CanSat Leader Training Program (CLTP) - 8th Cycle

Final Presentation

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Cansat Leader CLTP Training Program

NIHON UNIVERSITY

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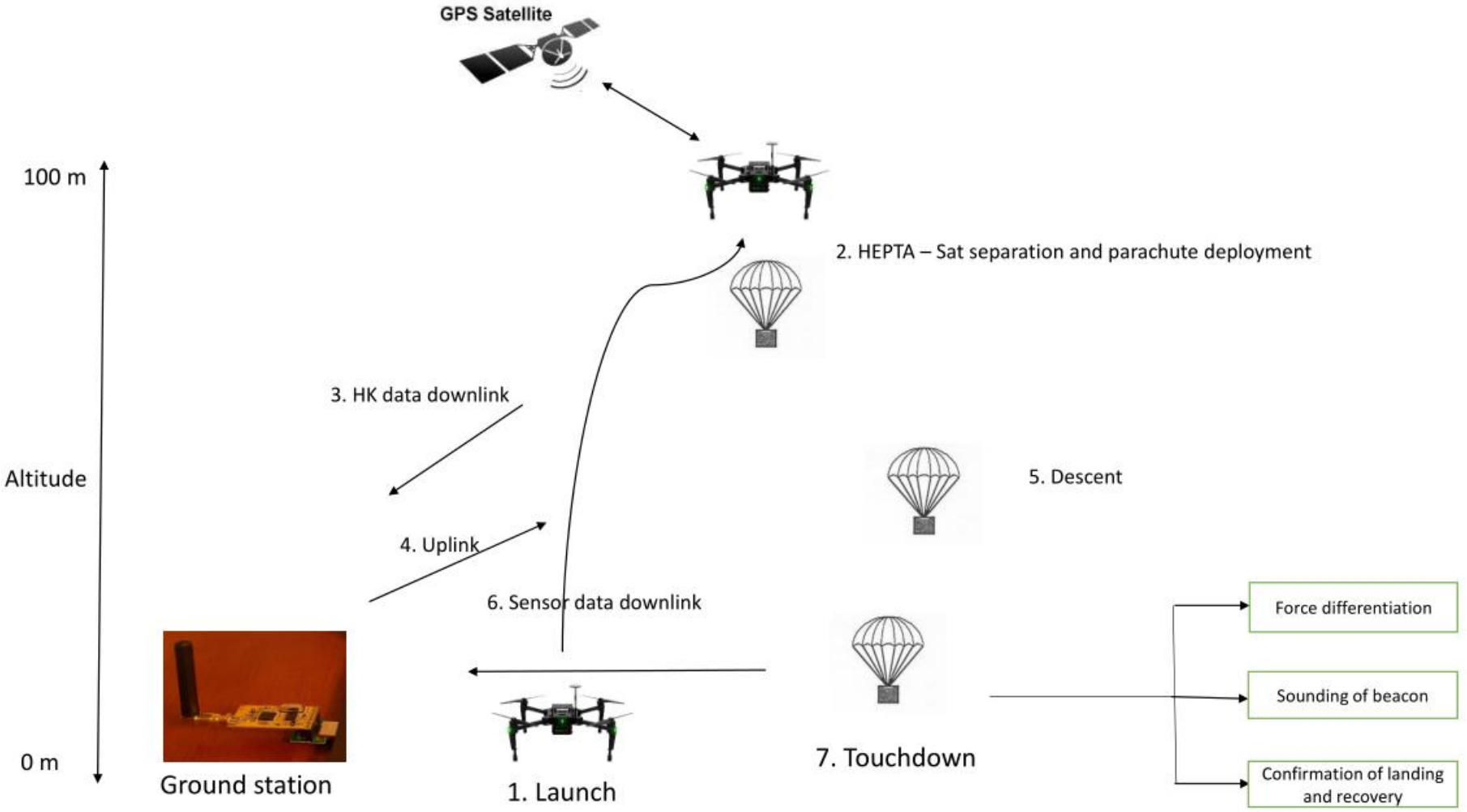
Mission Statement

“Confirmation of HEPTA-Sat touchdown through the use of force sensor and a sound beacon”

- Normally, the data from the sensors within the HEPTA-Sat are enough to locate the HEPTA-Sat over the flight course and after landing, but they don’t tell us whether the HEPTA-Sat has actually touched down.
- An additional assemblage of sensors like a force sensor or an accelerometer or a beacon can be used to confirm landing and locate the HEPTA-Sat for recovery.
- The sensors can give continuous data at a desired frequency and then through differentiation, the landing can be confirmed upon which the audio beacon starts buzzing. This sound can be used to locate the HEPTA-Sat and recover it.
- The benefit of this mission lies in the fact that seeking telemetry data from remote places which are visually inaccessible from the place of launch requires us to ensure that the HEPTA-Sat is safe during flight and upon landing. The sensor data thus obtained can help us ascertain whether the requirement has been met.

