Shenzhou Spacecraft

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Virtual-scene Description

The first scene describes the launch of the Shenzhou 11 from the earth. In order to make it vivid, we add some effect such as fire and smoke. The four auxiliary boosters and the main rocket will be dropped after the Shenzhou 11 has been launched successfully. We have a button to control this process and we also can follow the motion of Shenzhou 11. And then we can see this spacecraft and Tiangong2 move around the earth. Moreover, we simulate the process of rendezvous and docking (RVD) between Shenzhou 11 and Tiangong 2. During this process, the speed will be changed based on the distance between two space crafts. Finally, we provide totally SEVEN perspectives to see the whole process such as the whole view, following the rocket or following the spacecraft. And we also add another spacecraft which moving around the earth and we can see the whole process from this spacecraft. Some parameters (speed, distance) can be showed

Basic Objects (Modeling, Rendering in Blender)

There are three main objects that include one rocket (Shenzhou11) and two space crafts (Tiangong2 and Shenzhou11). We use blender to model them.

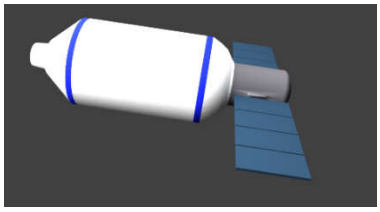
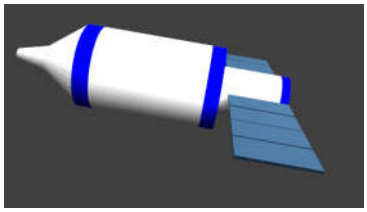
1. Rocket

The rocket has one main body and four auxiliary boosters. For the main body, the basic shape is a cylinder. But on the top of cylinder, it has the antenna. And there are four flat surface on the top middle of the cylinder. To make it more realistic, we enlarge the bottom of the cylinder and add some corrugation to it. We also add nine fire devices at the bottom of this main body for rocket. And for the four auxiliary boosters, we use small circular cones to simulate them and add some details to make them vivid.

We use white color to represent the overall tone for this rocket and add blue, red stripe to make it more like the real Shenzhou11. In order to get better visual effect, we add launching pad, meadowland and deongaree sky as the background. And give some light and shadow effect.

We also use the blender to simulate the launch process and add some fire effect, but it's too slow to render this process and get a high solution. So, we give up this process and use unity3D to do this work.

2. Spacecraft

Tiangong 2 spacecraft mainly consists of two parts, the body and solar panel. In fact, the body of the spacecraft is the Manned Space Laboratory where space experiments are conducted and solar panel is the device that traps the sun's light and convert it to electricity which will be used for human beings' activities and experiments in the laboratory.

In our project, Tiangong 2 spacecraft is modeled in Blender by using cylinder and cubes. Cylinder is applied in the body of the spacecraft and cubes are used for the solar panel. We utilize some transformation on the cylinder, such as extruding, resizing, smoothing and so forth to make the body like the real spacecraft. Then different materials are used to make the spacecraft more realistic, such as texture and color. The main color of the body is white interlaced with deep blue. As for solar panel, there are totally 8 panels in light blue with the half number of them on each side of the body.

The earth is made by using UV Sphere with enlarged segments and rings which are beneficial to similarity. We use two views to model the earth. One is the 3D view and the other one is UV/Image view which is also sometimes changed into Node editor view to configure the material and texture attributes. The 3D view is applied Sphere Projection in the process of earth modeling. Most of the material images that are utilized to create lively effects are downloaded from NASA website, such as the global map image of earth, corresponding earth bump image and cloud image. In addition, we also create another sphere a little larger than earth to make light blue atmosphere effect.

User Manual (Control and Special Effects in Unity3D)

Part 1: Seven perspectives (use Keyboard: 1 2 3 4 5 6 7)

