
CanSat 2026 Critical Design Review (CDR) Outline *Version 1.0*

#1064
Bamantara EEPISAT

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| Acronyms | Definition | | |
|-----------------|--|--------|---|
| | | DVR | Digital Video Recorder |
| 3D | Three Dimensional | EEPROM | Electrically Erasable Programmable Read Only Memory |
| ABS | Acrylonitrile Butadiene Styrene | EPS | Electrical Power Subsystem |
| | | FSW | Flight Software |
| ADC | Analog to Digital Converter | GB | Giga Byte |
| ASCII | American Standard Code for Information Interchange | GCS | Ground Control Station |
| BUS | Binary Unit System | GND | Ground |
| bps | Bits Per Second | GNSS | Global Navigation Satellite System |
| CAD | Computer Aided Design | GPIO | General Purpose Input Output |
| CDH | Communication and Data Handling | GPS | Global Positioning System |
| COTS | Commercial Of-the-Shelf | HDPE | High-Density Polyethylene |
| CSV | Comma Separated Value | I/O | Input/Output |
| dB | Decibel | I2C | Inter-Integrated Circuit |
| dB _i | Decibel Isotropic | IDE | Integrated Development Environment |
| dB _m | Decibel-Milliwatt | IMU | Inertial Measurement Unit |
| DC | Direct Current | LED | Light Emitting Diode |
| DoF | Degree of Freedom | | |

| | | | |
|--------|--|--|---|
| MB | Mega Byte | SDIO | Secure Digital Input Output |
| MCU | Microcontroller Unit | SMD | Surface Mount Device |
| NGL | Negligible | SPI | Serial Peripheral Interface |
| NMEA | National Marine Electronics Association | ToF | Time of Flight |
| OS | Operating System | UART | Universal Asynchronous Receiver/Transmitter |
| PCB | Printed Circuit Board | | |
| PETG | Polyethylene Terephthalate Glycol | USB | Universal Serial Bus |
| PFR | Post Flight Review | UTC | Universal Time Coordinated |
| PG | Para-glider | XCTU | XBee Configuration and Test Utility |
| PLA | Polylactic Acid | System Requirement Verification | |
| POV | Point of View | Acronyms | Definition |
| PWM | Pulse Width Modulation | A | Analysis |
| RAM | Random Access Memory | I | Inspection |
| RBF | Remove Before Flight | T | Test |
| RP-SMA | Reverse Polarity Sub-Miniature version A | D | Demonstration |
| RTC | Real-Time Clock | | |
| SATS | Satellites | | |
| SD | Secure Digital | | |

System Overview

Lintang Arum Sari

Main Objectives

The mission simulates Para-glider Instrument Delivery

1. Design a CanSat that shall consist of a payload and a container that mounts on top of the rocket.
2. The container with the payload shall deploy from the rocket when the rocket reaches peak altitude, and the rocket motor ejection forces a separation.
3. The container with the payload shall descend at a rate of no more than 15 m/s using a parachute.
4. At 80% peak altitude, the payload shall separate from the container and descend using a para-glider descent control system until landing. The descent rate shall be an average of 5 m/s.
5. The payload shall steer toward a specified position to deposit an egg instrument.
6. At 2 meters above the ground, the instrument shall be released and land intact.
7. A release camera shall show the separation of the payload from the container and the para-glider descent control system functioning.
8. A ground video camera shall be pointing downwards and show the ground during descent and the egg instrument being released.
9. The CanSat shall collect sensor data during ascent and descent and transmit the data to a ground station @1 Hz.
10. The sensor data shall include interior temperature, battery voltage, battery current, tilt angle, rotation rate, and GPS position.

Bonus Objectives

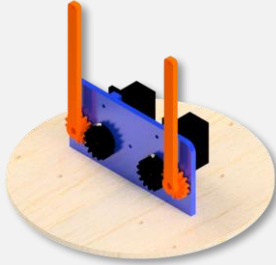
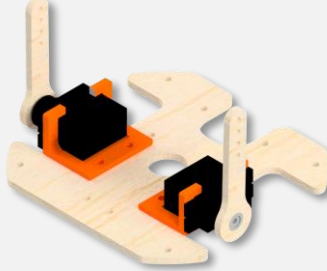
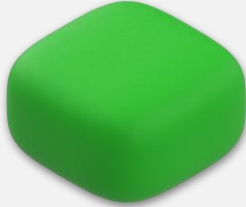

Design and develop a compact, portable ground station with high usability, reliable telemetry handling, and strong construction quality to compete for the Mark Walker Ground Station Design Award.

External Objectives


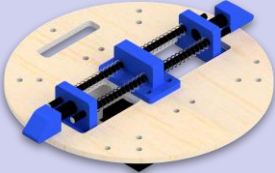

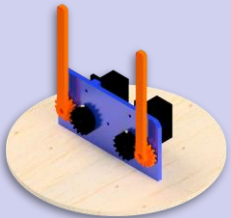
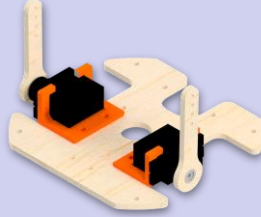
1. We have the intention to acquire the first place in the CanSat Competition 2026.
2. To increase experience through any engineering project, adapt to the teamwork environment, project implementation, and time management.

Summary of Changes Since PDR (1/6)

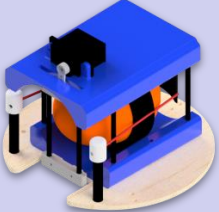
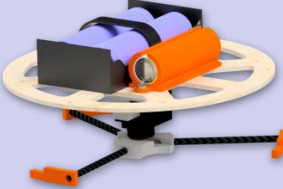




| Section | Part | PDR | CDR | Rationale |
|-------------------------|--|---|--|---|
| Sensor Subsystem Design | Payload Voltage and Current sensor. | ACS712 for current sensor and Divider for Voltage sensor. | INA219 to measure both payload Voltage and Current. | Simplifies measurement by using a single sensor to monitor both payload voltage and current. |
| | Release Camera and Ground Camera | RunCam Split 2 for both Release and Ground Camera | EYESEC X6D for Release Camera and Turbowing Cyclops 3 V3 for Ground Camera | The RunCam camera was replaced due to its excessive weight and high power consumption, with a lighter and more low consumption power camera |
| | Egg Release Sensor | BMP280 | VL53L1X | To achieve more precise altitude measurements at low heights, infrared from ToF sensor is used to measure the distance between the payload and the ground directly. |

| Section | Part | PDR | CDR | Rationale |
|------------------------|-------------------------------|--|---|---|
| Descent Control Design | Para-glider Control Mechanism |  <p>Left and right</p> |  <p>Forward and backward</p> | After we tested, the result is servo horn with upward and downward movements are more effective than side-to-side movement. |
| | Payload Mass | <p>Mass of the payload is 700.6g</p> | <p>Mass of the payload is 648.1g</p> | After going through the manufacturing process, the total weight of the payload decreased to 648.1g. |
| | Para-glider Bag |  <p>It's doesn't exist</p> |  | Avoid rope from being tangled. |



Summary of Changes Since PDR (3/6)

| Section | Part | PDR | CDR | Rationale |
|-----------------------------|-------------------------------|---|---|--|
| Descent Control Design | Instrument Descent Control | It doesn't exist |  Using Ribbon | In the PDR configuration, the instrument is released without using the nose cone, and a ribbon is employed to ensure the descent rate remains below 5 m/s. |
| | Payload Release Mechanism |  Using slider spring system |  Using arm connect to servo | Lighter and simpler mechanism |
| Mechanical Subsystem Design | Para-glider Control Mechanism |  Left and right |  Forward and backward | Optimize the moving area for servo horn |

Summary of Changes Since PDR (4/6)

| Section | Part | PDR | CDR | Rationale |
|-----------------------------|------------------------------|---|--|--------------------------------|
| Mechanical Subsystem Design | Instrument Release Mechanism |  Using slingshot system |  Using twist lock system | Decrease unnecessary dimension |
| | Instrument Cover Design |  Egg covered with cellulose, bubble wrap & 3D printed cover |  Egg covered with bubble wrap & carbon fiber nose cone | Better egg protection |
| | Payload Holder |  It doesn't exist |  | Better locking position |

Summary of Changes Since PDR (5/6)

| Section | Part | PDR | CDR | Rationale |
|-----------------------------|----------------------------|---|---|--|
| Mechanical Subsystem Design | Para-glider Bag Attachment |  <p>It doesn't exist</p> |  | Avoid the para-glider's rope from being tangled |
| Communication Data Handling | Payload Telemetry Format | Match with mission guide without additional fusion roll, and pitch data for 3D model. Also, incorrect placement of the checksum command | Added roll and pitch data to telemetry. And the command checksum position has been corrected at the end of the telemetry format | Improve the CanSat 3D model visualization in the GCS and ensure the checksum correctly verifies all received data. |
| Electronic Power Subsystem | Battery Holder | Velcro Strap | Zip Ties | Use zip ties instead of Velcro due to limited space, as they are lighter, simpler, and more secure. |

Summary of Changes Since PDR (6/6)

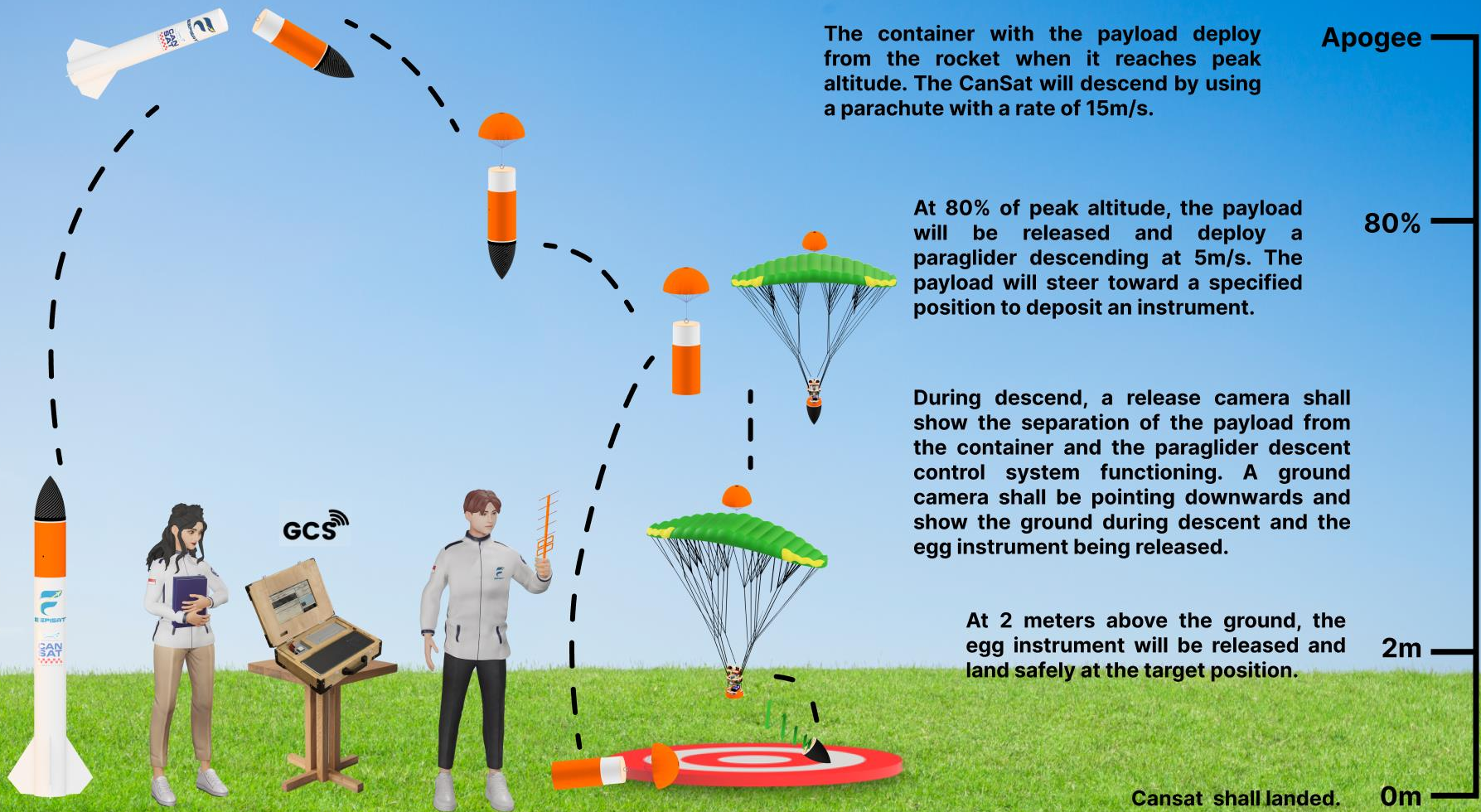
| Section | Part | PDR | CDR | Rationale |
|------------------------------|---|--------------------|-----------------------|--|
| Electronic Power Subsystem | Camera Battery | Blackcell 14500 2s | Soshine ICR14500 3.7V | The Soshine battery provides sufficient power for two hours while being lighter and more compact, reducing overall mass. |
| Flight Software Design | There were no changes to the Flight Software Design | | | |
| Ground Control System Design | There were no changes to the Ground Control System Design | | | |

| RN | Requirement | Subsystem | Priority | Verification | | | |
|-----|--|-------------|----------|--------------|---|---|---|
| | | | | A | I | T | D |
| C1 | The CanSat payload shall function as a nose cone during the rocket ascent portion of the flight. | Operational | High | ✓ | ✓ | ✓ | ✓ |
| C2 | The CanSat container shall be mounted on top of the rocket with the shoulder section inserted into the airframe | Operational | High | ✓ | ✓ | ✓ | |
| C3 | The CanSat payload and container shall be deployed from the rocket when the rocket motor ejection charge fires. | Operational | High | ✓ | | | |
| C4 | After deployment, the CanSat payload and container shall descend at 15 m/s using a parachute that automatically deploys. Error is +/- 3 m/s. | Operational | High | ✓ | ✓ | ✓ | |
| C5 | At 80% flight peak altitude, the payload shall be released from the container. | Operational | High | ✓ | ✓ | ✓ | |
| C6 | At 80% peak altitude, the payload shall deploy a para-glider descent control system. | Operational | High | ✓ | ✓ | ✓ | |
| C7 | The payload shall descend at 5 m/s averaged over the entire descent within +/- 3 m/s with the para-glider descent control system. | Operational | High | ✓ | ✓ | ✓ | |
| C8 | The payload shall steer toward a target location. | Operational | High | ✓ | ✓ | | |
| C9 | The sensor telemetry shall be transmitted at a 1 Hz rate | Operational | High | ✓ | ✓ | ✓ | ✓ |
| C10 | The payload shall record video of the release of the payload from the container and the deployment of the para-glider descent control system | Operational | High | ✓ | ✓ | ✓ | ✓ |

