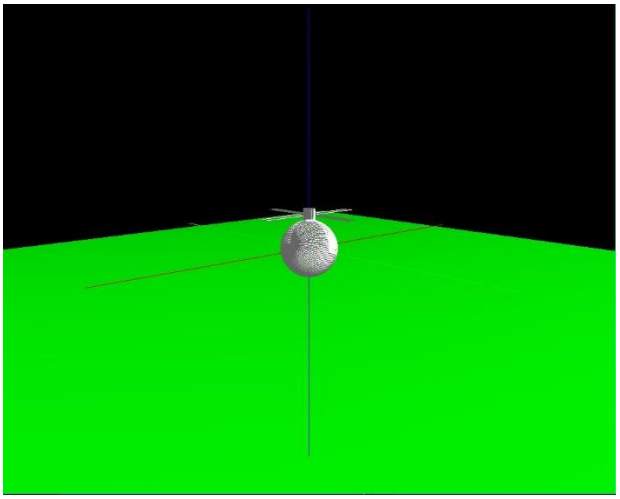
Project Logbook – Sasha Buskin – 19093824

Scale: 1 unit == 5 meters

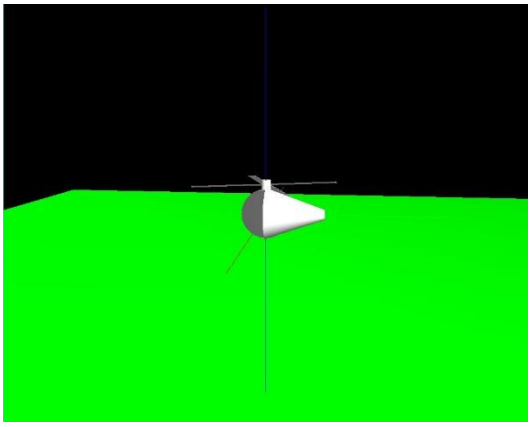
8/04/2023 – 4h

Work done:

- Drew square ground quad.
- Started on helicopter hierarchical model.
- Achieved propellor rotation by altering rotation angle in think().



```
for (int i = 0; i < 2; i++) {

    if (bladeRotation[i] == 360.0f) {
        bladeRotation[i] = 1.0f;
    }
    else {
        bladeRotation[i] += 1.0f;
    }
}
```



To do:

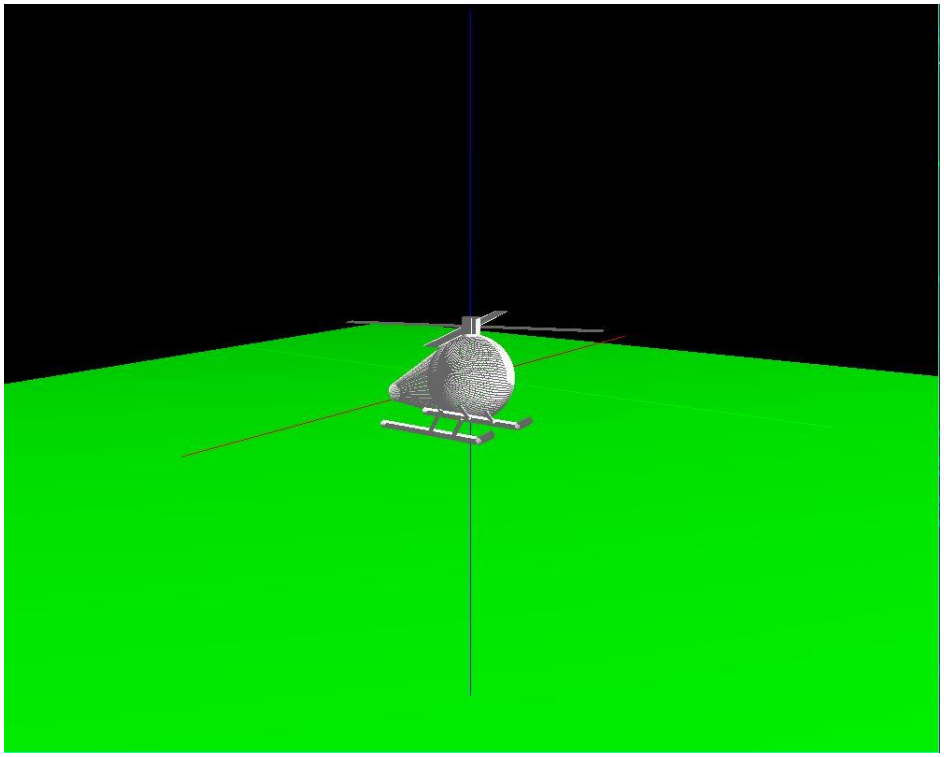
- Finish hierarchical model.
- Rotate model and calculate camera position based on rotation.

8/04/2023 – 6h

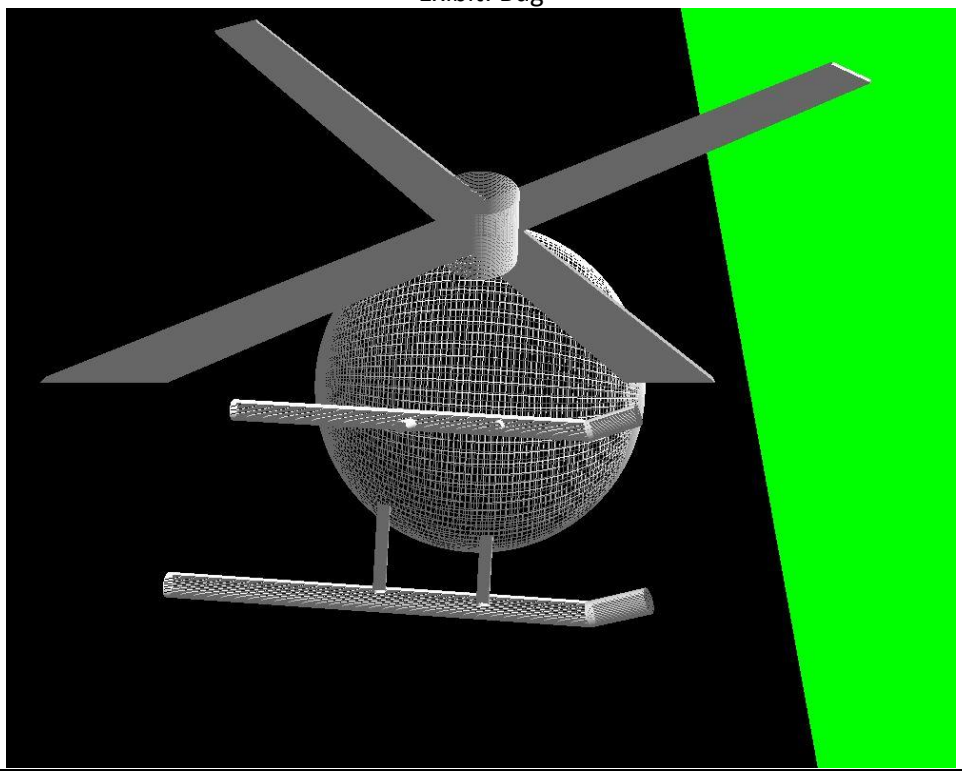
Work done:

