CS 148 Final Project (2025 Summer)
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1440 x 1920, rendered at 512 samples

Project Premise:

Even before beginning the project, I knew that creating anything "organic" such as animals and especially people would be extremely difficult due to their proportions, which I lacked a good understanding of. Opting to focus on rigid objects instead, I considered doing a scene of Optimus Prime or a Gundam as these two franchises greatly influenced my interest in mecha media growing up; I chose the latter.

Obviously from the start, I would have to overcome a huge hurdle before even getting to scene composition: making the Gundam itself. Although I would've liked to do more interesting Gundam designs, I took the compromise of modeling the RX 78-2 Gundam (Origin Ver.), as the overall design is simple and primarily consisted of differently shaped cubes. These more simplistic shapes likely saved dozens of hours of modeling, and allowed me to easily show reflections of light. I already had a mental visualization of how I would like the scene to be lit, what parts of the Gundam would be seen, and the overall composition. In particular, I wanted to put emphasis on scale – balancing dramatic lighting and shadows to invoke the feeling of looking at a towering figure was the main objective for ray tracing. As for overall scene story aesthetic, I wanted to allude to the events of wartime and destruction – Gundam has ultimately always been an allegory of war and a reflection of the human condition.

References:

Two main images from my references folder that reflect the aim for the scene and lighting

Workflow and Project Requirements:

Modeling:

To model the Gundam, I began by using several reference "blueprint" planes taken from the Gundam's plastic model manual. I then created each armor piece of the Gundam by tracing the objects over the references one by one, vertex by vertex. Since these references are of a fictional machine, and are used for plastic model decal references, I then had to make adjustments to the armor pieces to better fit the ideal Gundam armor proportions. Mirror modifiers were used for every piece to ensure symmetry. Solidify modifiers were used for finer details, especially when adjusting object planes to solidify into features of the head/face. Subdivision surface modifiers were used to smoothen curved armors(e.g. calves, head). These processes alone took around 3-4 weeks worth of time, although I was also learning modeling basics through trial and error which increased modeling time. The model is also rigged, which added more time to just the Gundam alone.

In addition to the Gundam and its beam saber, the models made from scratch include:

- The fire and smoke/fire simulations
- Broken concrete floor
- Broken rubble (very faint visibility behind the gundam's legs

Imported models include:

- Ruined buildings (two on the left, one on the right)

Lighting:

To achieve the desired lighting and its effects on the Gundam, I used a variety of area lights and point lights with different colors. There are three main light sources in the environment: the moon, the beam saber, and the background fire. The moon is just a plane with an emissive shader in front of an emissive night-sky textured hemisphere. For replicating true moonlight, I positioned an area light closer above the Gundam's right shoulder, with the intention of it being one of two sources to illuminate half of the Gundam's front. The other front source was the beam saber, itself being a cone with a volumetric emission shader. Additionally, a point light is placed at the saber base to emit a stronger light that mimics a burst of energy. This allowed me to create harsher shadows and better reflections on the right leg.

The fire lighting was more complex, involving several point and area lights to illuminate the scene and create an outline of the Gundam's edges. Creating an even orange lighting, I placed a dim area light at the Gundam's left side, and two stronger disk area lights with each focusing on one of the legs. These lights highlighted the gradual reflections of the smouldering flame, while the two disk area lights helped in highlighting the Gundam's edge outlines and produced soft shadows at the feet. Point lights were placed at the fire/smoke's source to give off a distant bloom-like effect. This bloom effect was only achieved through the use of volumetric fog to emulate smoke spreading throughout. Additionally, it allowed me to emulate the effects of light pollution from the fire(imagine California wildfires), with the fog being a very light orange to better show lighter gradations higher up in the image.

Some last minimal lighting effects are from the eyes and the top camera(the red point on the head). For the eyes, there is an outer object that has a simple glass material, and a duplicate set of eyes with an emission material that is slightly scaled down to fit inside the glass eyes. Something similar is done for the top camera; there is an outer dark red glass panel, with a white point light being placed inside of a cylinder to replicate a glowing camera lens. Although you will need to zoom in to notice this extremely subtle detail, this showcases an application of transmitted rays through cycles.

Materials, Textures:

All materials/textures were made from scratch using procedural generation, many of them being textures generated by following tutorials or merging the material nodes of those tutorial-taught textures together. Out of all textures in the scene, the most important were the textures used on the Gundam itself. Being an armored close-combat military-grade mech, I wanted to isolate weathering to accumulate at the edges of the Gundam's armors to reflect wear and staining from battle, while still maintaining enough metallic sheen to reflect the lights. I was able to merge two materials from different edge-wear tutorials, specifically making it so that the worn edges reflected more light compared to the rest of the armor to emulate the base metal underneath. To do so, I used a mix shader that connected two principled BSDF shaders. The first BSDF shader uses a noise + color ramp + color mix node to choose a somewhat rough but still somewhat reflective surface to emulate an outer metal coating/paint. The second BSDF shader is made from a bevel node that uses an image for the edge-wear patterns.

Sources:

RX 78-2 Gundam Workflow by Jeff Allen (his model was far more complex, so I could only take away how he adjusted the head proportions in his video):
▶ RX-78 Gundam - Mecha in Blender 3D Modeling Timelapse (no audio)

Beam Saber Effect:
▶ How to Make Lasers of Destruction in Blender - Iridesium

Rigging:
▶ Rigging for impatient people - Blender Tutorial

Simulations:
▶ Fire Simulations for Beginners 🔥 (Blender Tutorial)
▶ [4.2] Blender Tutorial: Quick And Realistic Fire And Smoke

Textures:
Procedural Fog: ▶ Procedural Fog Material 〰 (Blender Tutorial)
Night sky dome: ▶ Making a Night Sky in Blender
Chunky concrete(for ground): ▶ Procedural Chunky Concrete Material (Blender Tutorial)
Edge Wear(outer coat): ▶ 3 Easy steps to make Realistic Materials
Edge Wear(edge wear detail): ▶ The RIGHT Way to do Edge Wear (in Cycles!)

General tutorials for learning modeling(topology, modifiers, etc.):
▶ Sci-Fi Worker Robot-Part 1 (Blender Tutorial)
▶ Blender Beginner Modelling Tutorial - Part 1

Imported Assets:
Ruined buildings: https://www.blendswap.com/blend/28489