| RN | Requirement | Subsystem | Priority | Verification | | | |
|-----|--|-------------|----------|--------------|---|---|---|
| | | | | A | I | T | D |
| C11 | A second video camera shall point at the ground. | Operational | High | ✓ | ✓ | ✓ | ✓ |
| C12 | The payload shall release a protected hens egg when the payload is 2 meters +/- 0.5 m above the ground without breaking the egg. | Operational | High | ✓ | ✓ | ✓ | ✓ |
| C13 | The CanSat payload shall include an audible beacon that is turned on separately and is independent of the CanSat battery and electronics. | Operational | High | ✓ | ✓ | ✓ | ✓ |
| C14 | Cost of the CanSat shall be under \$1000. Ground support and analysis tools are not included in the cost of the CanSat. Equipment from previous years shall be included in this cost, based on current market value. | Operational | High | ✓ | ✓ | ✓ | ✓ |
| S1 | The CanSat and container mass shall be 1000 grams +/- 10 grams. | Structural | High | ✓ | ✓ | ✓ | |
| S8 | CanSat structure must survive 15 Gs vibration. | Structural | High | ✓ | ✓ | | |
| S9 | CanSat shall survive 30 G shock. | Structural | High | ✓ | ✓ | ✓ | ✓ |
| S17 | All electronics and mechanical components shall be hard mounted using proper mounts such as standoffs, screws, or high performance adhesives. | Structural | High | ✓ | ✓ | ✓ | |
| M3 | All mechanisms shall be capable of maintaining their configuration or states under all forces. | Mechanical | High | ✓ | ✓ | ✓ | |

| RN | Requirement | Subsystem | Priority | Verification | | | |
|------|---|----------------|----------|--------------|---|---|---|
| | | | | A | I | T | D |
| E3 | An easily accessible power switch through the container is required | Electrical | High | ✓ | ✓ | ✓ | |
| E6 | The CanSat shall operate for a minimum of two hours when integrated into the rocket. | Electrical | High | ✓ | ✓ | ✓ | ✓ |
| E8 | The audio beacon shall have an easily accessible power switch through the container | Electrical | High | ✓ | ✓ | ✓ | ✓ |
| X4 | The CanSat shall transmit telemetry once per second. | Communications | High | ✓ | ✓ | ✓ | ✓ |
| X5 | The CanSat telemetry shall include altitude, air pressure, temperature, battery voltage, command echo, and GPS coordinates that include latitude, longitude, altitude and number of satellites tracked. | Communications | High | ✓ | ✓ | ✓ | ✓ |
| SN6 | CanSat payload shall video record the deployment of the para-glider at 80% peak altitude. | Sensor | High | ✓ | ✓ | ✓ | |
| SN7 | CanSat payload shall video record the ground during descent. | Sensor | High | ✓ | ✓ | ✓ | |
| SN8 | The ground pointing camera shall capture video of the instrument (egg) being released and reaching the ground. | Sensor | High | ✓ | ✓ | ✓ | |
| SN10 | CanSat payload shall measure its battery current. | Sensor | High | ✓ | ✓ | | |
| G2 | The ground station shall generate csv files of all sensor data as specified in the Telemetry Requirements section. | Ground Station | High | ✓ | ✓ | ✓ | ✓ |

| RN | Requirement | Subsystem | Priority | Verification | | | |
|-----|---|-----------------|----------|--------------|---|---|---|
| | | | | A | I | T | D |
| G3 | Telemetry shall include mission time with 1 second resolution | Ground Station | High | ✓ | ✓ | ✓ | ✓ |
| G4 | Each team shall develop their own ground station. | Ground Station | High | ✓ | ✓ | ✓ | ✓ |
| G7 | Teams shall plot altitude, battery voltage, battery current, accelerometer value and rotation rates in real time. | Ground Station | High | ✓ | ✓ | ✓ | ✓ |
| G8 | Teams shall display mission time, temperature, GPS position, received packet count, lost packet count, and flight software state in real time. | Ground Station | High | ✓ | ✓ | ✓ | ✓ |
| G9 | The ground station shall include one laptop computer with a minimum of two hours of battery operation, XBee radio and an antenna. | Ground Station | High | ✓ | ✓ | ✓ | ✓ |
| G12 | When in simulation mode, the ground station shall transmit pressure data from a csv file provided by the competition at a 1 Hz interval to the CanSat. | Ground Station | High | ✓ | ✓ | ✓ | ✓ |
| G17 | The ground station shall be able to activate all mechanisms on command. | Ground Station | High | ✓ | ✓ | ✓ | ✓ |
| F1 | The flight software shall maintain a count of packets transmitted which shall increment with each packet transmission throughout the mission. The value shall be maintained through processor resets. | Flight Software | High | ✓ | ✓ | ✓ | ✓ |
| F2 | The CanSat shall maintain mission time throughout the entire mission even in the event of a processor resets or momentary power loss. | Flight Software | High | ✓ | ✓ | ✓ | ✓ |
| F7 | The flight shall include commands to activate all mechanisms. These commands shall be documented in the mission manual. | Flight Software | High | ✓ | ✓ | ✓ | ✓ |



The container with the payload deploys from the rocket when it reaches peak altitude. The CanSat will descend by using a parachute with a rate of 15m/s.

At 80% of peak altitude, the payload will be released and deploy a paraglider descending at 5m/s. The payload will steer toward a specified position to deposit an instrument.

During descent, a release camera shall show the separation of the payload from the container and the paraglider descent control system functioning. A ground camera shall be pointing downwards and show the ground during descent and the egg instrument being released.

At 2 meters above the ground, the egg instrument will be released and land safely at the target position.

Cansat shall land.

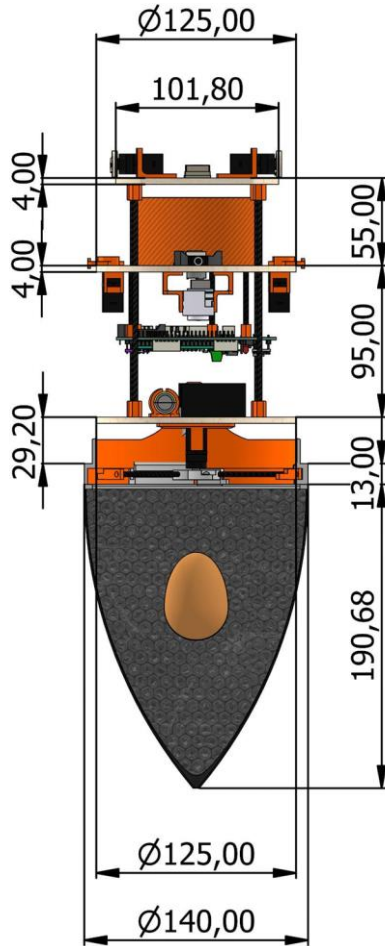
Apogee

80%

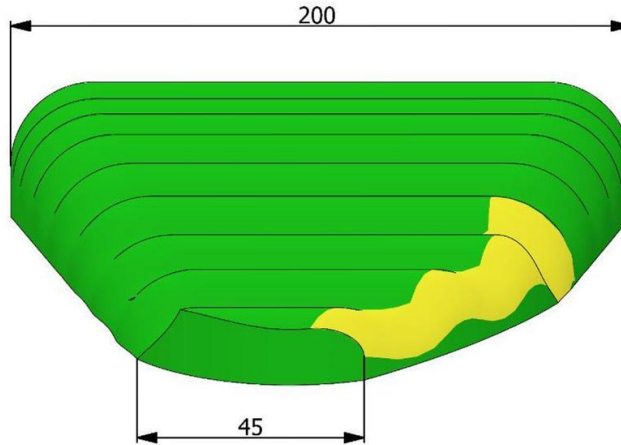
2m

0m

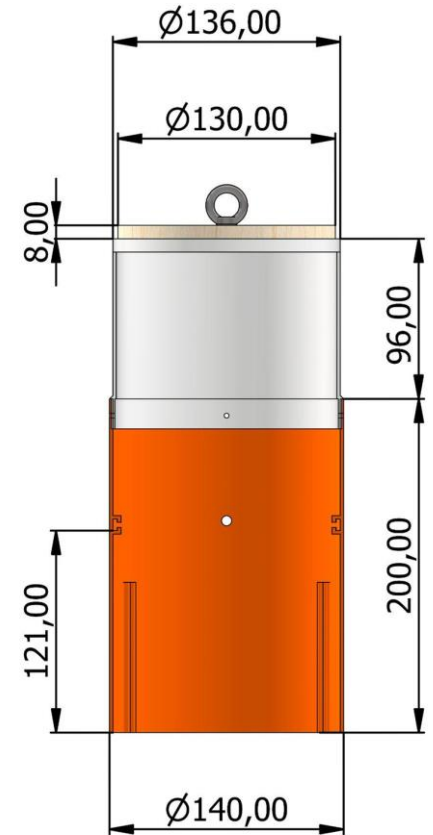
Payload Physical Layout



Chord Length



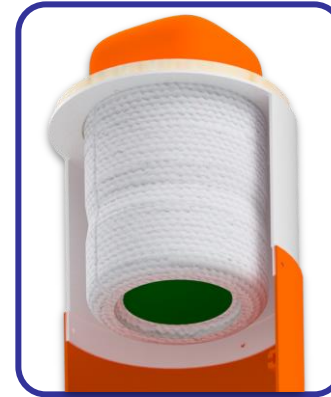
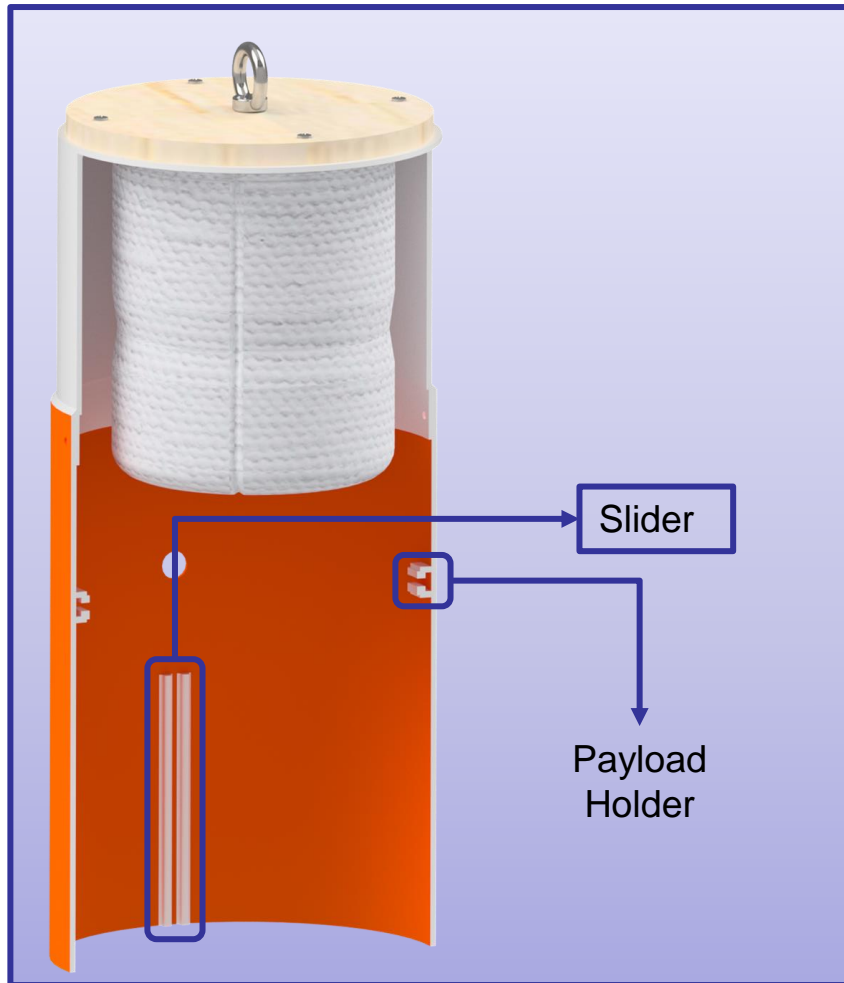
Container Physical Layout



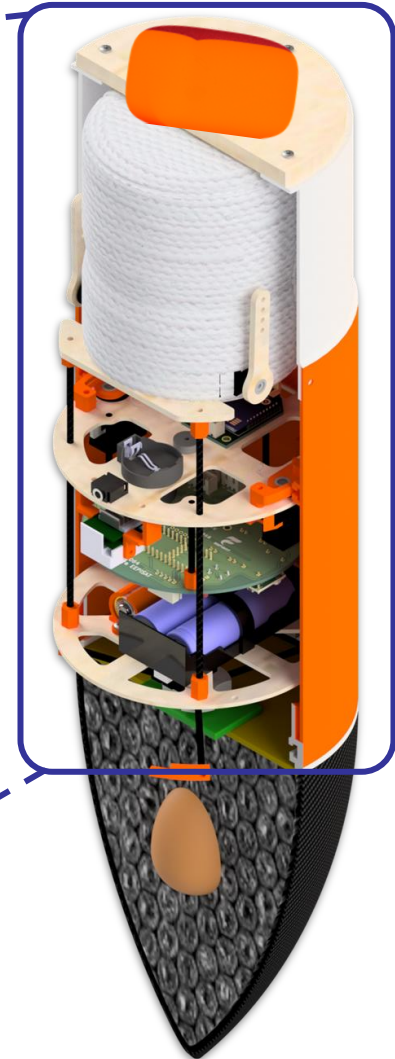
*The dimensions of the container and payload using technical drawing in **CAD software**