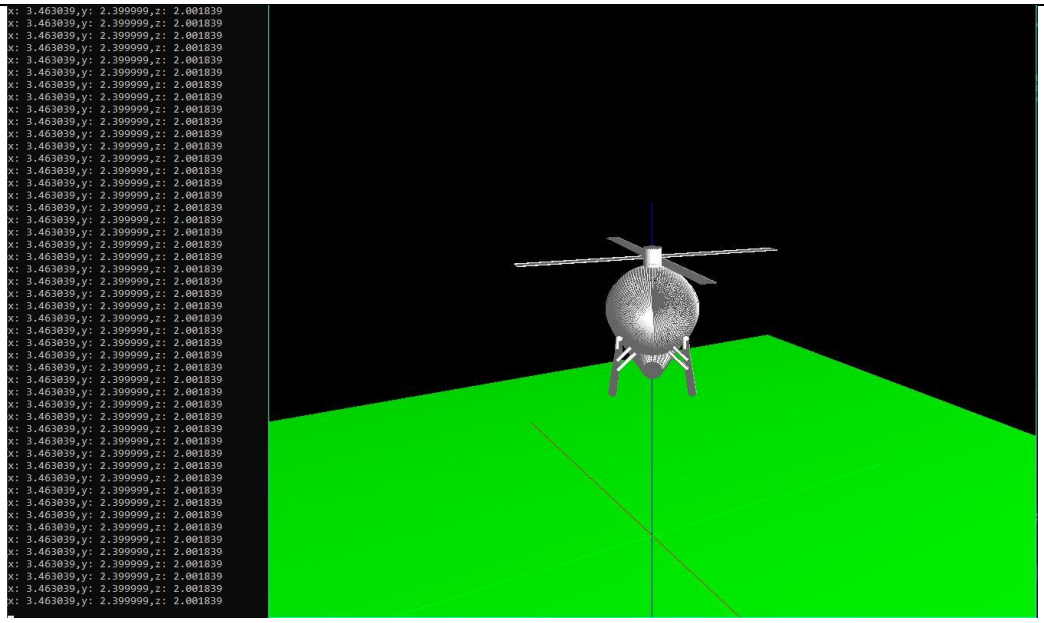
- Finished helicopter model with skis

- Completed rotation and successfully locked camera position to rear of helicopter.
- Added up and down motion to hierarchical model with arrow keys.



Exibit: Bug





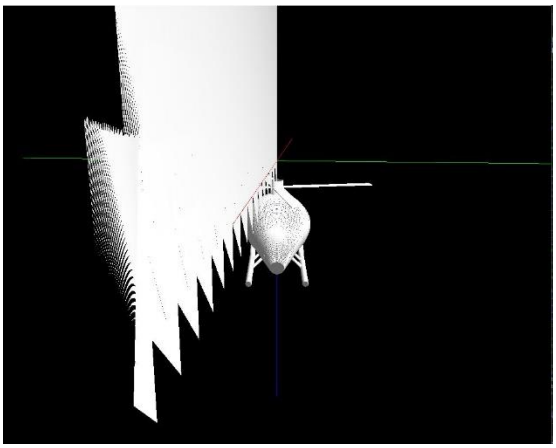
To do:

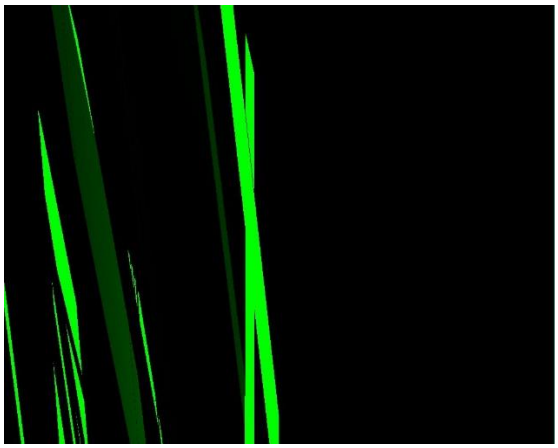
- Implement heightmap as ground.

25/04/23 – 4h

Work done:

- Have implemented a file loader to get pixel value of heightmap.ppm, however am having trouble implementing the greyscale values of each pixel as a height value in a triangle grid ground object.





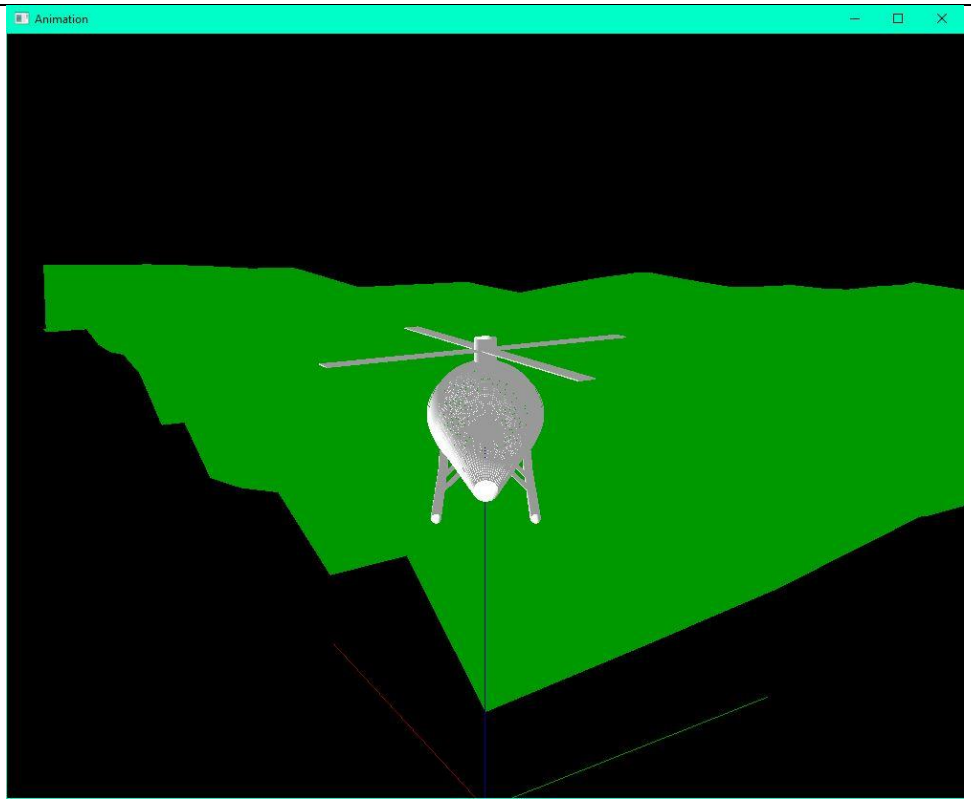
To do:

- Fix heightmap implementation.