Mission Statement

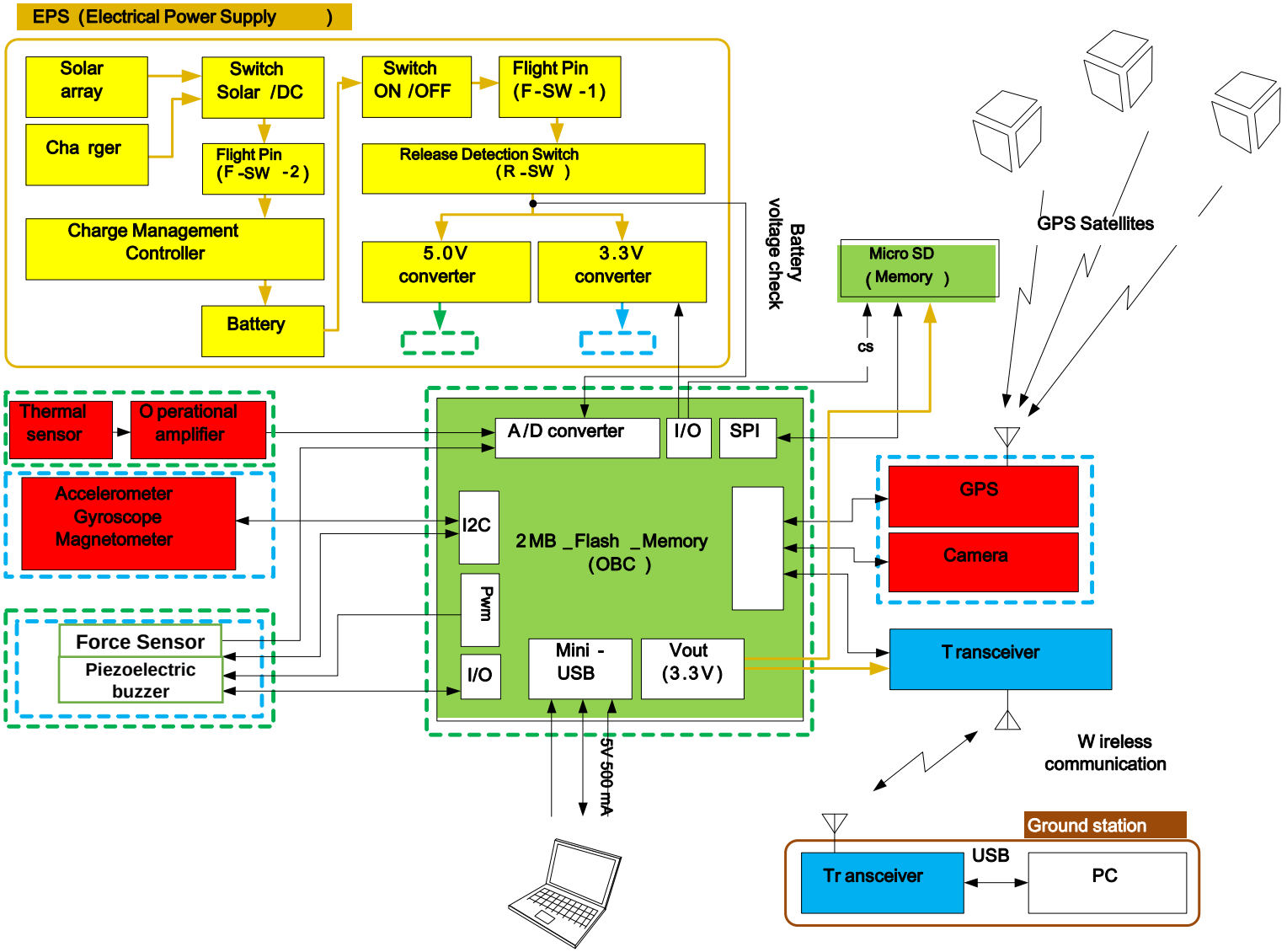


Graphical concept

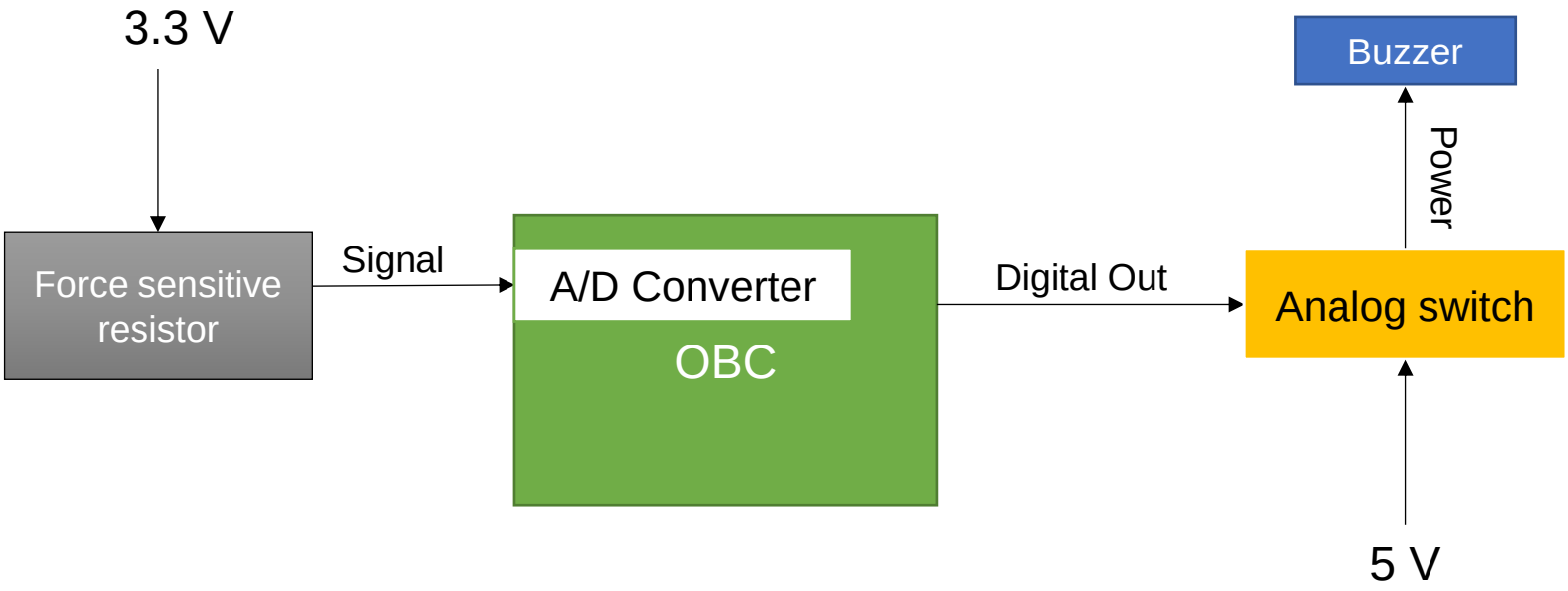
Mission Requirements

No.	Events	Requirements	Required Functions	Verification ways
R-1	Preparation phase	Programming	Program, reprogram and restart the OBC	Check the data and analog output
R-2		Operation check and Subsystem qualification	To check the effects on data uplink or downlink during mission phase	Confirm: i) Battery is charged ii) Telemetry to Xbee iii) Serial data to PC
R-3	Standby time phase	Battery voltage is 4.0 V or more	Function to charge from the external source	Confirm the battery is charged
R-4		Working sensor and actuator	Check the logged data and analog output	Confirm the two are properly working
R-5		A working communication	Send telemetry data from HEPTA-Sat to GS	Confirm data is obtained
R-6	Launch phase	The downward placement of sensor in the HEPTA-Sat deployer shouldn't cause the sensor to sense any more force than the threshold	Obtain the telemetry data from the HEPTA-Sat during the launch phase	Confirm the values stay within the threshold
R-7		Saving the flight phase data	Function to receive and save these data	Confirm the data is received and saved
R-8	Mission phase	Receive the sensor data	To receive proper data for mission purposes	Confirm the data is received
R-9		Deployment and descent of payload	To ensure the proper descent of payload and recovery	Confirm proper descent and recovery
R-10		Required landing and impact	To ensure proper touchdown	Confirm from sensor data
R-11	Analysis phase	Decide whether the mission has failed or succeeded	Analysis of acquired data	Confirm through data analysis
R-12		Mission performance analysis	To analyze the mission performance	Confirm if the mission performance criteria have been met