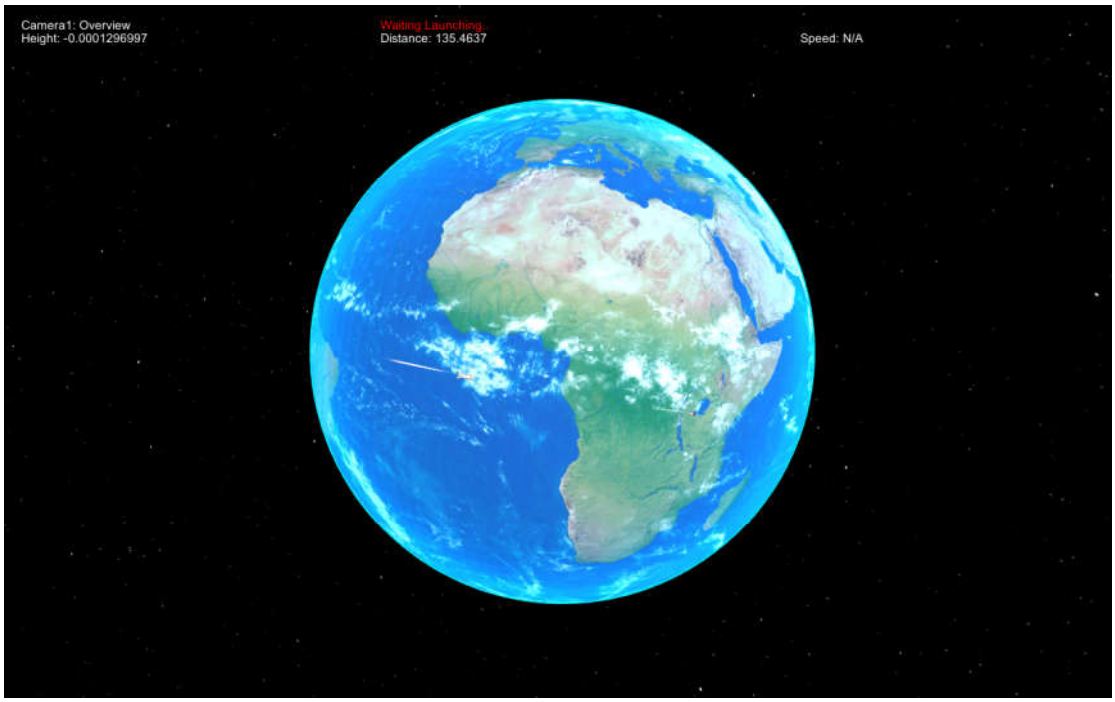


Figure 1. Overview

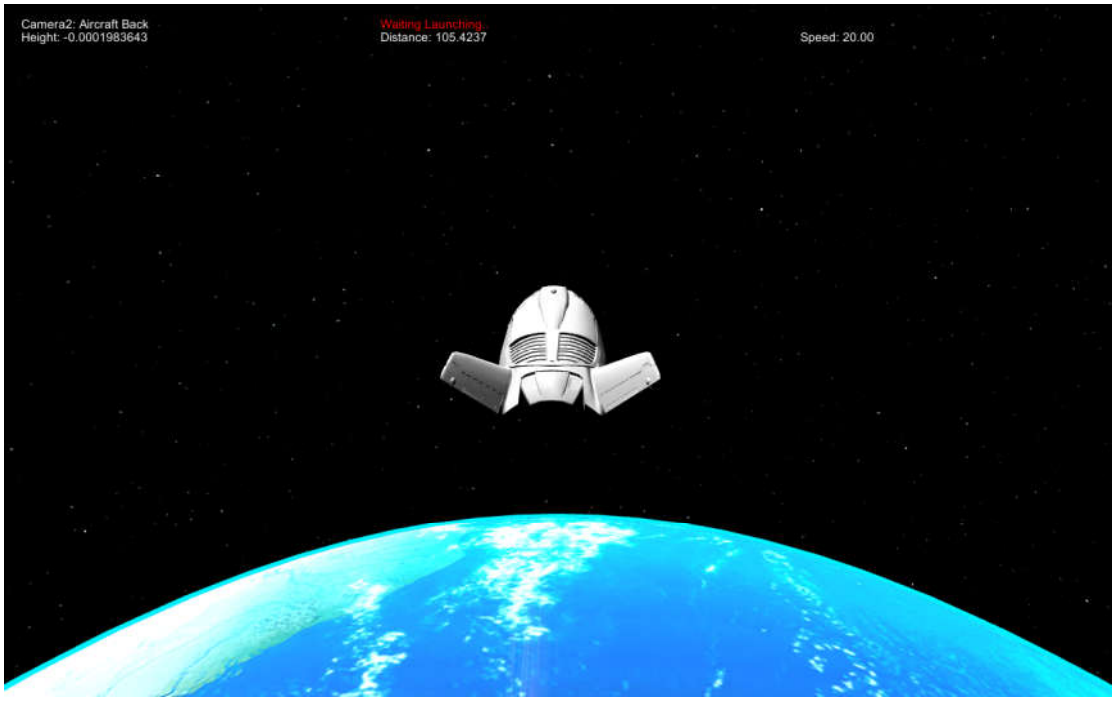


Figure 2. Aircraft View1

Figure 3. Aircraft View2

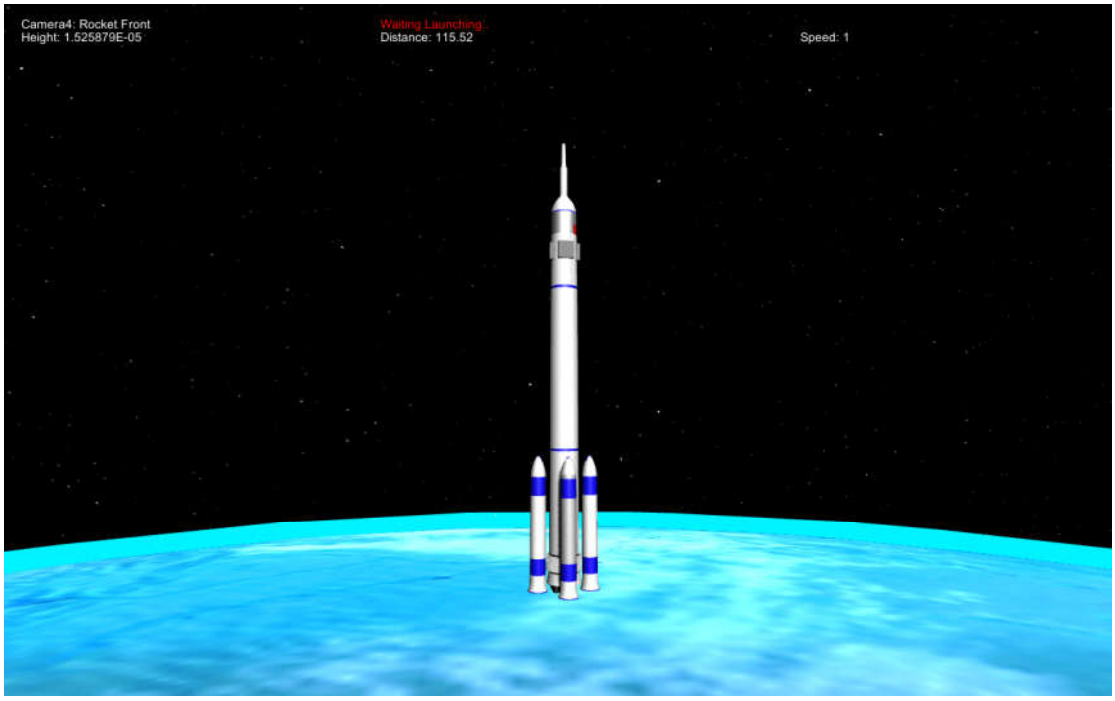


Figure 4. Rocket View1

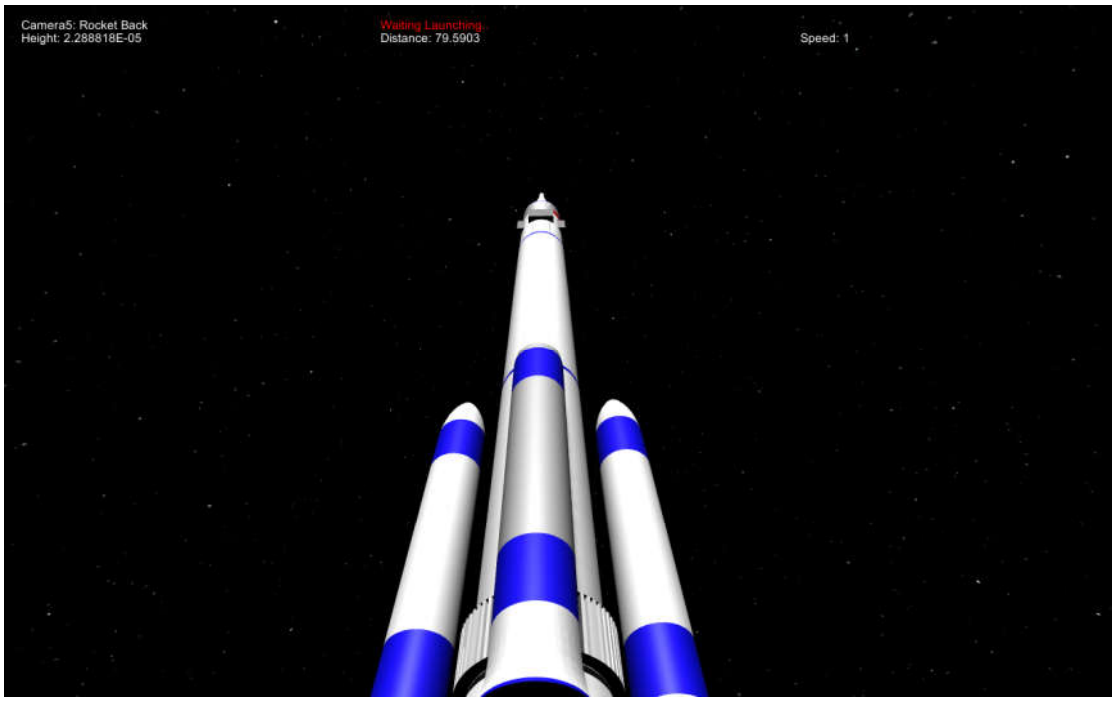


Figure 5. Rocket View2

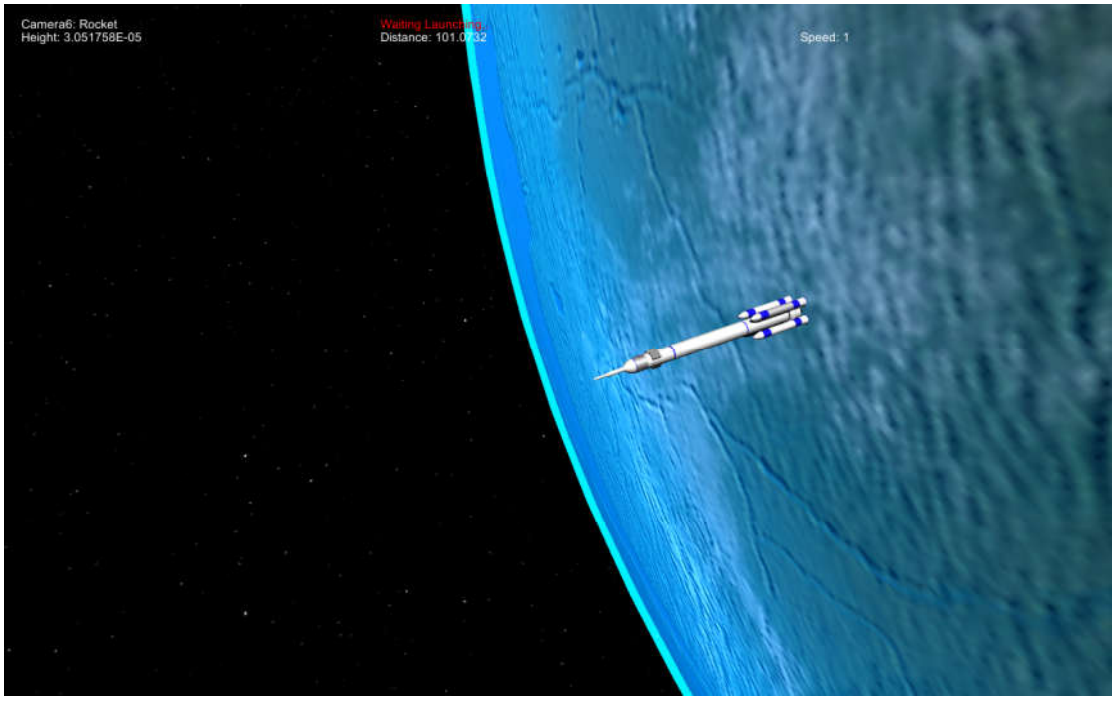


Figure 6. Rocket View3

Figure 7. Spacecraft2 View1

Part 2: Rocket (from launch to cruise)

Using “Left Ctrl” to go to the next step like launch, joint, etc.