28/04/23 - 2h

Work done:

- Rendered heightmap ppm, solved issue with different types of ppm encoding p3 v p6.



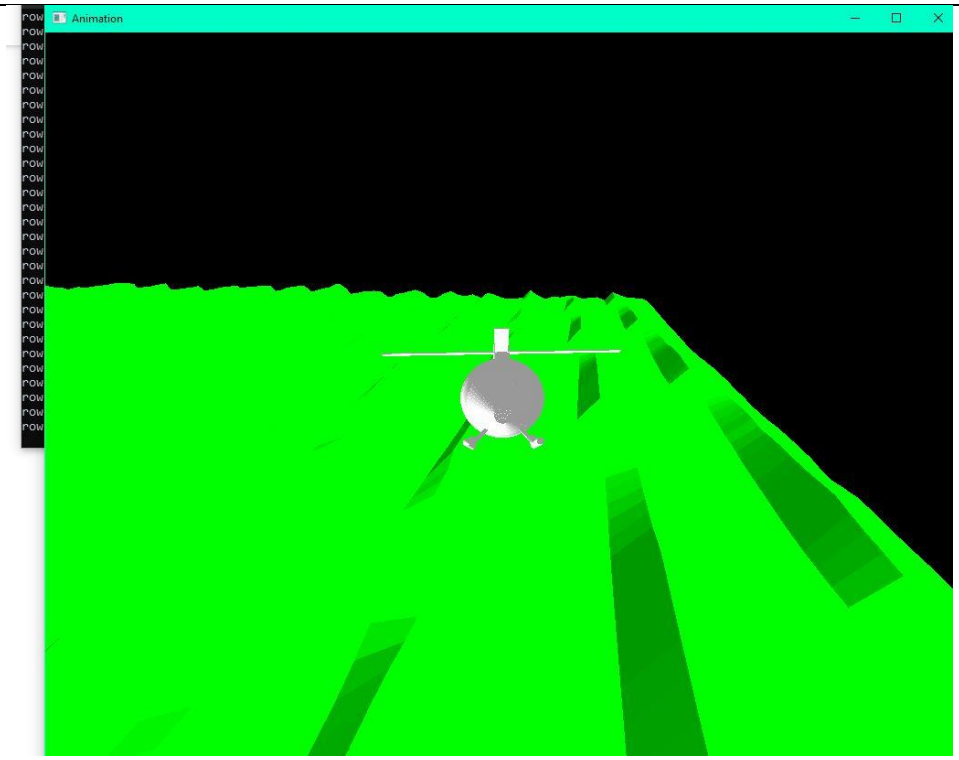
To do:

- I am not sure if the heightmap has implemented correctly as I cannot explore it with the helicopter, I therefore need to implement motion to my helicopter.
- Need to calculate each normal for the ground triangles so lighting reflects and 3d look is achieved.

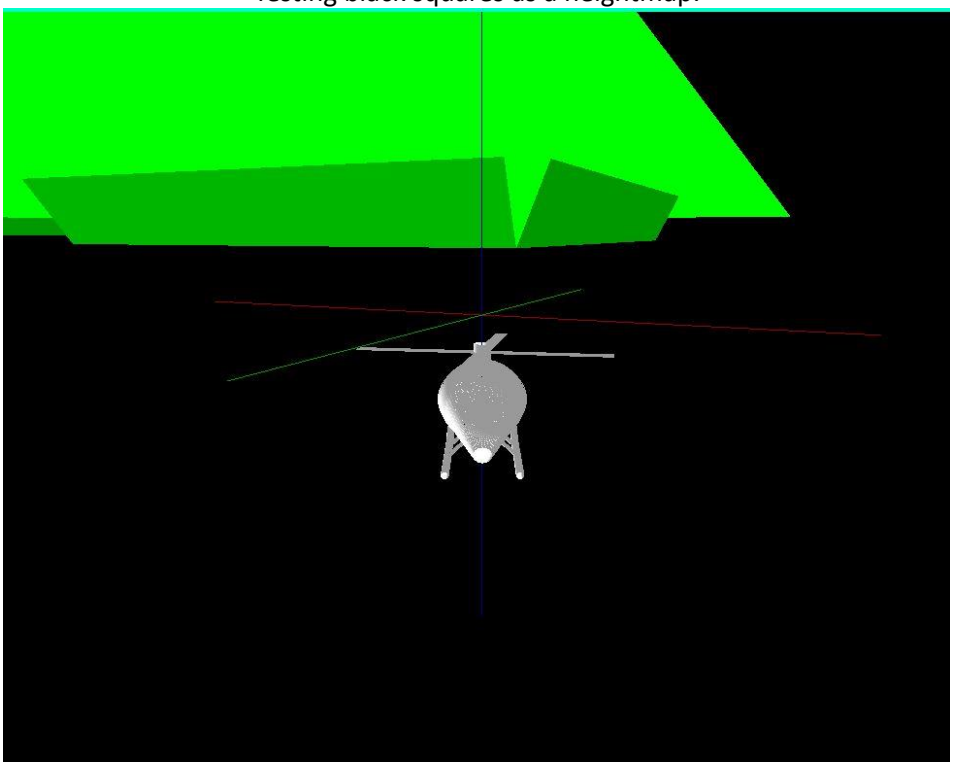
12/05/23 - 6h

Work done:

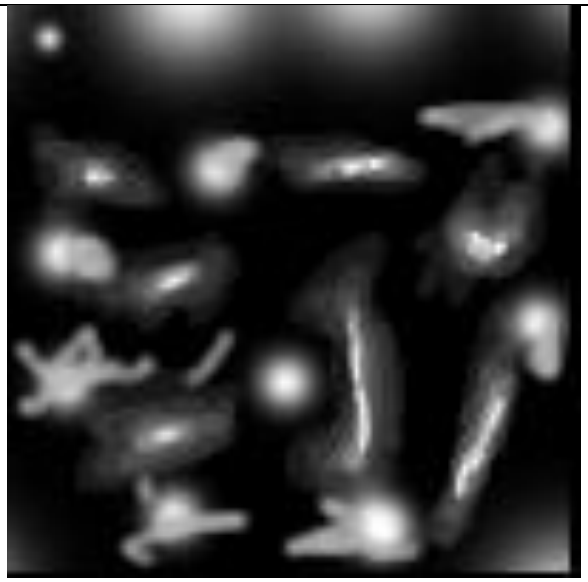
- Added rudimentary motion to helicopter model through use of ‘w’,’a’,’s’,’d’.
- Added normals to ground triangles.
- I found the heightmap I sourced obline was rendering an unsuitable landscape, so I created my own heightmap using greyscale colours in paint.net.
- Perspective projection changed to see further/more of the ground



Testing black squares as a heightmap:



My custom heightmap.png:



Successfully: implemented into drawTerrain function.

