SPACE ENGINEERING AS VIEWED AS A STUDENT

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CONTENTS

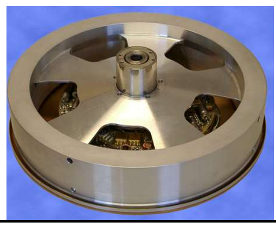
- Intro to Space Engineering & Outlook of Industry
- My Work: Generic Cube-Satellite Power Simulator (GCPS)
- My Work: Thesis – Three/ Four body problem

WHAT IS SPACE ENGINEERING?

- Satellites, Rockets and Spacecrafts
- Amalgamation of mechatronic, electrical, mechanical and aeronautical engineering
- Types of satellite/ spacecraft:
  - Large - ISS, SOHO, GPS Satellites, Optus-A1 – built by Boeing US
  - Medium – Proba-1, Nigeria-Sat-1&2, TET-1, Dubai-Sat1&2
  - Small/Micro/Nano (Cubesats) – IceCube (Earth-1), n-Sight-1, ASTERIA,
- International Goals: Human Presence in Moon & Mars (Mars Rover 2020, Elon's Car)
- Australia's Goals: Earth Observation Satellite (CSIROSat-1, CUAVA-1), Contribute to Human Presence in Moon & Mars, LEARN

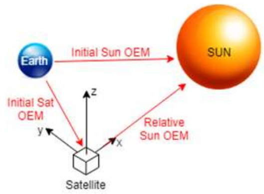
WHAT IS SPACE ENGINEERING?

- Subsystem based engineering:
  - Thermal
  - Power – EPS, Solar & Battery
  - RF/ Communications
  - On board Computer & Processing
  - Attitude Determination & Control
  - Payload

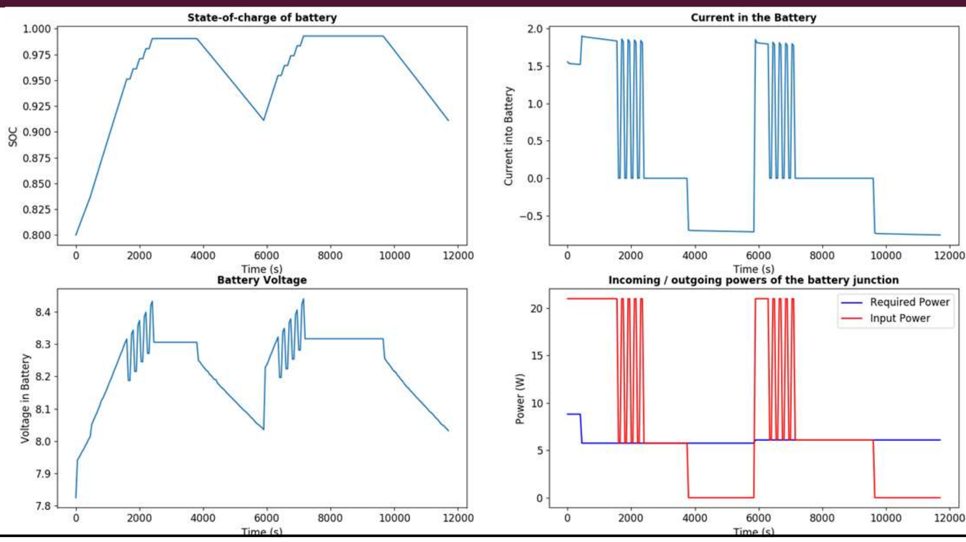


MY WORK: GENERIC CUBESAT POWER SIMULATOR

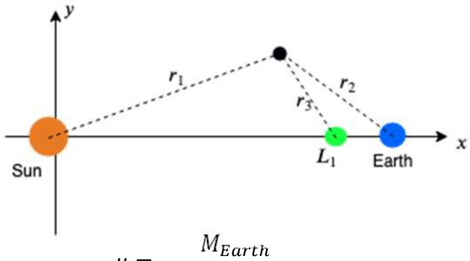
- Input:
  - Test Time
  - Solar Panel & Cell Arrangement
  - Satellite & Sun OEM file (in ECI – which can be obtained from Celestlab)
  - Satellite AEM file (quaternions)
  - Power Conditioning, Satellite modes, Power Consumption, Mission Plan Files
  - EPS Properties (Battery Max Voltage & MPPT Increment0 & Battery Initial Properties (SOC, data files)
  - Solar Cell Model
- Output: Power, Battery SOC, Battery Voltage & Battery Current