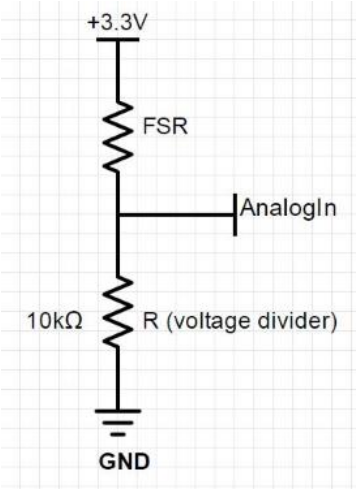
Satellite Bus System Architecture

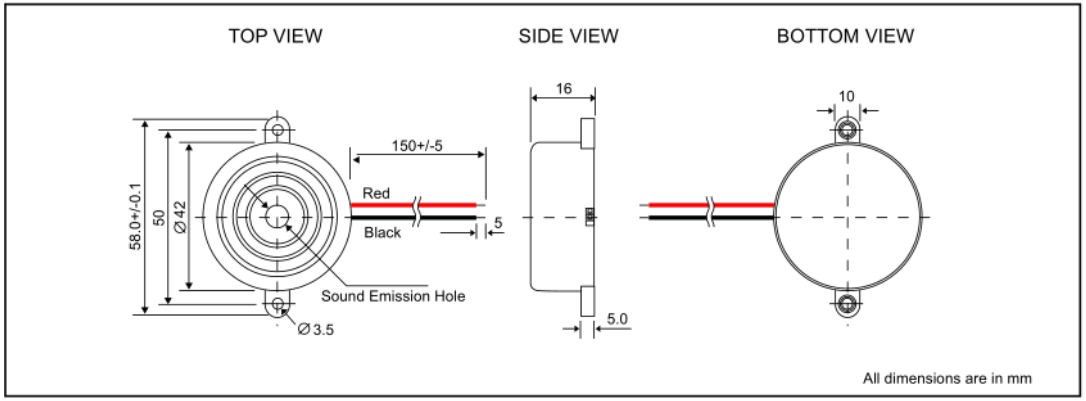


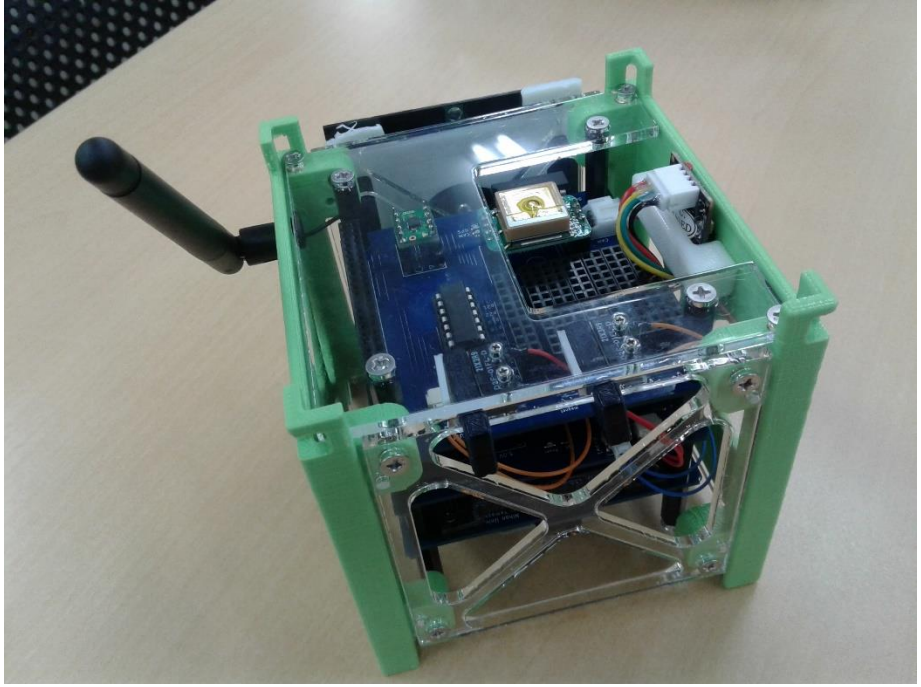
Payload subsystem architecture



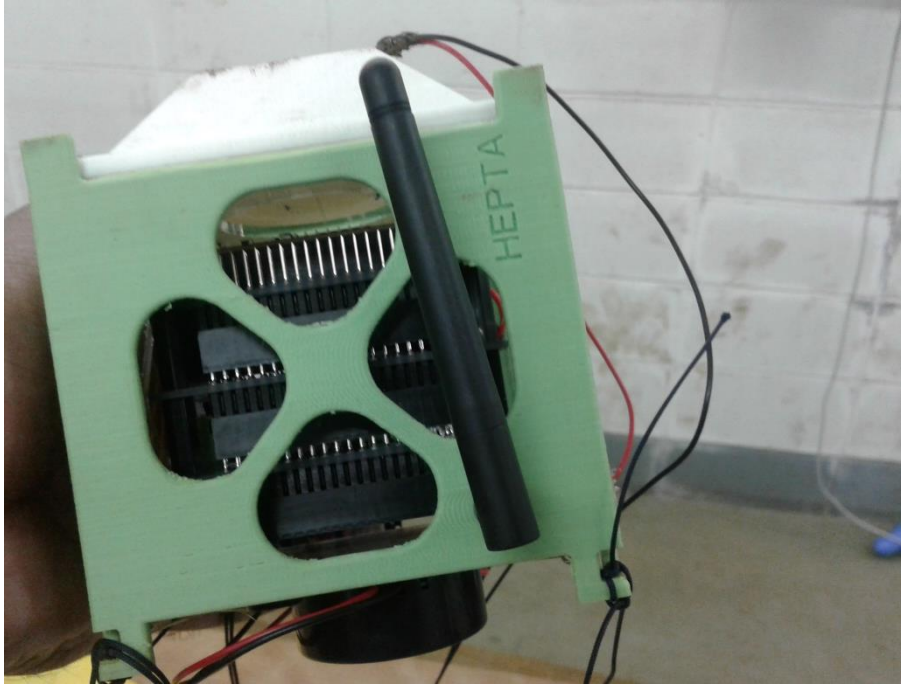
Payload Subsystem Components



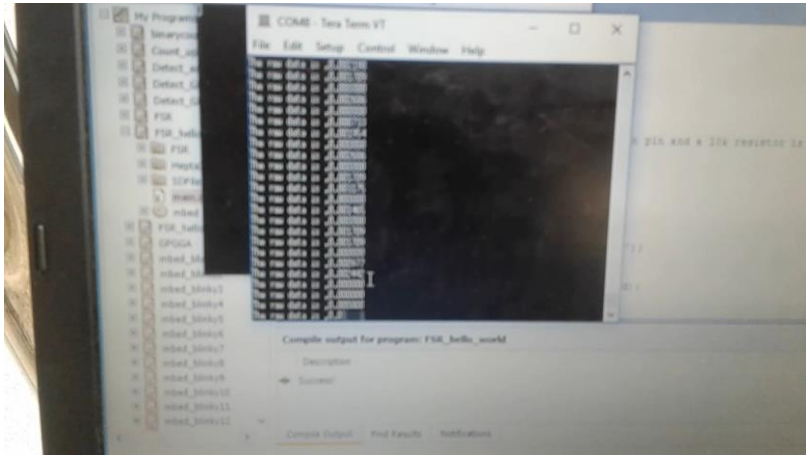




HEPTA-Sat before the payload integration



HEPTA-Sat after the payload integration



Validation and Verification Plan/Testing

No.	Events	Requirements	Required Functions	Verification
R-1	Preparation phase	Programming	Program, reprogram and restart the OBC	Check the data and analog output
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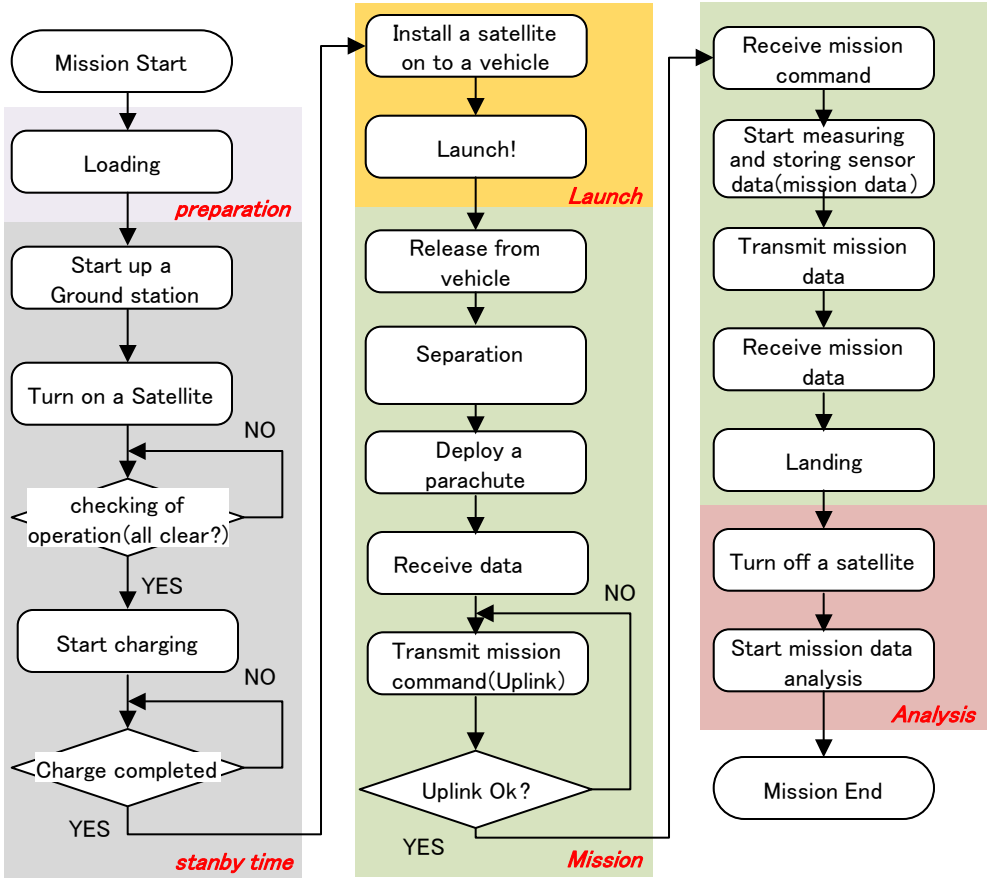
R-6	Launch phase	The downward placement of sensor in the HEPTA-Sat deployer shouldn't cause the sensor to sense any more force than the threshold	Obtain the telemetry data from the HEPTA-Sat during the launch phase	Confirm the values stay within the threshold
R-7		Saving the flight phase data	Function to receive and save these data	Confirm the data is received and saved
R-8	Mission phase	Receive the sensor data	To receive proper data for mission purposes	Confirm the data is received
R-9		Deployment and descent of payload	To ensure the proper descent of payload and recovery	Confirm proper descent and recovery
R-10		Near vertical landing and impact	Ensure proper release and touchdown	Confirm from sensor data
R-11	Analysis phase	Decide whether the mission has failed or succeeded	Analysis of acquired data	Confirm through data analysis
R-12		Mission performance analysis	To analyze the mission performance	Confirm if the mission performance criteria have been met

