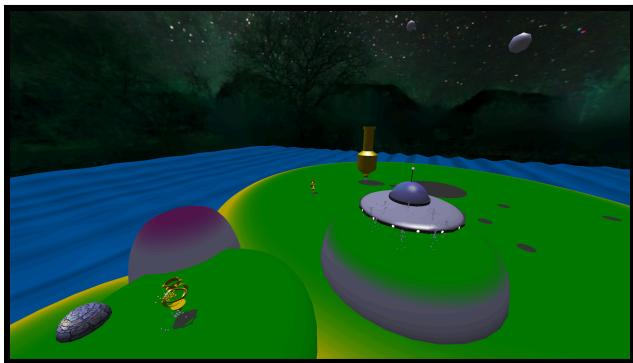


Andrew Smiles - 78116494

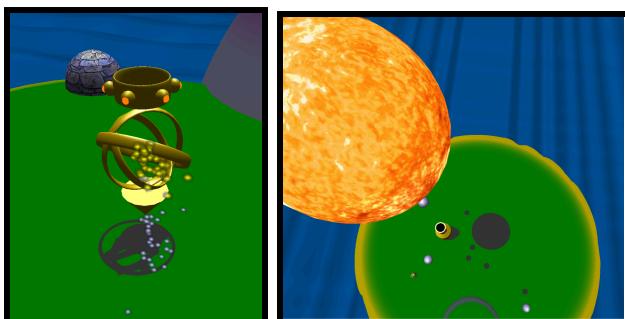
## Scene:

A wavy ocean under a starry sky. A ufo launches and darts around using its powerful spotlight to survey this area of the planet. It has a translucent cockpit, a spinning ring of lights, and flickering lights below used to communicate its findings. Two aliens wander around, exploring a newly discovered small group of islands. The aliens have set up a strange cannon-like apparatus to test the properties of an anomaly in the sky.

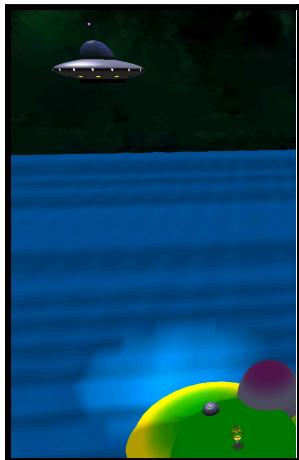


## Extra features:

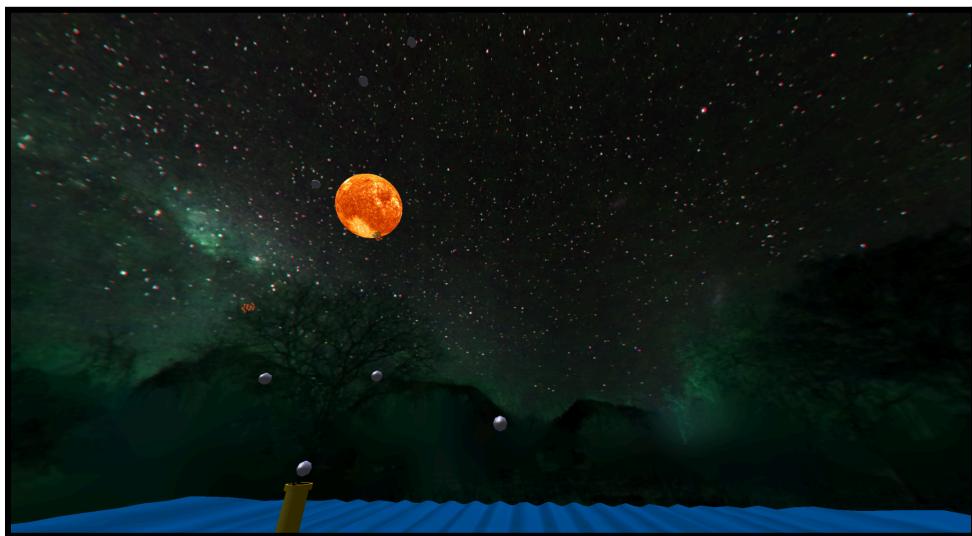
1. **Planar shadows** - Both of the aliens have shadows. The cannon, its projectiles, and the anomaly also have shadows.



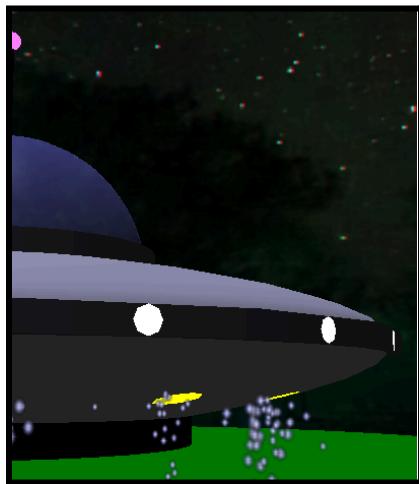
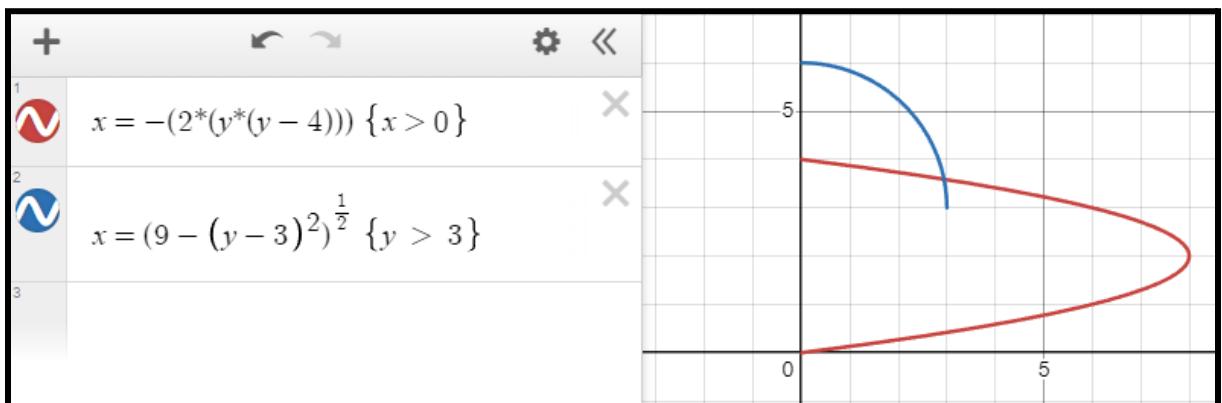
2. **Moving spotlight** - The UFO shines a spotlight down as it darts around.



