

Rocket CAD

All the rocket CAD files were designed in [OnShape](#), a cloud based, open-source CAD software. The basic designs modelled with OpenRocket were converted to CAD models that can be 3D printed. OnShape is similar to standard CAD software (Solidworks, AutoCAD), with the addition of version control and the ability to link between documents.

Standard parts and assemblies are incorporated in OnShape but it is advisable to contain all parts for a design or airframe in a single Part Studio to reduce complexity. A guide can be found [here](#).

OpenRocket Simulations

OpenRocket is a free, fully featured model rocket simulator that allows designing and simulating rockets with six degrees of freedom before building and flying them. Analysis includes designing the rocket and viewing flight simulation information in real time. This includes stability, drag, roll, centre of gravity, and centre of pressure. The simulator package is downloadable as a .jar file and can be found at: [OpenRocket](#). Centre of gravity and centre of pressure were calculated using OpenRocket to ensure the launch vehicle is aerodynamically stable i.e, the criteria is that the centre of gravity must be further towards the nose of the rocket than the centre of pressure [Sources from NASA \[1\] \[2\]](#). Ideally, the centre of pressure is within the third of the rocket length towards the motor; the centre of gravity is ideally at least one airframe diameter above that. This is referred to as "caliber stability" where a centre of gravity that is one diameter ahead of the centre of pressure has a caliber stability of 1 cal.

Launch 1 Simulations

The OpenRocket simulation for Launch 1 can be found here; [Launch 1 simulation characteristics](#). This is a figure that represents the most likely altitude, velocity and acceleration of the rocket used in launch 1. Detailed documentation of simulations can be found in the [Rocket Simulator folder](#)

Launch 2 Simulations

After two renditions, the rocket design for launch 2 has been created. Its OpenRocket simulation can be found here; [Launch 2 simulation characteristics](#). This is a figure that represents the most likely altitude, velocity and acceleration of the rocket used in launch 2. Detailed documentation of simulations can be found in the [Rocket Simulator folder](#)

Cambridge Rocketry Simulator

Cambridge Rocketry Simulator is free open source software for simulating high power rocket flights, it can produce six-degree-of-freedom simulations of rocket flights, including the parachute descent. Simulations can also generate splash-down plots and to simulate many different types of rocket and many different scenarios, including two stage flights. The software installer can be downloaded [here](#). The simulator may be used alongside OpenRocket as part of the design process of airframe for the second launch onwards.

The Simulator code may be useful for testing the control system. N.B. the simulator is written in C++.

However, trying to implement the Cambridge Rocketry Simulator resulted in a negative outcome. The simulator uses an old version of OpenRocket which doesn't contain the required parts for the shape of our

current rocket model. As such any simulations that the Cambridge Rocketry Simulator uses, will not be accurate by any means.

Launch Results

The launch history, schedule, and results can be found at the [launch history page](#), the page will be updated as more information becomes available.

Video recordings of launches can also be found at the [launch results folder](#).