***All measurement units are in mm**

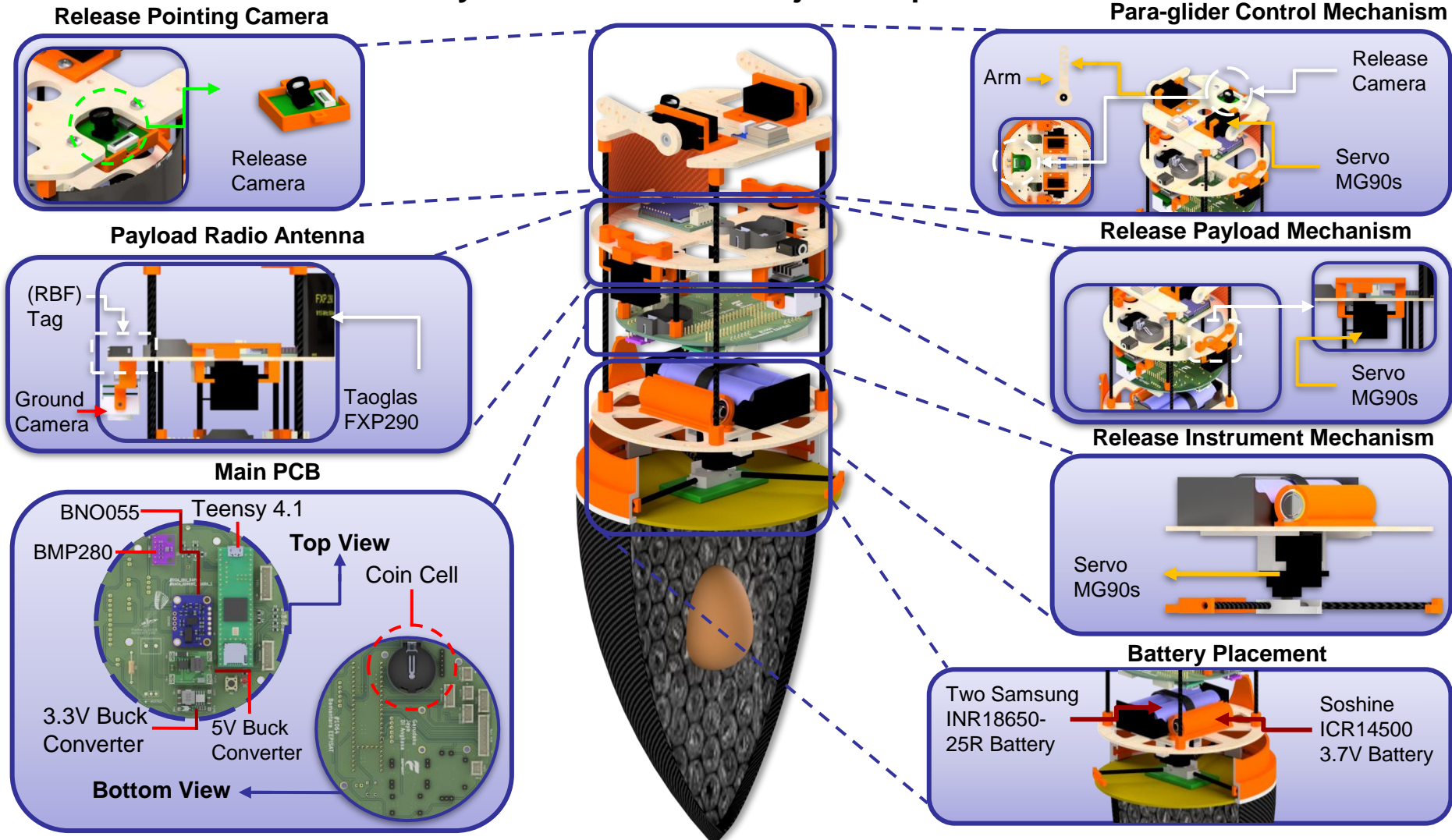
Container Placement of Major Component



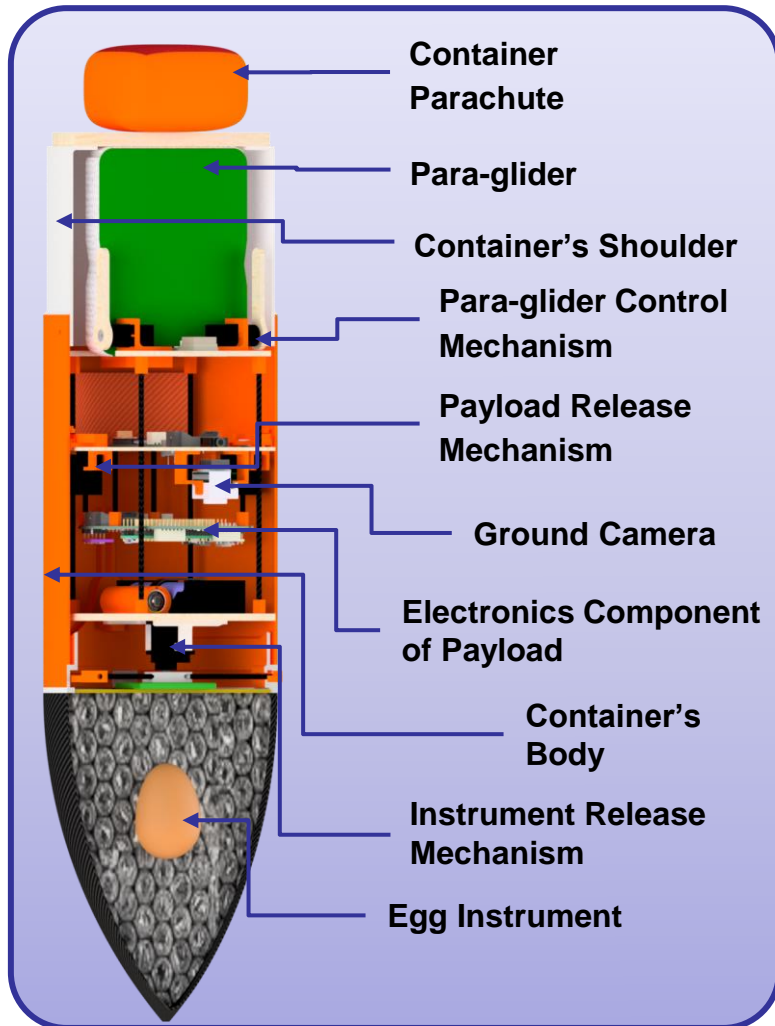
Para-glider Bag is Attached to the Balsa Container



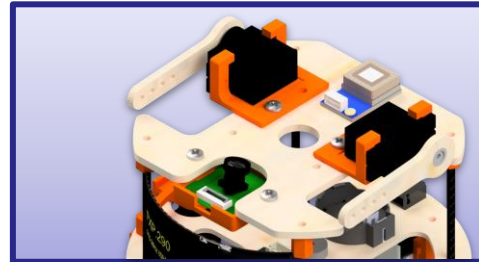
Payload Placement of Major Component



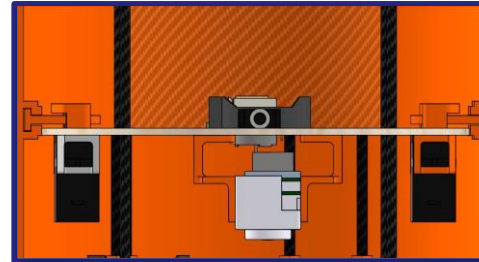
Payload Launch Configuration



Para-glider Control Mechanism



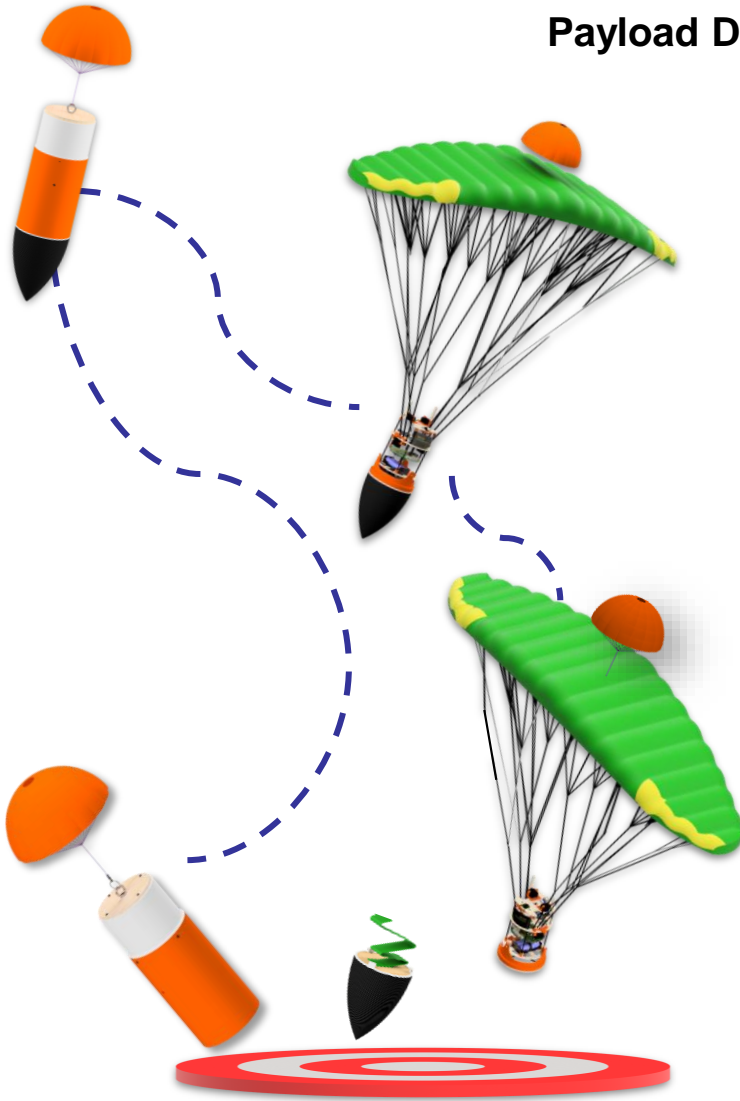
Release Payload Mechanism



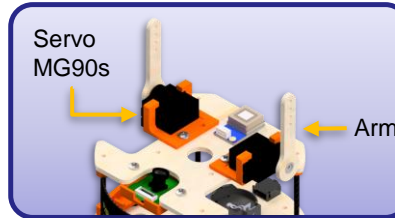
Release Instrument Mechanism



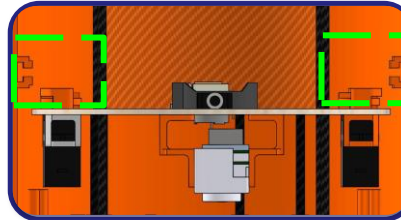
Payload Deployment Configuration



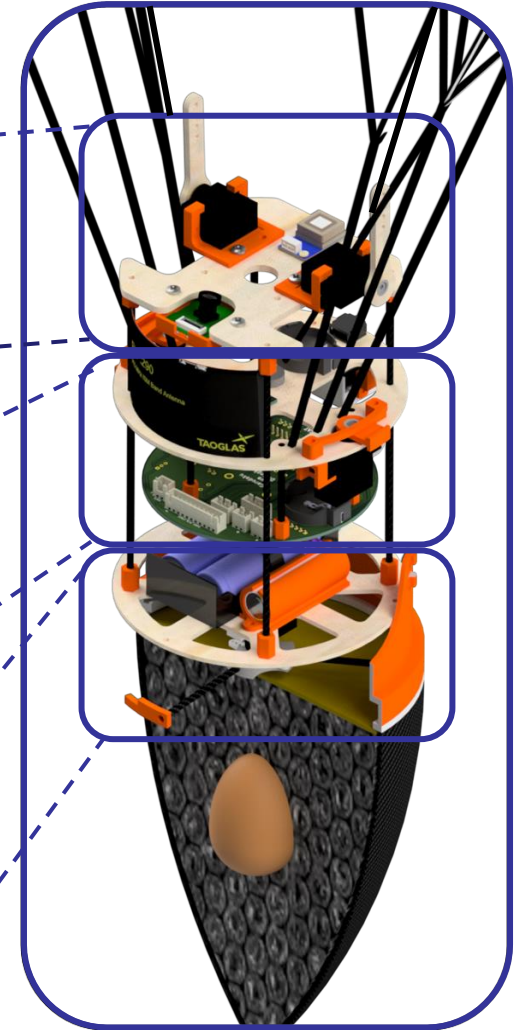
Para-glider Control Mechanism

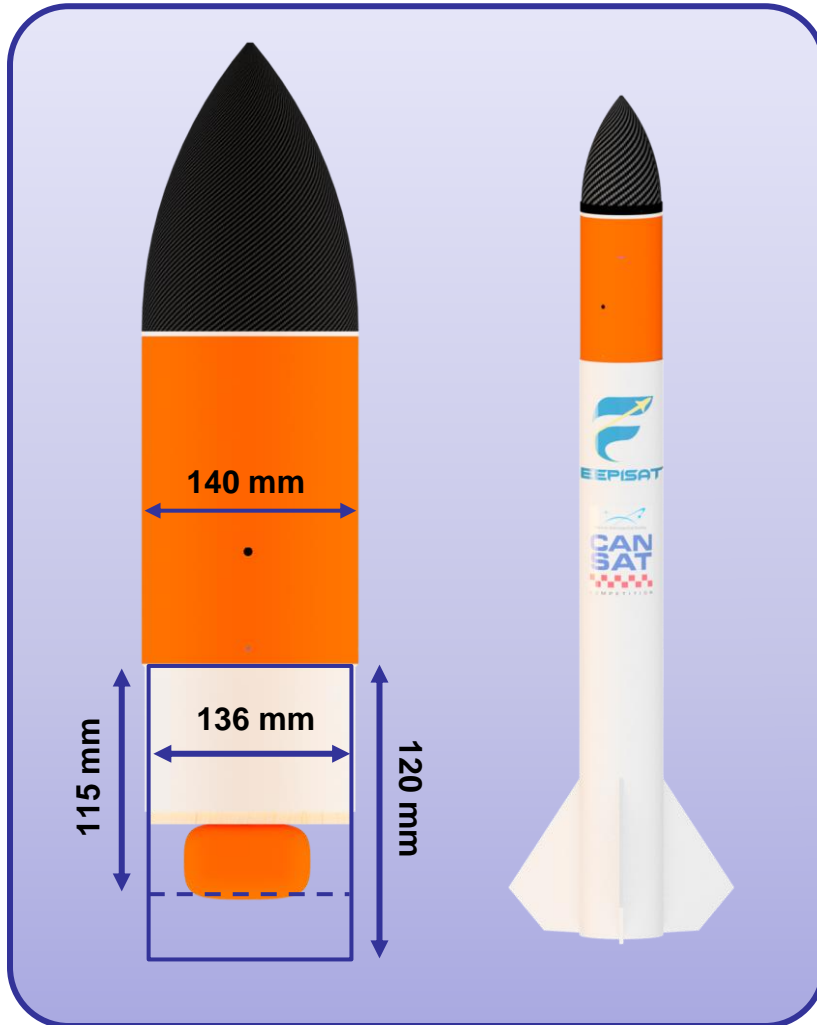


Payload Release Mechanism



Instrument Release Mechanism





| Dimension (Section) | Height (mm) | Diameter (mm) |
|---------------------------------|-------------|---------------|
| Rocket (Requirement Dimensions) | 120 | 136 |
| CanSat | 115 | 136 |

Information

1. The CanSat design was created in purpose to fit with the rocket
2. The sharp part of CanSat was built use to strengthen the durability
3. The rocket will not use as a part of CanSat missions.