To do:

- Motion is not smooth and does not resemble real life physics, needs to be upgraded.
- Apply texture to terrain.
- Enlarge map, add sky cylinder.

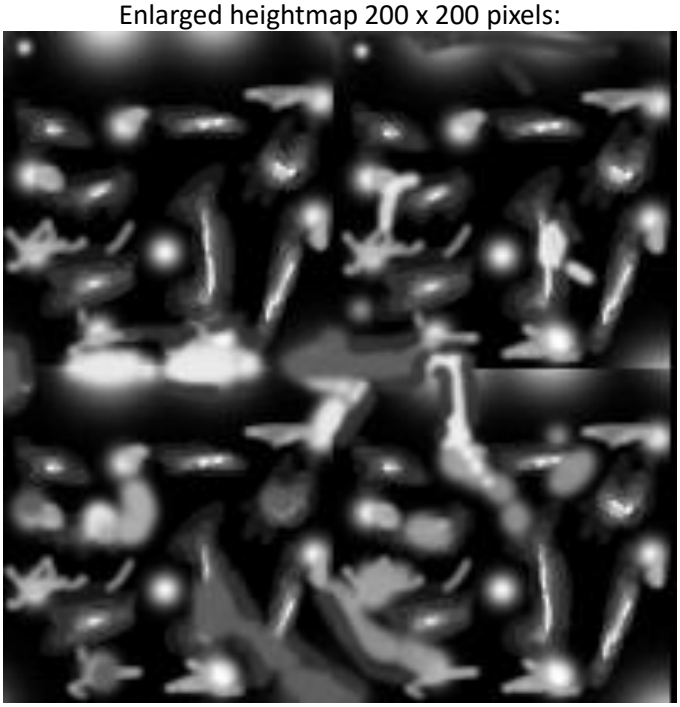
24/05/23 – 6h

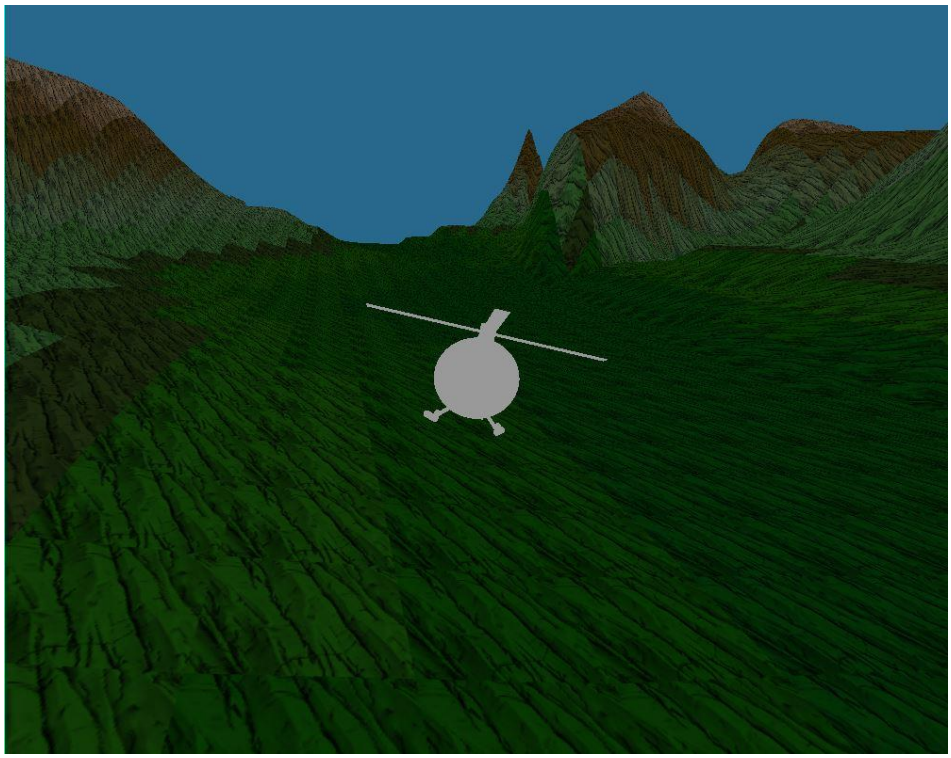
Work done:

- Added blue sky cylinder
- Successfully rendered texture to ground panels.
- Implemented terrainColourPicker function that alters the currently drawn triangle colour depending on its height value.

- Enlarged the map by altering the drawing loop, array values and creating a larger heightmap.ppm
- Started on collision with ground implementation by calculating the heightmaps height at the current x,z of the chopper, however there are still bugs and fall through areas and can still move when stopped.

Enlarged heightmap 200 x 200 pixels:





Terrain texture source: https://depositphotos.com/stock-photos/mountain-texture.html

To do:

- Implement lighting.
- Add materials to helicopter.
- Add fog

28/05/23 - 3h

Work done:

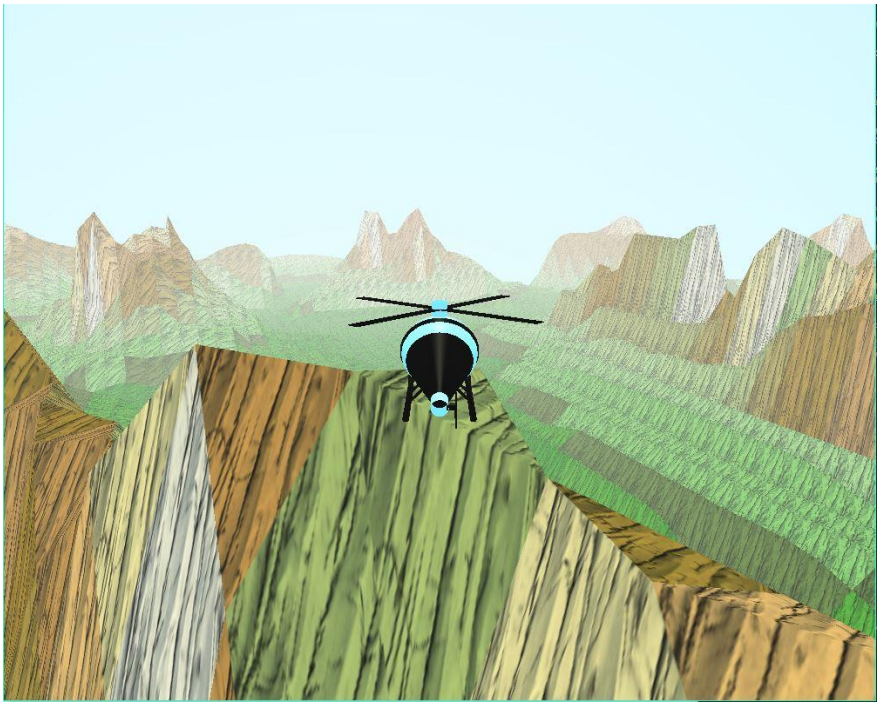
- Fixed motion. Applied velocity-based motion, up and down, acceleration/deceleration to simulate natural physical.
- Added rotation/tilt when helicopter is moved forward/backward/sideways