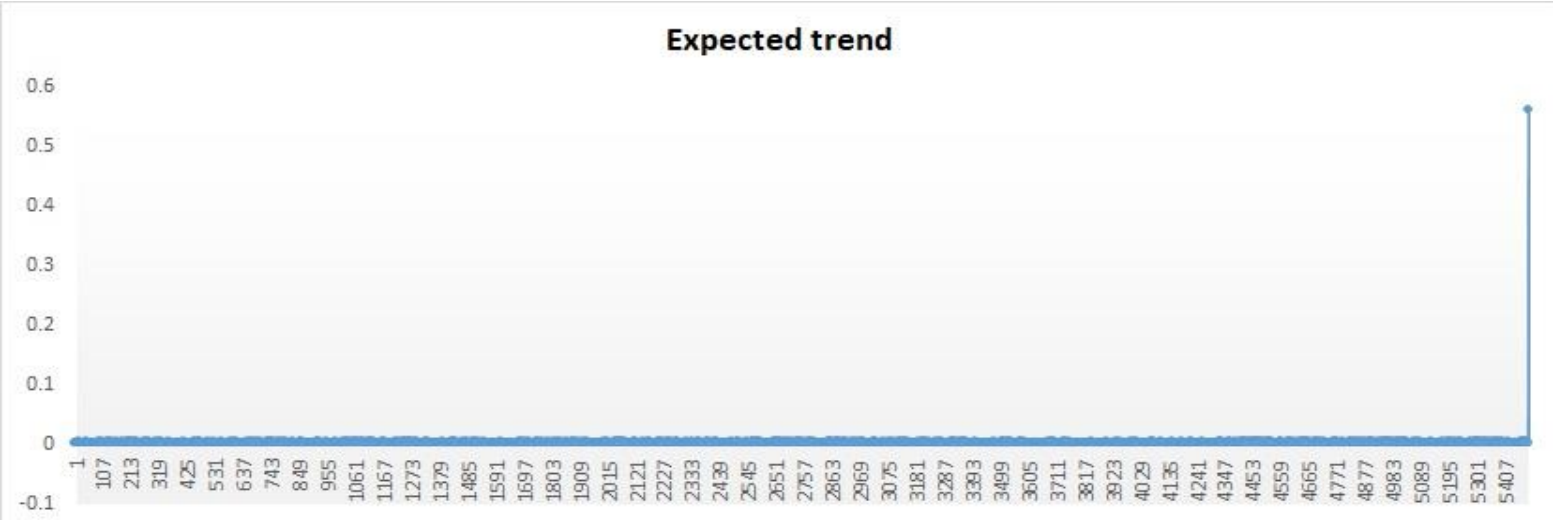
Mission Sequence

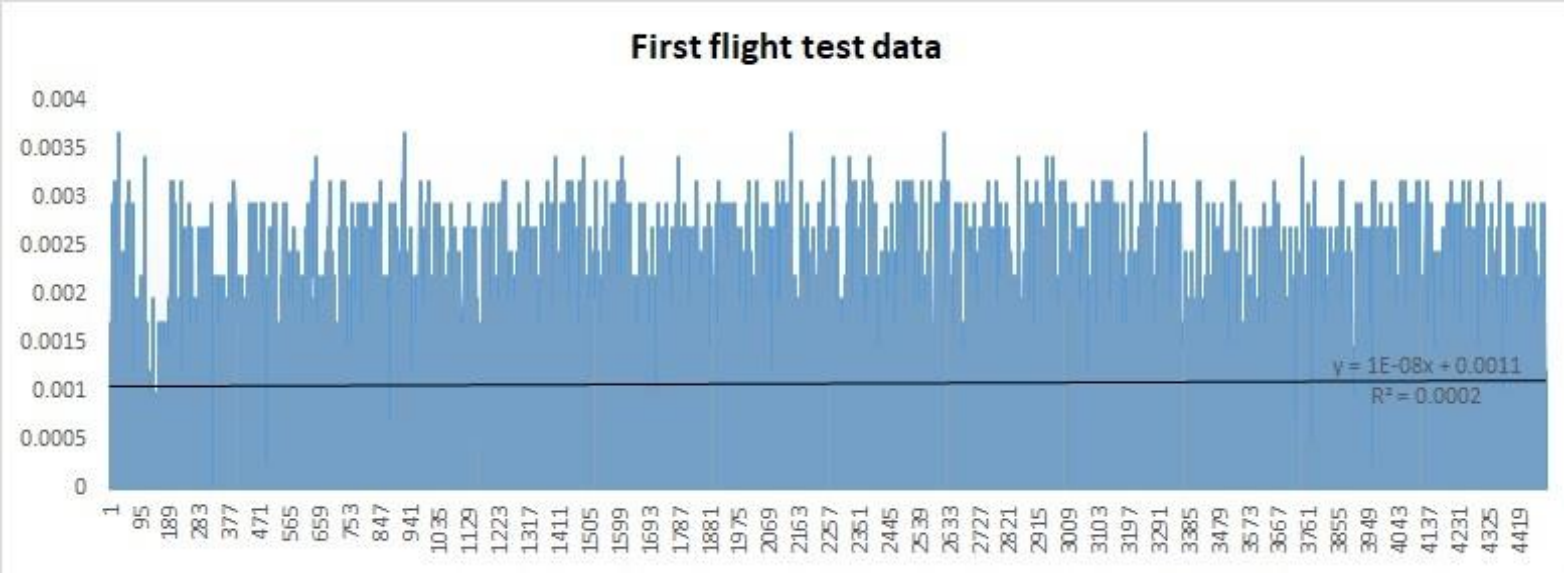


Mission success criteria

1) **Mission failure:** Loss of reception of sensor data during the mission and improper landing
2) **Minimum success**: Reception of sensor data during the mission, but improper landing and no differentiation of impact
3) **Partial mission success**: Reception of non-zero raw data from sensor but no sounding of buzzer
4) **Full mission success**: Reception of non-zero raw data from sensor as well sounding of buzzer