Sensor Subsystem Design

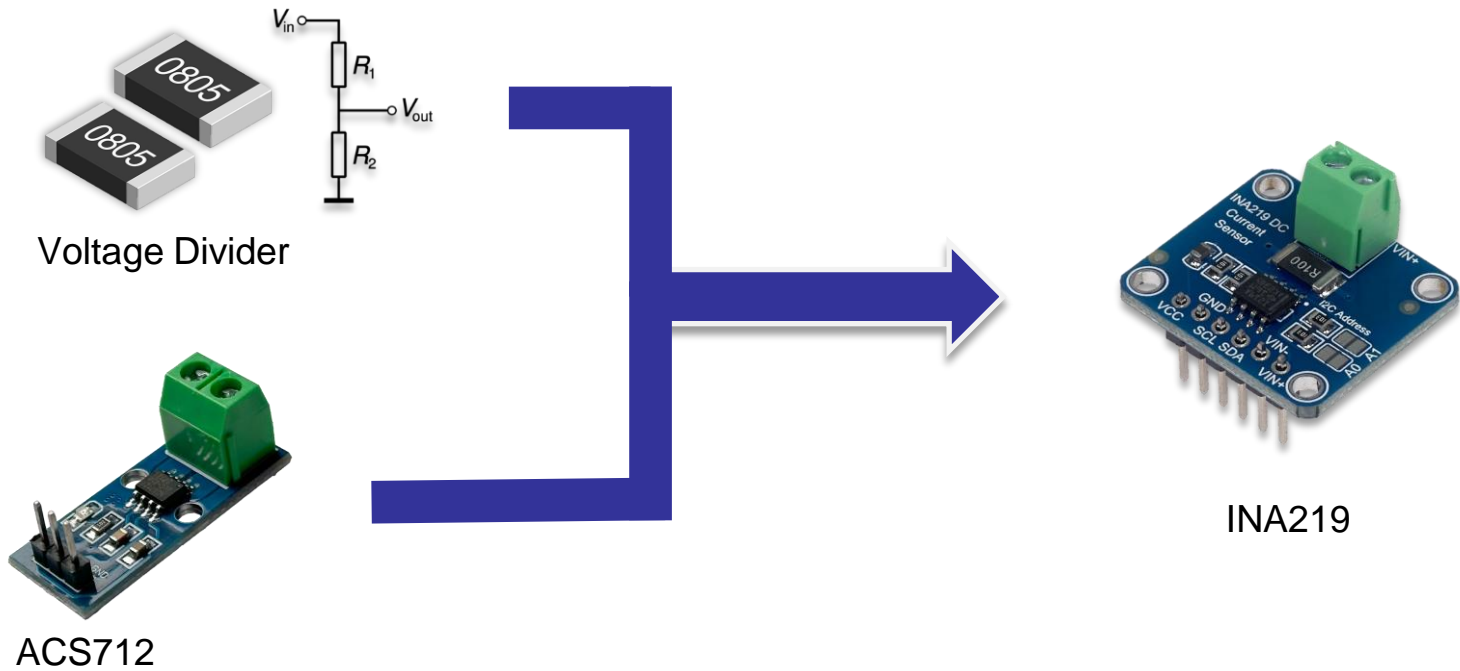
Ax'I Nurrahim

Sensor Subsystem Overview

| Sensor Type | Selected Model | Function | Located In |
|---------------------|------------------------|--|------------|
| Air Pressure | BMP280 | Measuring air pressure of the CanSat | Payload |
| Air Temperature | BMP280 | Measuring air temperature of the CanSat | Payload |
| GNSS | SAM-M10Q | Determining the position of the CanSat | Payload |
| Voltage and Current | INA219 | Measuring battery voltage and current of the CanSat | Payload |
| Rotation Rate | BNO055 | Measuring the rotation rate of the CanSat | Payload |
| Acceleration | BNO055 | Tracking the acceleration of the CanSat | Payload |
| Release Camera | EYESEC X6D | Recording the separation of the payload from the container and the para-glider descent control system functioning. | Payload |
| Ground Camera | Turbowing Cyclops 3 V3 | Record the ground during descent and the egg being released | Payload |
| Egg Release | VL53L1X | Measuring the distance from the payload to the ground | Payload |

Sensor Changes Since PDR (1/3)

| Part | PDR | CDR | Rationale |
|--|---|---|--|
| Payload Voltage and Current sensor. | ACS712 for current sensor and Voltage Divider for Voltage sensor. | INA219 to measure both payload Voltage and Current. | Simplifies measurement by using a single sensor to monitor both payload voltage and current. |



Sensor Changes Since PDR (2/3)

| Part | PDR | CDR | Rationale |
|---|---|--|---|
| Release Camera and Ground Camera | RunCam Split 2 for both Release and Ground Camera | EYESEC X6D for Release Camera and Turbowing Cyclops 3 V3 for Ground Camera | The RunCam camera was replaced due to its excessive weight and high power consumption, with a lighter and more low consumption power camera |



Release Camera RunCam Split 2



EYESEC X6D

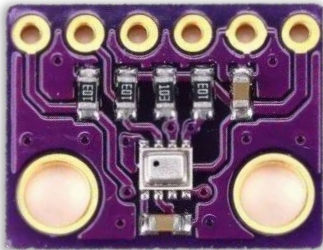


Ground Camera RunCam Split 2



Turbowing Cyclops 3 V3

| Part | PDR | CDR | Rationale |
|---------------------------|--------|---------|---|
| Egg Release Sensor | BMP280 | VL53L1X | To achieve more precise altitude measurements at low heights, infrared from ToF sensor is used to measure the distance between the payload and the ground directly. |



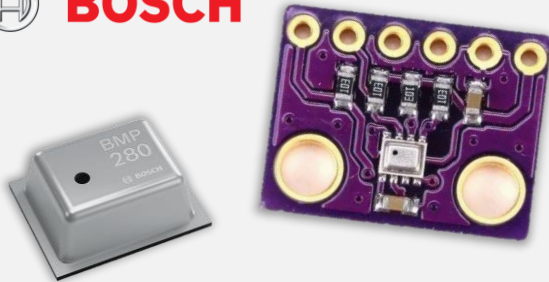
BMP280



VL53L1X

| Model | Interface | Pressure Resolution [hPa] | Accuracy [hPa] | Operating Voltage [V] | Consumption Current [μA] | Pressure Range [hPa] | Mass [g] | Size [mm] | Price [USD] |
|--------|-----------|---------------------------|----------------|-----------------------|--------------------------|----------------------|----------|-------------------|-------------|
| BMP280 | I2C/SPI | 0.016 | ± 1.0 | 1.71 ~ 3.6 | 2.7 | 300 ~ 1100 | 4.8 | 15.5 x 12.1 x 2.5 | 0.42 |

BMP280 ✓



The BMP280 will collect pressure data according to its configured settings, which will then be converted into altitude data.

Data Format

(Altitude, m)

Equation

$$Altitude = 44330 \times \left(1 - \left(\frac{P}{P_0} \right)^{\frac{1}{5.255}} \right)$$

P: Atmospheric pressure at current altitude (hPa)

*P*₀: Atmospheric pressure at sea level (hPa)

Sample Output

```
Altitude : 20.1 m
Altitude : 20.3 m
Altitude : 20.4 m
```

Sample output in packet data:

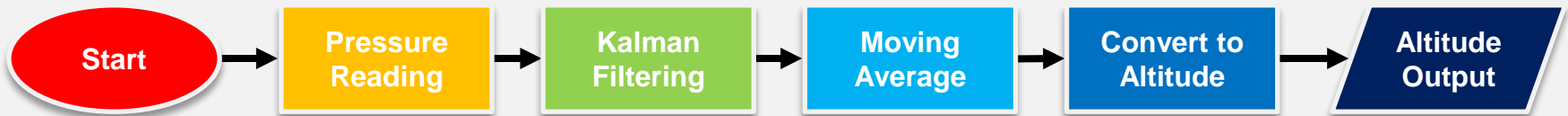
```
1064,15:26:09,1,F,LAUNCH_PAD,1,1,31.3,101.3,7.9,0.08,0.1,-0.1,0.1,-0.2,0,9.5,15:26:09,24.0,-7.2758,112.7942,4,CAL,,0.4,-1.4,106.6,_PG_OFF,1.5,5,37
```

Sensor Settings

The sensor filter settings are:

- Sensor Mode : Normal Mode
- Pressure Sampling : Oversampling 10x
- Temperature Sampling : Oversampling 3x
- Infinite Impulse Response Filter : Oversampling 10x
- Standby Time : 0.5 ms

Pressure Sensor Acquisition Process



Kalman Filter

1. Obtain input (U), after that calculate \hat{U}_{k+1} using these equations:

$$k = \frac{P \cdot H}{H^2 \cdot P + R}$$

$$\hat{U}_{k+1} = k \cdot (U - H \cdot \hat{U})$$

$$P = (1 - k \cdot H) \cdot P + Q$$

2. The \hat{U}_{k+1} is the output of Kalman Filter
3. After that, it will be forwarded to the moving average

Moving Average

1. Obtain first data of Kalman Filter output (k=3), after that calculate the output using these equations:

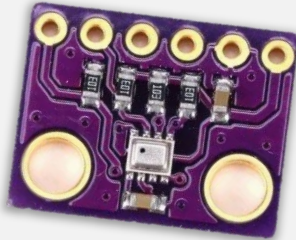
$$MA_{k=3} = \frac{1}{k} \sum_{i=n-(k-1)}^k v_i$$

2. Following this step, it is necessary to eliminate the earliest data and substitute it with current data before continuing with the computations
3. Perform this process constantly

Payload Air Temperature Sensor Summary (1/2)

| Model | Interface | Temperature Resolution [C] | Accuracy [°C] | Operating Voltage [V] | Operating Current [µA] | Temperature Range [°C] | Mass [g] | Size [mm] | Price [USD] |
|--------|-----------|----------------------------|---------------|-----------------------|------------------------|------------------------|----------|-------------------|-------------|
| BMP280 | I2C/SPI | 0.01 | ± 1.0 | 1.71 ~ 3.6 | 2.7 | -40 ~ 85 | 4.8 | 15.5 x 12.1 x 2.5 | 0.42 |

BMP280 ✓



The BMP280 collects temperature data based on predefined settings, which is then processed using a moving average and Kalman filter.

Data Format

(Temperature, °C)

Equation

No equations for this measurement

Sample Output

```
Temp : 34.1 °C
Temp : 34.2 °C
Temp : 34.4 °C
```

Sample output in packet data:

```
1064,15:26:09,1,F,LAUNCH_PAD,1.1,31.3,101.3,7.9,0.08,0.1,-0.1,0.1,-0.2,0,9.5,15:26:09,24.0,-7.2758,112.7942,4,CAL,,0.4,-1.4,106.6,_PG_OFF,1.5,5,37
```

Sensor Settings

The sensor filter settings are:

- Sensor Mode : Normal Mode
- Pressure Sampling : Oversampling 10x
- Temperature Sampling : Oversampling 3x
- Infinite Impulse Response Filter : Oversampling 10x
- Standby Time : 0.5 ms

Temperature Sensor Acquisition Process



Moving Average

1. Obtain first data of input ($k=3$), after that calculate the output using these equations:

$$MA_{k=3} = \frac{1}{k} \sum_{i=n-(k-1)}^k v_i$$

2. Following this step, it is necessary to eliminate the earliest data and substitute it with current data before continuing with the computations
3. Perform this process constantly

| Model | Interface | Rate [Hz] | Resolution Accuracy [m] | Operating Voltage [V] | Operating Current [mA] | Mass [g] | Size [mm] | Price [USD] |
|------------|-----------|-----------|-------------------------|-----------------------|------------------------|----------|-------------|-------------|
| SAM – M10Q | UART | 1 ~ 25 | 1.5 | 3.3 ~ 5 | 12 | 10 | 26 x 16 x 8 | 28.25 |

SAM – M10Q ✓



The SAM – M10Q will connect to at least three satellites in orbit, calculate their distances, and generate GPS data.

Data Format

(Time, hh:mm:ss)

(Latitude, °)

(Longitude, °)

(Altitude, m)

(Satellites, integer value showing number of satellites that was connected)

Equation

It will automatically calculate the distance of this sensor with reference to satellite (at least 3)

Sample Output

```
Time: 11:34:45
Lat : -7.1827 °
Long: 112.7806 °
Alt : 25.2 m
Sat : 7
```

Sample output in packet data:

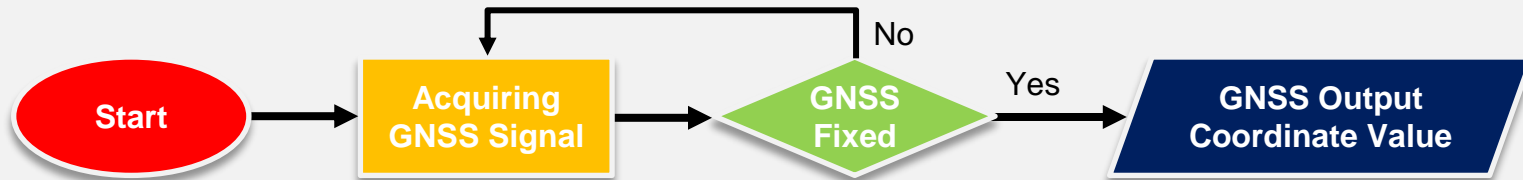
```
1064,15:26:09,1,F,LAUNCH_PAD,1,1,31.3,101.3,7.9,0.08,0.1,-0.1,0.1,-0.2,0,9.5,15:26:09,24.0,-7.2758,112.7942,4,CAL,,0.4,-1.4,106.6,_PG_OFF,1.5,5,37
```

Sensor Settings

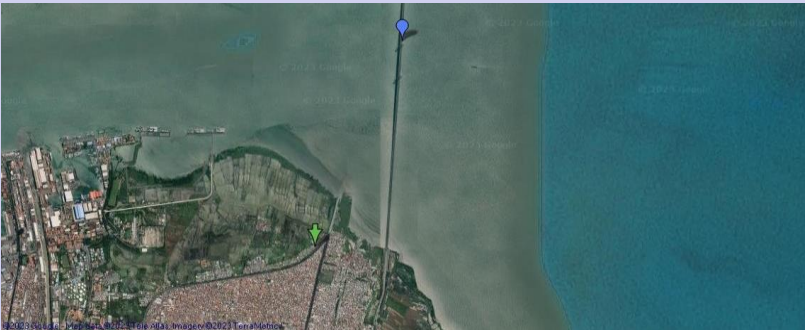
We are using a standard initiation of NMEA protocol. We configure the sensor settings as follows:

- Baud Rate : 115200 bps
- Data : 8 bits
- Stop : 1 stop bit
- Parity : None
- Output Protocol : NMEA

GNSS Sensor Acquisition Process



GNSS Test

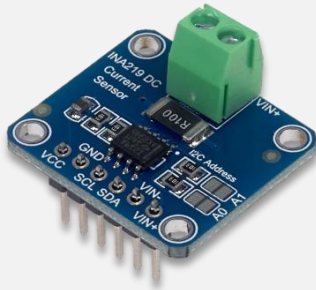


Reading Latitude : -7.1827
 Reading Longitude : 112.7806
 Actual Latitude : -7.1827
 Actual Longitude : 112.7806

Payload Voltage and Current Sensor Summary

| Model | Interface | Measurement Method | Resolution | Operating Voltage [V] | Maximum Current Measure [μ A] | Mass [g] | Size [mm] | Price [USD] |
|--------|-----------|---------------------------|------------|-----------------------|------------------------------------|----------|-----------------|-------------|
| INA219 | I2C | High-side current sensing | 12 Bits | 3 ~ 5.5 | \pm 3.2 | 5 | 22.5 x 22.3 x 2 | 0.95 |

INA219 ✓



Note:

INA219 will measure both the voltage and current data from the payload battery,

Data Format

(Voltage,V),
(Current, mA)

Equation

No equations for this measurement

Sample Output


```
Voltage: 8.0 V
Current: 0.08 mA
Voltage: 8.0 V
Current: 0.07 mA
Voltage: 8.0 V
Current: 0.07 mA
```

