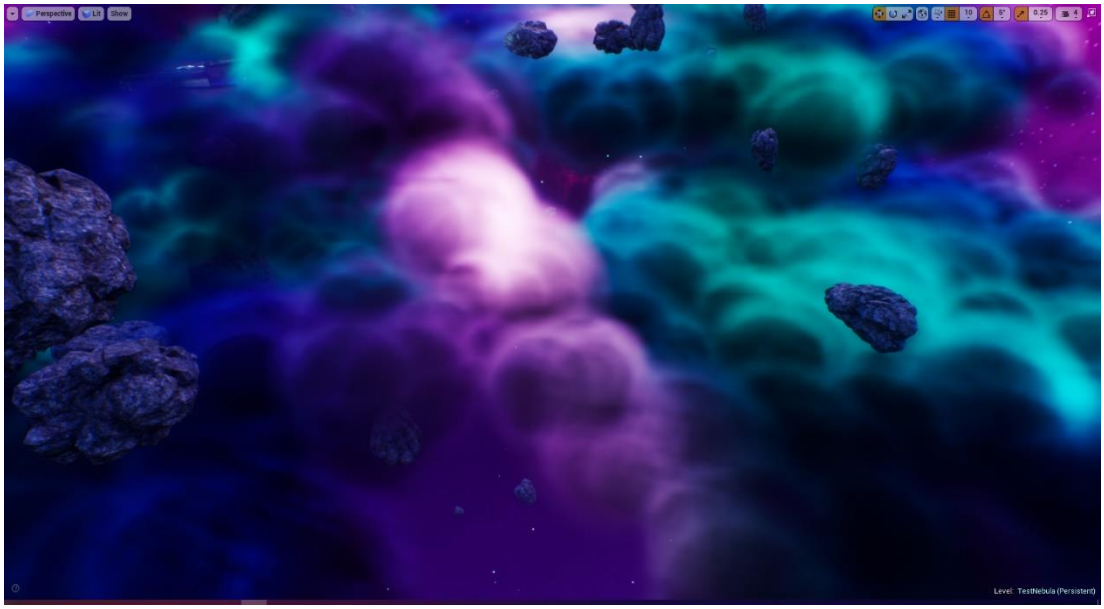
Development

NEBULA

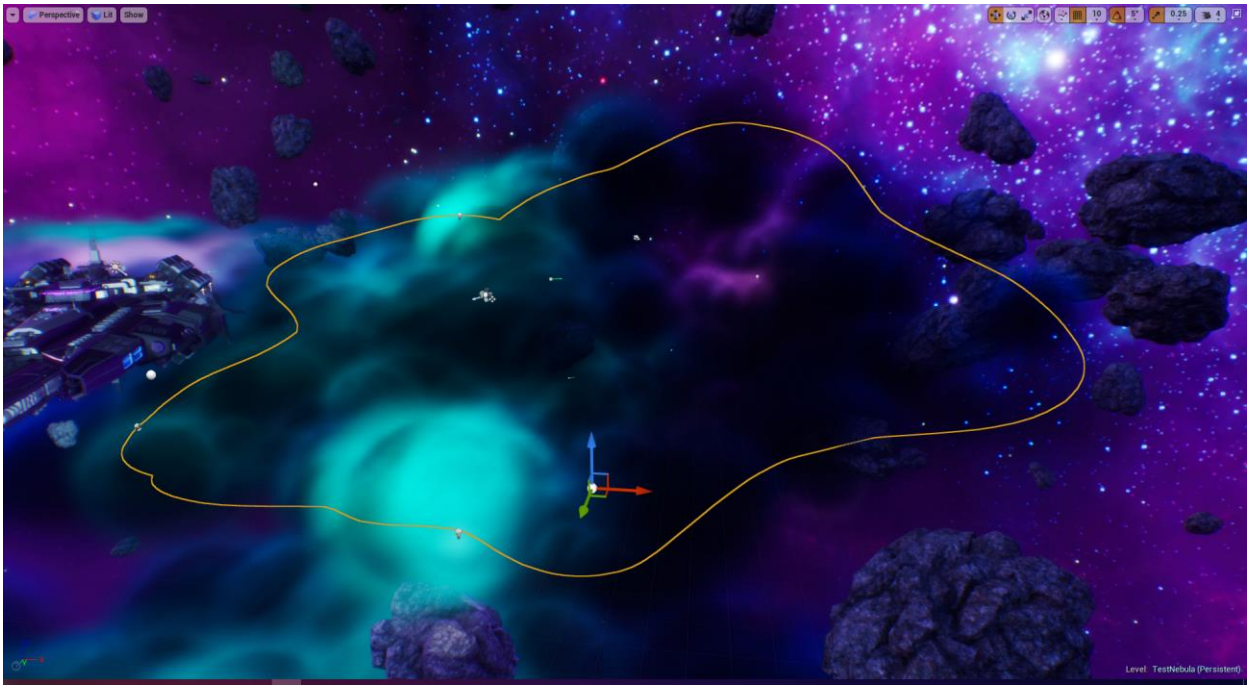
I followed Epic Game's Sjoerd De Jong live session to understand his use of volumetric clouds and exponential height fog. I looked at his node examples which were incredibly performant as a base to create my own nebula effect. In UE4 I created a complex node tree system that still rendered very efficiently using minimum draw calls, featuring several micro and macro noise variations, and nodes to brighten the inside of the nebula and darken the bottom part, as well as simulated godrays and opacity filters. I then adjusted the colours of the nebula using a seamless texture crated in photoshop from blurring some of the reference images.



