CanSat Leader Training Program (CLTP) - 8th Cycle

Final Presentation

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Mission Statement

- In future we may have small satellite re-enter back to the earth.
- As the satellite is small, it is difficult to find the location if the problem occurs where the GPS location cannot be transmitted or problem on communication system when it touch the ground.
- Therefore, we may need additional device to track the location using ear and eyes.
- In this mission the satellite will make a noise from buzzer/audio beacon. For visibility, it is good to have smoke SOS so that the location can be seen from far. But, due to availability, the smoke will replaced with a flag.
- This flag will be raised up once the satellite touch the ground

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Mission Objectives

- To transmit and save sensors data and images
- To start audio beacon and raise a flag when HEPTA is landed

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Mission Requirements

- The Hepta Sat should fit into pod/deployer
- Data should be transmiting during preparation, launch and stop once it touch the ground
- Buzzer and servor need to be activated once the satellite touch the ground
- Data needs to be saved to sd card along the mission

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Success Criteria

Level	Requirement	Evaluation Criteria
Minimum Mission Success	Sensors Data transmit to ground station	Sensors data received by ground station
Full Mission Success	Buzzer transmitted sound Flag raised	Confirmation received in PC and sound can be heard, Flag visually seen in raised condition

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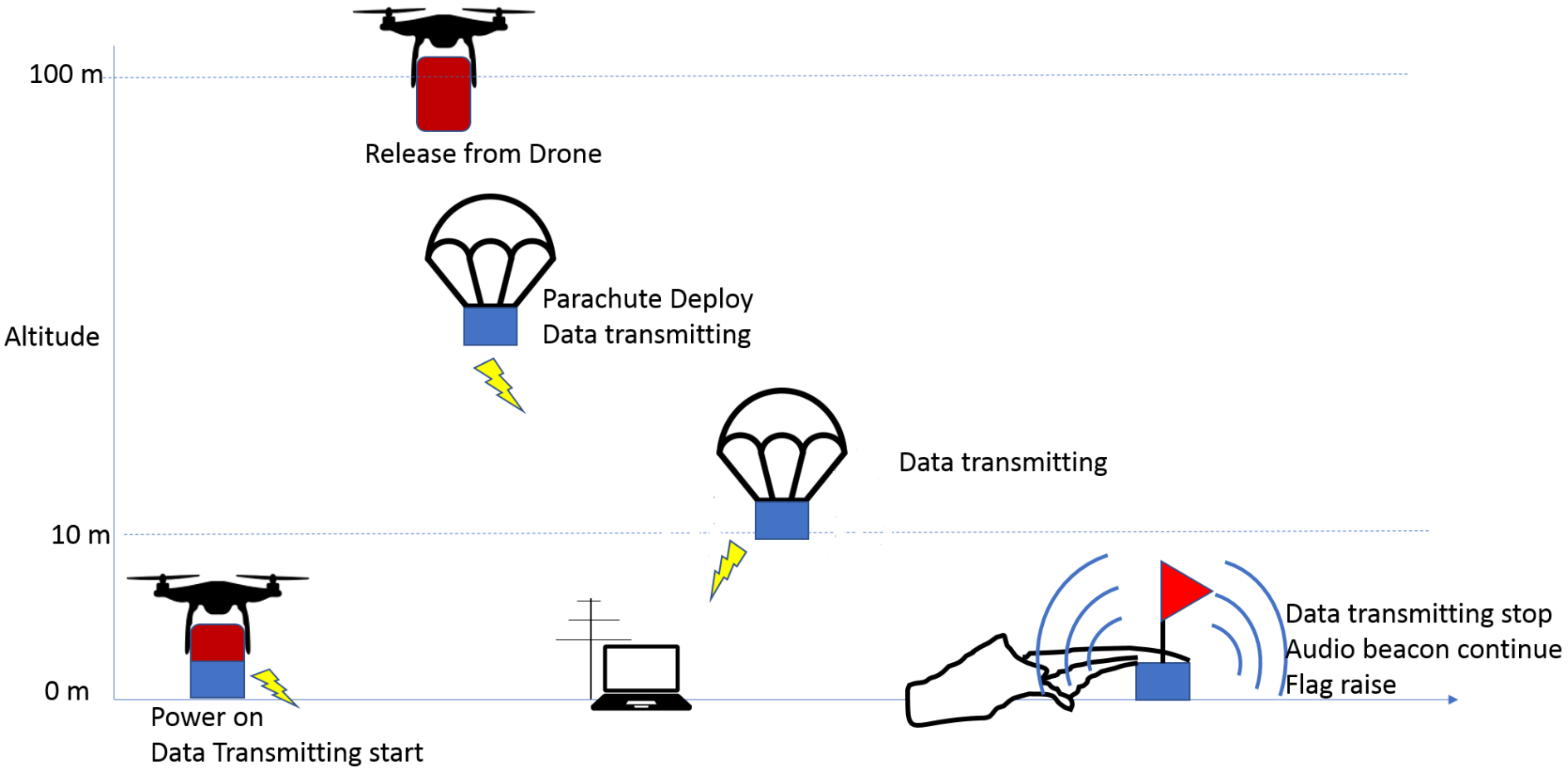

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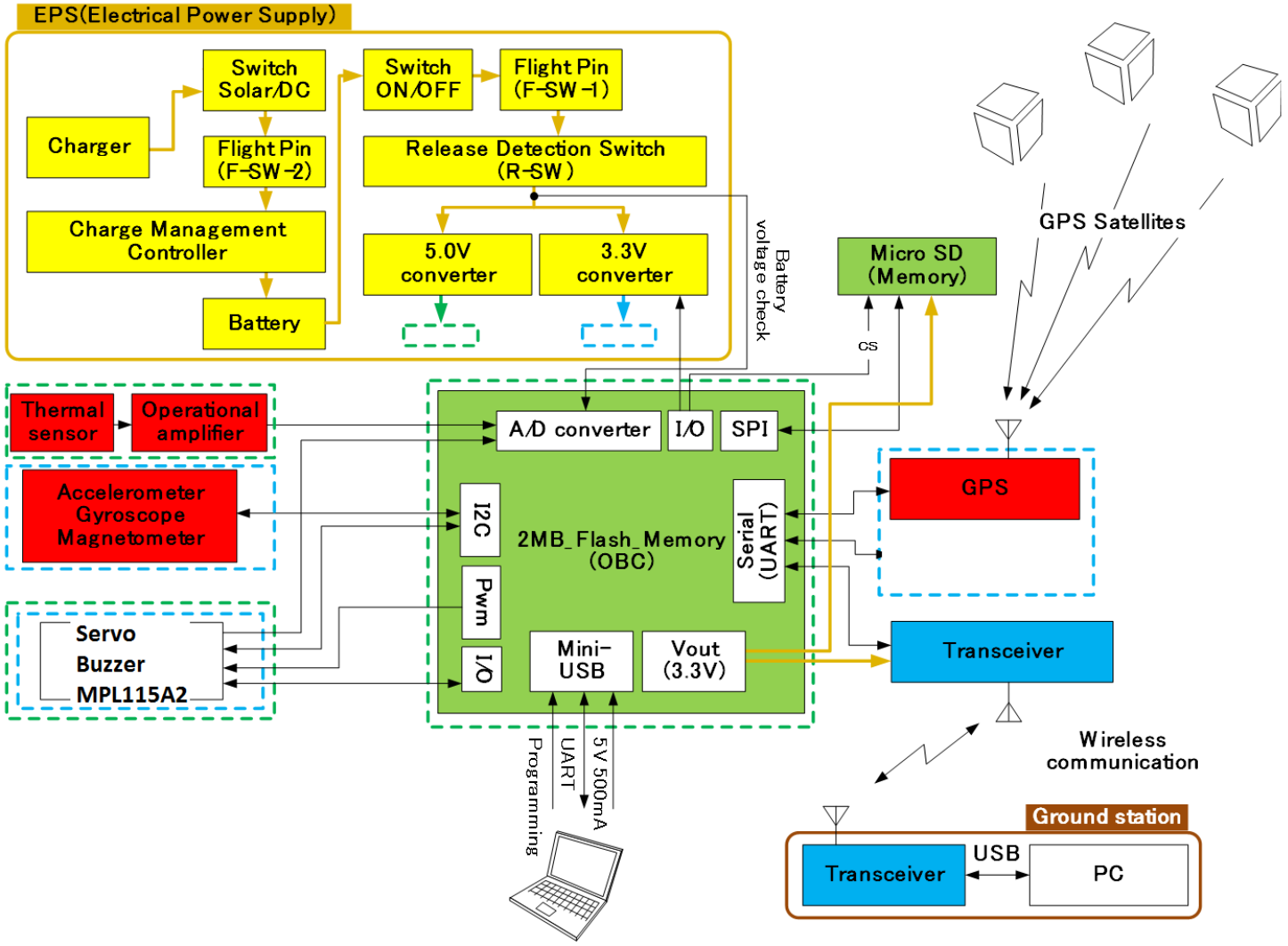
Bus System Architecture & Subsystem