Sample output in packet data:

```
1064,15:26:09,1,F,LAUNCH_PAD,1.1,31.3,101.3,7.9,0.08,0.1,-0.1,0.1,-0.2,0,9.5,15:26:09,24.0,-7.2758,112.7942,4,CAL,,0.4,-1.4,106.6,_PG_OFF,1.5,5,37
```

Payload Rotation Rate Sensor Summary

| Model | Interface | Resolution [bits] | Accuracy [%] | Operating Voltage [V] | Operating Current [mA] | DoF [Axis] | Mass [g] | Size [mm] | Price [USD] |
|--------|-----------|-------------------|--------------|-----------------------|------------------------|------------|----------|-------------------|-------------|
| BNO055 | I2C | 16 | >95% | 3.3 ~ 5 | 12.3 | 9 | 3 | 26.8 x 20.3 x 2.7 | 48.77 |


| Range | Sensitivity | Data Format |
|--|---|---|
| Gyro (125~2000 °/s) Accelerometer (2~16 G) Magnetometer (±1300 μT for x, y axis) (±2500 μT for z axis) | Gyro (16 bits) Accelerometer (14 bits) Magnetometer (14 bits) | (Gyro Roll, °/s), (Gyro Pitch, °/s), (Gyro Yaw, °/s) |
| BNO055 ✓ | | Equation $a_r = \frac{\Delta\omega_r}{\Delta t}, a_p = \frac{\Delta\omega_p}{\Delta t}, a_y = \frac{\Delta\omega_y}{\Delta t}$ (differentiate gyro's data to get angular acceleration) |
|  <p>IMU sensor sense Gyroscope, Accelerometer and Magnetometer values.</p> | | Sample Output <pre>GYRO R: 1 °/s, GYRO P: -1 °/s, GYRO Y: 3 °/s</pre> |

Sample output in packet data:

```
1064,15:26:09,1,F,LAUNCH_PAD,1.1,31.3,101.3,7.9,0.08,0.1,-0.1,0.1,-0.2,0,9.5,15:26:09,24.0,-7.2758,112.7942,4,CAL,,0.4,-1.4,106.6,_PG_OFF,1.5,5,37
```

Payload Acceleration Sensor Summary

| Model | Interface | Resolution [bits] | Accuracy [%] | Operating Voltage [V] | Operating Current [mA] | DoF [Axis] | Mass [g] | Size [mm] | Price [USD] |
|--------|-----------|-------------------|--------------|-----------------------|------------------------|------------|----------|-------------------|-------------|
| BNO055 | I2C | 16 | >95% | 3.3 ~ 5 | 12.3 | 9 | 3 | 26.8 x 20.3 x 2.7 | 48.77 |

| Range | Sensitivity | Data Format |
|--|---|--|
| Gyro (125~2000 °/s) Accelerometer (2~16 G) Magnetometer (±1300 μT for x, y axis) (±2500 μT for z axis) | Gyro (16 bits) Accelerometer (14 bits) Magnetometer (14 bits) | (Accelerometer Roll, °/s²), (Accelerometer Pitch, °/s²), (Accelerometer Yaw, °/s²) |
| BNO055 ✓ | | Equation $ax = \frac{x_{raw}}{100}, ay = \frac{y_{raw}}{100}, az = \frac{z_{raw}}{100}$ VECTOR_ACCELEROMETER: 1 m/s² = 100 LSB |
|  <p>IMU sensor sense Gyroscope, Accelerometer and Magnetometer values.</p> | | Sample Output <pre>ACCEL_R: 2 °/s², ACCEL_P: -1 °/s², ACCEL_Y: 9 °/s²</pre> |

Sample output in packet data:

```
1064,15:26:09,1,F,LAUNCH_PAD,1,1,31.3,101.3,7.9,0.08,0.1,-0.1,0.1,-0.2,0,9.5,15:26:09,24.0,-7.2758,112.7942,4,CAL,,0.4,-1.4,106.6,_PG_OFF,1.5,5,37
```

| Model | Interface | Resolution [Pixels] | Operating Voltage [V] | Operating Current [mA] | Frame Rate [Hz] | Mass [g] | Size [mm] | Price [USD] |
|------------|-----------|---------------------|-----------------------|------------------------|-----------------|----------|------------|-------------|
| EYESEC X6D | Digital | 640 x 480 | 3.3 ~ 5 | 137 | 30 | 4.1 | 10 x 6 x 4 | 11.64 |

EYESEC X6D ✓



Note:

We removed the camera from the case, because we designed our own camera case to minimize its size and weight.

Reason

- Lightweight
- **Long recording capability**
- **Availability of SD card slot**

Output Camera



| Model | Interface | Resolution [Pixels] | Operating Voltage [V] | Operating Current [mA] | Frame Rate [Hz] | Mass [g] | Size [mm] | Price [USD] |
|------------------------|-----------|---------------------|-----------------------|------------------------|-----------------|----------|----------------|-------------|
| Turbowing Cyclops 3 V3 | Digital | 1280 x 720 | 3.5 ~ 5.5 | 250 | 30 | 10.3 | 18.7 x 21 x 19 | 29.1 |

Turbowing Cyclops 3 V3 ✓



Note:

We are using Turbowing Cyclops 3 V3 because its has wider angle view to capture ground and egg release.


Reason

- **120° wide angle camera**
- Has low current consumption
- **Lightweight**

Output Camera



| Model | Interface | Accuracy [mm] | Measurement Range [m] | Operating Voltage [V] | Consumption Current [mA] | Mass [g] | Size [mm] | Price [USD] |
|---------|-----------|---------------|-----------------------|-----------------------|--------------------------|----------|-----------------|-------------|
| VL53L1X | I2C | ± 1 | 0.5 ~ 4 | 5 | 40 | 5 | 19.7 x 11.7 x 6 | 2.37 |

| VL53L1X ✓ | Data Format | (Distance, m) |
|---|---------------|--|
|  <p>Note: An infrared ToF sensor measures altitude starting from 4 meters, and triggers the egg release mechanism at approximately 2 meters above ground.</p> | Equation | <i>No equations for this measurement</i> |
| | Sample Output | <pre>Distance: 3 m Distance: 3 m Distance: 3 m</pre> |

Sample output in packet data:

```
1064,15:26:09,1,F,LAUNCH_PAD,1.1,31.3,101.3,7.9,0.08,0.1,-0.1,0.1,-0.2,0,9.5,15:26:09,24.0,-7.2758,112.7942,4,CAL,,0.4,-1.4,106.6,_PG_OFF,1.5,5,37
```

Descent Control Design

Muhammad Rizky



Material: Balsa Composite, ABS

Dimension: 304 mm (height) and 140 mm (diameter)

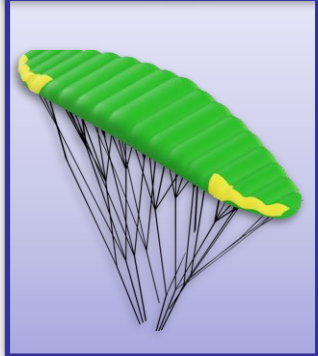
Feature: Parachute attachment using ¼ inch eye bolt, Payload Holder, Slider



Material: Ripstop Nylon

Dimension: 0.265m (diameter)

Feature: Spill hole 0.0265 m (diameter)



Material: Ripstop Nylon

Dimension: 200 mm (chord length), 630 mm (wingspan) of the para-glider, 7° angle of attack

Feature: Semi-elliptical ram-air para-glider



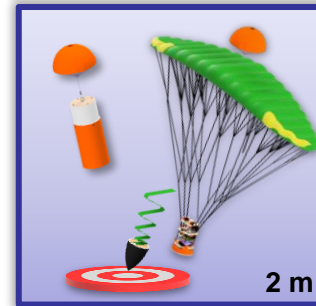
Apogee

The CanSat deploys from the rocket when the rocket reaches the apogee. The CanSat with the payload shall descend at a rate of 15 m/s using a parachute that automatically deploys at separation.



80%

At 80% of apogee, the payload shall separate from the container and descend using a para-glider descent control system and make the descent rate of 5 m/s until landing.




2 m

The payload must head for the landing pad and at a height of 2 meters from the ground, the payload must safely release the instrument containing the eggs.


Descent Control Changes Since PDR (1/4)

| Section | Part | PDR | CDR | Rationale |
|---------|-------------------------------|---|--|---|
| CanSat | Para-glider Bag |  <p>It's doesn't exist</p> |  | Avoid rope from being tangled. |
| | Payload Mass | <p>Mass of the payload is 700.6g</p> | <p>Mass of the payload is 648.1g</p> | After going through the manufacturing process, the total weight of the payload decreased to 648.1g. |
| Payload | Para-glider Control Mechanism |  <p>Left and right</p> |  <p>Forward and backward</p> | After we tested, the result is servo horn with upward and downward movements are more effective than side-to-side movement. |


Descent Control Changes Since PDR (2/4)

| Section | Part | PDR | CDR | Rationale |
|----------------|-----------------------------------|------------------|---|---|
| Payload | Instrument Descent Control | It doesn't exist |  <p>Using Ribbon</p> | <p>In the PDR configuration, the instrument is released without using the nose cone, and a ribbon is employed to ensure the descent rate remains below 5 m/s.</p> |

Descent Rate of Parachute Prototype Testing

| Documentation | CanSat Parachute Descent | |
|---|--------------------------|---|
|  | <p>Goal</p> | <p>The CanSat shall descend using container parachute at a rate of 15 m/s.</p> |
| | <p>Procedure</p> | <ol style="list-style-type: none"> 1. The parachute was tied to the dummy CanSat with a mass of 1000 ± 10 g. 2. Drop the container prototype from top of building (12 m). 3. Observe and measure time elapsed during container descent. |
| | <p>Result</p> | <p>It takes time to be fully stable descend with a descent rate ± 15.05 m/s using the container parachute.</p> |

Descent Rate of Para-glider Prototype Testing

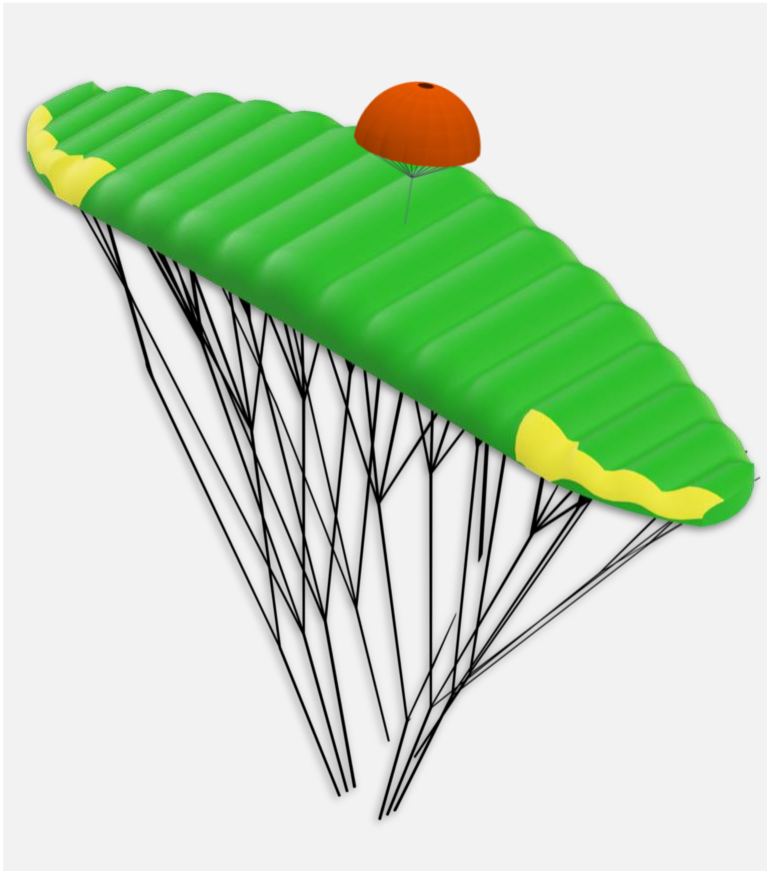
| Documentation | CanSat Parachute Descent | |
|---|--------------------------|---|
|  | <p>Goal</p> | <p>The payload shall descend using para-glider at a rate of 5 m/s.</p> |
| | <p>Procedure</p> | <ol style="list-style-type: none"> 1. The para-glider mounted on dummy payload with mass 650g, including the para-glider. 2. Drop the payload prototype from top of building (16 m). 3. Observe and measure time elapsed during payload descent. |
| | <p>Result</p> | <p>It takes time to be fully stable descend with a descent rate 3.85 m/s using the payload para-glider.</p> |

Passive Component of Container Parachute Descent Control



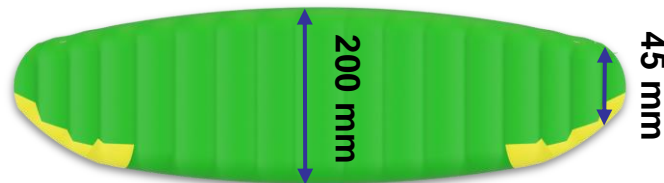
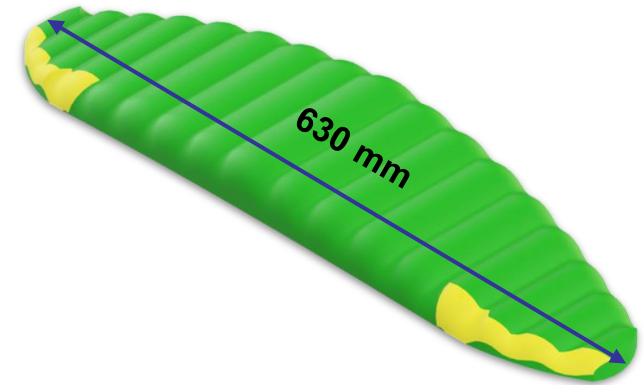
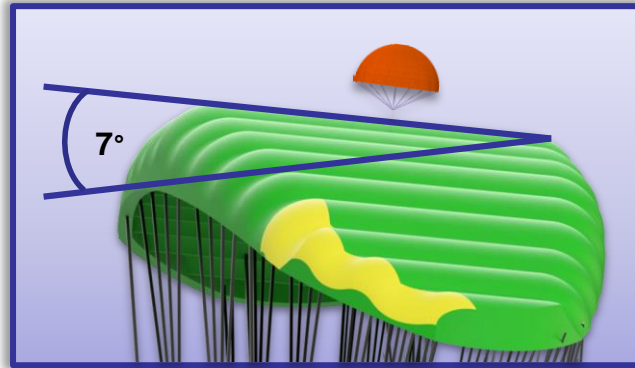
| | |
|----------------------------------|---|
| Component Sizing | <ul style="list-style-type: none"> Parachute diameter: 0.265 m Spill hole diameter : 0.0265 m |
| Key Design Considerations | Round parachute with a spill hole |
| Color Selection | Bright Orange |
| Passive Component | The container's parachute is attached to a carabiner and connected to the container with an eyebolt. |