To add to the nebula effect I used various point lights to simulate the effect of chemical reactions happening within the inside of the clouds.



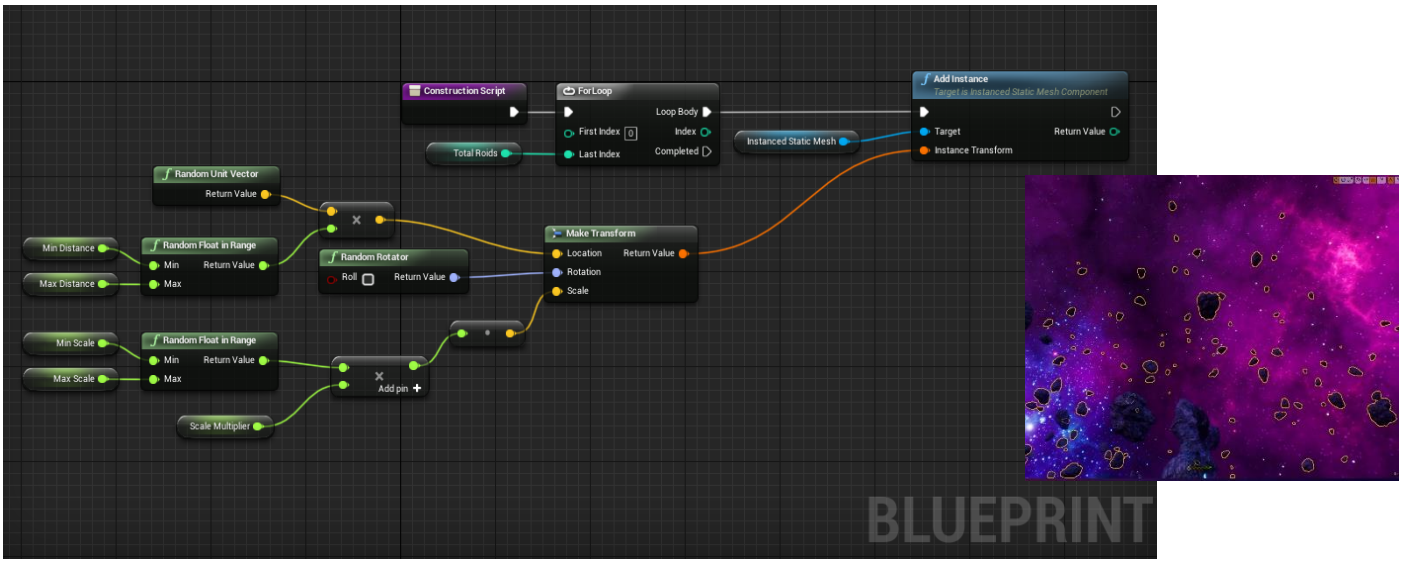
I also used a skeletal mesh to feed into the particle emitter as the spawn point of the particle systems, so that I could shape the nebula clouds using a mesh, in essence, shaping the nebula cloud into any form I wanted.



For the surrounding skybox, I made a custom texture using Spacescape, a free tool to generate space HDRIs. I then made a blueprint for the space skybox featuring custom parameters to individually control the brightness of the sky and starts and the lightness of the overall scene.

ASTEROIDS

After creating a basic sculpt and using a wold positioned texture to create rock variation, I used a blueprint to spawn the asteroids as Instanced static meshes, so that I could have hundreds of asteroids in the scene and only use one draw call, making generating a massive asteroid field extremely efficient. The blueprint creates a group of asteroids that is procedurally placed in a user defined radius, given a certain size constraint.