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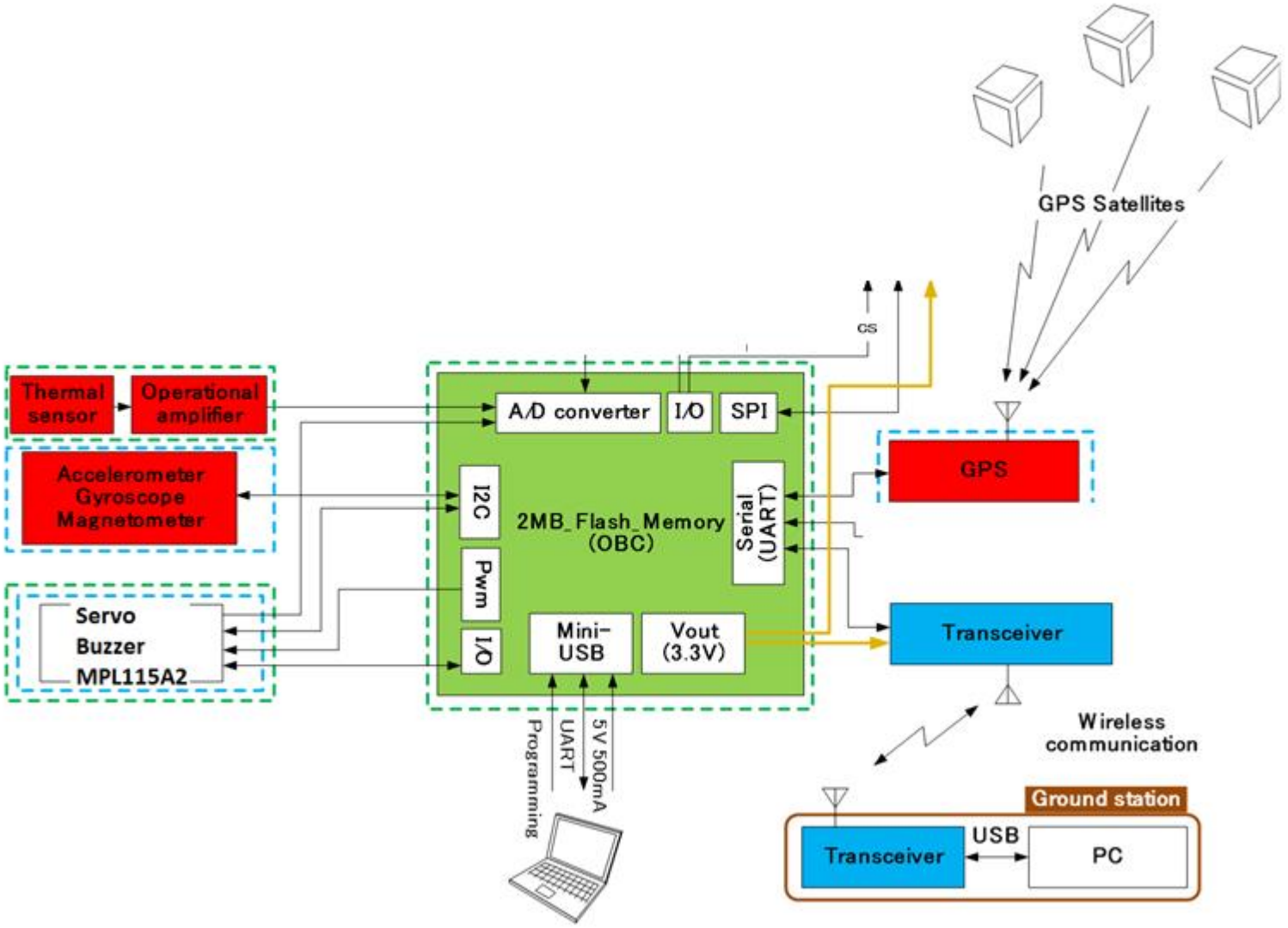
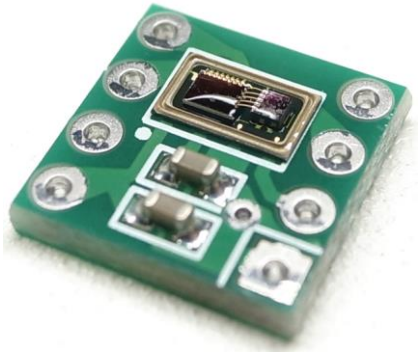
Payload Subsystem Architecture



Payload components



Pressure Sensor

Parameter	Value
Power supply	2.3 - 5.5 V
Size	
Operating Temp	-40 to +150
Interface	I2C or SPI bus

Servo motor

Parameter	Value
Operating voltage	4.8 - 6.0 V
Operating Temp	-20 to +70
Weight	6.20 g
Torque (kg/cm)	0.79

Buzzer

Parameter	Value
Operating voltage	3.0 - 7.0 V
Operating Temp	-20 to +70
Interface	PWM
Frequency (Hz)	2300(+- 400)

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Mission Verification

No	Event	Requirements	Required Function	Verification
R-1	Preparation Phase	Ground Station GUI starts	n/a	GS display at PC
R-2		Flag attach to the servo	n/a	Attachment at servo
R-3		Stop Pin taken from at switch	n/a	Data transmitting and display
R-4		Start charging	Function to charge from external source	
R-5		Data write to SD	Function written data in sd	Confirm data written
R-6	Standby time phase	Battery voltage is 4.V or more	Function to charge from external source	Confirm Battery is charged
R-7		Properly install in deployer	n/a	Visual Check - fitted
R-8		Power on		LED blink
R-9		Data start trasmitting	Function to display downlink data	Data displayed on PC

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Mission Verification

No	Event	Requirements	Required Function	Verification
R-10	Launch Phase	Send the sensor start command	Function to send command	Data displayed on PC
R-11		Save sensors data to usb	Function to display error	if not > error reading display
R-12	Mission Phase	Housekeeping data transmiting	Function to display downlink data	Data displayed on PC
R-13		Buzzer on at altitude ON at h=0	Function command buzzer on	send confirmation to ground station
R-14		Buzzer on continuously when touch the ground	Function error display when buzzer stop	if stop = error reading
R-15		servo moves the flag to 90 deg at h=0	Function to command buzzer on	send confirmation to ground station
R-16	Analysis Phase	Housekeeping data written in sd	Function written data in sd	Data written in sd