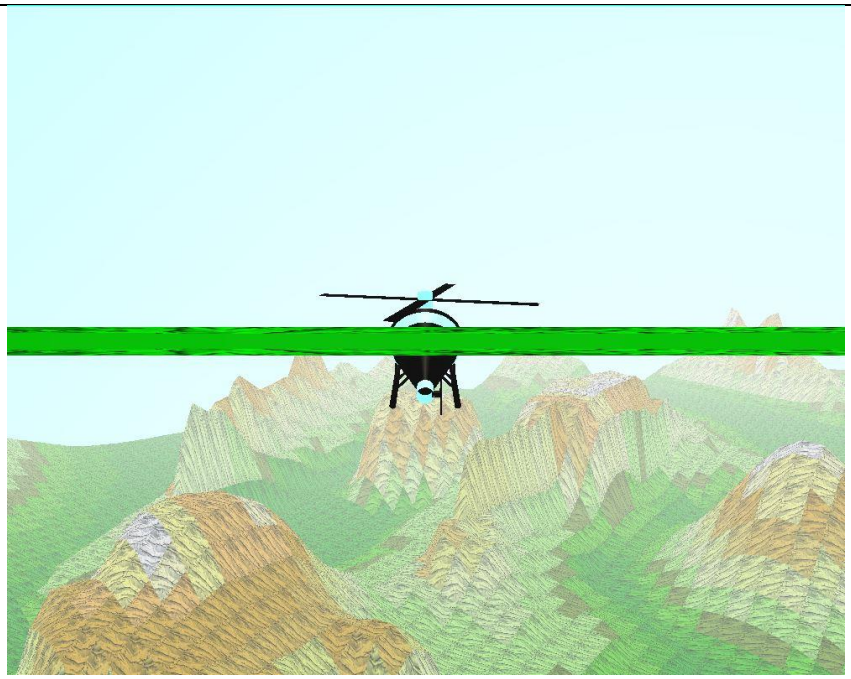
01/06/23 - 6h

Work done:

- Added light fog to obscure distance.
- Implemented lighting, global ambient.
- Added materials to helicopter model to reflect light.
- Added texture mapped helipad object to the scene.
- Fixed collision with ground, I forgot to account for the coordinate shift, i.e. the helicopter collided with bottom corner ground height when in the middle of the map.

Fixed and landed:





Helipad concrete texture source: https://www.all3dfree.net/concrete-textures.html

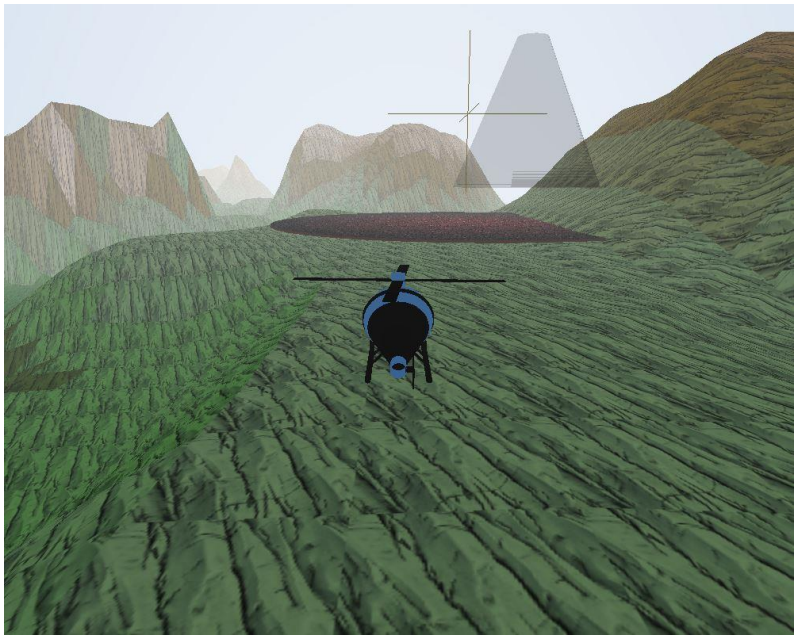
To do:

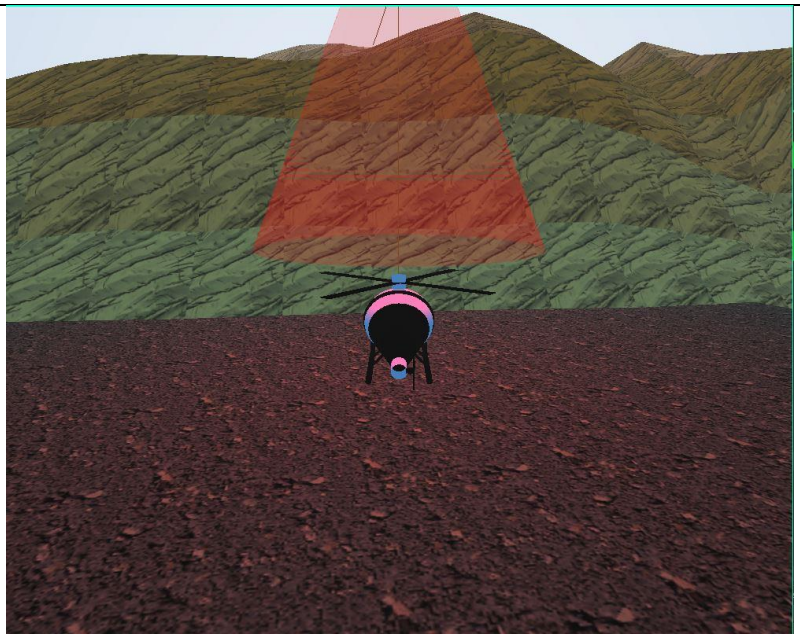
- Implement spotlights.
- Fix collision with ground.
- Improve helicopter physics.