The use of instanced static meshes makes the most use of memory and resources.

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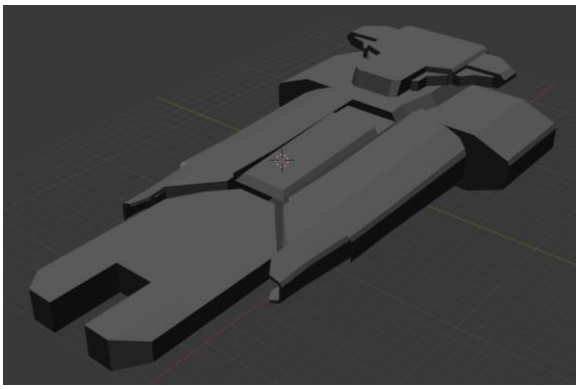
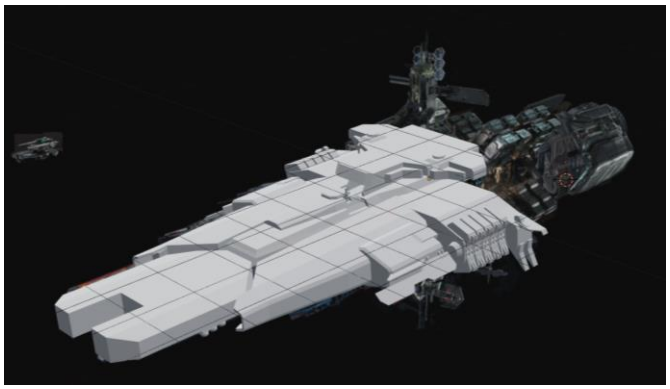
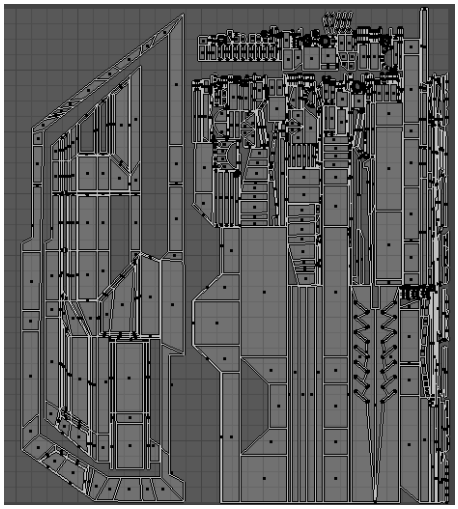
SPACESHIP

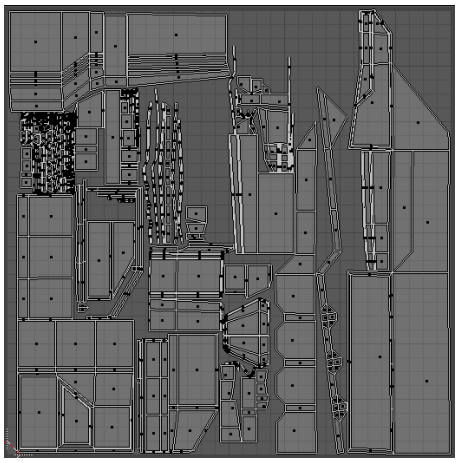
I used fSpy to place a camera in my scene that matched the concept image and made a rough blockout of the spaceship to start detailing it.