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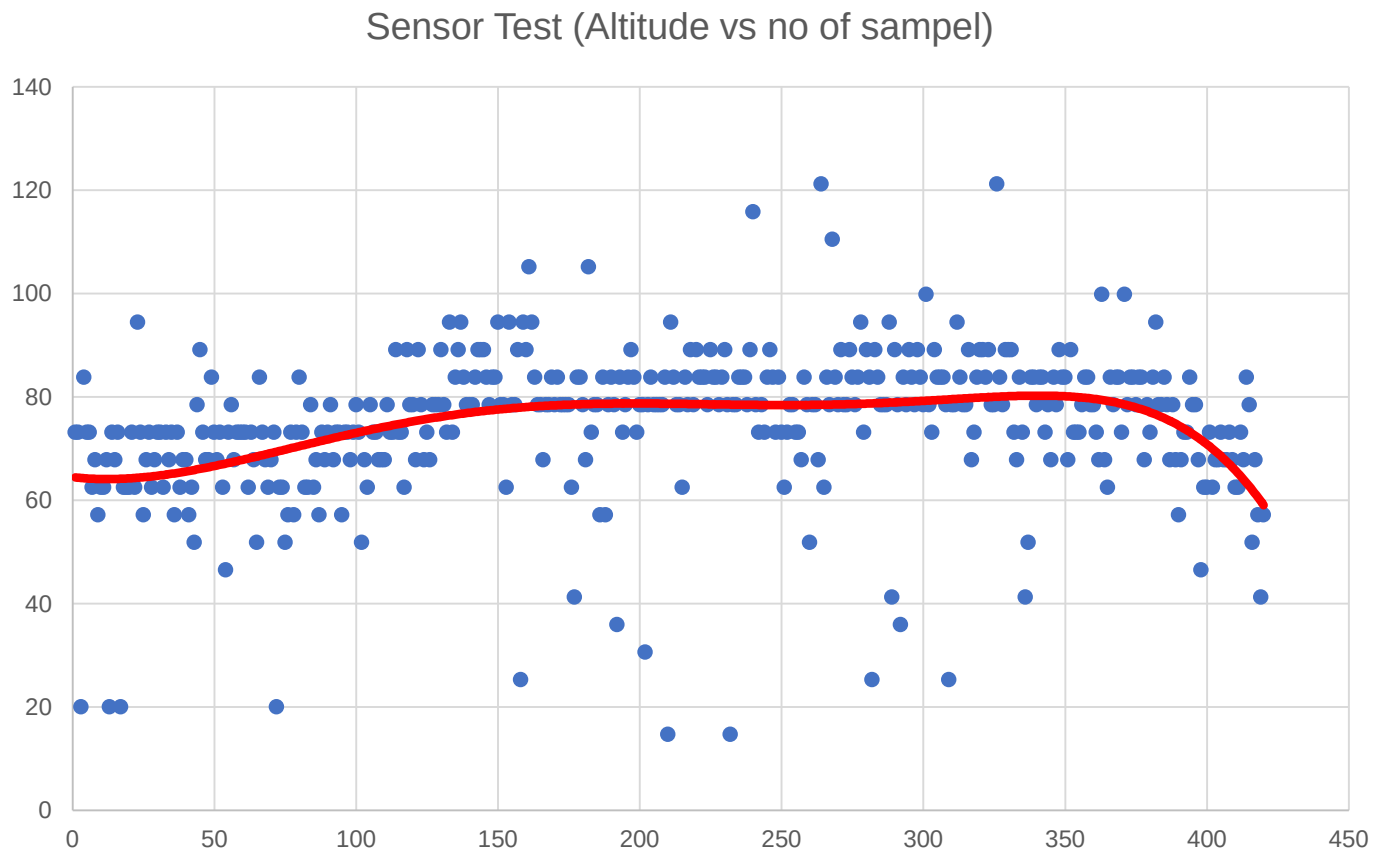
Validation and Verification Plan/Testing

1.0 Pressure Sensor Testing



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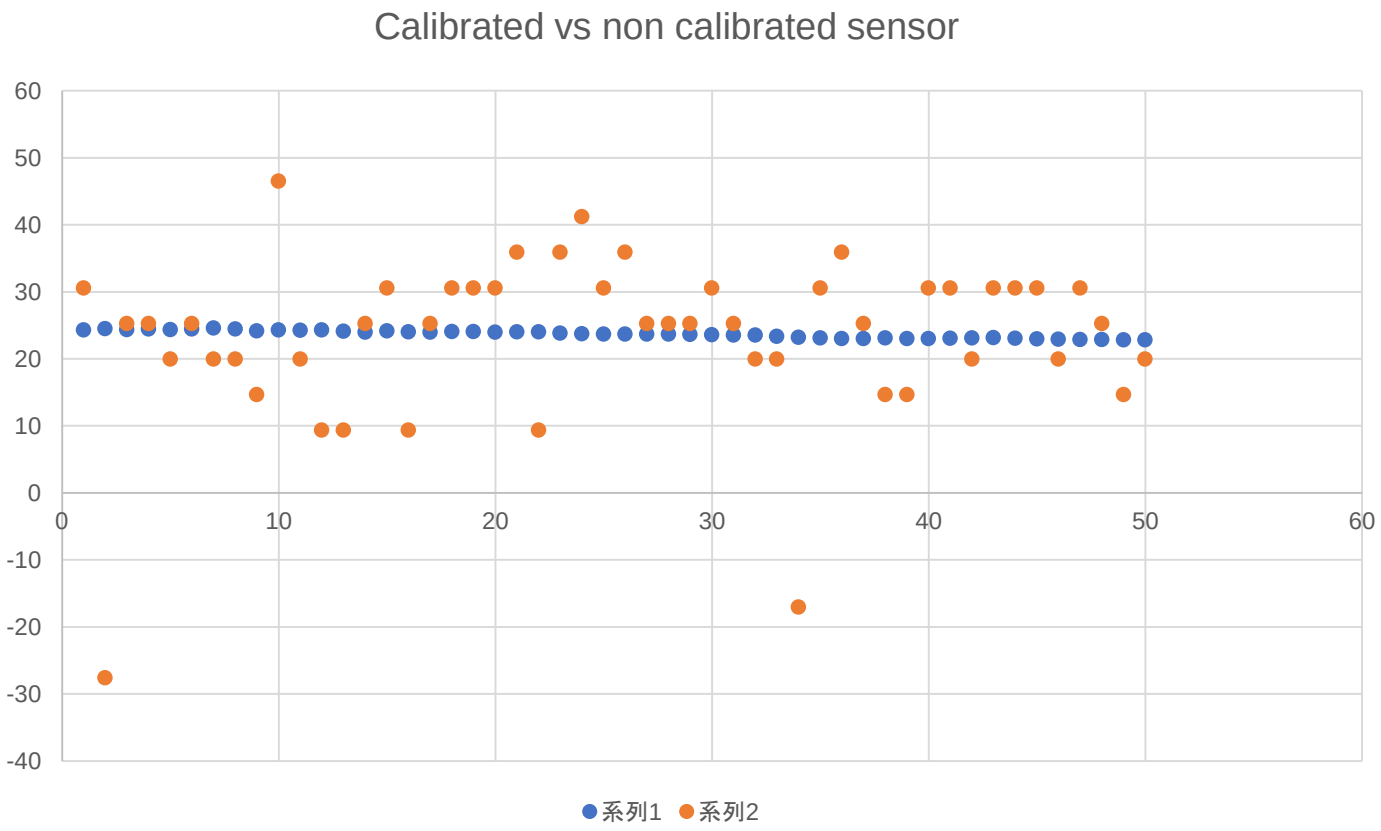
- Applied Low band pass filter – averaging the data



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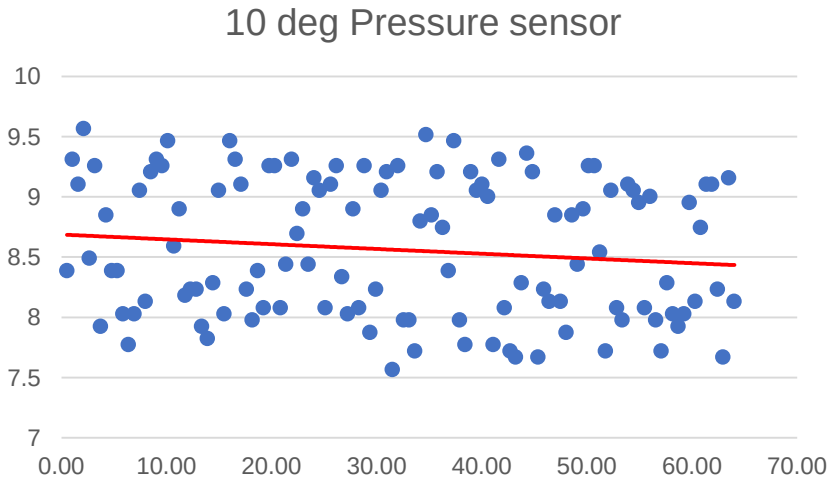
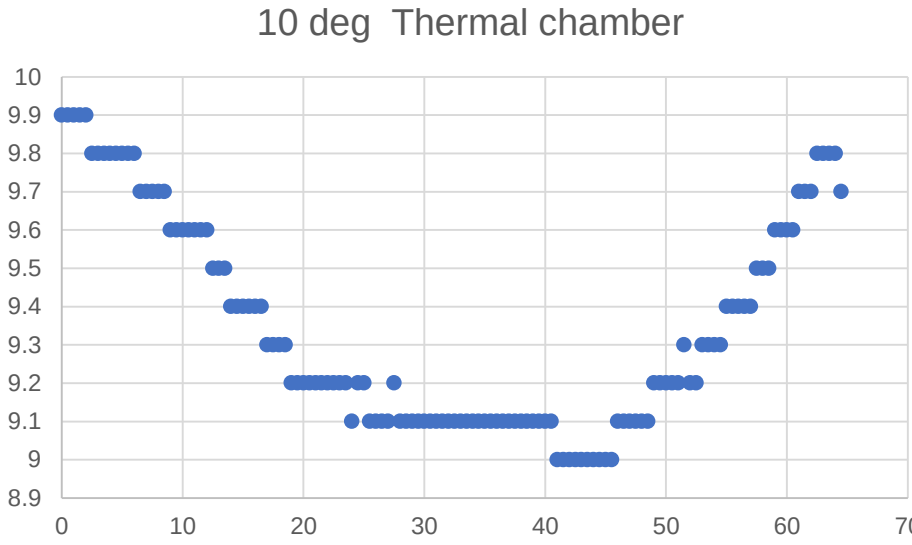
Thermal Test