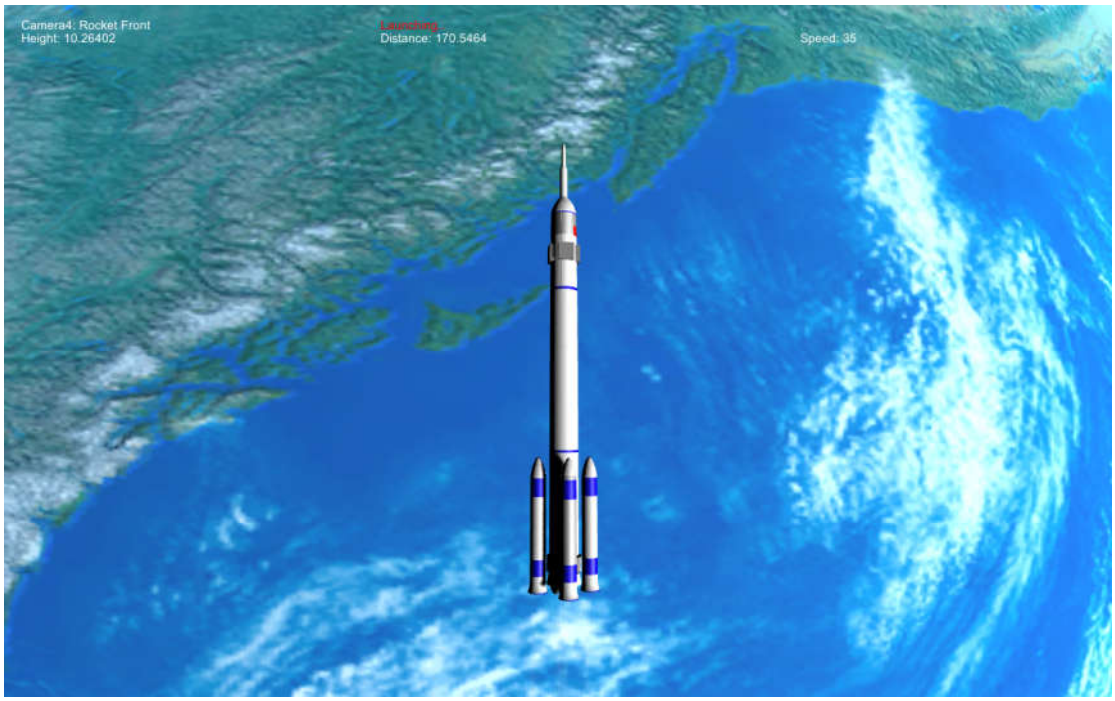


Figure 8. Rocket Launching 1

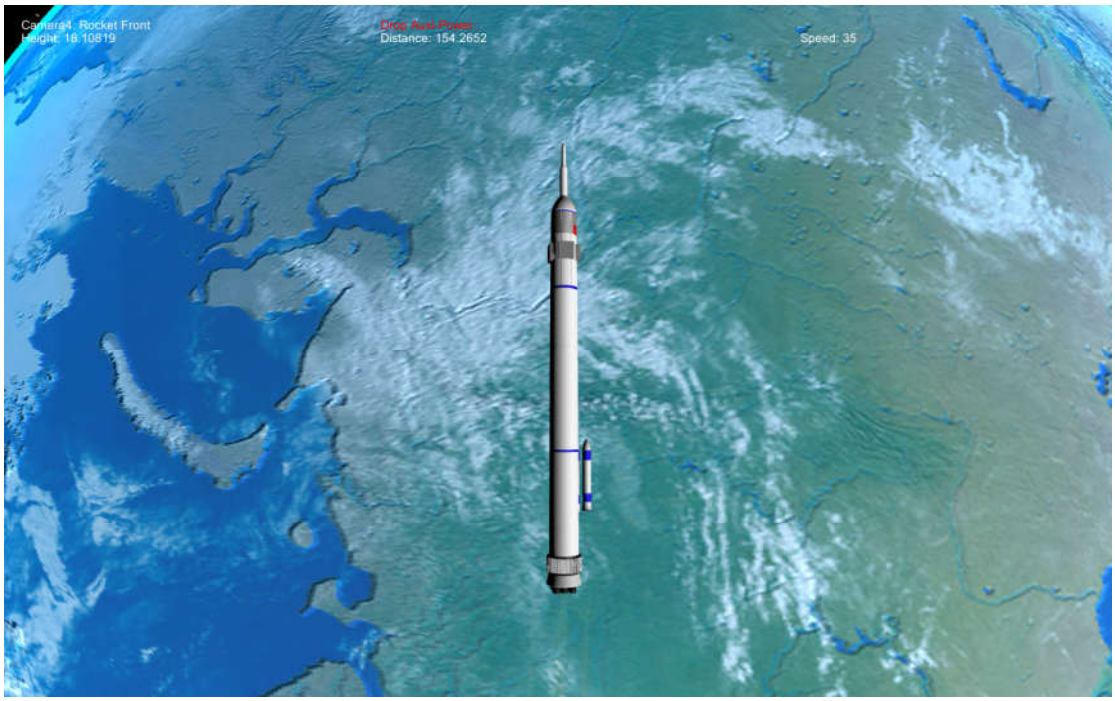


Figure 9. Rocket Drop the Auxi-Power

Figure 10. Rocket Cruise 1

Figure 11. Rocket Cruise 2

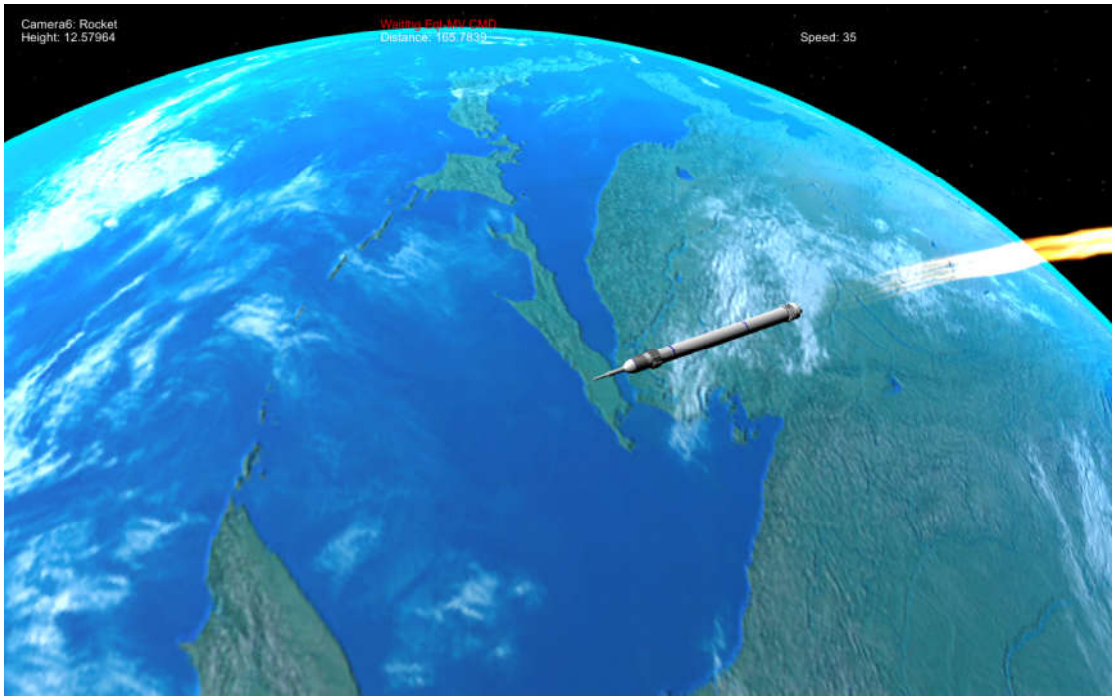


Figure 12. Rocket Cruise 3

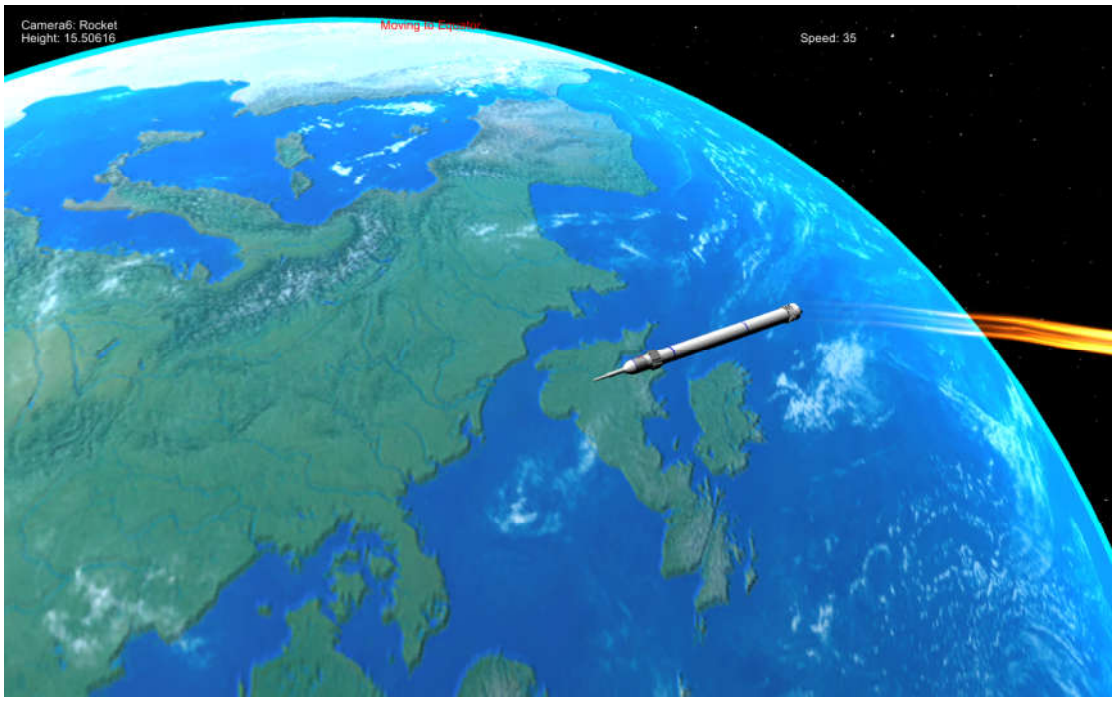


Figure 13. Rocket Move to Equator