Passive Component of Container Parachute Descent Control



| | |
|----------------------------------|---|
| Component Sizing | <ul style="list-style-type: none"> Wing span: 0.630 m Chord Average : 0.115 m |
| Key Design Considerations | <p>Low-mid aspect ratio semi-elliptical ram-air para-glider.</p> |
| Color Selection | <p>Light Green</p> |
| Passive Component | <p>The para-glider is attached to payload by an eyebolt.</p> |

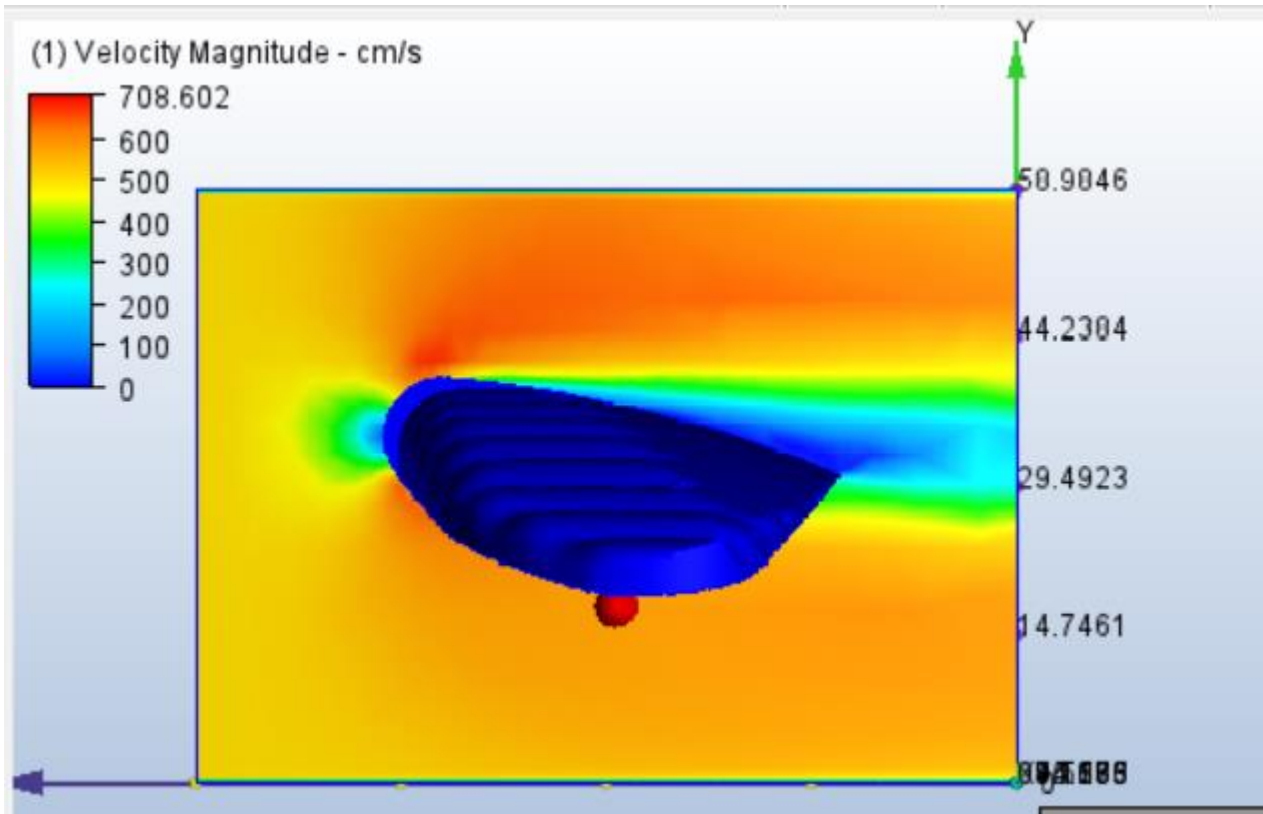
Folded Position



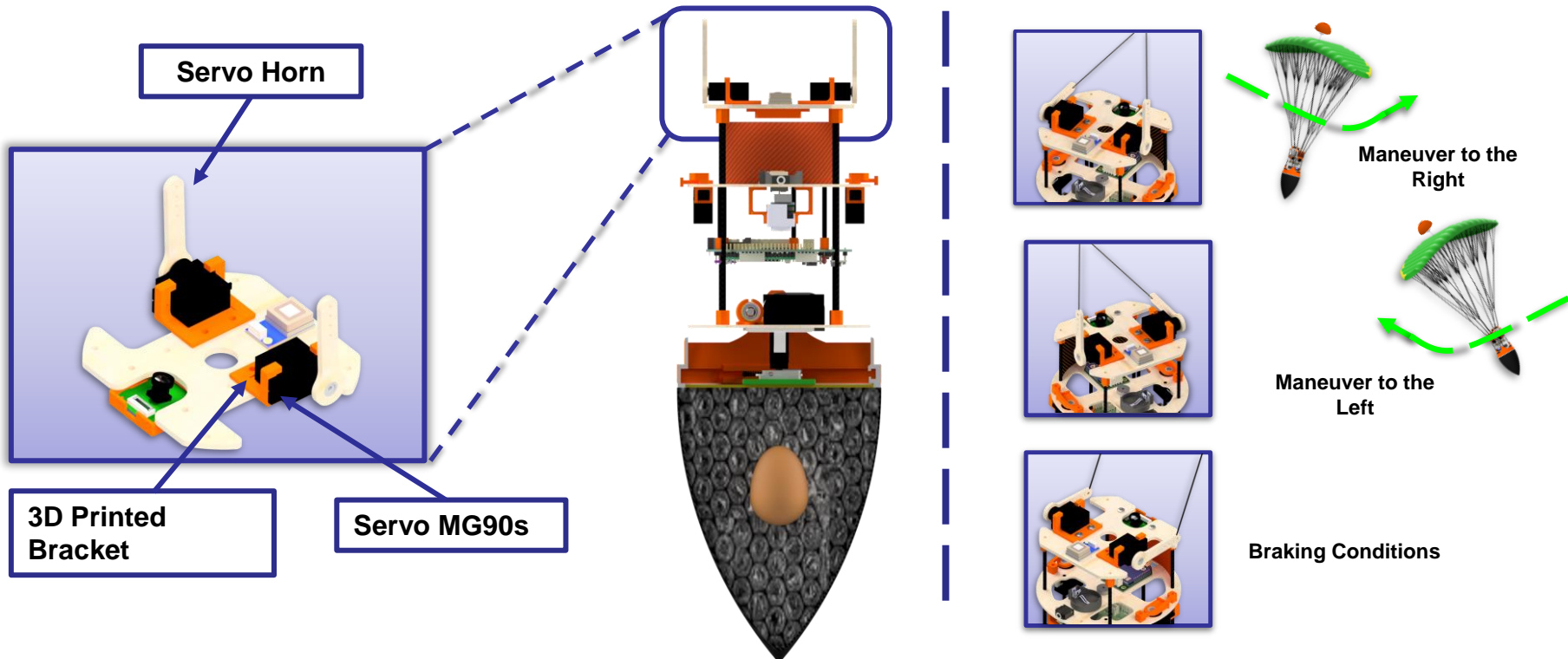
Information

- The stowing position using para-glider's bag
- Low-mid aspect ratio semi-elliptical ram-air para-glider with 7° AoA
- The para-glider will be deployed using support of the drogue-chute

Para-Glider Descent Control Summary (3/3)



Low-mid aspect ratio semi-elliptical ram-air para-glider with 7° AoA simulation using CFD software

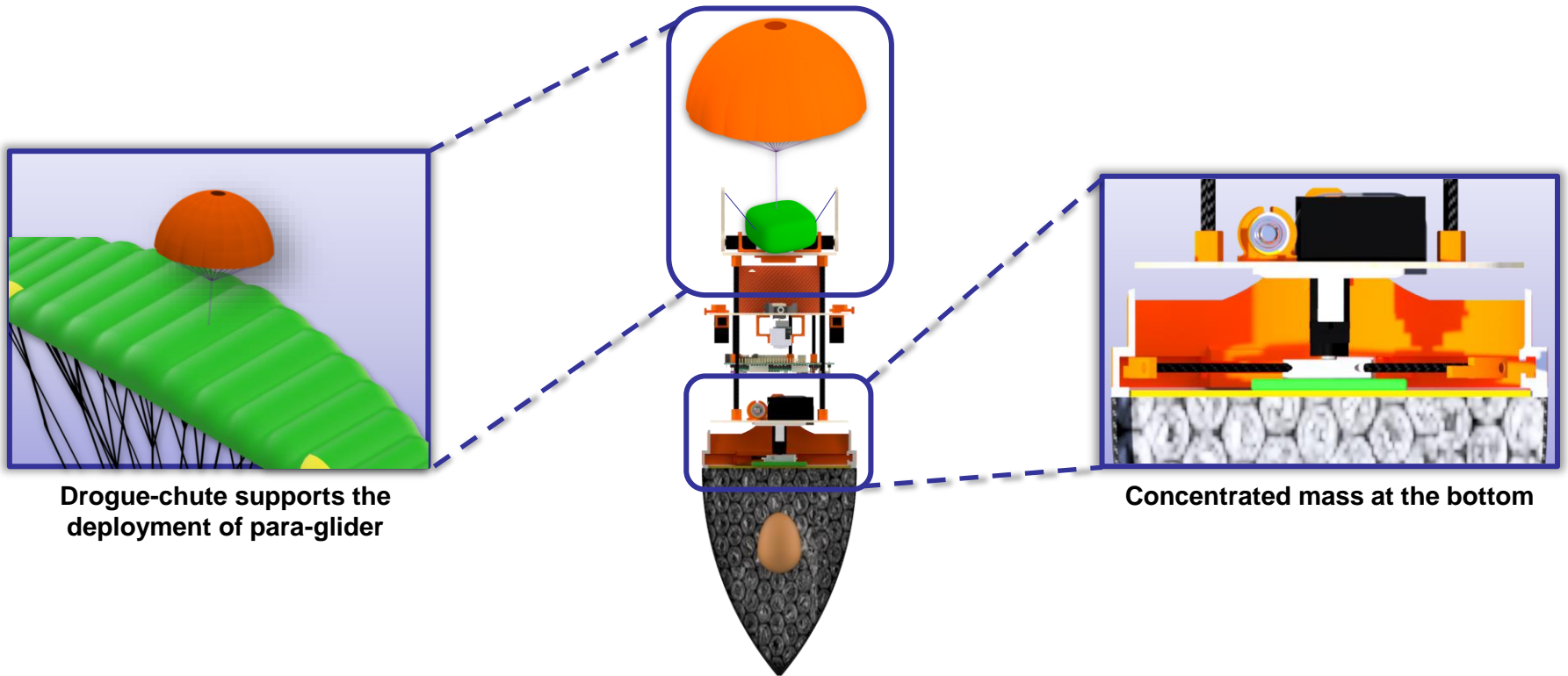


Information

Type of Descent Control: Active Control

Description:

The para-glider will be controlled by two servos mounted on the top of the balsa base. Which will move forward and backward to control the para-glider's movements, such as turning left, right and braking.



Drogue-chute supports the deployment of para-glider

Concentrated mass at the bottom




Information

Type of Stability Control: Passive Control

Description:

The para-glider will use a drogue-chute as a passive mechanism to support the deployment of para-glider. The para-glider design to get high stability and high coefficient lift. The payload will maintain the nadir and prevent it from swaying by the focused mass at the bottom.

The descent rate of each descent phase will be estimated using different parameters

| | | |
|---|--|--|
|  |  |  |
| <p>CanSat Parachute</p> | <p>Payload Para-glider</p> | <p>Payload Instrument</p> |
| <p>Parameters:</p> <ul style="list-style-type: none"> • Diameter of parachute (D_p) • Diameter of spill hole (D_{sh}) | <p>Parameters:</p> <ul style="list-style-type: none"> • Wing Span (b) • Angle of Attack (AoA) • Chord Length Average (c_{avg}) | <p>Parameters:</p> <ul style="list-style-type: none"> • Ribbon Profile (A) |
| <p>Requirement: Descent rate shall be 15 m/s (± 3 m/s)</p> | <p>Requirement: Descent rate 5 m/s (± 3 m/s)</p> | <p>Requirement: Descent rate no more than 5 m/s</p> |

*to comply the requirements number S20

CanSat Parachute

We will use the decent velocity with range between minimum [$V_{min} = 12 \text{ m/s}$] and maximum [$V_{max} = 18 \text{ m/s}$] to determine the parachute radius.

$$\sqrt{\frac{8 \times m \times g}{\rho \times (v_{min})^2 \times \pi \times Cd}} \leq Dp \leq \sqrt{\frac{8 \times m \times g}{\rho \times (v_{max})^2 \times \pi \times Cd}}$$

$$\sqrt{\frac{8 \times 1 \times 9.8}{1.225 \times (12)^2 \times 3.14 \times 1.28}} \leq Dp \leq \sqrt{\frac{8 \times 1 \times 9.8}{1.225 \times (18)^2 \times 3.14 \times 1.28}}$$

$$0.33 \leq Dp \leq 0.22$$

Information:

Dp = The diameter of the parachute (m)

v = Descent speed (m/s)

$\pi = 3.14$

g = gravitational acceleration (9.8 m/s^2)

Dsh = Spill hole and side holes diameter (m)

*Assumption

* $Cd = 1.28$ (Drag coefficient of parachute)

* $m = 1 \text{ kg}$ (CanSat)

* $\rho = \text{air density } (1.225 \text{ kg/m}^3)$

Diameter of the spill hole and side holes is chosen to be 10% of the diameter of parachute

Diameter of spill hole = $Dsh = Dp \times 10\% = \mathbf{0,0265 \text{ m}}$

Spill hole radius = $\frac{Dsh}{2} = \mathbf{0,0132 \text{ m}}$



| Chosen Diameter | Chosen Radius |
|-----------------|----------------|
| 0.265 m | 0.132 m |

Payload Para-glider

We will use the descent velocity at 3.85 m/s to determine the descent speed.

$$V = \sqrt{\frac{2W}{\rho S}} \times \arctan \frac{1}{L/D}$$

$$V = \sqrt{\frac{2 \times 6.37}{1.225 \times 0.0725}} \times \arctan \frac{1}{3}$$

$$V = 3.85 \text{ m/s}$$

Information:

L/D = Lift to Drag Ratio

C_{avg} = Chord Average

W = Weight

V = Descent Speed ($\frac{m}{s}$)

S = Span Area (m^2)

*Assumption

* L/D = 3 (lift to drag ratio of para-glider)

* m = 0.648 kg (payload)

* ρ = air density (1.225 kg/m^3)



$$S = b \times c_{avg}$$

$$S = 0.63 \times 0.115$$

$$S = 0.0725$$

Payload Instrument

We will use the descent velocity at 4.35 m/s to determine the descent speed.

$$V = \sqrt{\frac{2 \times m \times g}{\rho \times Cd \times A}}$$

$$V = \sqrt{\frac{2 \times 0.092 \times 9.8}{1.225 \times 1.3 \times 0.06}}$$

$$V = 4.35 \text{ m/s}$$

$$A = 1.5 \times 0.04$$

$$A = 0.06$$



Information:

A = Ribbon profile (m^2)

g = gravitation acceleration (9.8 m/s^2)

*Assumption

* $Cd = 1.3$ (Drag coefficient)

* $m = 0.092 \text{ kg}$ (Instrument)

* $\rho = \text{air density } (1.225 \text{ kg/m}^3)$

Information

Container mass : **352.7 g**
 Payload mass : **648.1 g**
Total CanSat mass: 1000.8 g

Payload Para-glider Descent Rate

$$v = \sqrt{\frac{2W}{\rho S}} \times \arctan \frac{1}{L/D}$$

$$v = \sqrt{\frac{2 \times 6.37}{1.225 \times 0.0725}} \times \arctan \frac{1}{3}$$

$$v = 3.85 \text{ m/s}$$



Container Parachute Descent Rate

$$v = \sqrt{\frac{8 \times m \times g}{\rho \times (Dp)^2 \times \pi \times Cd}}$$

$$v = \sqrt{\frac{8 \times (1) \times (9.8)}{1.225 \times (0.265)^2 \times (3.14) \times (1.28)}}$$

$$v = 15.05 \text{ m/s}$$



Payload Instrument Descent Rate

$$V = \sqrt{\frac{2 \times m \times g}{\rho \times Cd \times A}}$$

$$V = \sqrt{\frac{2 \times 0.092 \times 9.8}{1.225 \times 1.3 \times 0.06}}$$

$$v = 4.35 \text{ m/s}$$



Final Result

Parachute and Para-glider Summary

| Altitude | The descent rate each descent phase will be estimated using parameters |
|---------------|---|
| Peak Altitude | Type parachute: Round parachute The diameter of parachute: 0.265 m The descent speed: 15.05 m/s |
| 80% | Type parachute: Para-glider The wing span of parachute: 0.63 m The descent speed: 3.85 m/s |
| 2m | Type control: Ribbon The ribbon profile: 0.06 m² The descent speed: 4.35 m/s |

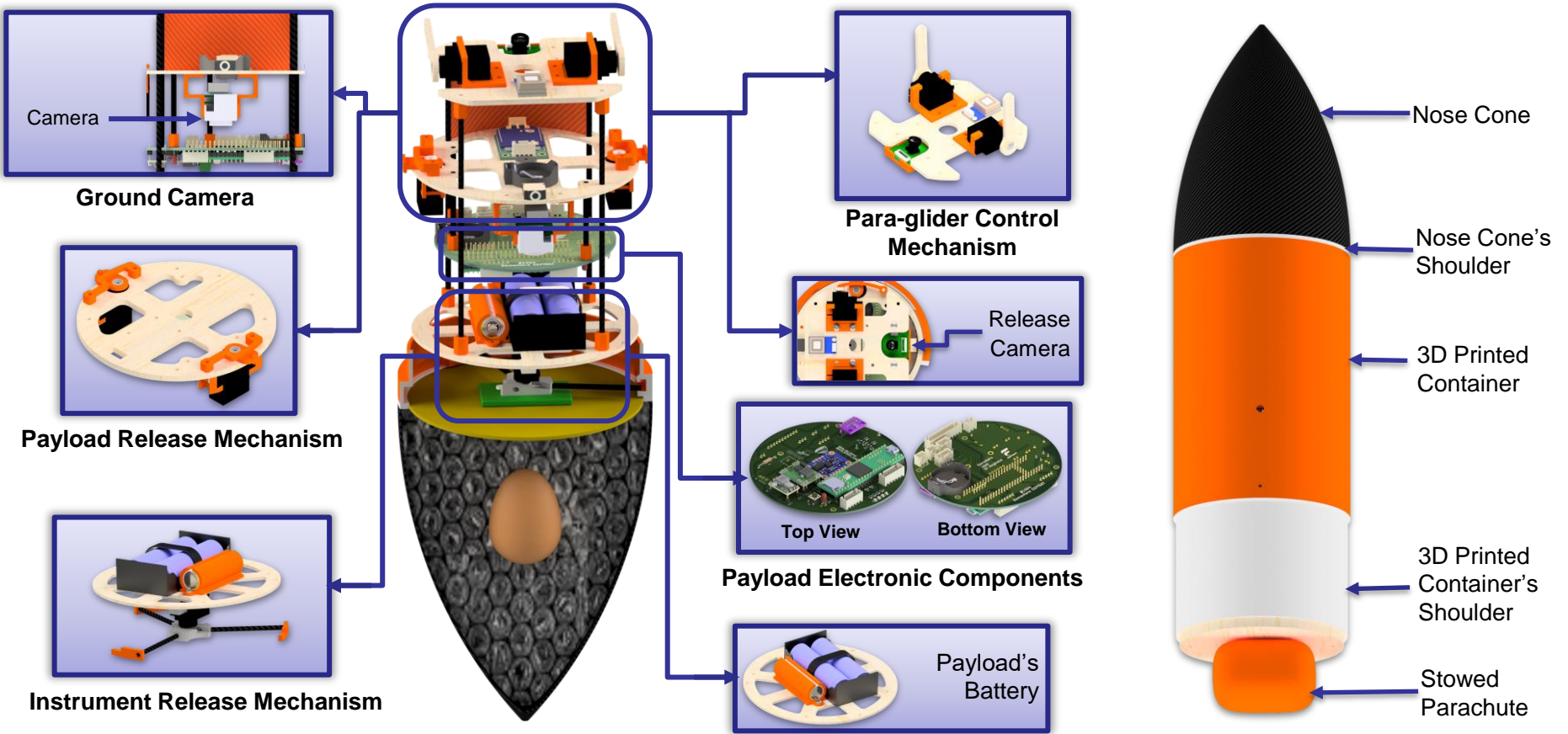
CanSat Summary

The CanSat para-glider uses active control of two servos. The focus of mass is in the bottom of the CanSat to keep the stability and prevent from swaying.

Mechanical Subsystem Design

Muhammad Rizky

Mechanical Subsystem Overview



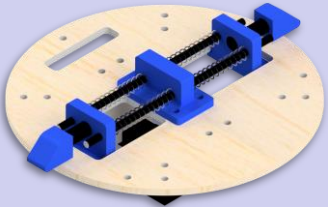

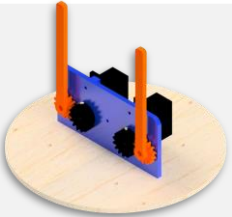
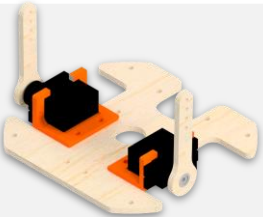
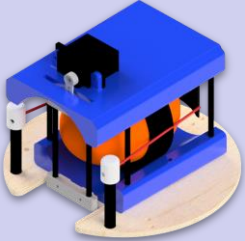
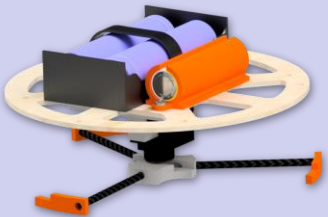
Information

Material: Easy ABS, Balsa Composite, Carbon Fiber

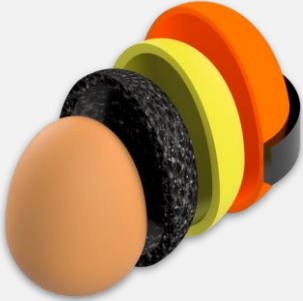

Parachute: Ripstop Nylon

Note: The para-glider will be deployed by a passive mechanism.

Mechanical Subsystem Changes Since PDR (1/3)

| Section | Part | PDR | CDR | Rationale |
|---------|-------------------------------|--|---|---|
| Payload | Payload Release Mechanism |  <p>Using slider spring system</p> |  <p>Using arm connect to servo</p> | Lighter and simpler mechanism |
| | Para-glider Control Mechanism |  <p>Left and right</p> |  <p>Forward and backward</p> | Optimize the moving area for servo horn |
| | Instrument Release Mechanism |  <p>Using slingshot system</p> |  <p>Using twist lock system</p> | Decrease unnecessary dimension |

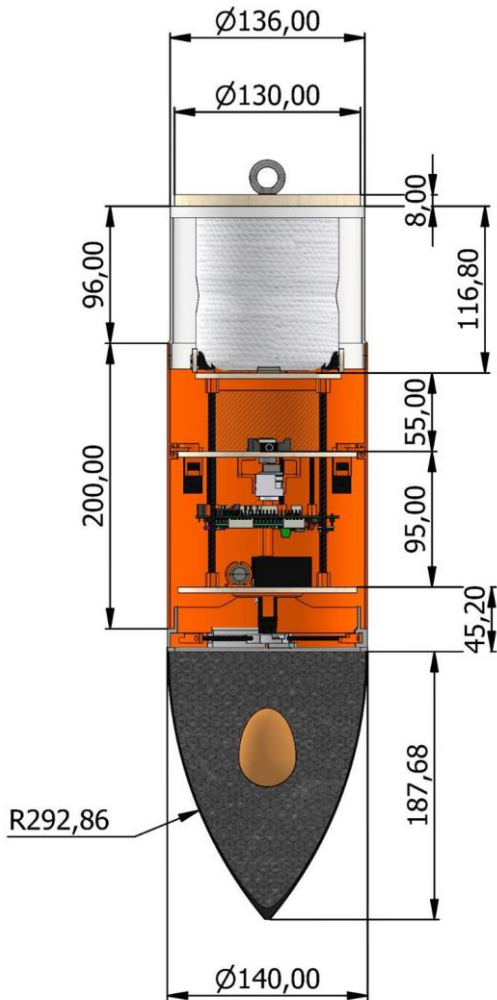
Mechanical Subsystem Changes Since PDR (2/3)

| Section | Part | PDR | CDR | Rationale |
|---------|-------------------------|--|--|-----------------------|
| Payload | Instrument Cover Design |  <p>Egg covered with cellulose, bubble wrap & 3D printed cover</p> |  <p>Egg covered with bubble wrap & carbon fiber nose cone</p> | Better egg protection |

Mechanical Subsystem Changes Since PDR (3/3)

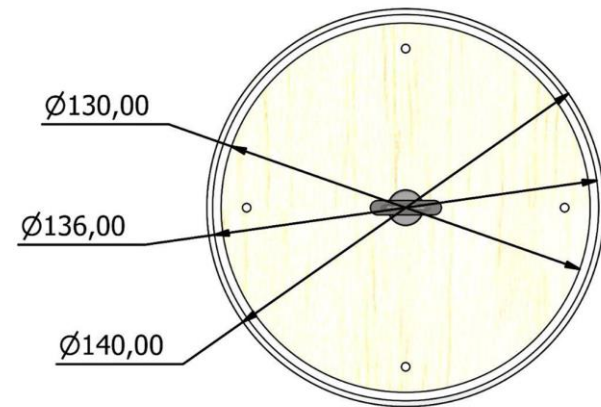
| Section | Part | PDR | CDR | Rationale |
|-----------|----------------------------|--|--|---|
| Container | Payload Holder |  <p data-bbox="782 901 1025 933">It doesn't exist</p> |  | Better locking position |
| | Para-glider Bag Attachment |  <p data-bbox="782 1215 1025 1248">It doesn't exist</p> |  | Avoid the para-glider's rope from being tangled |