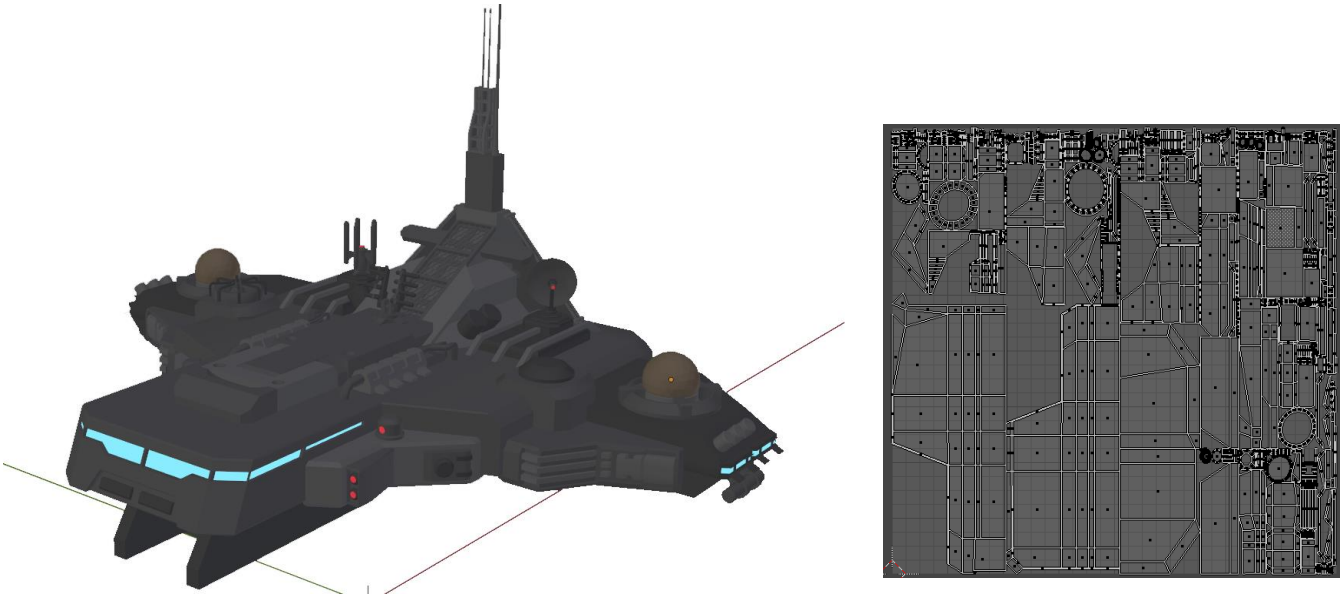
I used a modular workflow for the modelling process, by dividing the ship into sections and detailing each section accordingly. Each section was then Unwrapped to an individual UV set. I ended up with 3 UV sets to use 3 Baked textures in the final asset.

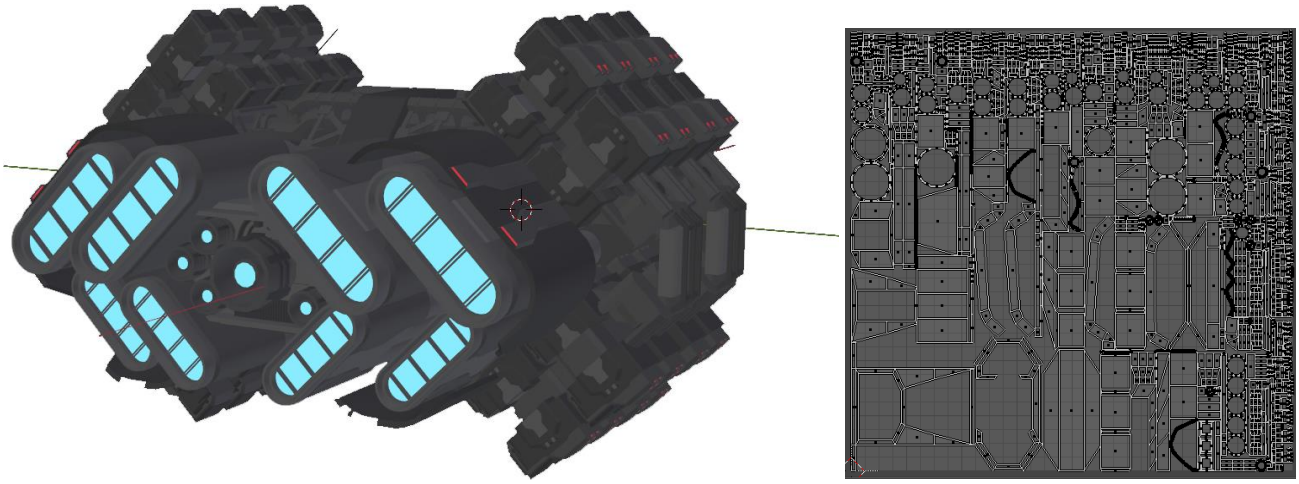
Front section: Railgun

Mid Section: Hangar and Weapon Emplacements



Top Section: Command Bridge and Radar Tower



Rear Section: Engine and Thrusters

I looked at varied references for wall panelling and used a lot of extrusions and bevels to create the detailing of the ship. I adopted the Star Citizen's workflow of face weighted normals to conserve and make the more use of the polygons to add bevels and protrusions while still allowing for the use of tiling textures.