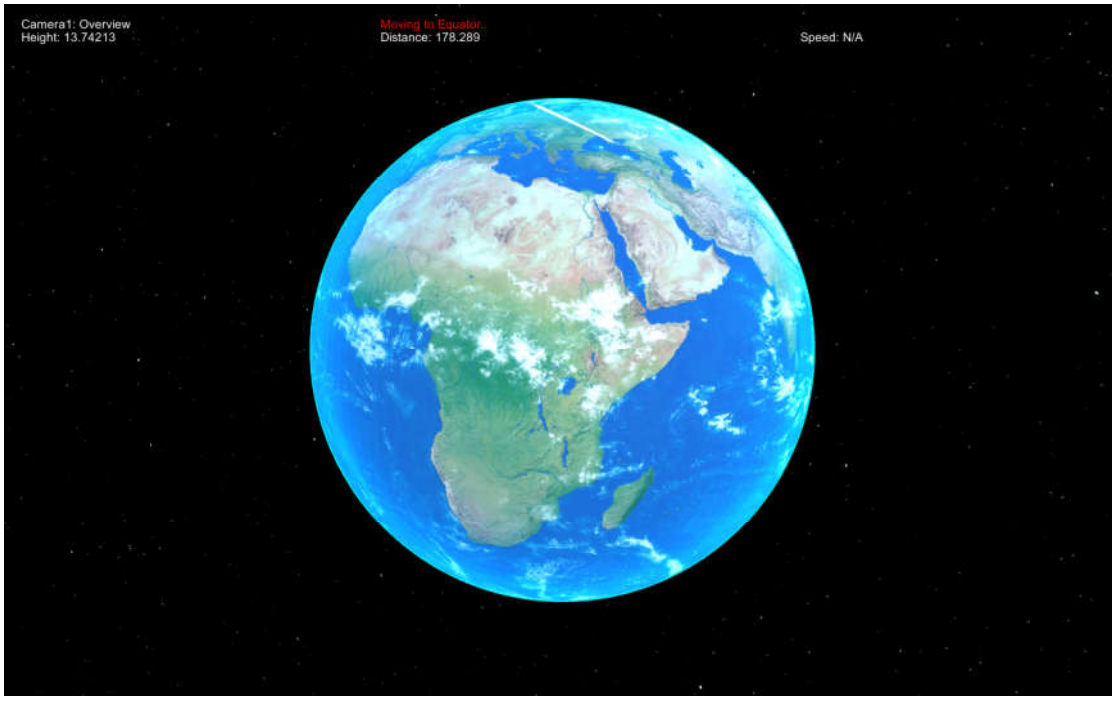


Figure 14. Rocket Move to Equator

Part 3: rendezvous and docking (RVD) preparation

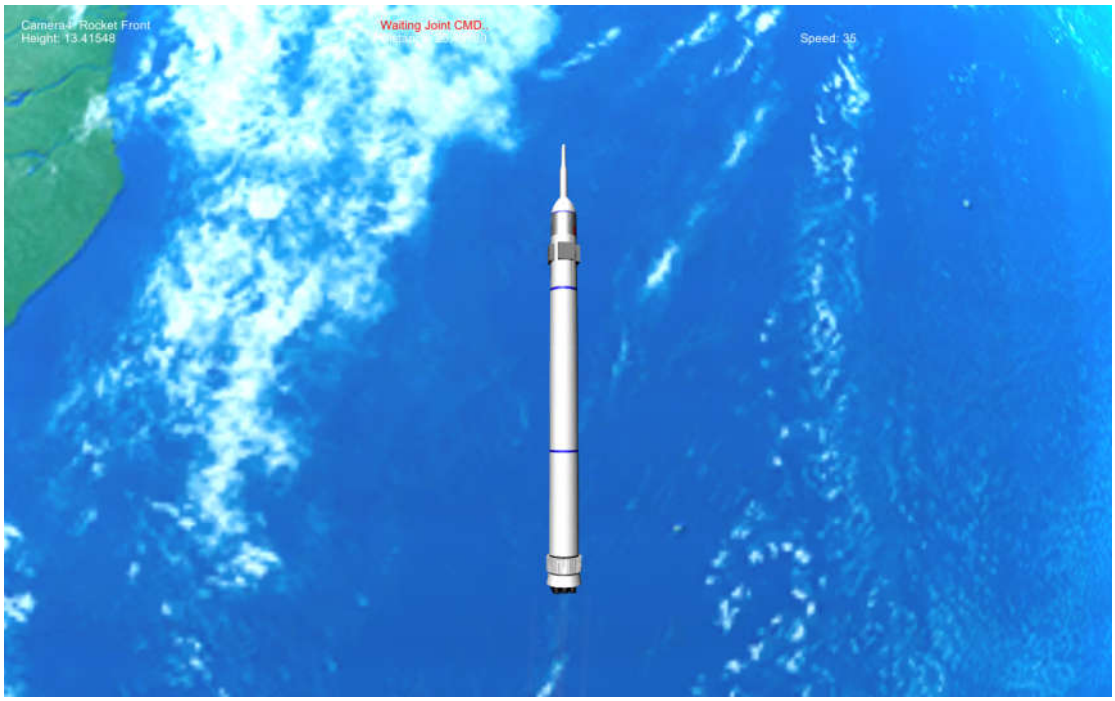


Figure 15. Waiting for Joint Command 1

Figure 16. Waiting for Joint Command 2

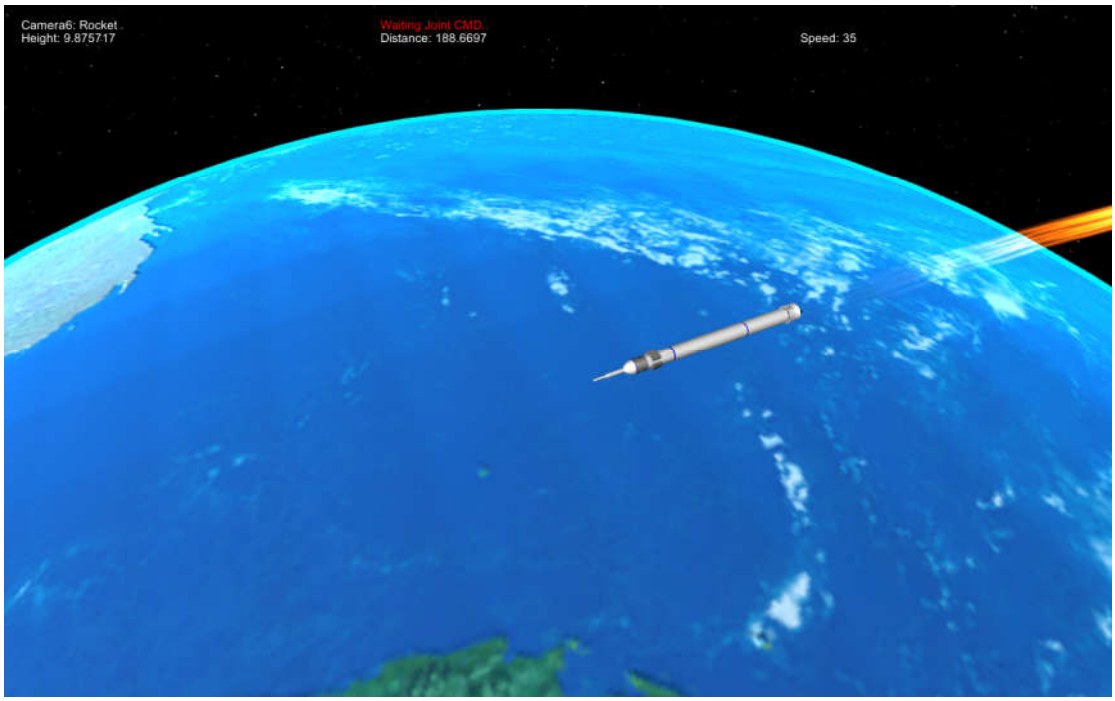


Figure 17. Waiting for Joint Command 3

