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Project Proposals

Future Air Combat

Problem Domain:
According to Dr. John Stillion[1], air combat in the near future is likely to be a BVR (beyond visual range) slug-fest with two or more low-observable missile trucks exchanging volleys of long-range missiles after spotting targets through the use of semi-expendable reconnaissance drones.

This begs the question, how "missile-trucky" is too much? Would an aircraft the size of an F-22 be ideal? Something the size of a B-1? Or even a monster like Lockheed's CL-1201 concept. The purpose of this project is to simulate air combat as an abstracted game to find the best vehicle configuration to capture air dominance.

Modeling:
Aircraft and missiles would be modeled using a modified and somewhat simplified version of the system used for *Harpoon*, a naval-combat tabletop game that originated as a combined-armed naval combat training tool. Damage would be modeled as a simple hit-points system, using data checked against *Harpoon* and *Command: Modern Air-Naval Operations* which are roughly equivalent to a subject-matter expert.

Simulation:
Battles would be run with different force compositions in a grid matrix to make sure every composition fights ever other composition. Battles would be fought until one party was destroyed. Multiple battles would be run for each combination in the matrix to try and avoid flukes.

Visualization:
The end result would be a "victory matrix" for each force composition showing how often it defeated each possible opponent. By the nature of the simulation, a direct visualization (possibly through Gnuplot, or an in-engine display using something like Unity, since I've previously implemented something similar in Unity) could easily be provided for the reviewing the actual battle.

Analysis:
Winning most battles most of the time would be considered better. The average of each value from the victory matrix would be a numerical representation of that particular force composition's average combat effectiveness.

1 http://csbaonline.org/research/publications/trends-in-air-to-air-combat-implications-for-future-air-superiority

Air Freight

Problem Domain: During WWII with German U-boats threatening to lock down Atlantic trade, the Howard Hughes and Henry J. Kaiser (of liberty ship fame) developed the HK-1 (later H-4) flying boat as a "flying cargo ship." In the real world, the concept was never adopted, but that begs the question: How bad would shipping losses need to be for the Spruce Goose to take off (pun intended.)

Modeling:
A HK-1 Hercules, Liberty-ship, and conjectural ground-effect version of the HK-1 would simulated in the abstract in terms of cargo throughput (tons per mile-hour) with only the Liberty ships being subject to submarine losses (a variable that could be scaled to represent a more or less aggressive U-boat force.)

The number of liberty-ships needed will be kept constant, but the number of planes will vary to match cargo throughput. Cost of each will be displayed, as will the cost of ships to transport the same amount of material *with* losses.

Simulation:
Run cargo missions while under differing U-boat threat.

Visualization:
Numerical output plotted as graphs.

Analysis:
Which transport system provides better strategic material delivery (in terms of dollars spent per ton/mile-hour), and where's the point where airplanes take over from surface ships.