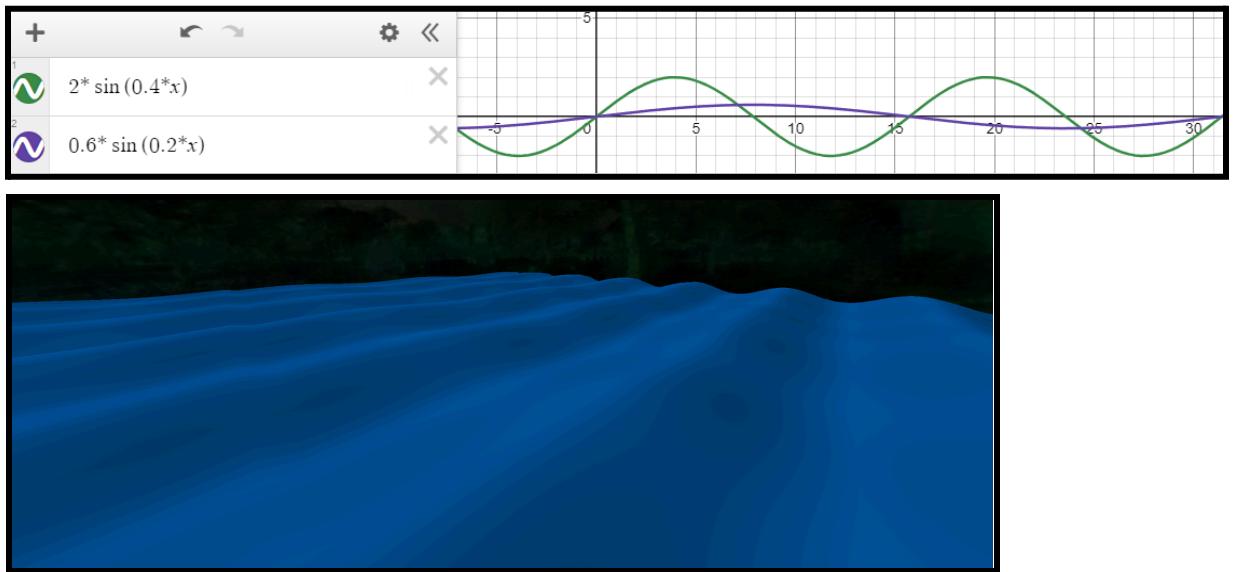
3. **Sky dome** - A starry sky dome is used to minimize distortion.



4. **Surface of revolution** - The UFO shape is constructed by creating quad rings at intervals with their top and bottom radii calculated by a parabola function. Its normals are calculated using the slope of this function via the derivative.



5. **Mathematically generated surface shape** - The ocean is a grid of quads with a modified sine wave running in the x direction and a different wave in the z direction. These are averaged to define the height of the wave. This approach came with performance issues, and so I programmed it to generate the vertices with larger gaps the further they are from the camera. This allows for an ocean with smooth detail up close and a vast scale from afar without the performance issue.



6. **Physics model** - The cannon fires randomized projectiles that orbit the anomaly by applying gravity but without affecting the anomaly. Also they explode if they hit the anomaly or after a delay. I based it on this equation:

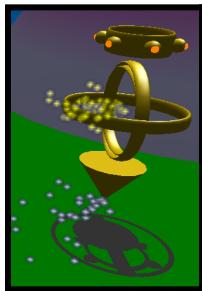
$$F = G \frac{m_1 m_2}{r^2}$$



7. **Spaceship liftoff** - On pressing space the UFO turns on and then propels itself, accelerating upwards.



8. **Particle systems** - I adapted the provided particle system code to have a XZ quad due to the vertical nature of my scene. I created three different emitters; downdraft (Blue), explosion (Orange), and flames (Yellow).



### Control functions:

**W** - Move forward.

**A** - Move left.

**S** - Move backward.

**D** - Move right.

**Space** - Increase height and activate UFO launch.

**Shift** - Decrease height.

**Mouse Move** - Look around.

**L** - Leave the scene.

### Build instructions:

This project was developed using Visual Studio on Windows according to the provided instructions.

### External sources:

I adapted code from the lab for; quadric texture mapping, planar shadows, and particle drawing.

#### **Textures -**

Labs - Glow.bmp

tilingtextures.com - Wall.bmp

polyhaven.com - Sky.bmp

solarsystemscope.com - Sun.bmp

### Declaration:

I declare that this assignment submission represents my own work (except for allowed material provided in the course), and that ideas or extracts from other sources are properly acknowledged in the report. I have not allowed anyone to copy my work with the intention of passing it off as their own work.

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Date: 27/03/2024