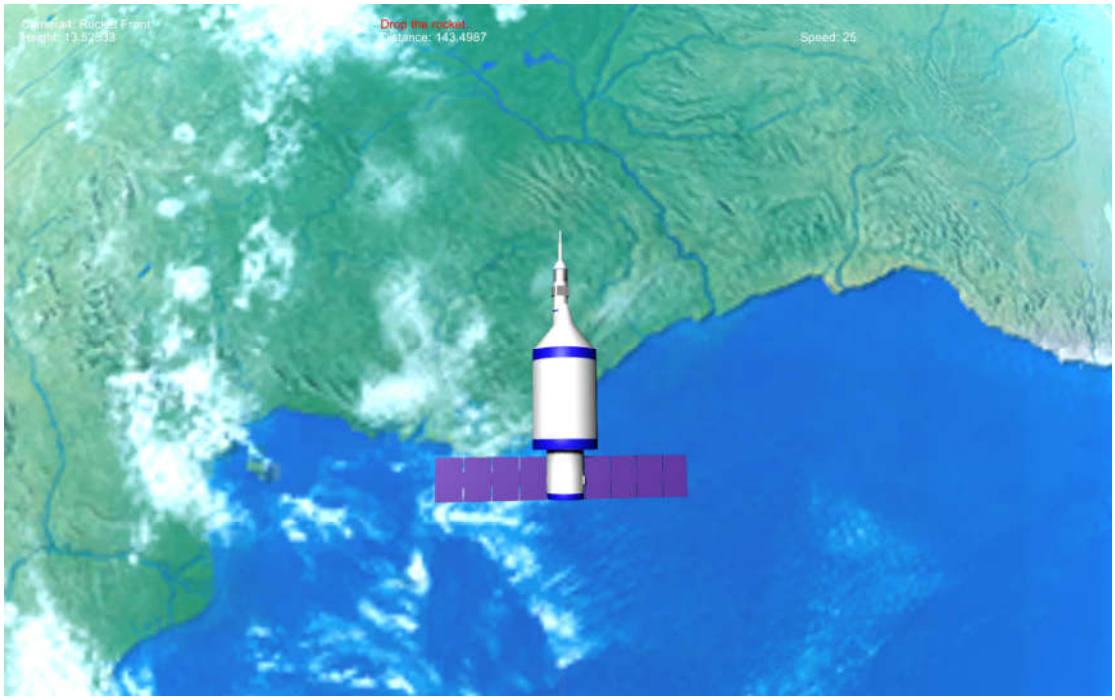


Figure 18. Drop Rocket 1

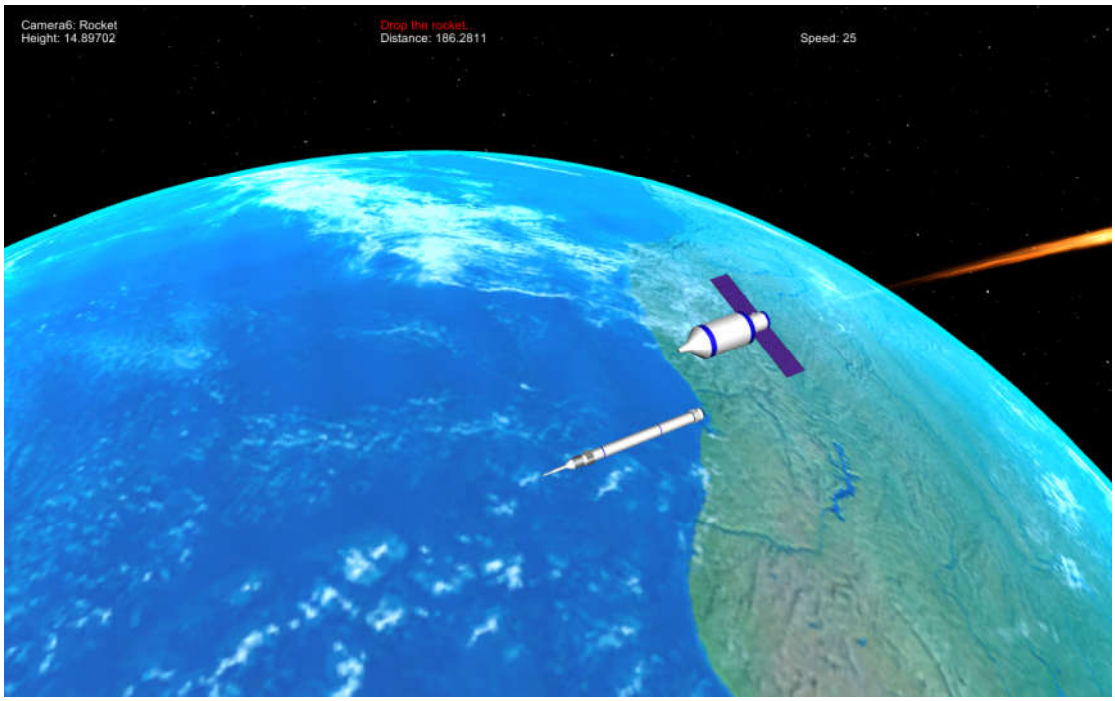


Figure 19. Drop Rocket 2

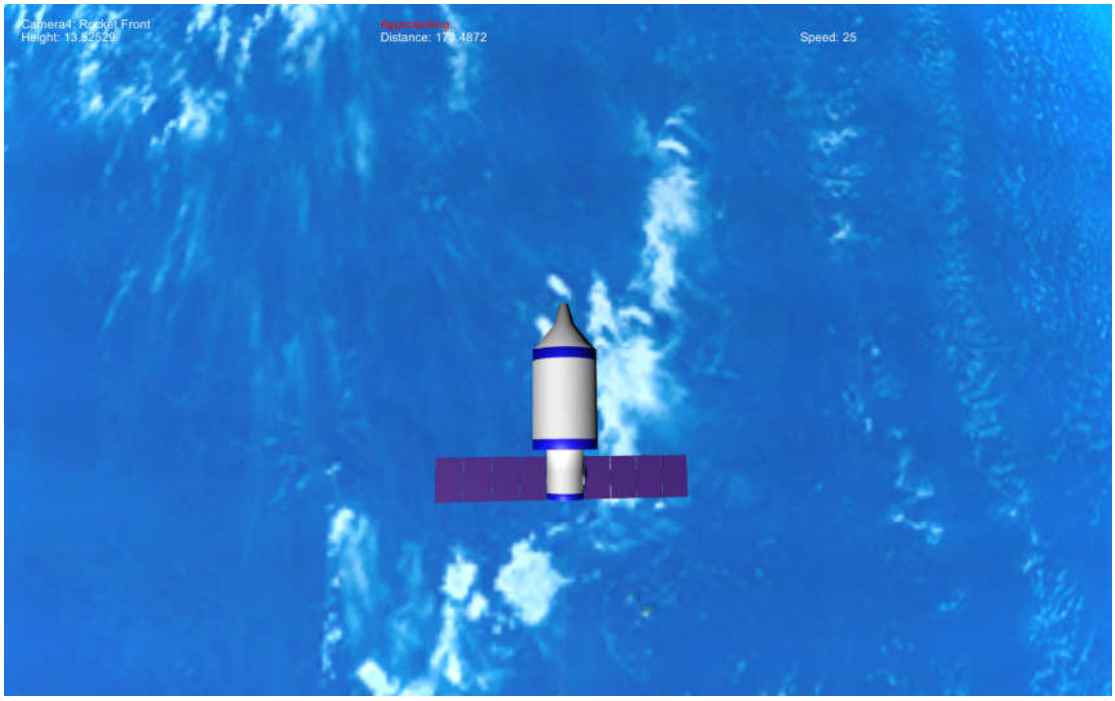


Figure 20. Spacecraft1 Approaching Spacecraft2

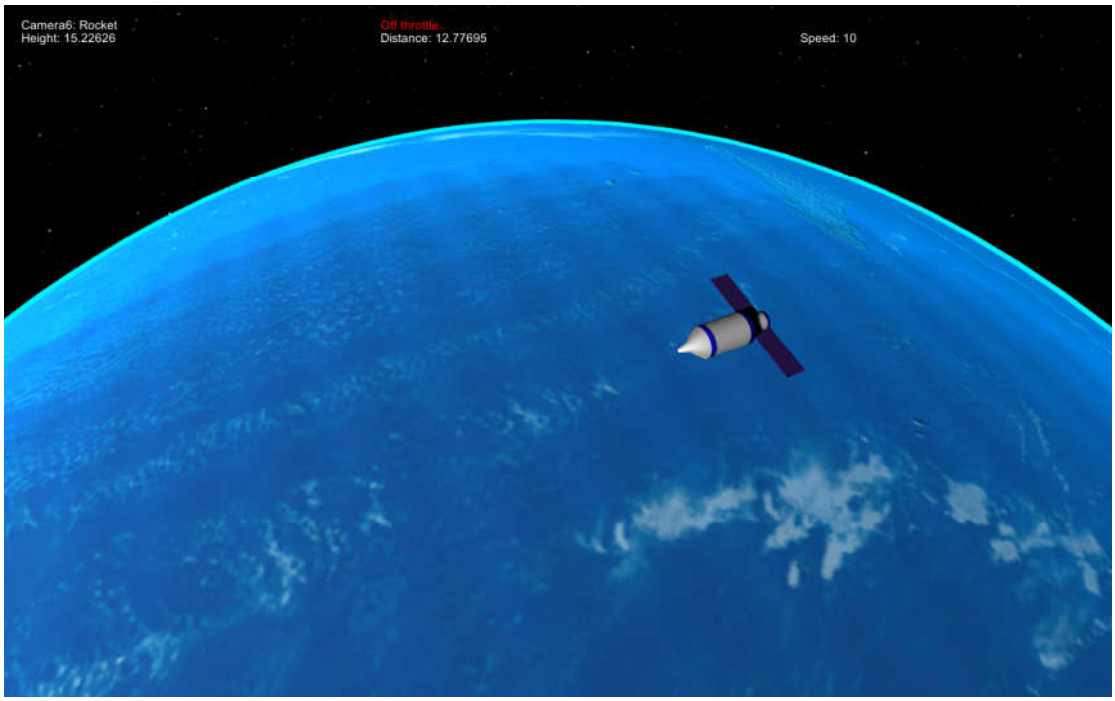


Figure 21. Turn off throttles

Part 4: rendezvous and docking (RVD)