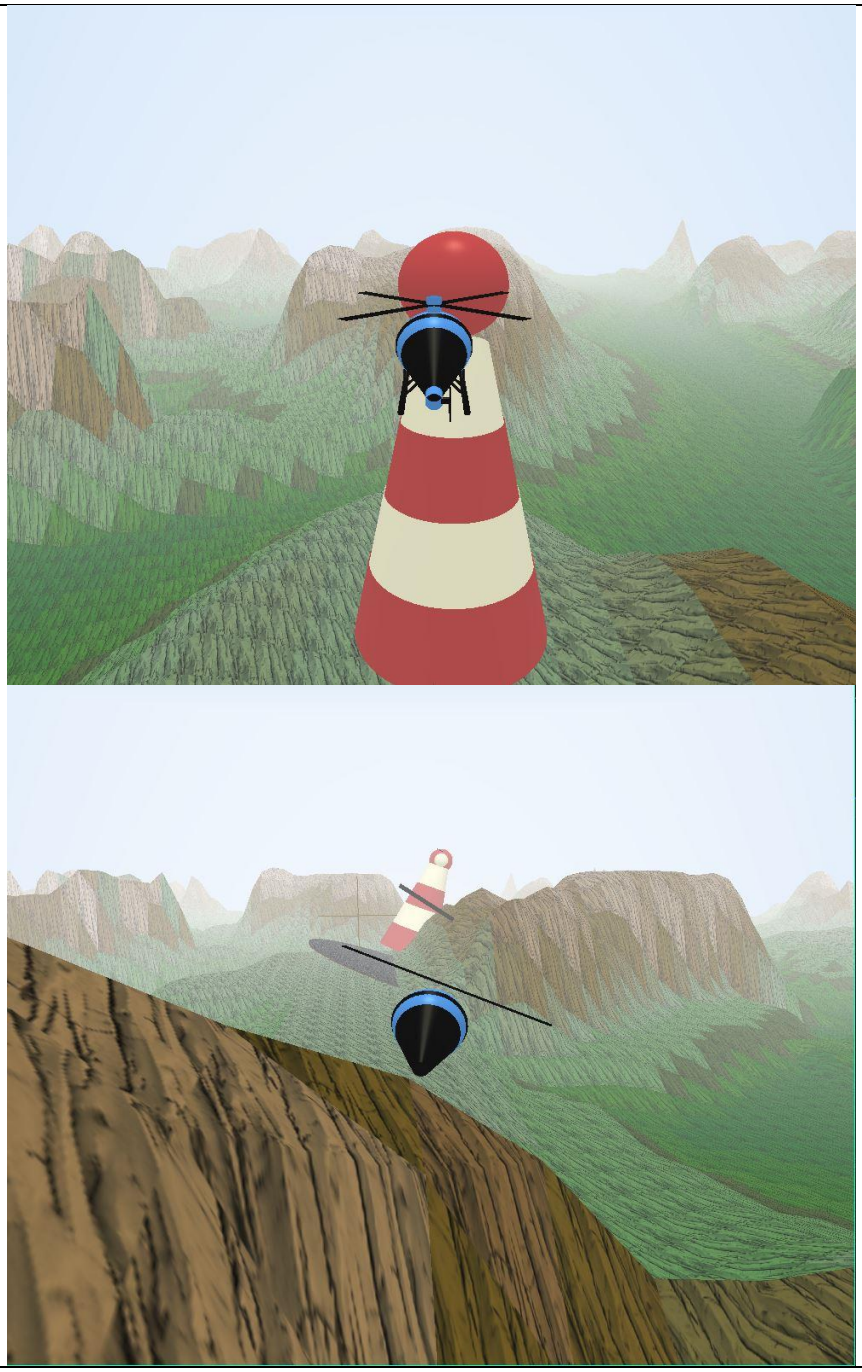
03/06/23 - 6h

Work done:

- Successfully added 1 spotlight to the scene, with a coloured, transparent cone to display its beam.
- Added a windmill hierarchical model with animated blades.







To do:

- Add multiple windmills facing different directions at appropriate points around the map.
- Add multiple, different colours spotlights and make them move randomly around the map.

05/06/23 - 6h

Work done:

- Added multiple windmills with random rotation angles generated on compilation at predefined set of map coordinates around the map.
- Added multiple moving lights of different colours, generated through use of a spotlight struct with variables including velocityx and velocityz, the spotlights are set up and put in spotlights array.
  Initially I had issues with amount of lights, and could not implement them all through a loop.

Multiple windmills:

Multiple lights:

Multiple colours:

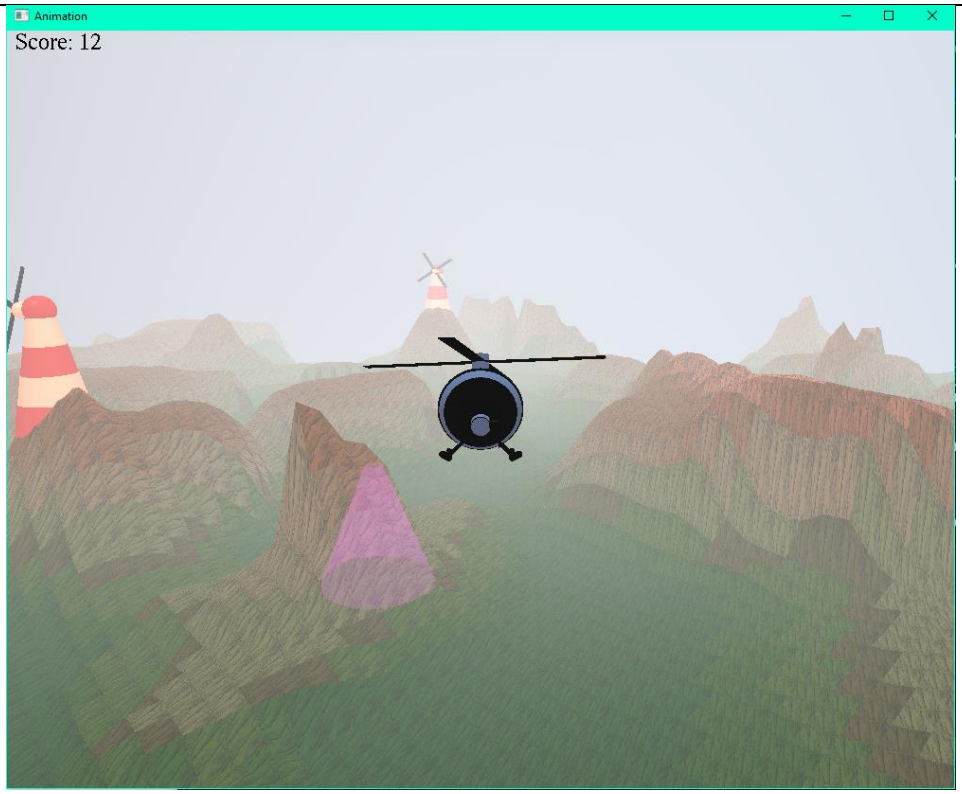
To do:

- Implement the spotlights to turn off and regenerate elsewhere when the helicopter flies through them.
- Count score and display as 2d bitmap

06/06/23 – 3h

Work done:

- Successfully added game aspect, by comparing the spotlights location with the helicopters, they now turn off when caught and the score is increased and displayed through 2d rendering. The spotlight is the reset with a new random location, colour and velocities and turned back on.