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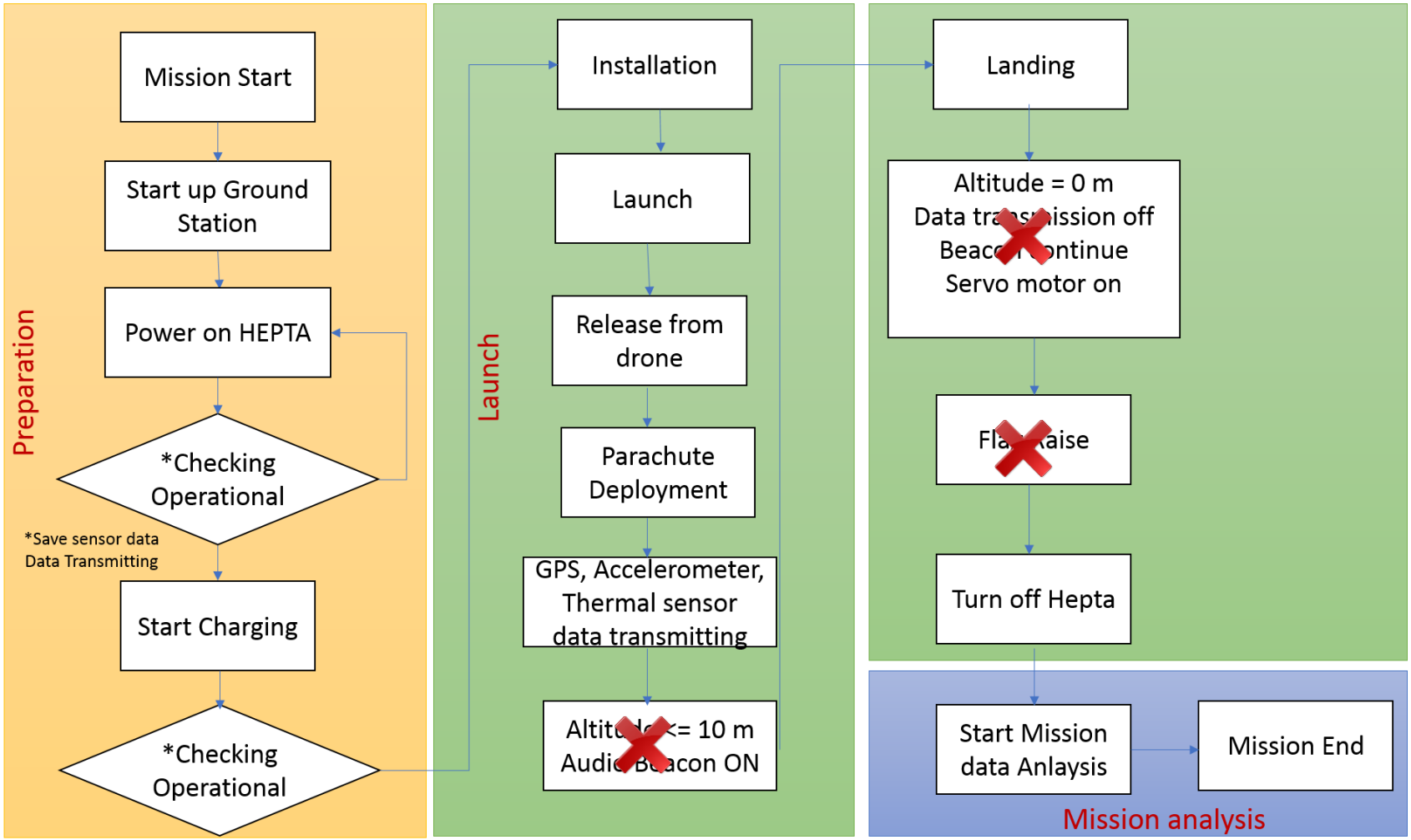
Mission Sequence



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Flight Result – Data Analysis

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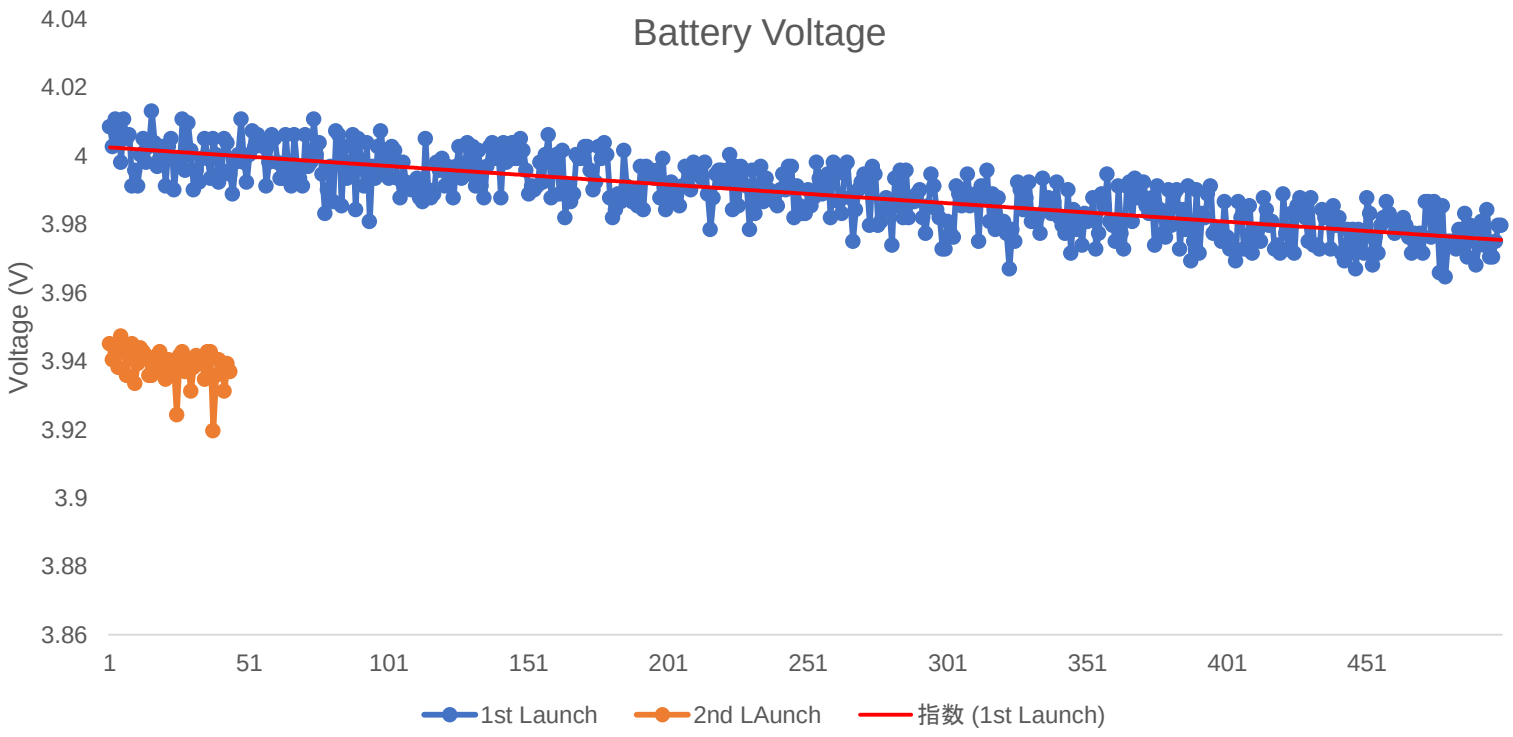
Telemetry Data - Voltage