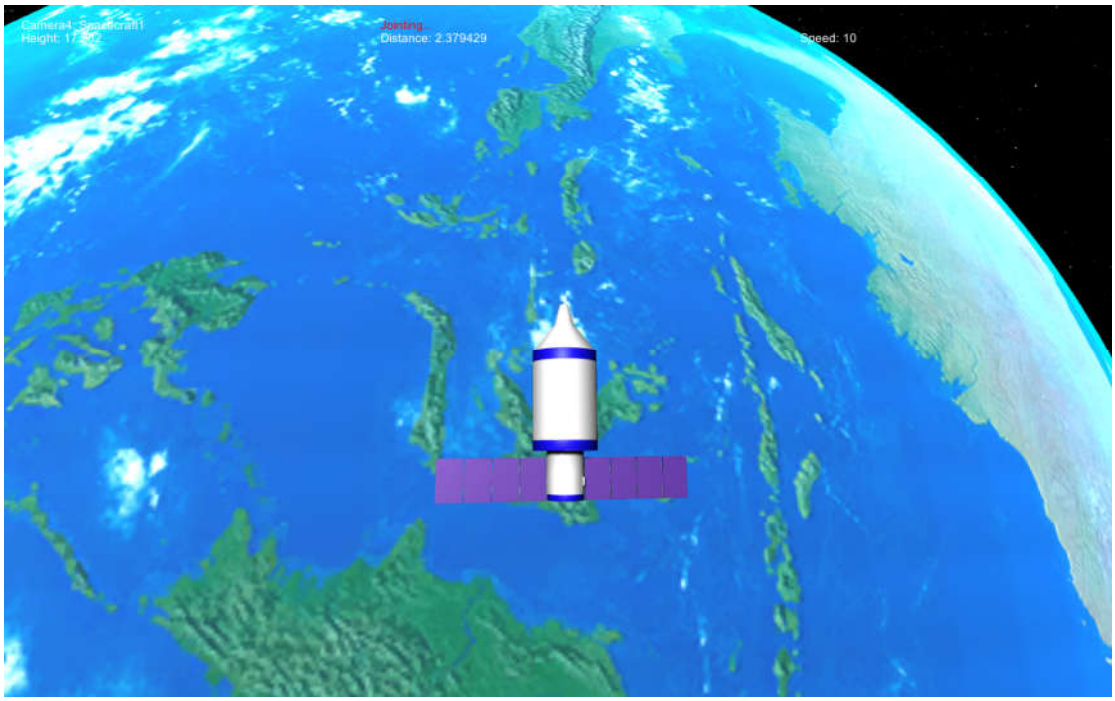


Figure 22. Jointing

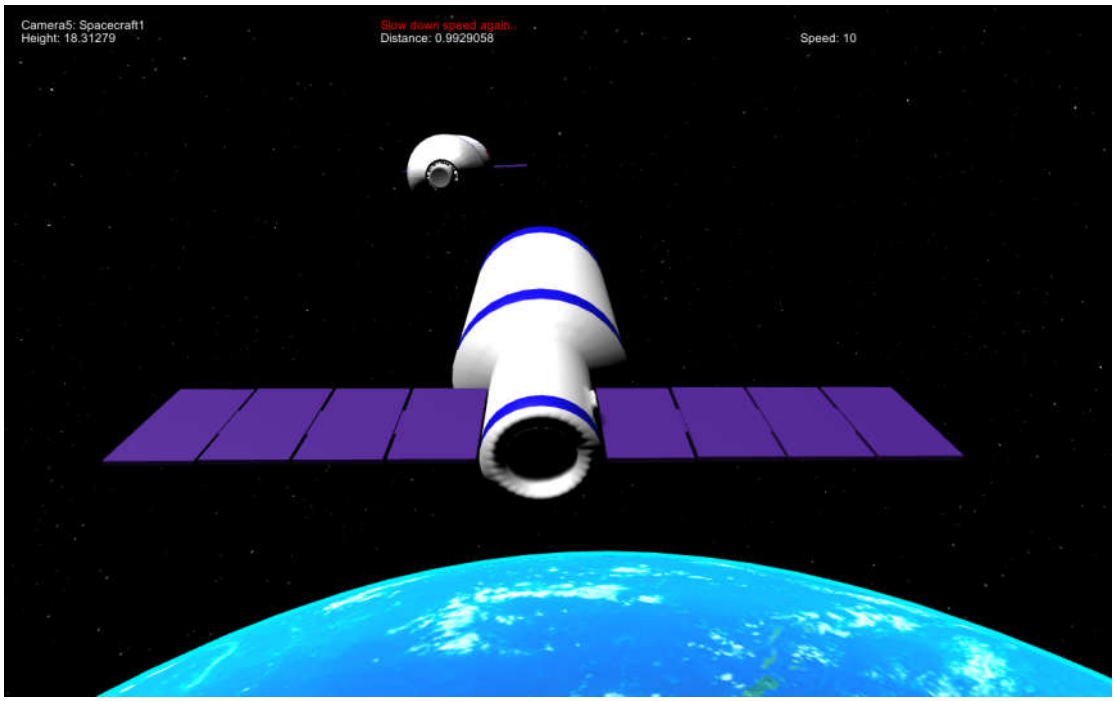


Figure 23. Slow down 1

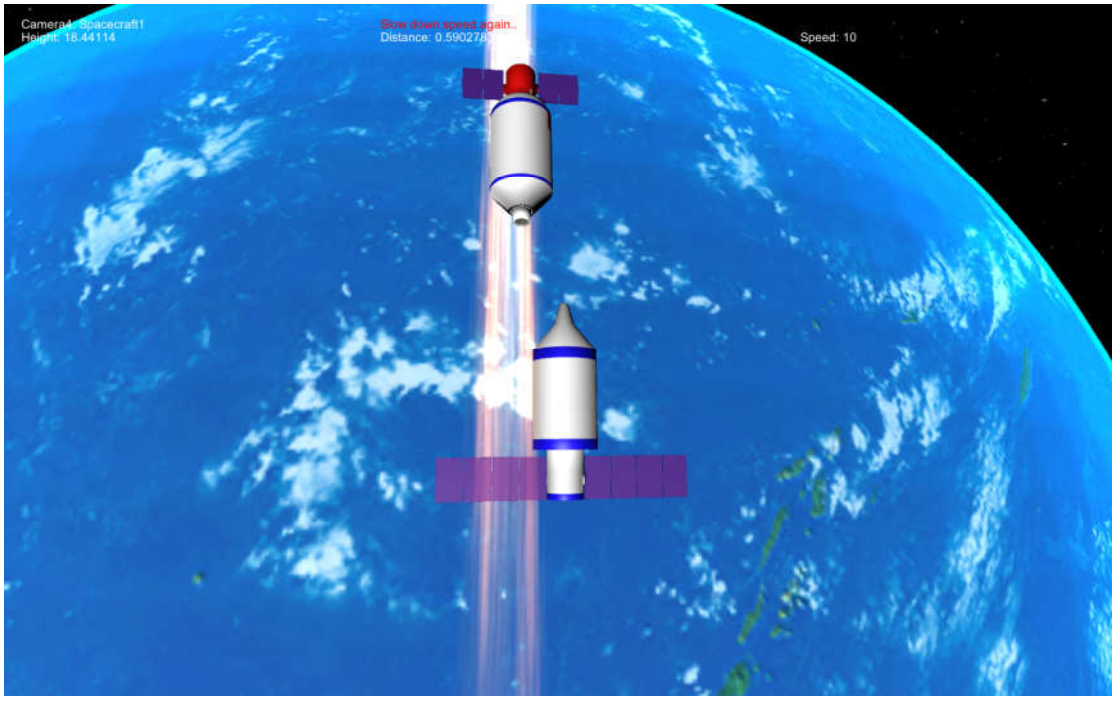


Figure 24. Slow down 2

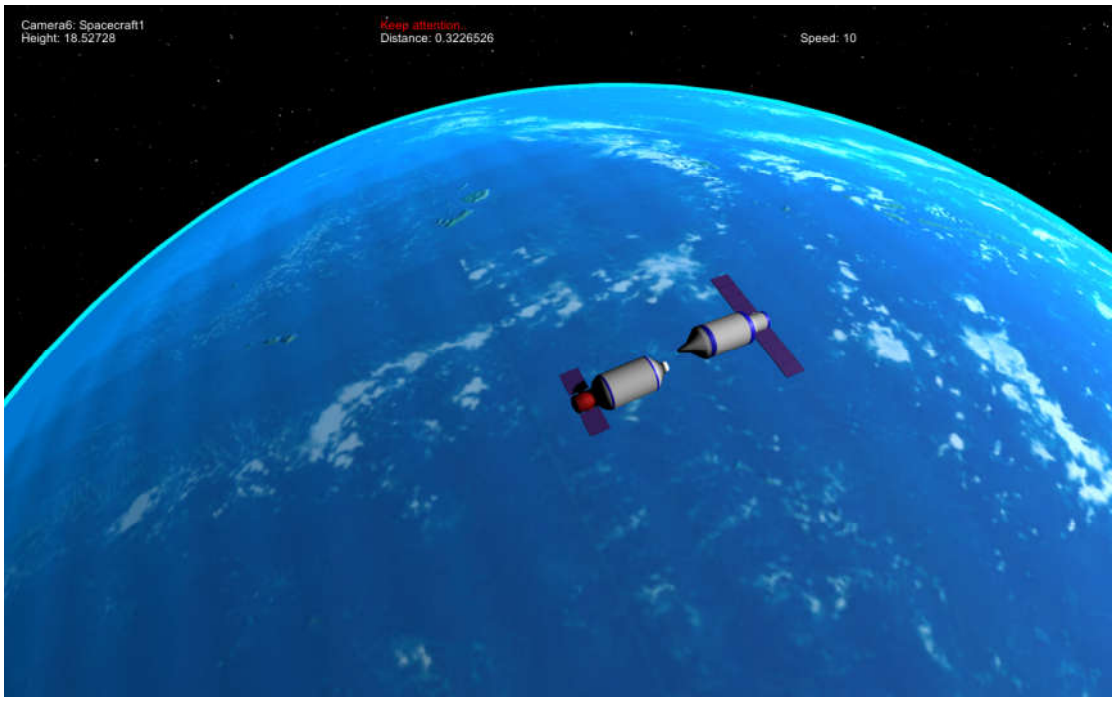


Figure 25. Keep Attention