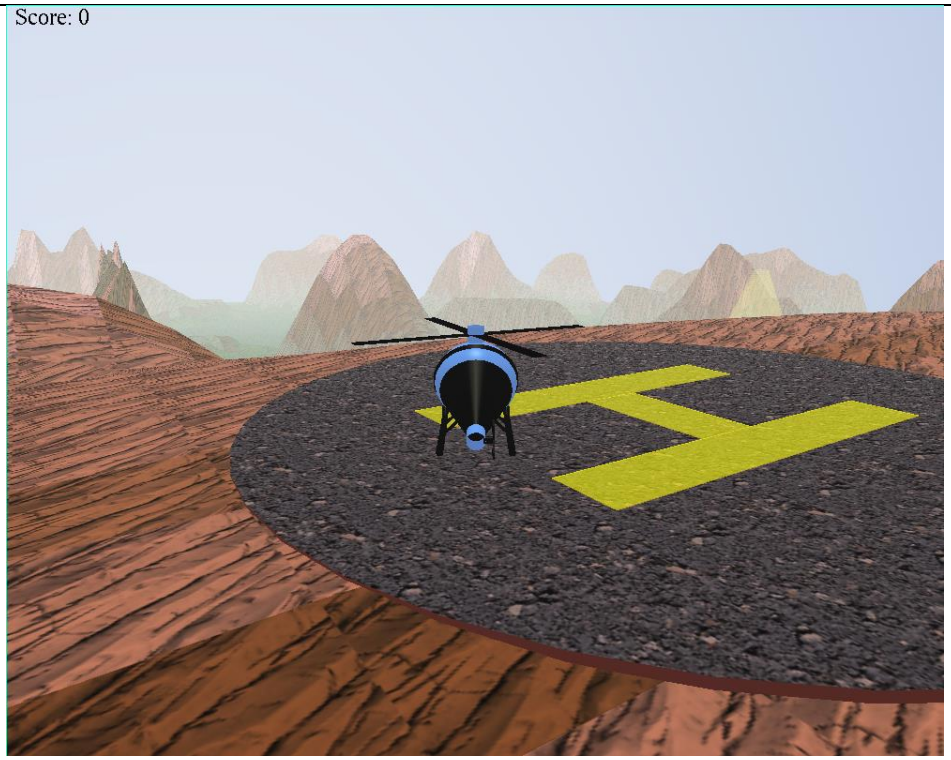


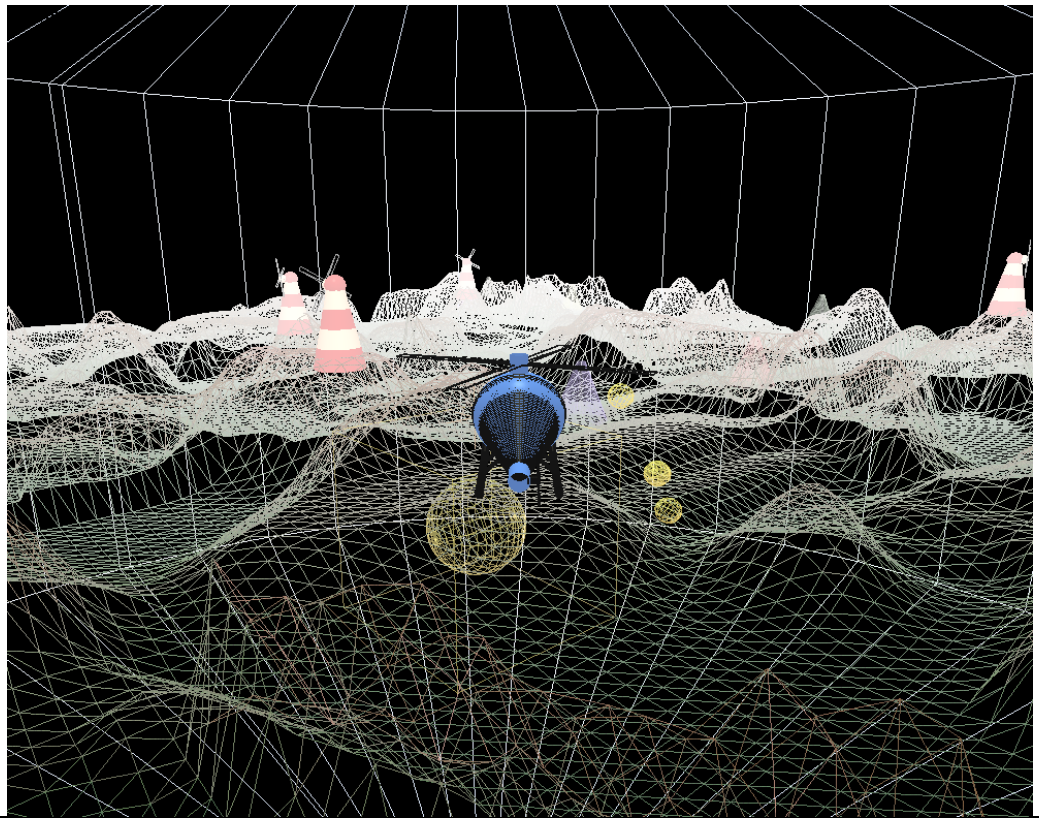

```
for (int i = 0; i < 7; i++) {

    if (heliCoord[0] < (spotlights[i].x + 0.5f)) {

        if (heliCoord[0] > (spotlights[i].x - 0.5f)) {

            if (heliCoord[2] > (spotlights[i].z - 0.5f)) {

                if (heliCoord[2] < (spotlights[i].z + 0.5f)) {
                    if (heliCoord[1] < spotlights[i].y)
                    {
                        if (spotlights[i].alive == 1) {
                            score += 1;
                            spotlights[i].alive = 0;

                            resetSpotlight(&spotlights[i]);

                        }

                    }
                }
            }
        }
    }
}
```