- Battery Voltage sufficient for mission



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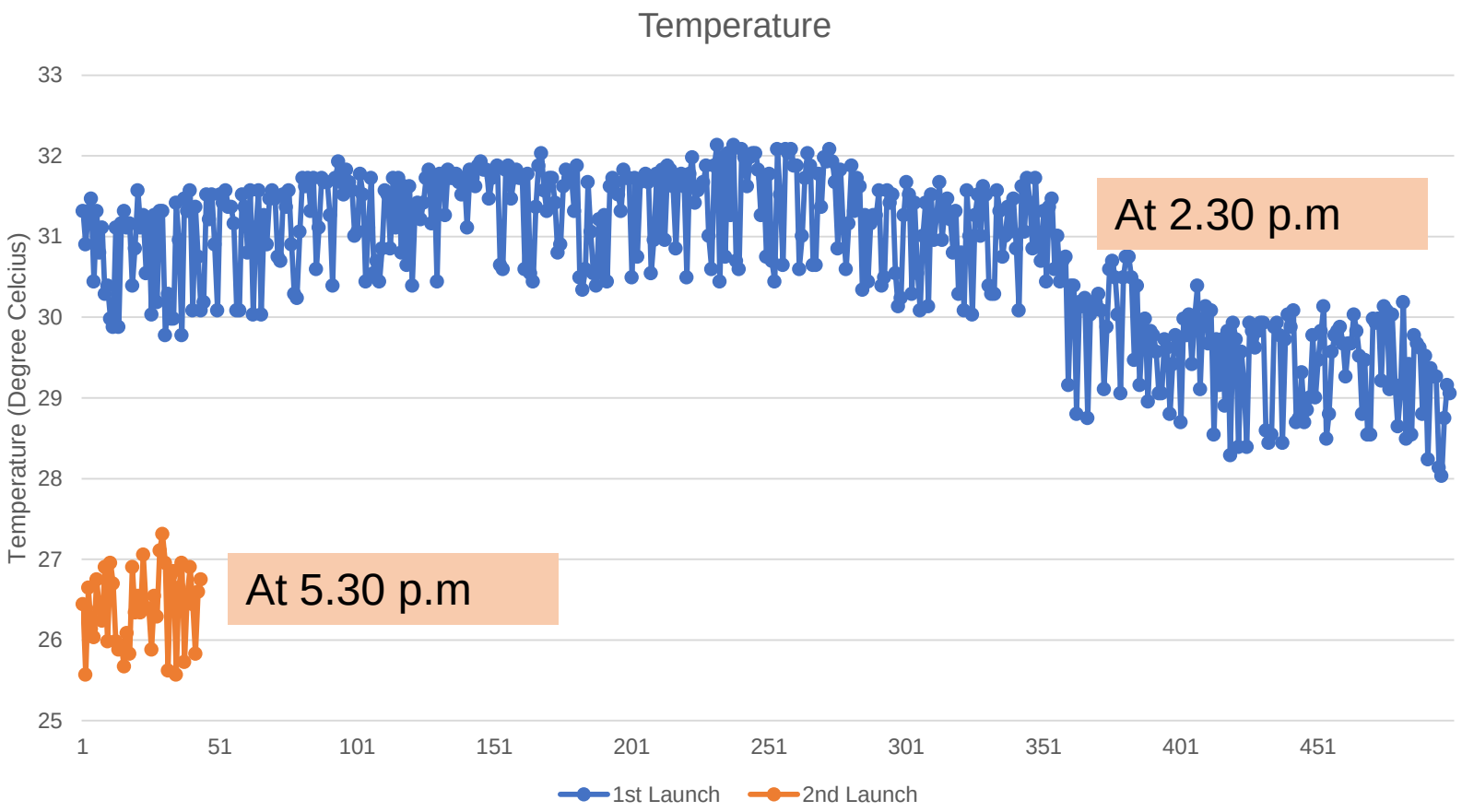
Telemetry Data - Temperature



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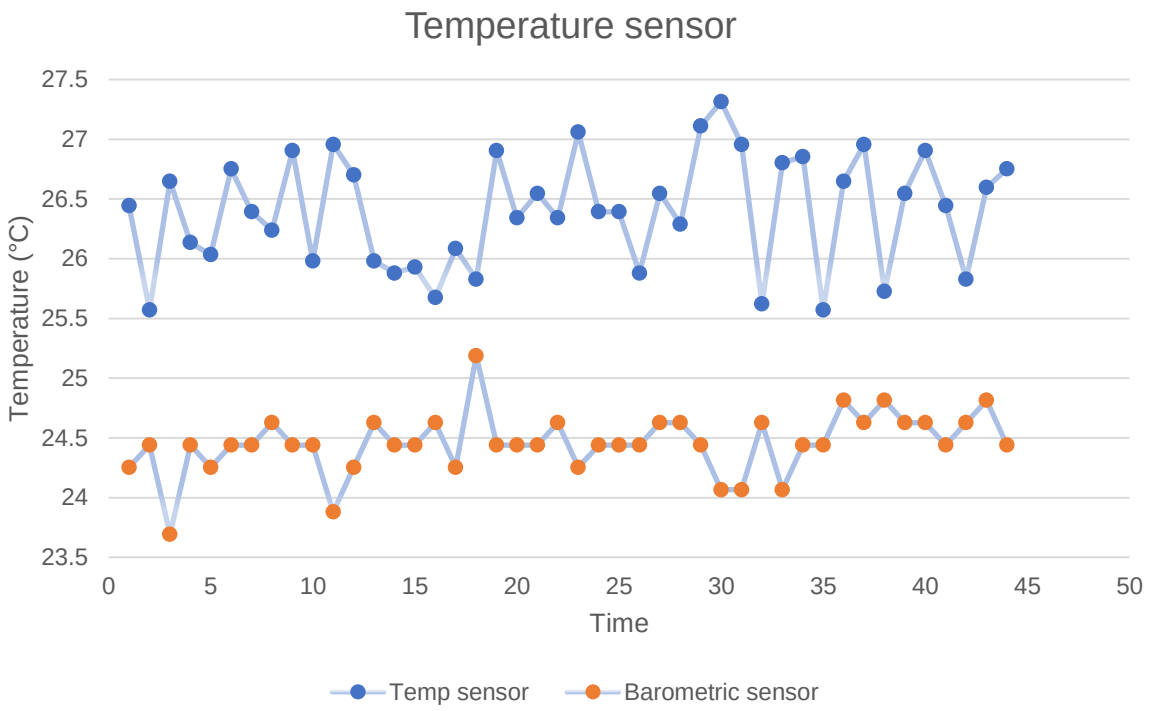
Flight Result: Second Attempt

- Comparison of temperature data between temperature sensor and Pressure sensor. (1 to 2 deg Celcius difference)
- Temperature sensor more reliable – (calibrated during thermal test)



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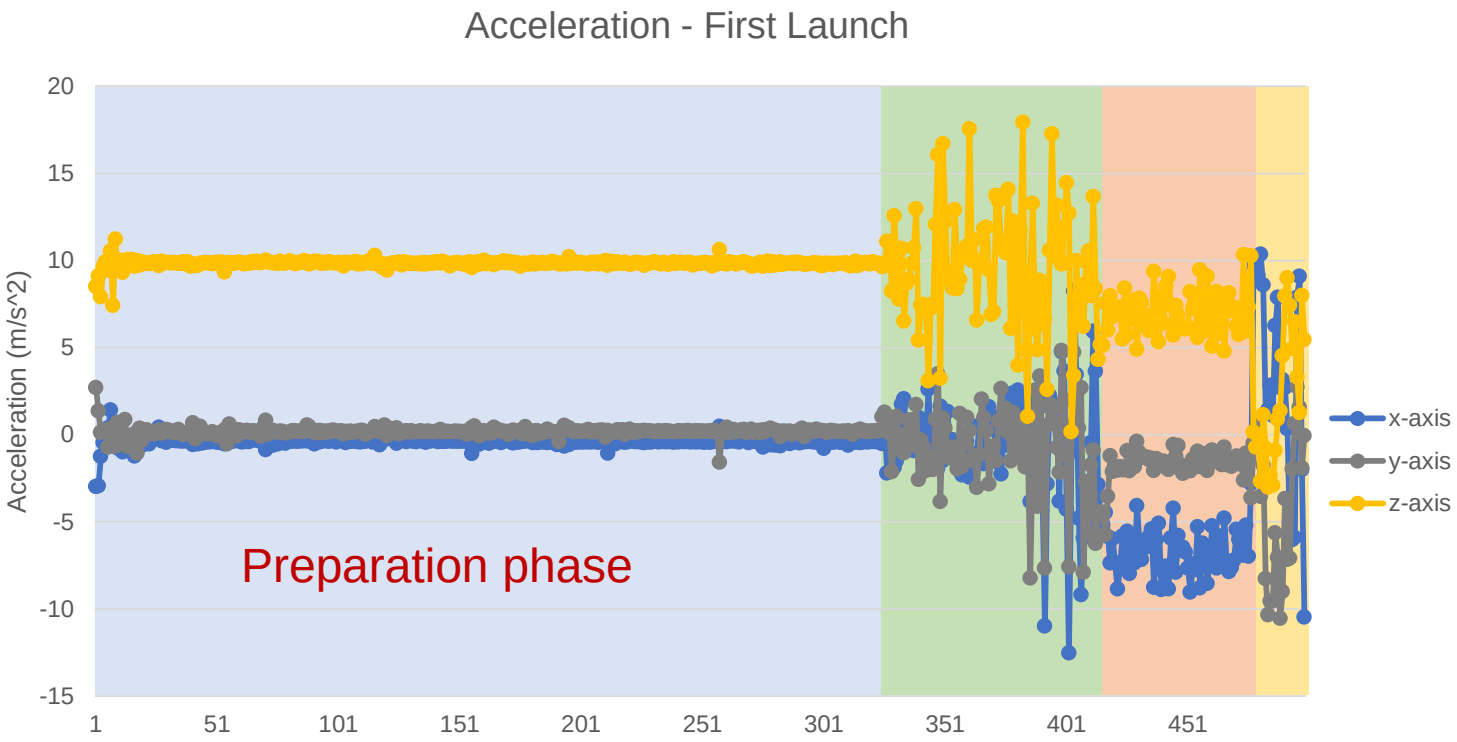
Flight Result: 9 axis sensor output.