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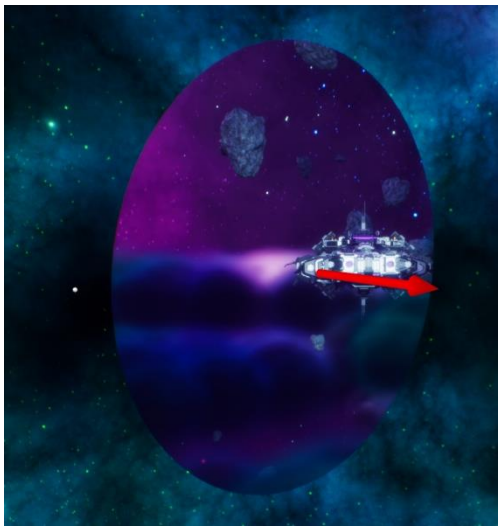
PORTAL WORMHOLE

The idea of making a portal wormhole emerged as a natural progression of the scene. I wanted the portal to be embedded in the asteroid belt so I sculpted its form from the previous asteroid meshes.

For the wormhole effect I used a circle with skewed EVs and a noise material with a panner node.

To simulate the portal effect of looking into a different galaxy, I duplicated my skybox to a place outside the bounds of the scene and used a screen reflection capture projecting into a material placed on the portal mesh, to simulate the player looking into the portal from any angle.



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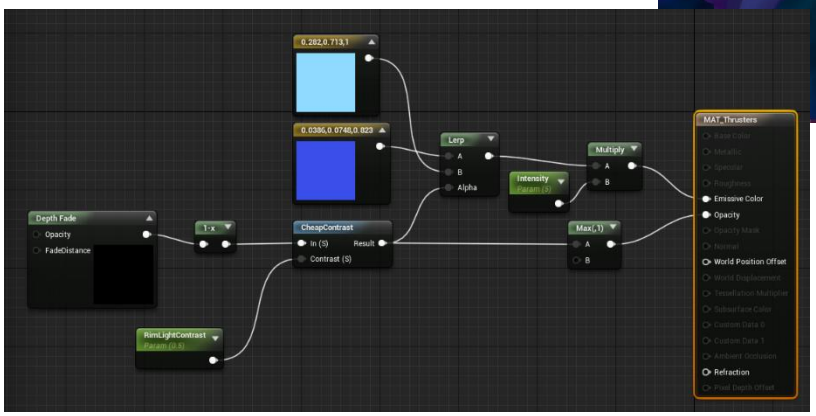
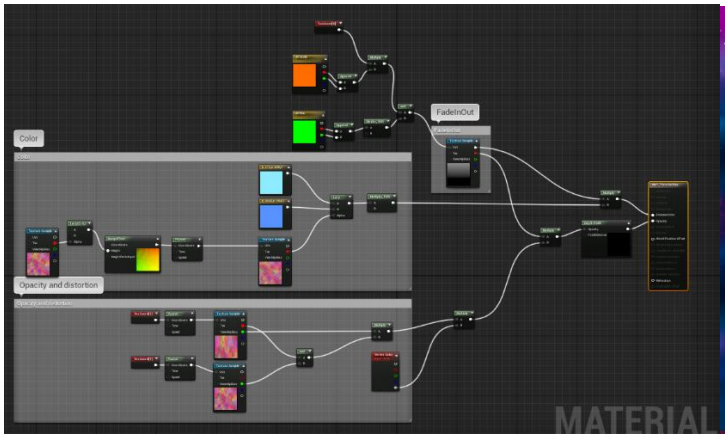
Shield VFX

I wanted to add a more dynamic feeling to the spaceship to complement the rest of the scene. I started by making a simple holographic shield shader with the use of a panner node and masking overlay textures. This helped to give emphasis to the hangar bays of the spaceship.



Thruster VFX

For the rear thrusters of the spaceship, I added a similar effect to the portal wormhole but without the skewed UVs, to simulate thruster fire emitting from the engines. I also used a panner node as well as a masking overlay texture.



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Evaluation

The overall result of this project was very faithful to the initial inspiration. I feel like I have captured the essence of the nebula scene that I initially set out to create, whilst exploring my own ideas in the process.

The project provided me with the opportunity to explore a variety of hard-surface techniques while modelling the spaceship and even some simple organic modelling with the creation of the asteroid debris.

However, I did not expect to learn so much about visual effects and unreal node based material shaders in the process, and I feel like I have gained valuable skills for future projects.

Most importantly, the exploration of several optimization techniques such as instanced static meshes and material node optimizations, as well as the overall modelling and UV techniques used provided me with a wealth of knowledge about optimization, and I feel I have managed to create a complex scene while retaining a very optimized result, both in the engine as well as the 3D assets themselves.