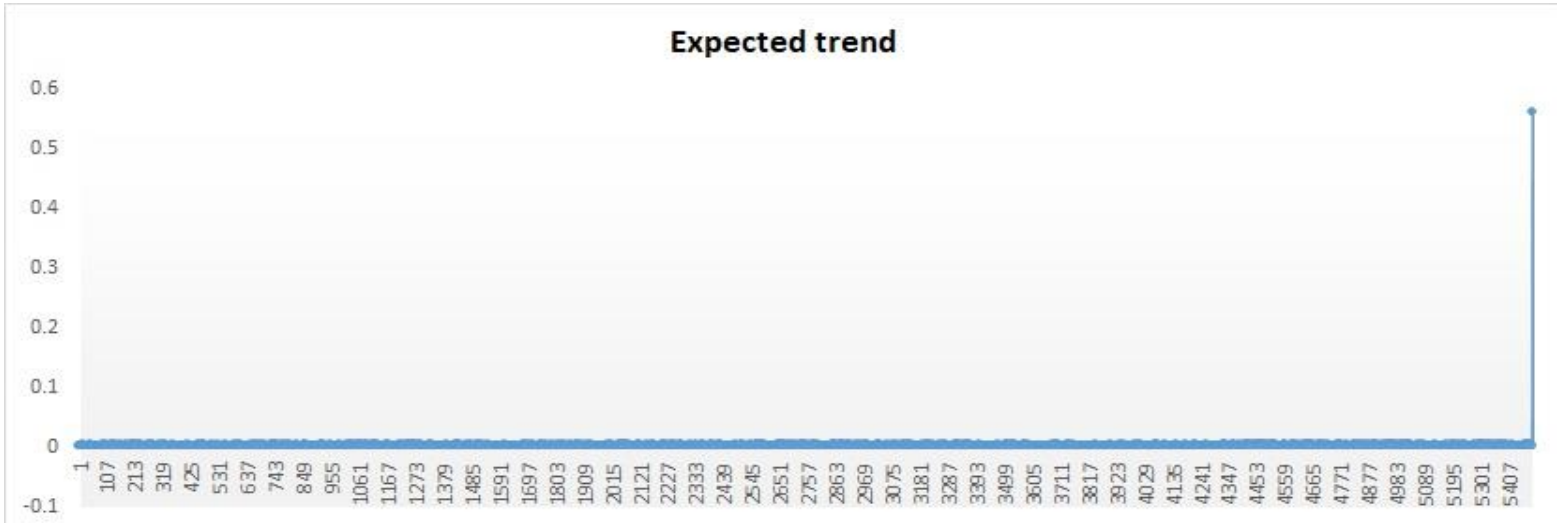
Flight Result: First Attempt

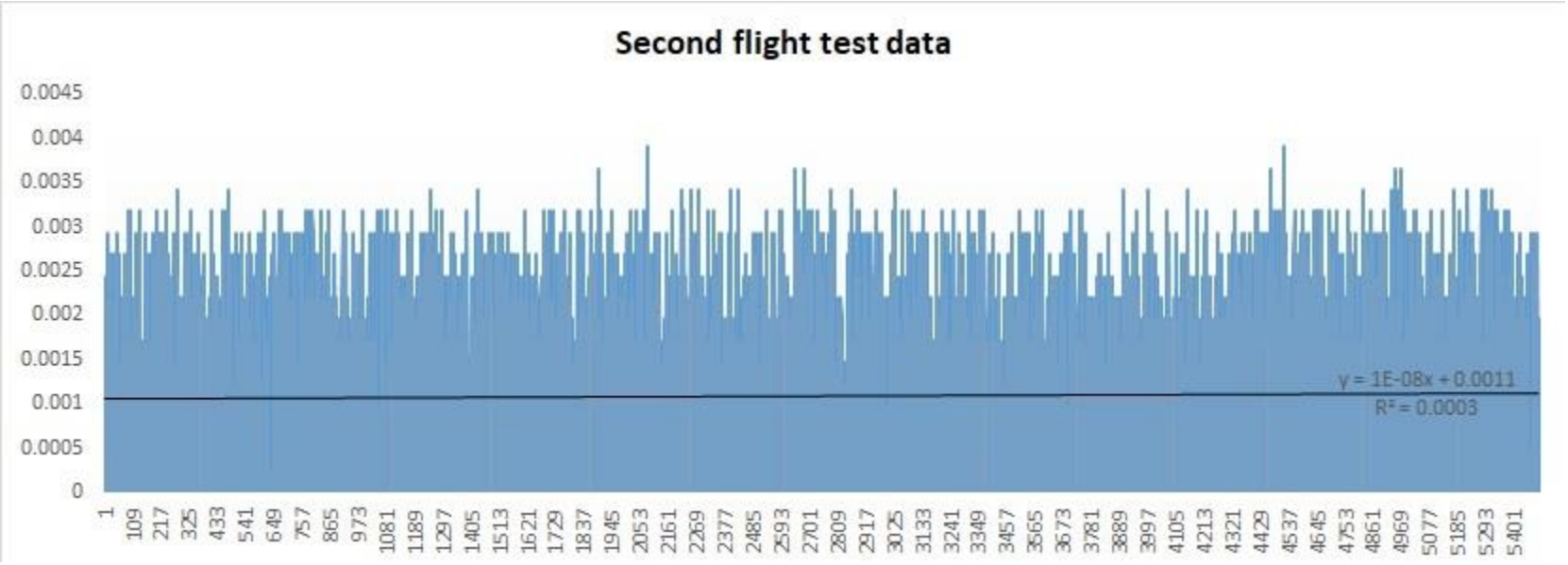


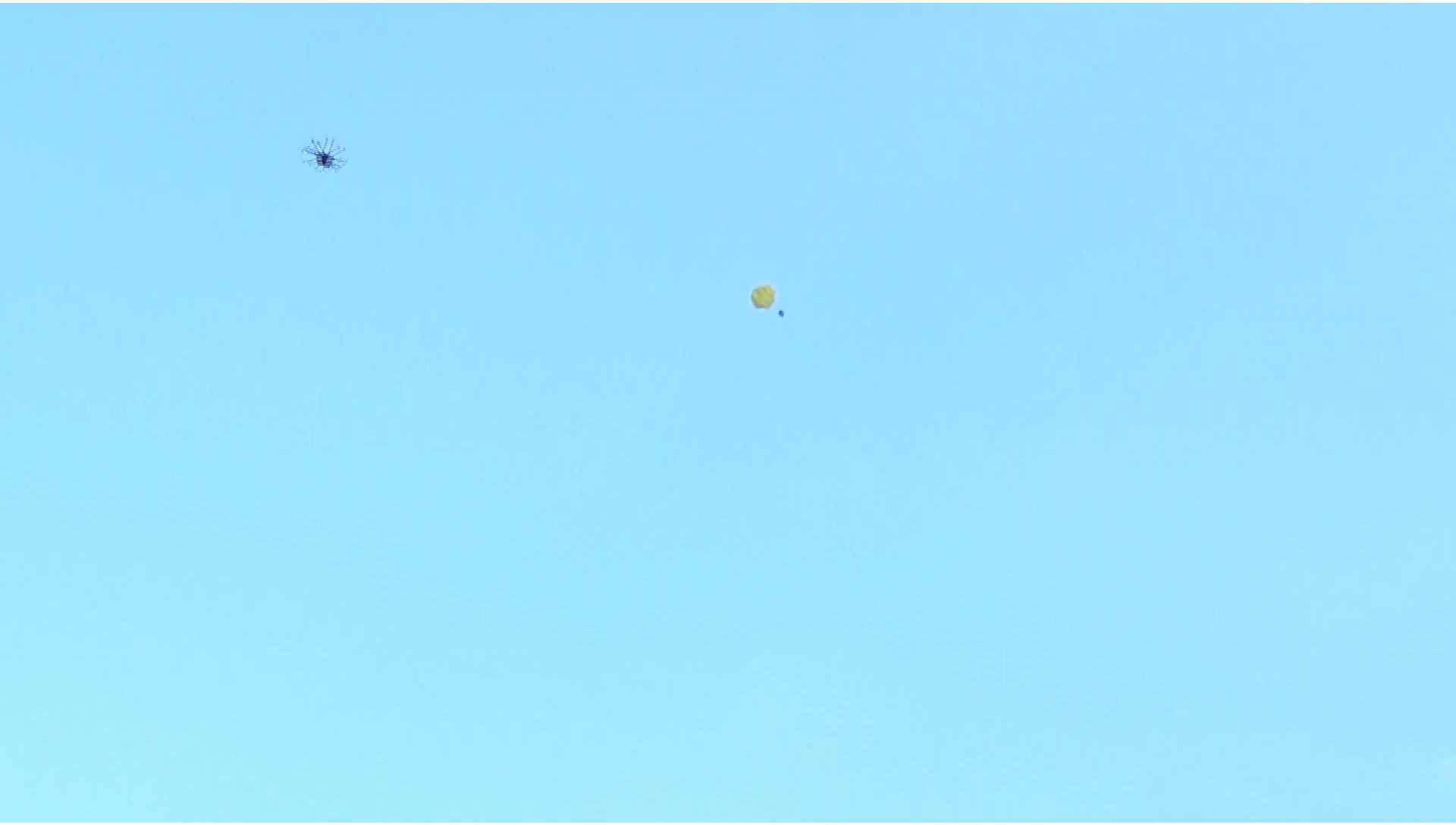


- Minimum success

Flight Result: Second Attempt







Conclusions

- Minimum success
- Reasons:
  i) Strict geometrical and structural limitations
  ii) Use of a single force sensor
  iii) Improper landing
  iii) Failure to consider other variables
- Can be improved upon

Recommendation and Future Work (Mission)

- The use of accelerometer would quite likely give better results.
- Or the number of force sensors could be increased and one could be attached to each corner of the bottom-side of the HEPTA-Sat structure to make way for more force concentration
- In a more advanced approach, some motion control methods (like attitude control, yaw control, etc) could be used to make the HEPTA-Sat land the right way
- More sensitive force sensors could be used.

Feedback and Recommendation (CLTP)

- More time must be given to the lecture notes.
- Improvements need to be made to deal with the communication barrier. The availability of at least one staff with good English communication skills would do.

- All in all, a great learning experience

Thank you!