- Stable output for first 300 sample = preparation phase



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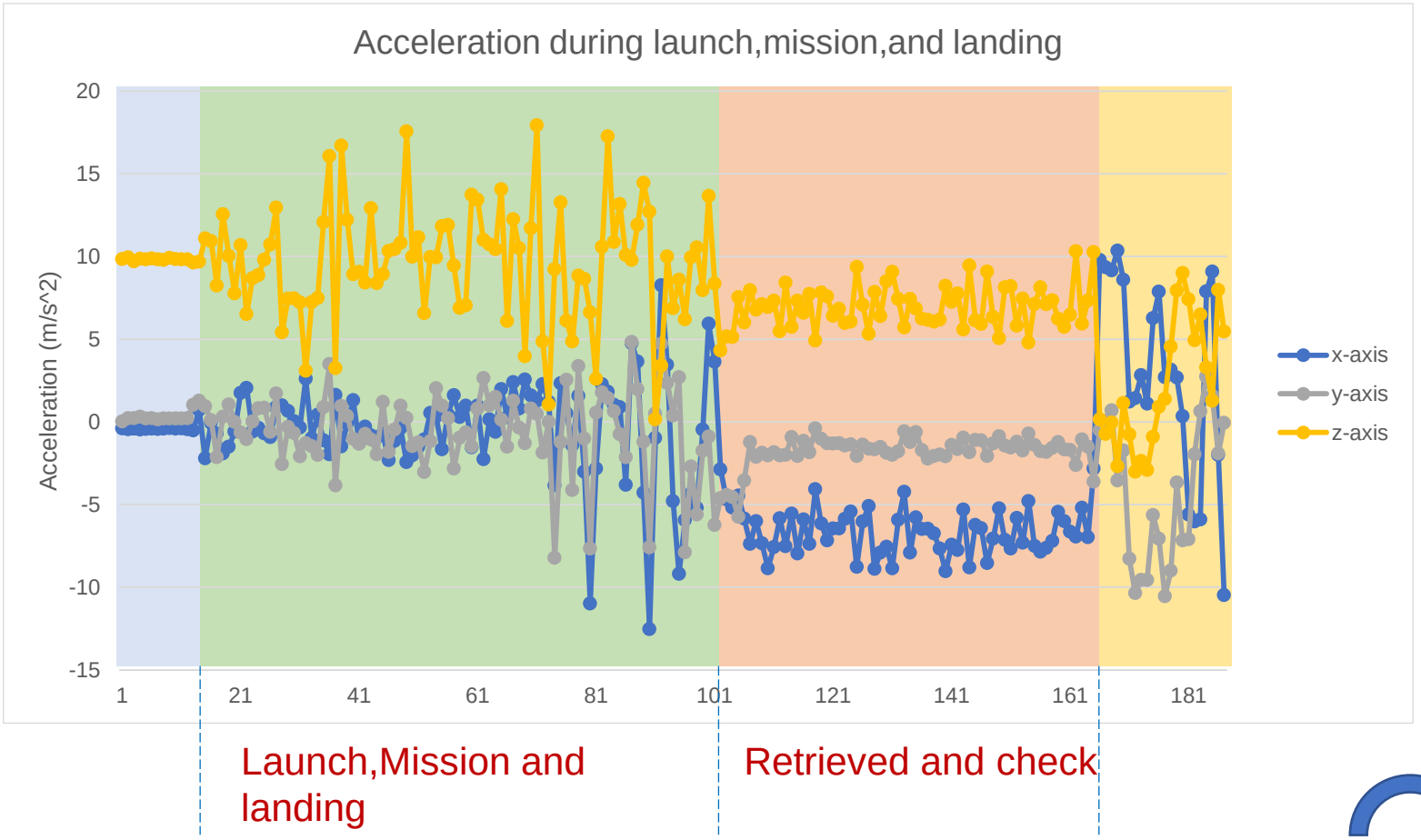
Flight Result: First Attempt

- 9 axis sensor output.



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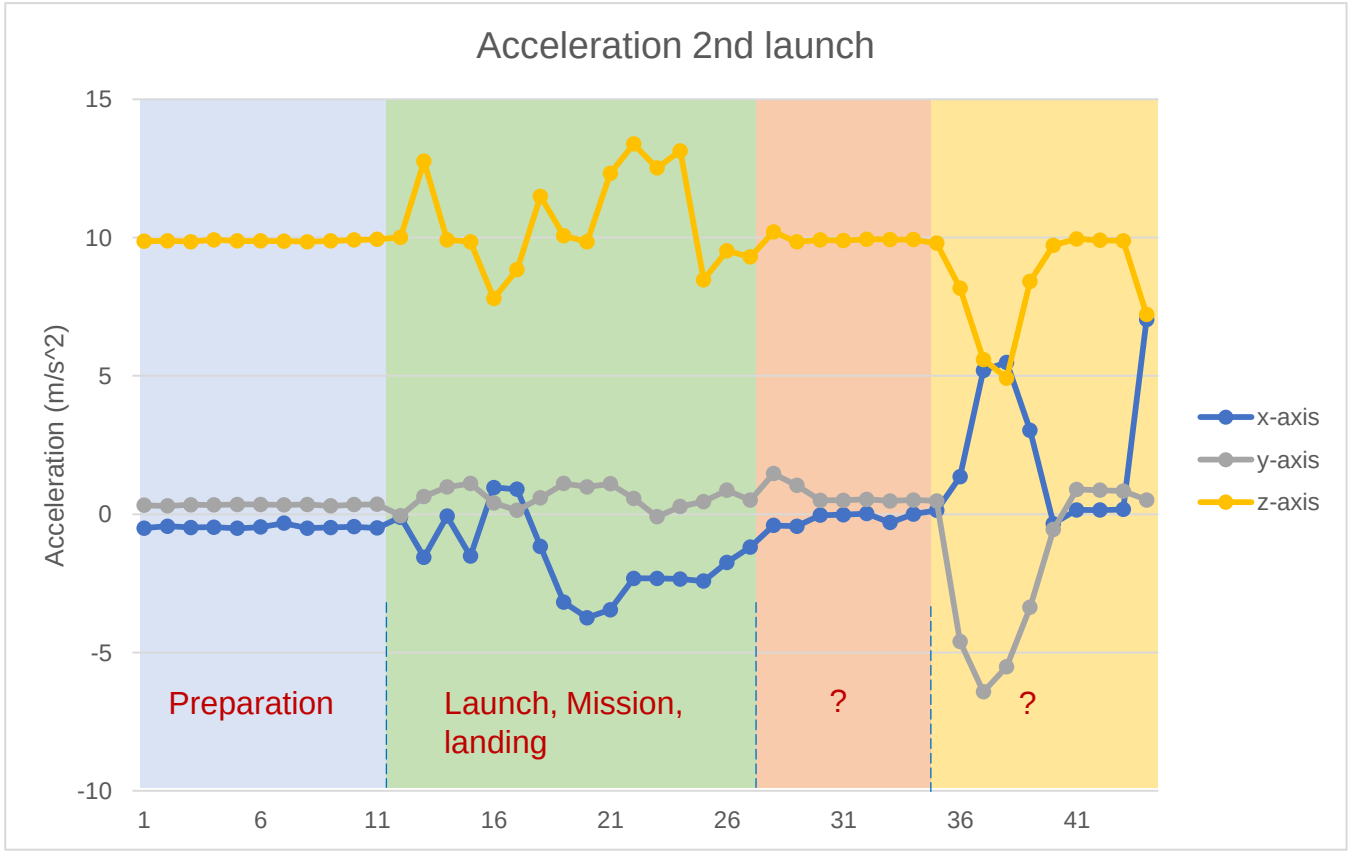
Flight Result: Second Attempt

- 9 axis sensor output.