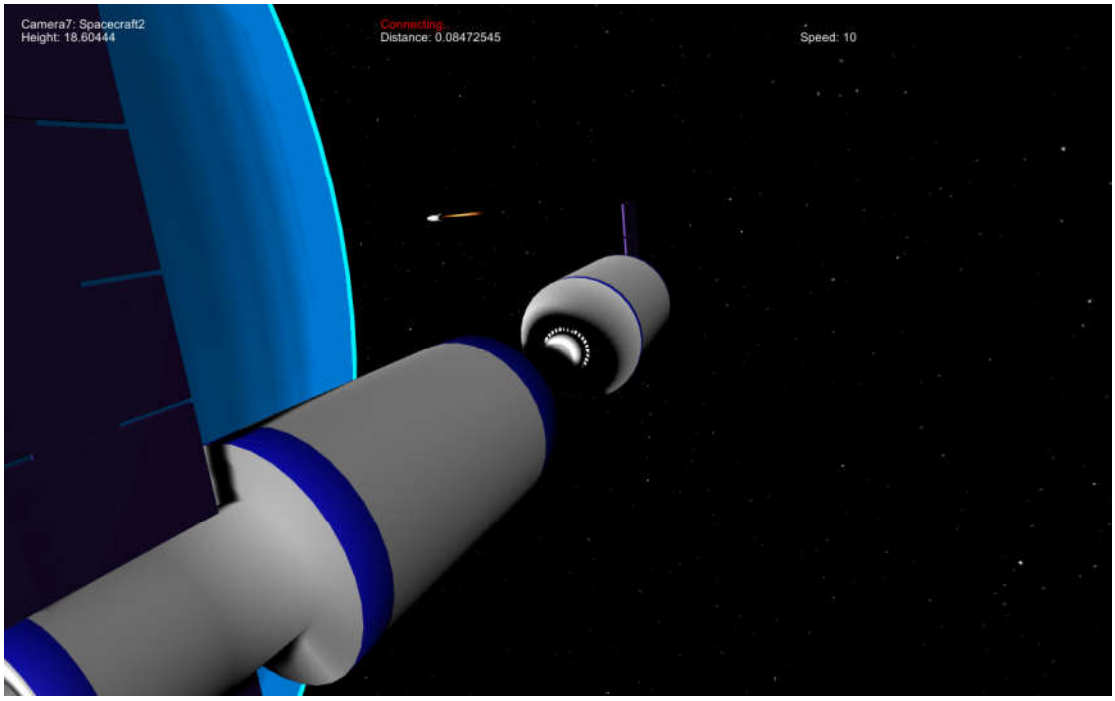


Figure 26. Connecting

Part 5: Mission Complete

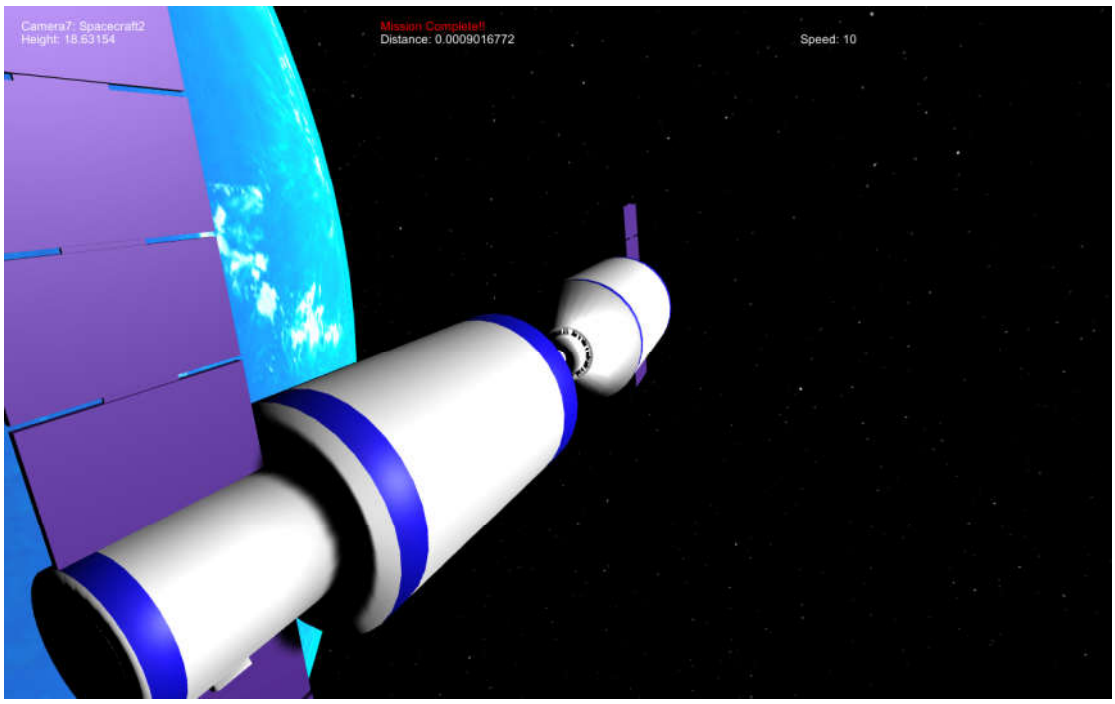


Figure 27. Mission Complete 1

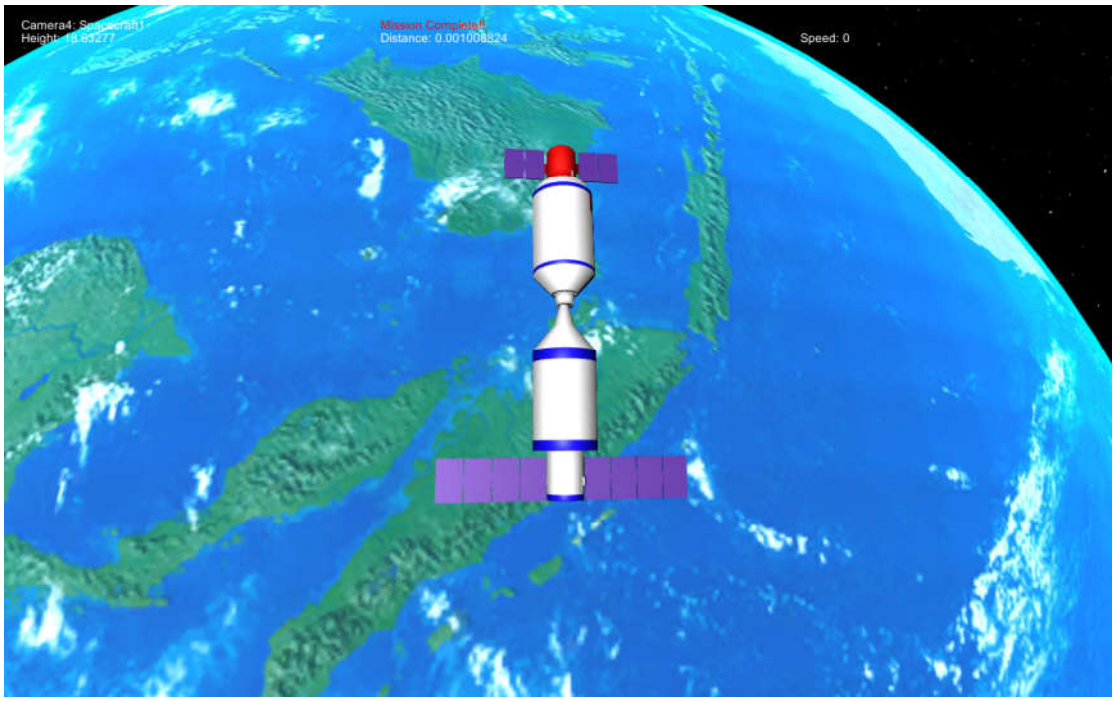


Figure 28. Mission Complete 2

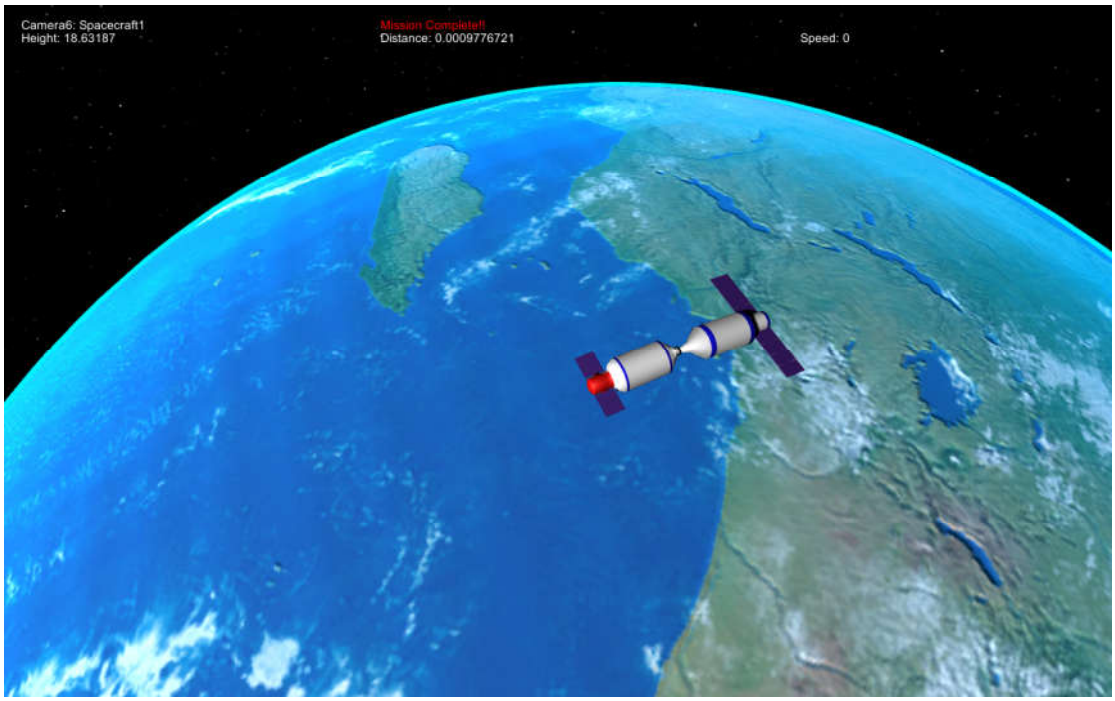


