

# eVTOL Simulation Problem

## Objective

Show us your awesome skills! The intent of this problem is to allow you to showcase your design, coding, documentation, testing and communication skills!

## What we are asking

Read the problem statement, then set out with a solution. This work should be coded in **C++**, and submitted through GitHub. You can simply upload the code and documentation to your personal account and send us a link.

If at all possible, provide a way to compile this on Linux. (e.g. CMake, Makefile, or a shell script)

## Skills to showcase

At Joby we love good OOP design. Please exercise the basic tenants of OOP, using relevant principles where appropriate. We also would be interested in seeing your ability to operate in a multi-threaded environment. Elegant, clean, clear, simple and well documented code is what we are looking for.

## Test your code

Unit Testing is a big part of our development process. Please include a few examples of unit tests. They don't really need to run in any test framework, but please be ready to talk about what and why you tested. Using GoogleTest would be a bonus.

## Problem Statement

There are five companies developing eVTOL aircrafts. The vehicles produced by each manufacturer have different characteristics. Six distinct properties are laid out in the below table:

	Alpha Company	Beta Company	Charlie Company	Delta Company	Echo Company
Cruise Speed (mph)	120	100	160	90	30
Battery Capacity (kWh)	320	100	220	120	150
Time to Charge (hours)	0.6	0.2	0.8	0.62	0.3
Energy use at Cruise (kWh/mile)	1.6	1.5	2.2	0.8	5.8
Passenger Count	4	5	3	2	2
Probability of fault per hour	0.25	0.10	.05	.22	.61

The objective is to run a **three minute simulation**. For the sake of time, each second that passes in real-time is equivalent to one minute of simulated time. So a three minute simulation will allow three hours of simulated data to be produced. 20 total vehicles should be deployed, a random number of each type of vehicle should be used (with the total between all five types being 20).

There are only three chargers available for all 20 vehicles! A single charger can only be used by one vehicle at a time. Assume the chargers can charge the batteries in the *Time to Charge* time listed for each vehicle.

At the vehicle type level keep track of: average time in flight, average time charging, average time waiting in line to charge, **max** number of faults, and total distance traveled by passengers (if there are four passengers on a vehicle that cruises for a hour at 100 mph, total distance traveled by passengers == 400 passenger-miles. If there are six instances of this vehicle in the simulation 400 \* 6 is the answer we are looking for).

Assume each vehicle starts the simulation with full battery, that it is airborne for the full use of the battery, that it instantaneously reaches Cruise Speed, and that it instantaneously is in line for the charger right when it runs out of battery.

At the end of the simulation represent the results of the simulation in whatever way you see best.

Please do not hesitate to reach out to ask any questions over the problem!

Problem metadata:

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