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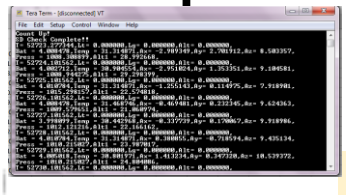
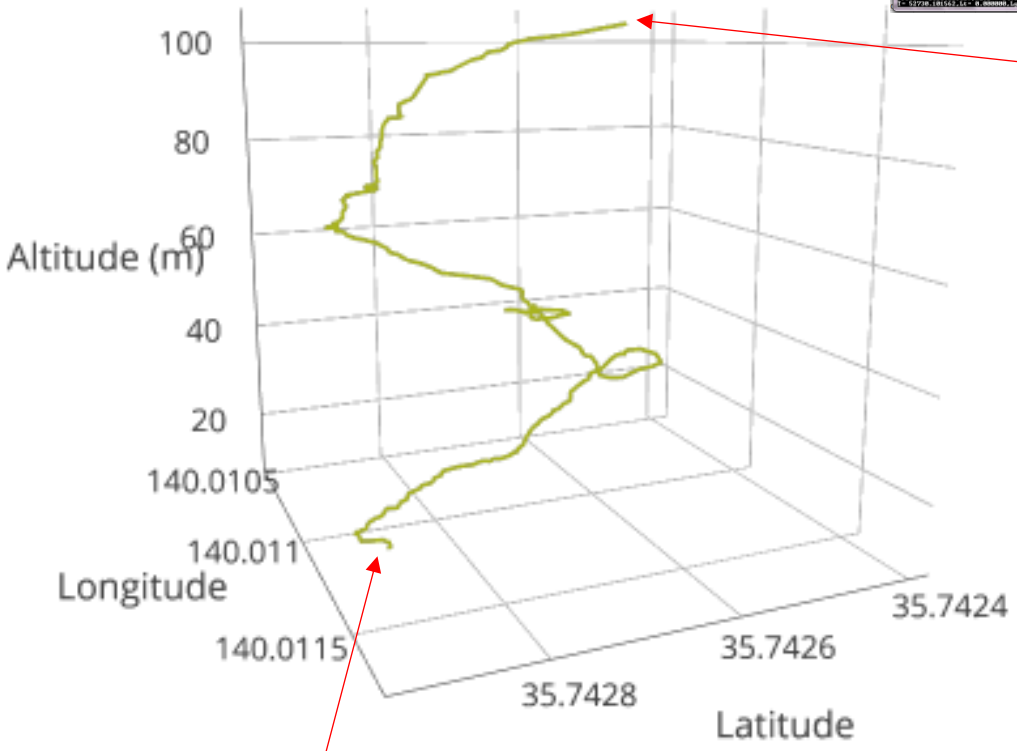
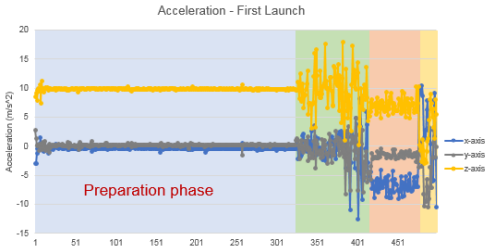
Flight Result First Attempt : GPS output





Show the highest Altitude at 104 m (launch altitude at 60 m)

- Check with Ground station data, the first GPS data transmitted is at 2:28 pm with altitude 104m (other sensor data start receive at 2.27 pm) – sd card show the same
- Check with 9 axis data : at sequence 45, steady state condition - preparation



Lowest Altitude at 9.9 m (Funabashi is at around 21-22m above sea level)*

*https://www.maps.ie/coordinates.html

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GPS data analysis

From Launch video :

- The video end at 2.32 pm. Hepta Sat release about 15 second before.
- At 2.32 pm, sd card data and GS data show altitude is at around 70 m.
- The GS connection has been stop at 2.33 pm when payload reached ground. The data on that time is at altitude 22 m
- But Hepta still ON and write data until 2.34pm. The last data show the altitude is 9 m.
- The data from sensor 9 axis, chaotic start at 2.32 pm 19sec.
- Based on all data, re-plotted the trajectory in goggle earth

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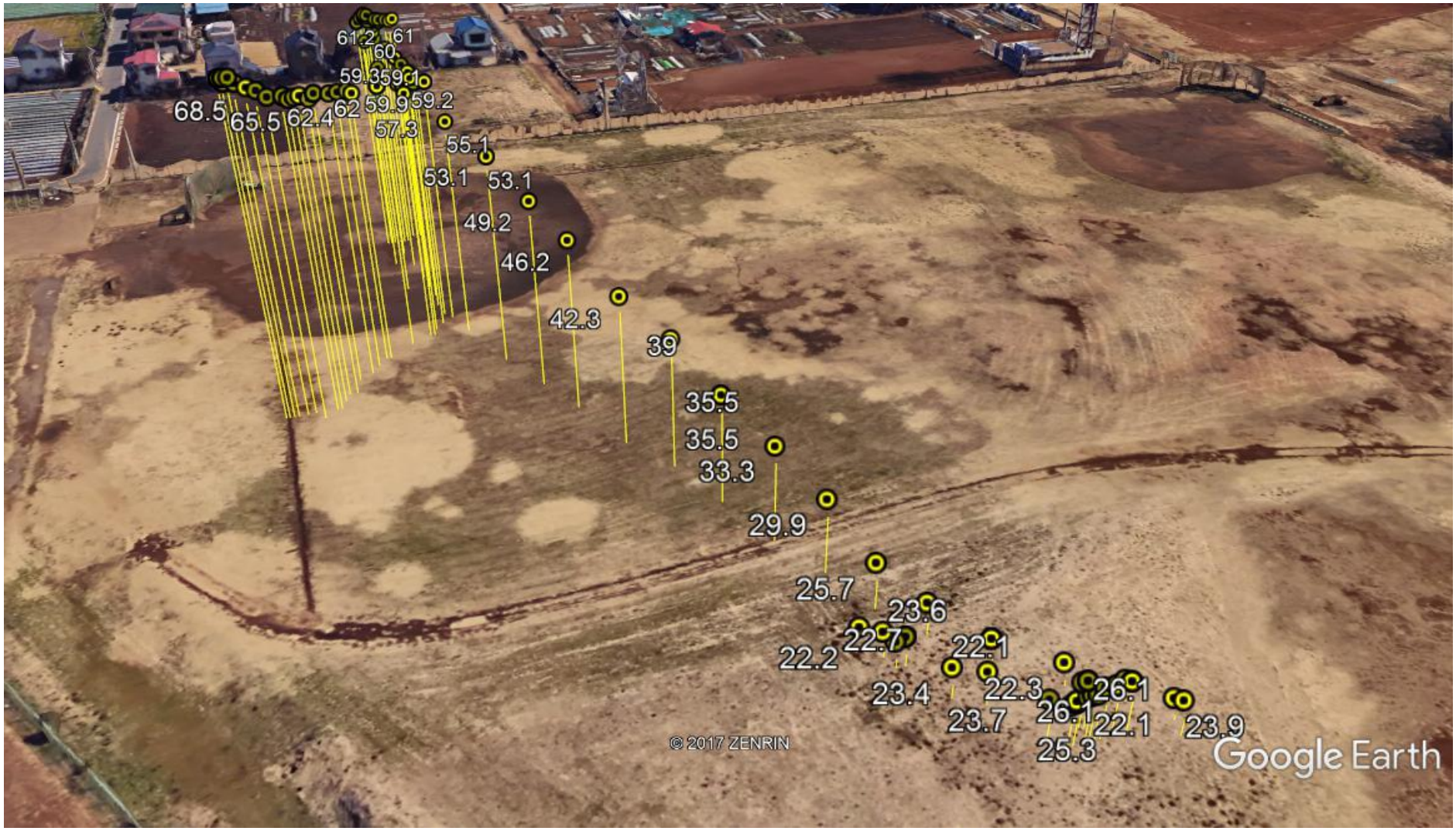

