Executive Summary

The Office of Strategic National Alien Planning (OSNAP) has made a sample project proposal for a realtime cannon defense system against UFO's, and our group has adopted this idea as our own. We will deal with a 2d environment rather than three, and implement a very similar environment. We will send ufos across a region monitored by a few cannons equipped with our own defense software and change the speed and direction of the ufos to add complication.

Project Description

This project will simulate ufo's flying into some space that is monitored and defended by the cannons. The simulation will require a number of cannons, ufos, and time range in order to be run correctly.

To accommodate our program, we will build a visualization of what's happening in real time, a radar system to account for all the data on the screen, a defence system to help give the cannons intelligence, and a random ufo generator. The visualization will show the area the radar is watching as well as the cannons, ufos, and any movements and collisions that occur during the given time frame. The radar system will essentially be raw data about the 2d space and a given instance of time. The intelligence will use some prediction methods to guess where to shoot the ufo down. Lastly there will be something to generate ufos and dictate their flight.

The simulation will require the user to give it a time frame, number of cannons, and number ufos. While exploring the project if options arise to add other inputs we may add or subtract fields depending on what is best.

Highlevel Architecture

Radar

This will keep a set of data of everything in the range of radar or rather just what is being displayed. This will be manipulated by the simulator (physics) which gets info from intelligence (cannons).

Simulator

The simulator is where our physics is calculated. This engine tracks everything in the radar space and applies the laws of physics to it and tells us if something hit or not. The simulator will manipulate the data the radar creates and also take into account the actions of the cannons and then return new models of data to the simulator and back to the radar to update as time continues.

Intelligence

Our intelligence will be the guide to our cannons firing methods. This will evaluate the data from the radar and use different methods to calculate the next location of the ufo.

Visualization

The visualization will show everything in the radar. Since this skill is not a strong point for anyone in the group, we we strive for a functional layout. We will show the ufos, cannons, and radar space over given piece of time.

Parallel Plan

The entire program will incorporate multiple areas to implement parallelism.

The radar and simulator will create a data representation in blocks that are able to be assigned to a single thread per block. This will require efficient pattern use to handle movements and interactions (collisions) that occur during the simulation. We will partition the grid of data in this way to get the most efficient parallelism

With a partitioned set of data we will write methods to compute intelligence to shoot down ufos as well as track them. This will require some physics calculations and predictions that will be parallelized as much as possible.

If we have extra time, we would like to explore using MPI to spread the simulator and AKWDS computations across nodes to increase the size of simulation that can be done in realtime.

Project Schedule

Iteration 1:

-animation w/ flying ufo (constant speed)
-cannon in graphics

Iteration 2:

-cannon tracking
-ufo fly w/ random velocities

Iteration 3:

-ufos get shot (collision detected)
-ufo random y movement

Iteration 4:

-implement things in parallel -> improve