University of Auckland

Space Club – Project 1: Basic Avionics Package

# Aim

This project aims to complete a basic avionics program, run in Python, that can calculate atmospheric and orbital trajectories of a rocket.

# Key Tasks

The avionics program will include:

* A basic atmospheric model
* Engine thrust modelling (momentum and pressure) for an ideally expanded engine
* Rocket mass modelling
* Acceleration modelling
* Velocity modelling
* Position modelling
* Drag
* Staging

# Extra Tasks:

* Advanced atmospheric model (includes location and local weather)
* Engine thrust modelling for a single engine nozzle (over & under expanded flow)
* A nozzle design program
* Re-entry prediction for expendable hardware
* Interplanetary trajectory plotting

## Atmospheric Model:

**0-86 km**: Adapted version from *U.S. Standard Atmosphere 1976* (<https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/19770009539.pdf> ) written in Python (found at <http://www.pdas.com/atmos.html>). Equations are explained succinctly on <http://www.pdas.com/hydro.pdf>

**86-1000 km:**

Described here <http://www.braeunig.us/space/atmmodel.htm> - model and extension

NASA link: <https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/19770003812.pdf>

Modern models: <http://spaceweather.usu.edu/files/uploads/PDF/COSPAR_INTERNATIONAL_REFERENCE_ATMOSPHERE-CHAPTER-1_3(rev-01-11-08-2012).pdf>