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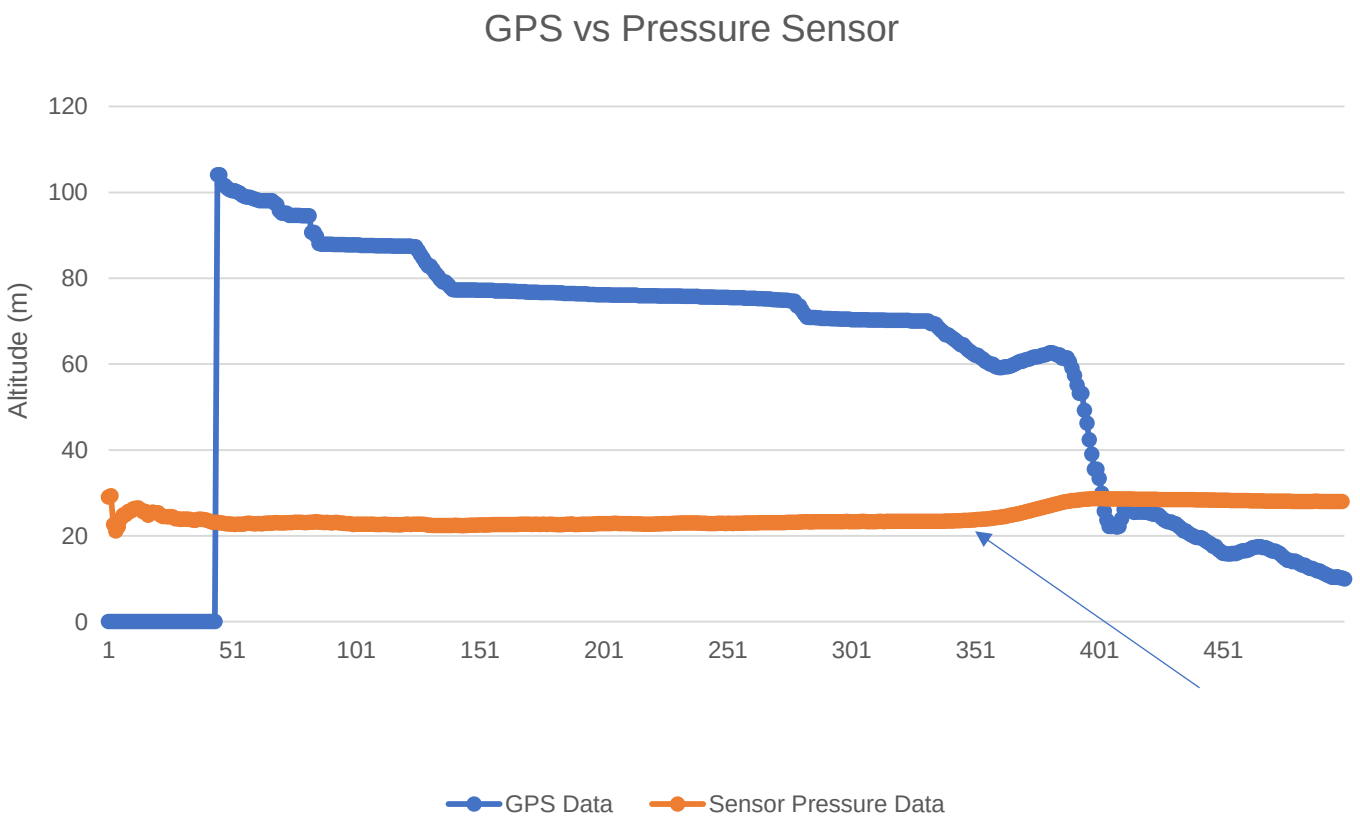
GPS vs Pressure sensor data



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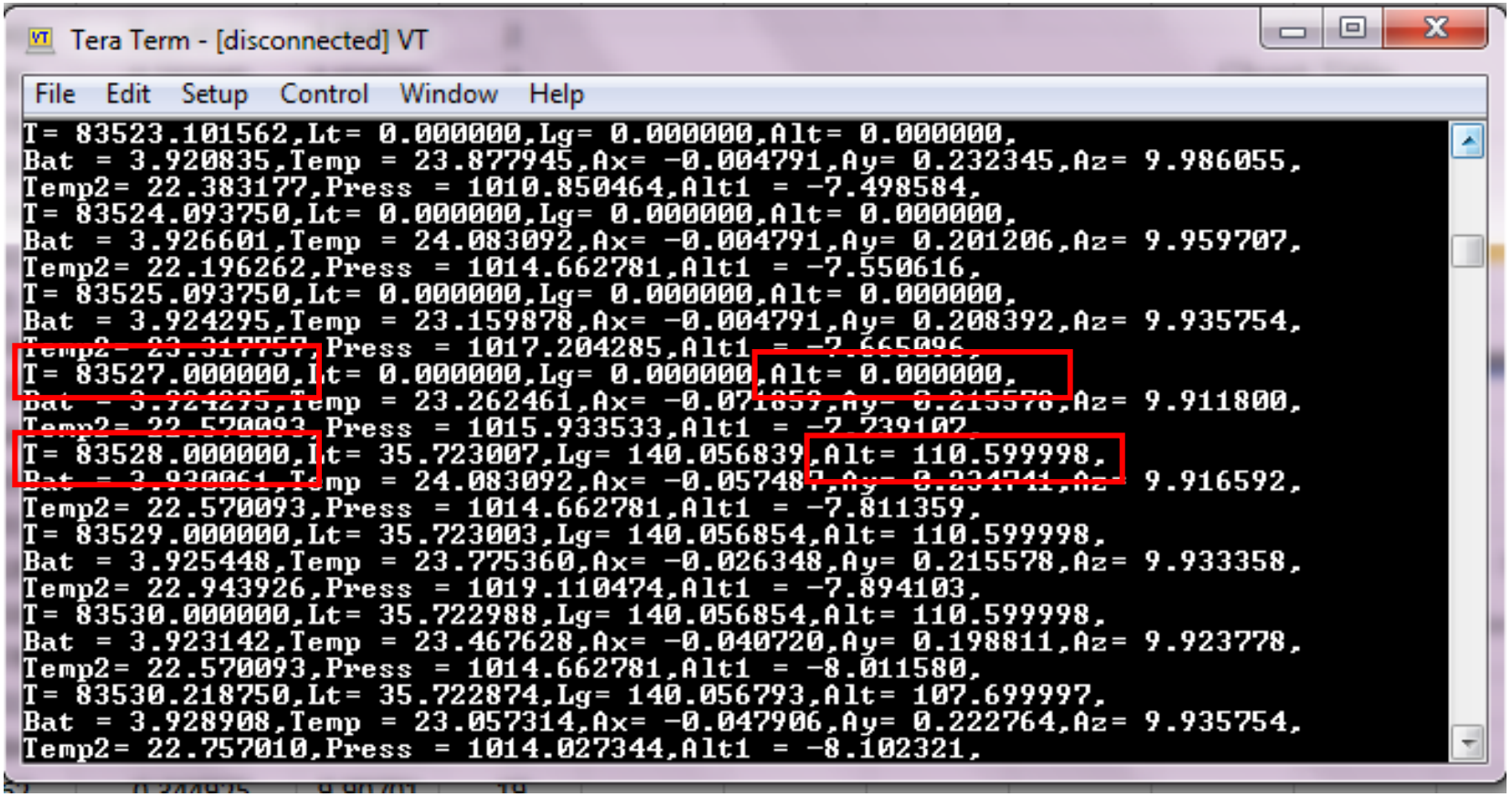

- GPS signal have a wait time before transmiting data. Should ON GPS earlier
- Found GPS data need time to stable.

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Conclusion

- Servo and Buzzer not working
- Telemetry data were transmitted

Level	Requirement	Evaluation Criteria
Minimum Mission Success	Sensors Data transmit to ground station	Sensors data received by ground station
Full Mission Success	Buzzer transmitted sound Flag raised	Confirmation received in PC and sound can be heard, Flag visually seen in raised condition

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Recommendation and Future Work (Mission)

- Check reliability of the data by conducting a number of test on the sensors.
- Should include GPS checking in verification sheet.
- Continue improving the programming to actuate sensor and buzzer
- Don’t be too ambitious! Reality check!

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Feedback and Recommendation (CLTP)

- Feedback:
  i. The hands-on training was a really good experience and easily to understood but need a good background in coding and electronic.
  ii. I have learnt the ‘know how’ especially when do the mistakes. (benefit of hands-on)
  iii. Tight schedule

Recommendation;

i. Teaching material can be brought outside the class for revision.
ii. Longer time for preparation of the mission.
iii. Team up Japanese participant with Foreign participant – more conversation. (layout the seat in the class)

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Thank you, and hope to see all of you again!