MY WORK: GENERIC CUBESAT POWER SIMULATOR



MY WORK: THESIS – OUTLINE



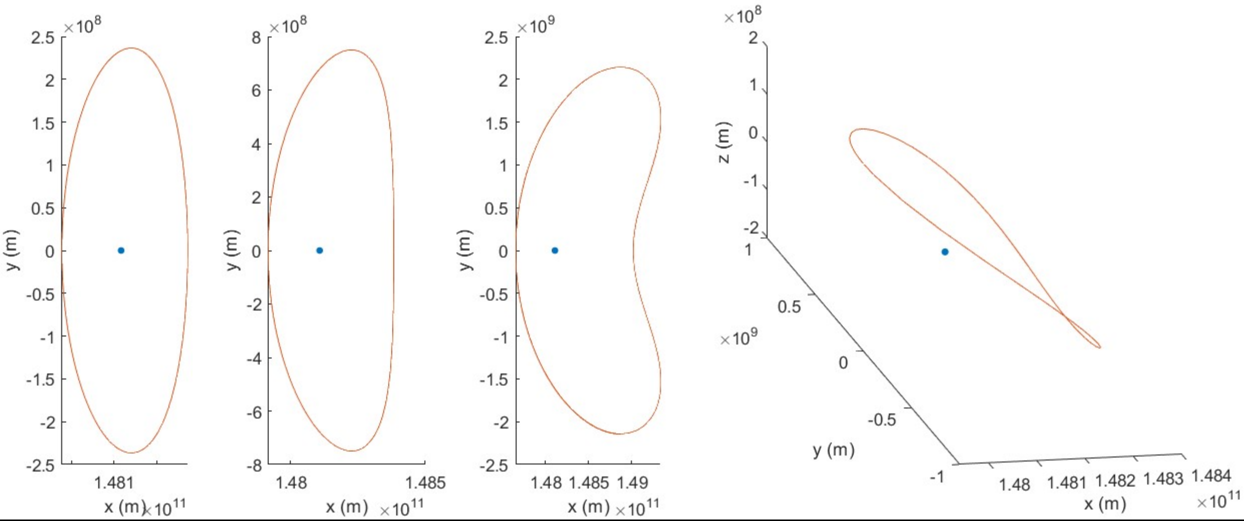
$$\mu = \frac{M_{Earth}}{M_{Sun} + M_{Earth}}$$

$$\mu_s = \frac{M_{Space\ Station}}{M_{Sun} + M_{Earth}}$$

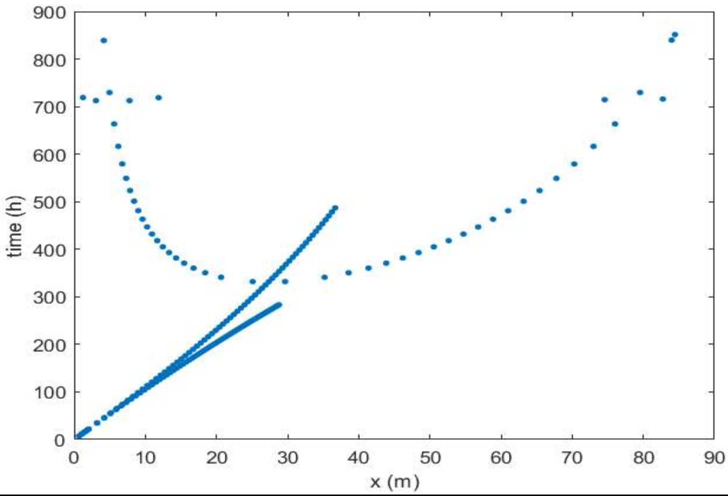
- Lagrange Point Dynamics- Specifically L1 (unstable)
- Actually a 4 body problem – main space craft (space station about 5000kg placed at L1)
- Due to smaller potential of space station – new Lagrange points are about 100m either side of L1
- 2 types of analysis – inside 100m and outside 100m
- Rescaled Equations of Motion:

$$\dot{x} = p_x - y$$
$$\dot{y} = p_y - x$$
$$\dot{z} = p_z$$
$$\dot{p_x} = p_y - \frac{\mu(x - (1-\mu))}{r_2^3} - \frac{(1-\mu)(x+\mu)}{r_1^3} - \frac{\mu_s(x - L1)}{r_3^3}$$
$$\dot{p_y} = -p_x - \frac{\mu y}{r_2^3} - \frac{(1-\mu)y}{r_1^3} - \frac{\mu_s y}{r_3^3}$$
$$\dot{p_z} = -\frac{\mu z}{r_2^3} - \frac{(1-\mu)z}{r_1^3} - \frac{\mu_s z}{r_3^3}$$

MY WORK: THESIS – OUTSIDE 100M ORBITS



MY WORK: THESIS- INSIDE 100M



QUESTIONS?