Figure 29. Mission Complete 3

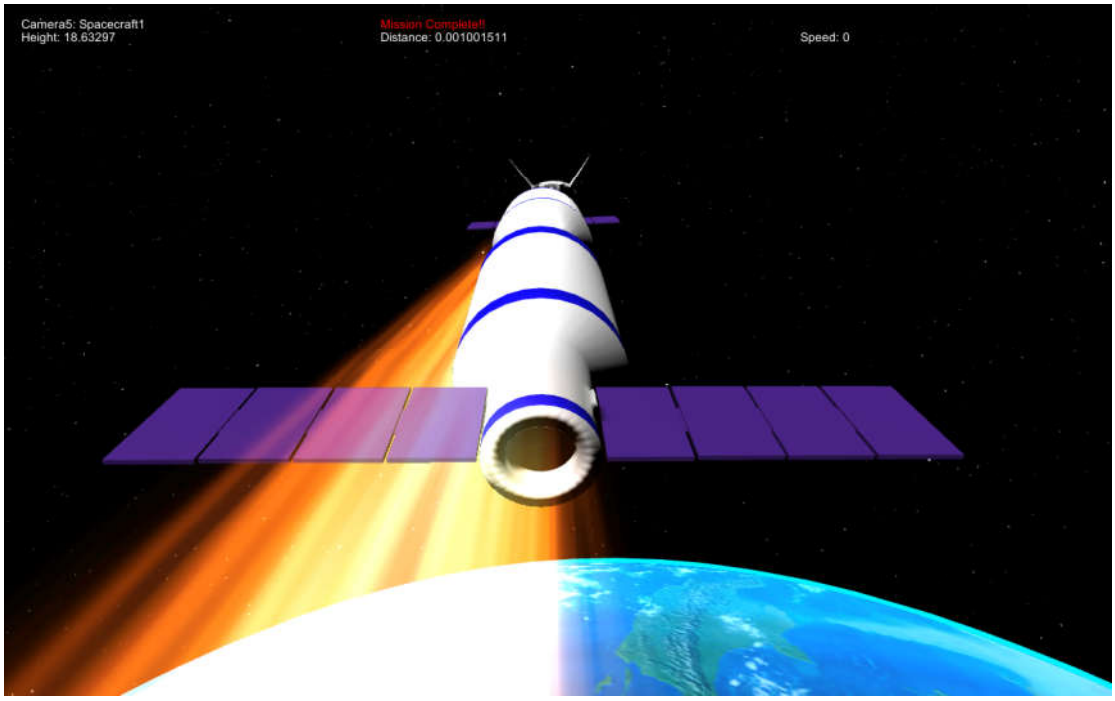


Figure 30. Mission Complete 4

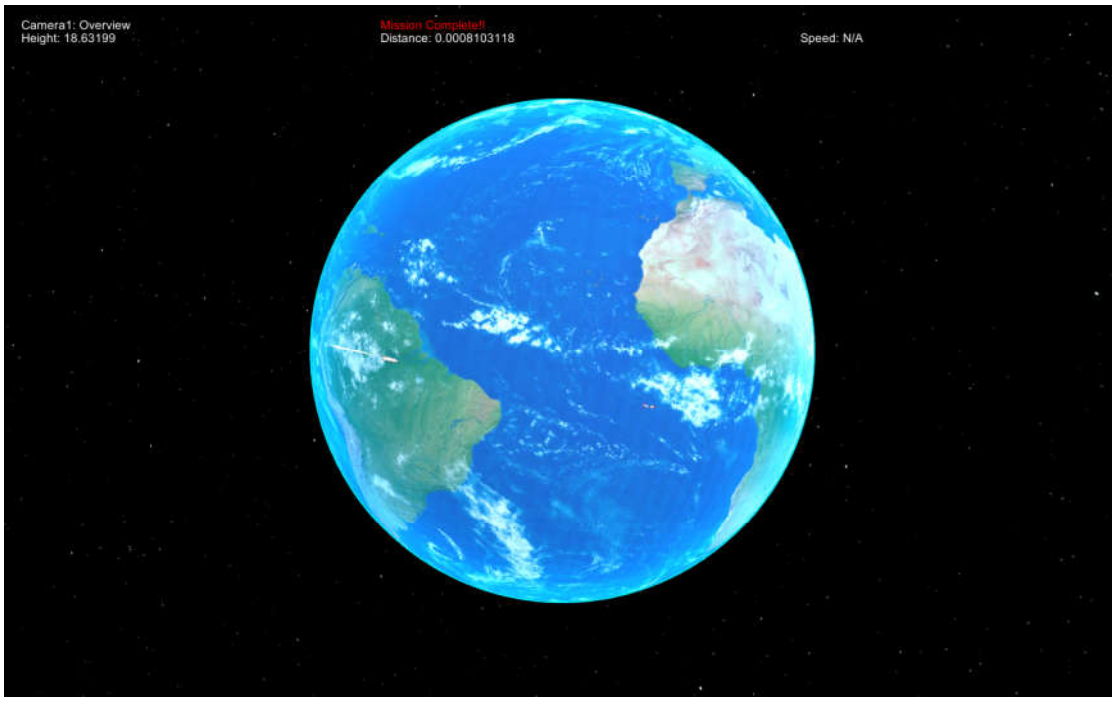


Figure 31. Mission Complete 5

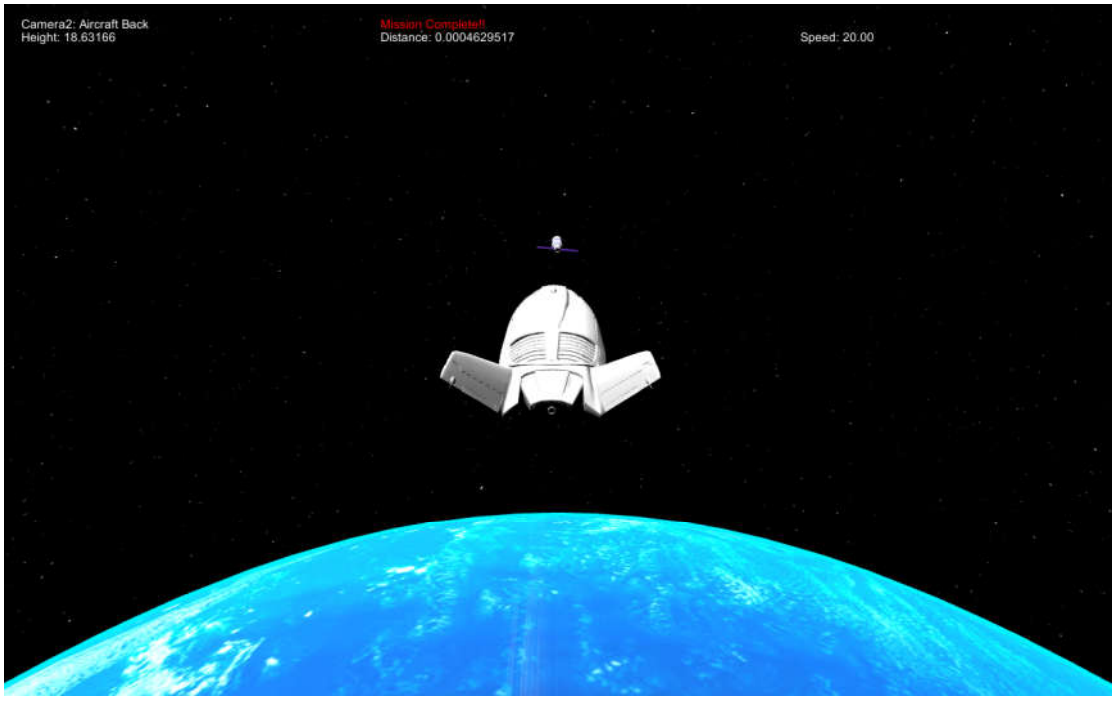


Figure 32. Mission Complete 6

Figure 33. Mission Complete 7