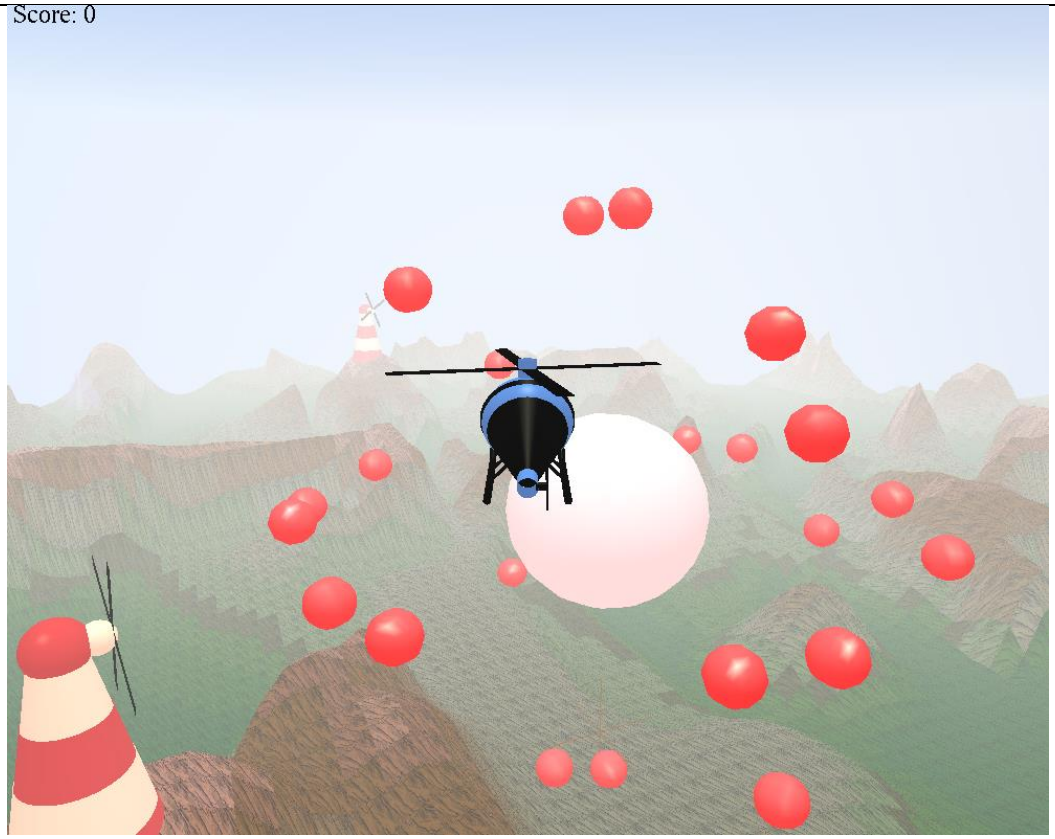
07/06/23 - 7h

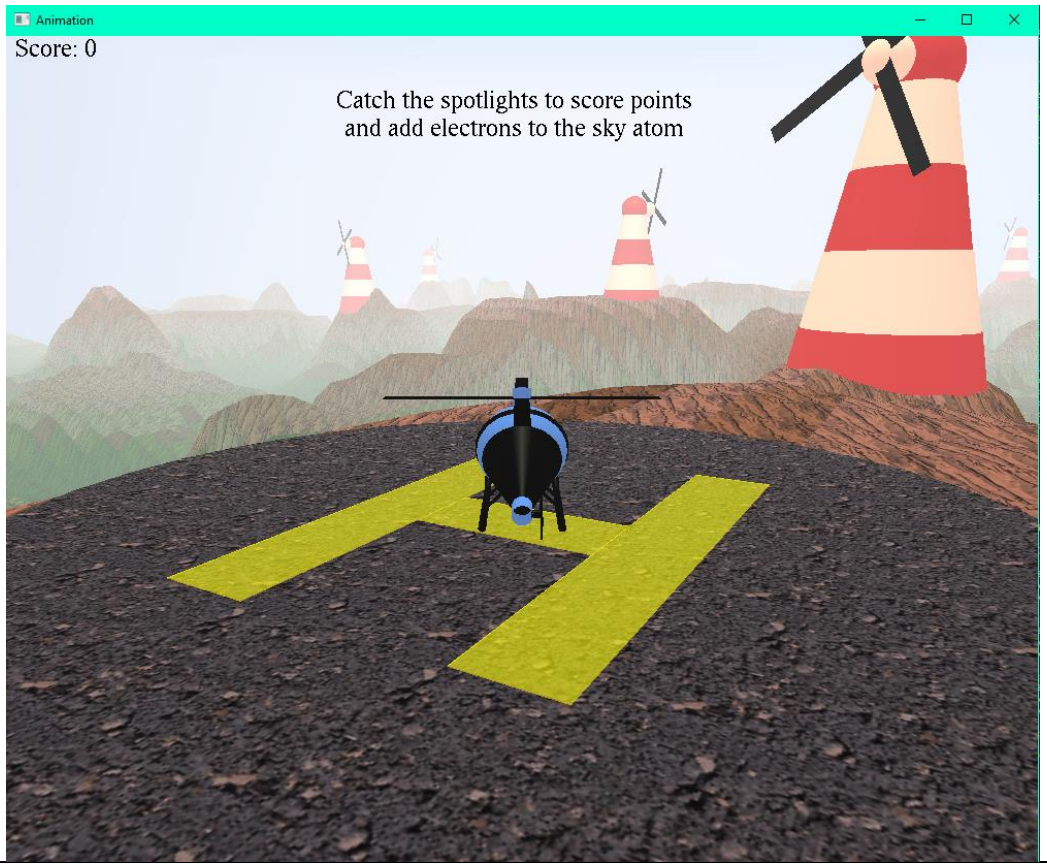
Work done:

- Helipad finished + H symbol added
- Backward movement bug fixed to taper instead of abruptly stop when key lifted.
- After getting comfortable with rotation animation throughout the project, I decided to create a fun atom graphic that gains an electron with every point gained. This was for fun I hope this is allowed I didn't have it in my proposal.
- I have also added a game instruction that displays until the helicopter first takes off.


Score: 0




Score: 0


Animation
Score: 0
Catch the spotlights to score points
and add electrons to the sky atom

Reflection:

On completing this project, I have gained a grasp of various aspects of the OpenGL pipeline. I have also gained new insight into working within a 3D space and manipulating objects within 3 axis. Additionally, lighting and its importance in the scene was something I had no prior knowledge of, but gained rudimentary experience with in this project. In totality, I have gained a foothold in graphics programming, a field in which I had prior interest yet no experience. I hope to build upon the knowledge I have learned in this project and explore other graphics technologies such as Touchdesigner, and other forms of computer graphics e.g. generative art. A thorough yet creative learning experience, this paper was one of the most enjoyable undertaken in my degree.