CubeSat Project Logbook

Team B

Fizza Naqvi

# Common part

## Team members

Claudio Vestini

Alex Berresford

Fizza Naqvi

Hani Moussa

## Code of Conduct

This Code of Conduct establishes guidelines for behaviour and collaboration among members of the [Project Name] group. We aim to create a respectful, inclusive, and productive environment for all participants.

Please continue from here.

## Summary of the project and objectives

This project…

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# 2024-21-10 First meeting

Present: Claudio Vestini, Hani Moussa, Alex Berresford, Fizza Naqvi

Apologies: None

Location and time: RSL Study Room 4 at 14:00

Author of minutes: Claudio Vestini

* Discussion of project organisation:
  + File system (GitHub repository, GitHub Projects roadmap (Gantt chart))
  + Google Drive folder
  + Report LaTeX file
  + References (.bib master file)
  + Meetings and WhatsApp group for communications
* Allocation of tasks (initial draft):
  + Claudio:
    - Aerothermal
    - Instrumentation
  + Hani:
    - Electronics
    - Interfaces
  + Fizza:
    - Trajectory
    - Internal heat generation
  + Alex:
    - Mechanical
    - Launch service provider
    - Launch environment
* Discussion of scientific goals:
  + CubeSat constraints dictated by launch service provider (size, weight, center of mass, electronics, stress response) - Alex
  + Ionospheric disruption due to re-entry impact - Fizza
  + Consideration of Magnus Effect during hypersonic re-entry – Alex
  + Budget analysis - everyone
  + Model Predictive Control for maintaining trajectory attitude (both in orbit and during re-entry). Use of cold gas thrusters as actuators - Claudio
  + Black box (GPS-tracked, ablative-protected) for retaining re-entry data – Alex
  + Materials testing for re-entry – Hani
  + Communications: information transfer during blackout – Claudio
  + Modelling the aerothermal environment in different re-entry stages - Claudio

### References

### Actions

* Discuss scientific goals with supervisors

### Deadlines

# 2024-22-10 Second meeting

Present: Alex, Claudio, Hani, Fizza, Tobias (Supervisor)

Apologies:

Location and time:LR7 at 2:00pm

Author of minutes: Alex Berresford

-Briefing Tobias on our progress, file system, organisation etc

-Mendeley for .bib file for automatically referencing papers

-Briefing Tobias on project ideas

-Ionosphere disturbances

-Feedback:Interesting, but a bit of a secondary goal, not directly related to re-entry

-Materials for re-entry

- Use Cubesat as a test rig for materials and how they demise in extreme flow conditions

-Feedback:On topic, very current bit of research for space industry

-How would you mitigate inequaltities in material conditions

-Sample sphere’s inside sacrificial shell?

-Altitude control using spin

-Magnus effect

-Feedback: Could be used to control material conditions to allow for testing

-Serious control problem

Overall Feedback:

-Find rough bounds to problem through research and rough calculations

-Budget unlimited, but must be justified

-Black box vs Comms system

-Both realistic, depends on specific design choices

Long Term goals

### References

### Actions

### Deadlines

Research Tasks by 29/10/2024

-Hani – sensors for material degradation

-Claudio – Magnus effect, and realism of generating spin

-Fizza – Look into trajectory, expected burn altitude and ideal orbital altitude as well as ionosphere

-Alex - Investigate different cubesat geometries, costs, pros, cons et. Keep up with Launch provider research.

# 2024-28-10 Third meeting

Present: Claudio Vestini, Hani Moussa, Alex Berresford, Fizza Naqvi

Apologies: None

Location and time: RSL Study Room 2 at 13:00

Author of minutes: Fizza Naqvi

* Discussion on how to get Mendeley working for references
* Hani’s research: discussion on the different types of sensors that already exist
  + Accoustic emission sensor
  + Recession sensors (used to measure how thermal protection systems are damaged as they enter the atmosphere); NASA and ESA has used this before so there’s lots of information available
  + Look into what we’re actually going to measure before deciding on what sensors we should use
  + Ensure that our experiment cannot be easily conducted on Earth
* Claudio’s research: magnus effect and MPC
  + Magnus effect at hypersonic speeds works very differently
  + Most research is done on sphere’s but calculations might be able to be manipulated to work with a cube
  + Looking at simulations- the ones that are currently available are limited as it won’t test everything we need
  + Magnus effect can be tested when we have our CAD models
  + For control: our main options are cold gas thrusters
  + Reaction wheels- cheapest, easiest to manufacture, least risk involved but takes up lots of space, quite heavy
  + other forms of thrust such as hypergolic- mainly used in thrust systems in capsules or small satellites; easy however it’s extremely toxic; slightly more expensive
  + MPC
  + Find a company that has architecture already made up for this or make it from scratch
  + We need 2 separate controllers
* Fizza’s research:
  + Burn up altitude is typically 80-120km but depends on size, mass orientation and material composition
  + Design for Design study- use semi controlled re-entry
  + Trajectory model that simulated Cubesat re-entry trajectory; lots of assumptions are made on the atmosphere calculations and dynamic calculations
  + Ionospheric impact research- the range at which satellite demise occurs overlaps with the “E region” which reflects radiowaves and is essential for long distance communication
  + Could monitor atmospheric composition changes because materials from the cubesat could remain in the ionosphere temporarily- use spectrometers to detect the wavelengths and see how the different material affects the ionosphere composition, therefore radio wave reflection and long distance communication
* Alex’s research:
  + NASA has info on different possible cubesat sizes- we want to do a 1U size due to how easy the geometry is, but we could expand greater if needed
  + Endurosat- cost calculator; limited to a 1.5U platform

### References

### Actions

* Ask Tobias about what data would be good for our measurements

### Deadlines

# 2024-10-05 Fourth meeting

Present: Name1, Name2, Name3

Apologies: Name4

Location and time: … at …

Author of minutes: Name 2

Content goes here

### References

### Actions

### Deadlines

# 2024-10-05 Fifth meeting

Present: Name1, Name2, Name3

Apologies: Name4

Location and time: … at …

Author of minutes: Name 2

Content goes here

### References

### Actions

### Deadlines