CAD Model of CanSat Structure



Front View

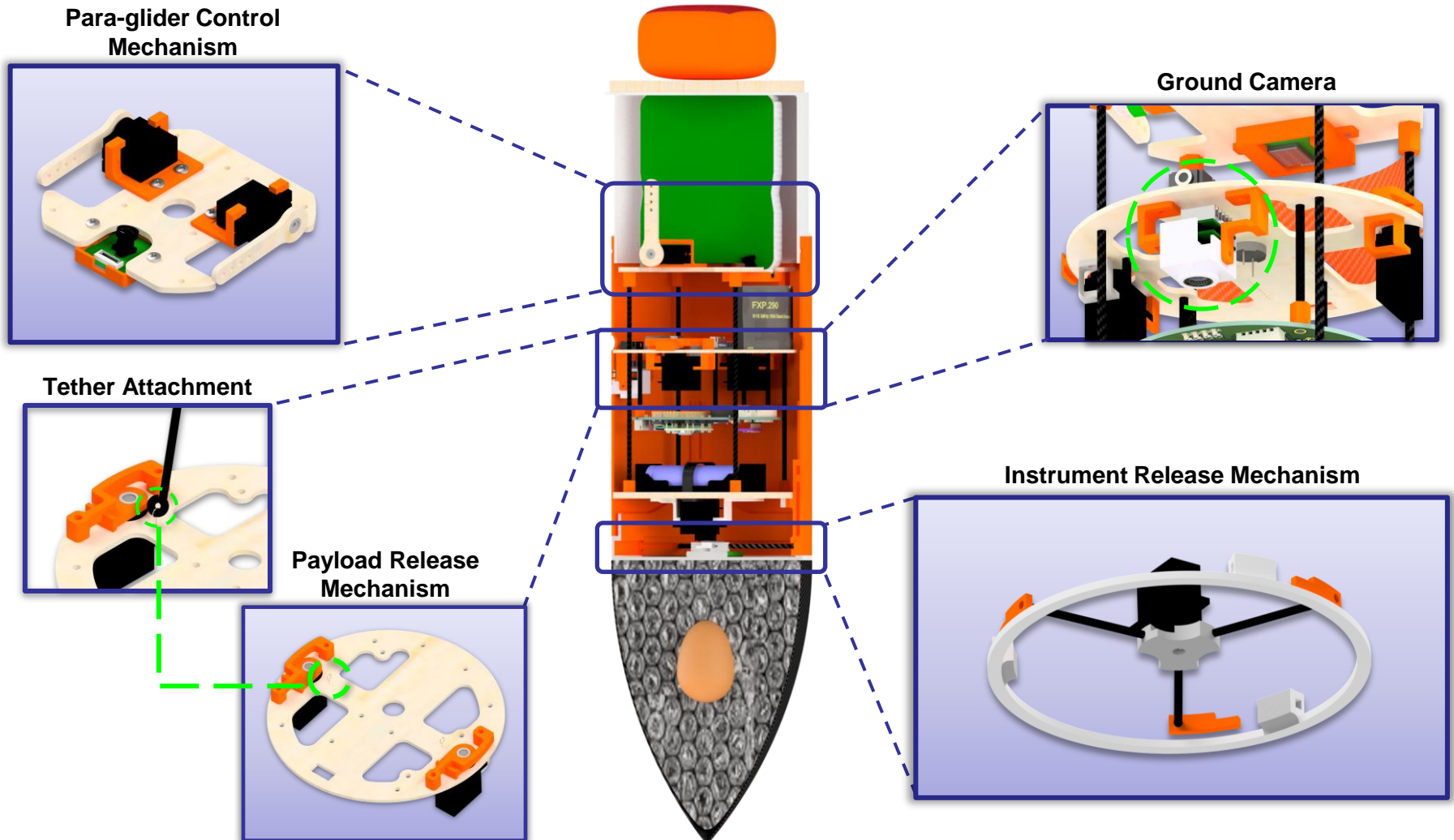
Top View



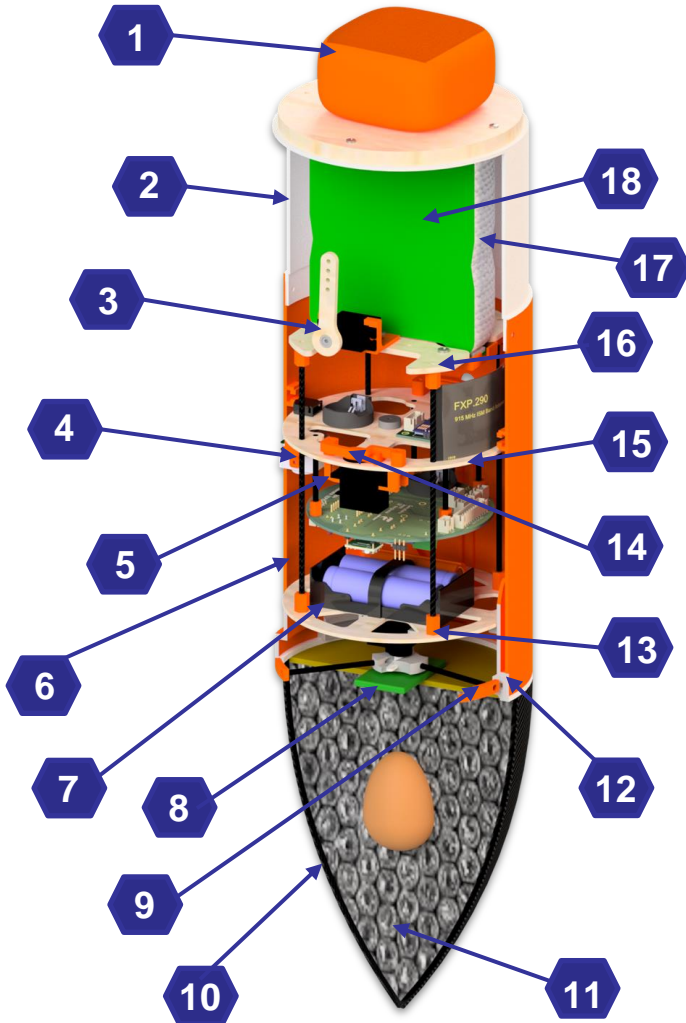
*The dimension of CanSat is using technical drawing in CAD software

*All measurement units are in mm

CanSat Placement of Major Components

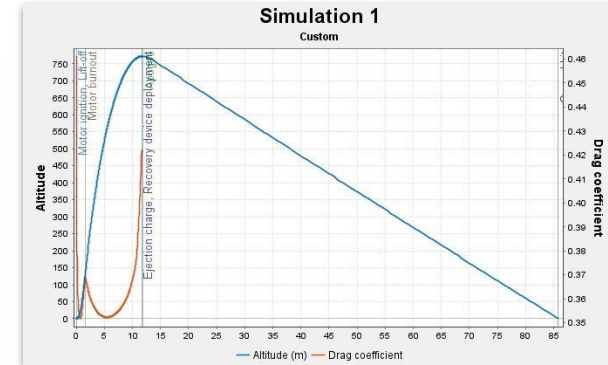
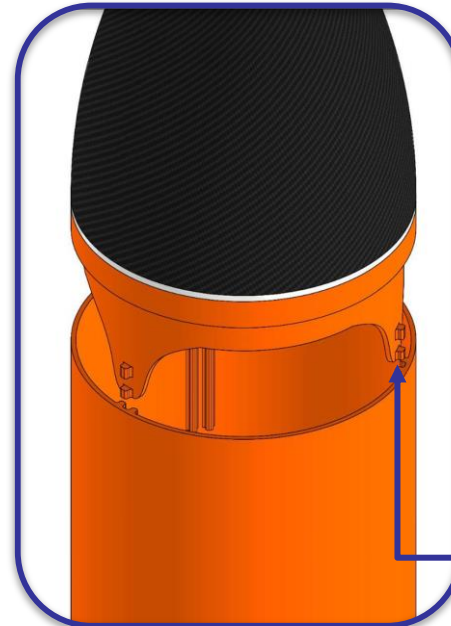
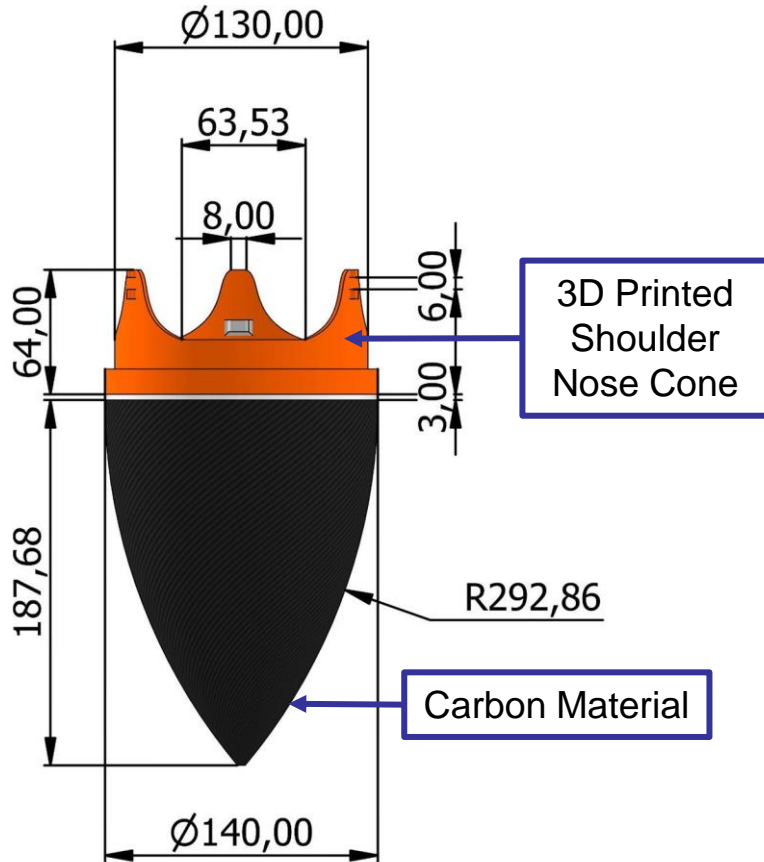


Structural Material



| Part | Material |
|---|----------------------|
| [2] Container's Shoulder [4] Ground Camera Bracket [5] Servo Bracket [6] Container [9] Instrument's Lock Pin [12] Shoulder Nose Cone [13] Payload Mount [14] Payload Release Arm | Easy ABS 3D Printing |
| [1] Container Parachute [18] Para-glider | Ripstop Nylon |
| [10] Nose cone | Carbon Fiber |
| [3] Para-glider Control Arm [15] Payload Release Frame [16] Para-glider Control Frame | Balsa Composite |
| [11] Egg Instrument Cover | Bubble Wrap |
| [17] Para-glider's Bag | Tetoron Cotton |
| [7] Battery Holder | Thermoplastics |
| [8] Instrument Ribbon | Polyester |

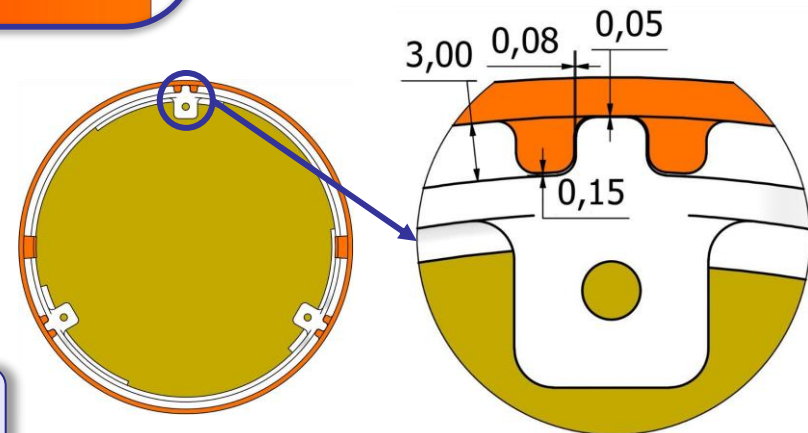
Tangent Ogive Nose Cone



Average Coefficient Drag = 0.3646

Source : openrocket simulation

Support Slider



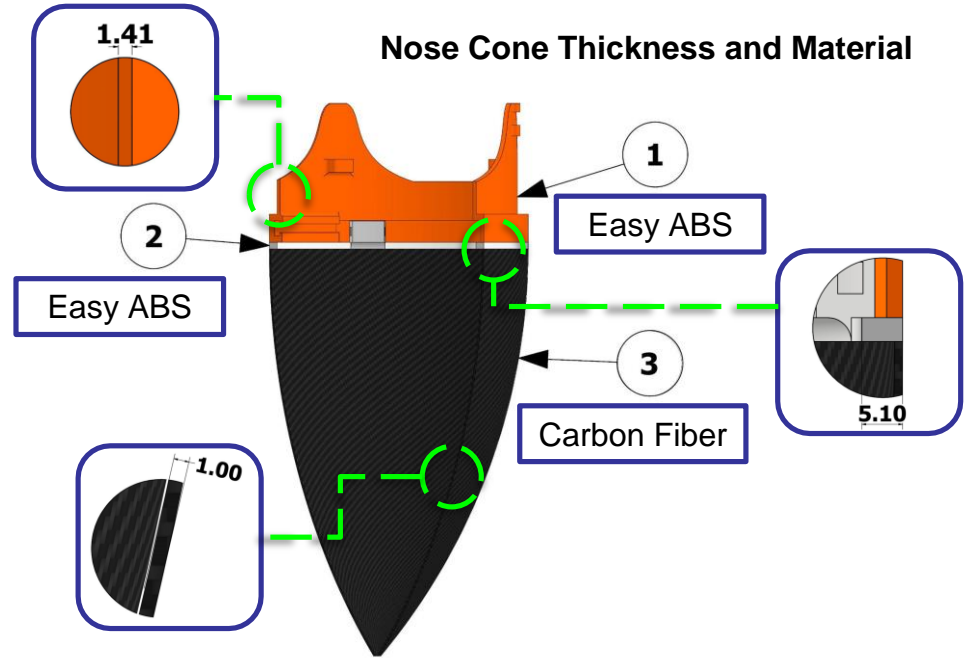
Tolerance to Container Wall

*The dimension of CanSat is using technical drawing in CAD software

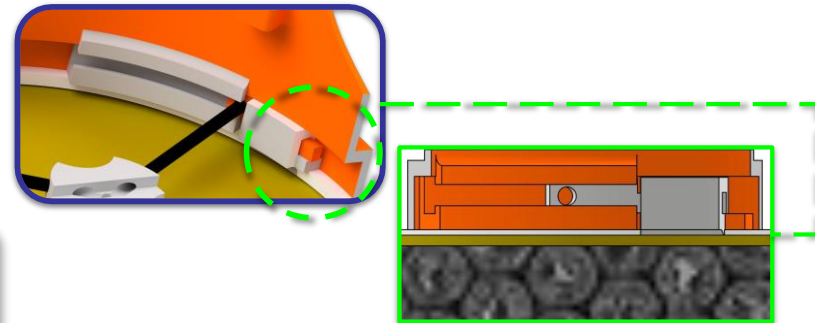
*All measurement units are in mm



Nose cone inserted to the shoulder nose cone

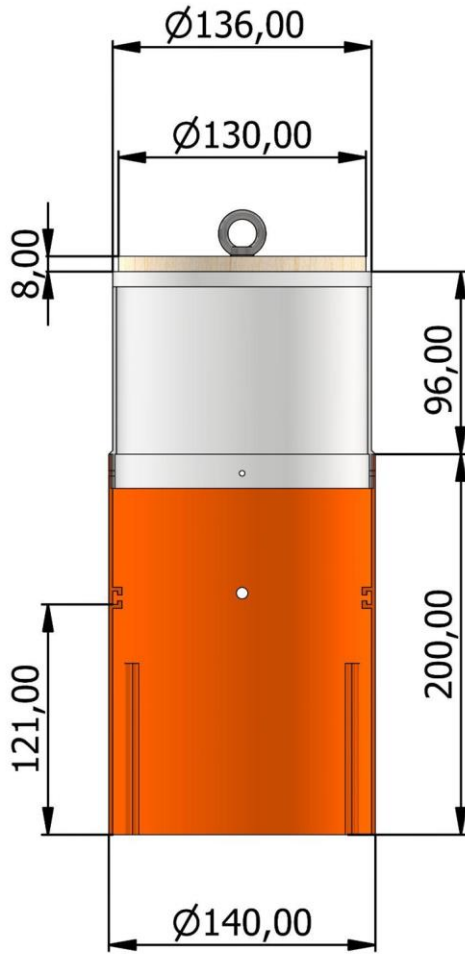


Instrument Release Mechanism Is Locked

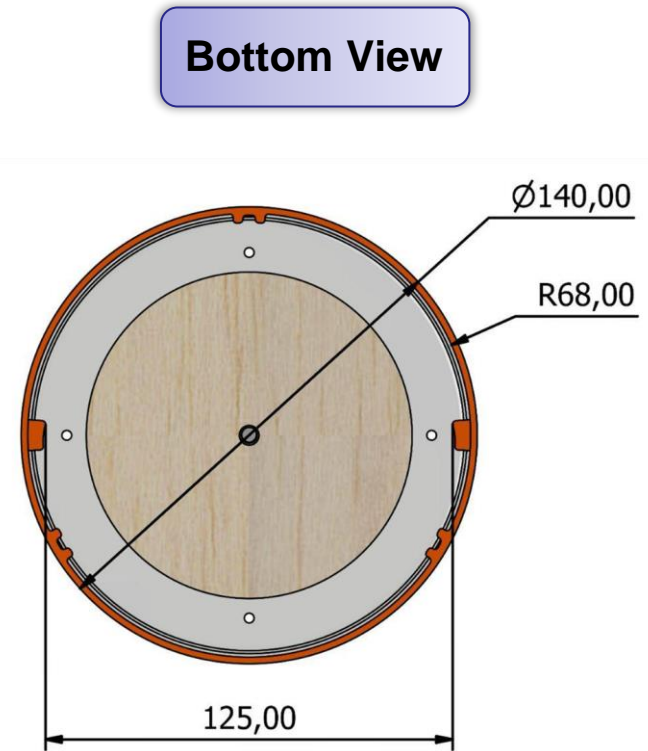


*The dimension of CanSat is using technical drawing in CAD software
 *All measurement units are in mm

CAD Model of Container Design



Front View





Bottom View

*The dimension of CanSat is using technical drawing in CAD software

*All measurement units are in mm

Part Changes from Reference Design

| Section | Part | Reference | CDR | Rationale |
|-----------|-----------------------------------|---|---|---------------------------|
| Container | Support Slider and Payload Holder |  <p data-bbox="788 882 1006 915">It doesn't exist</p> |  | Maximize locking position |

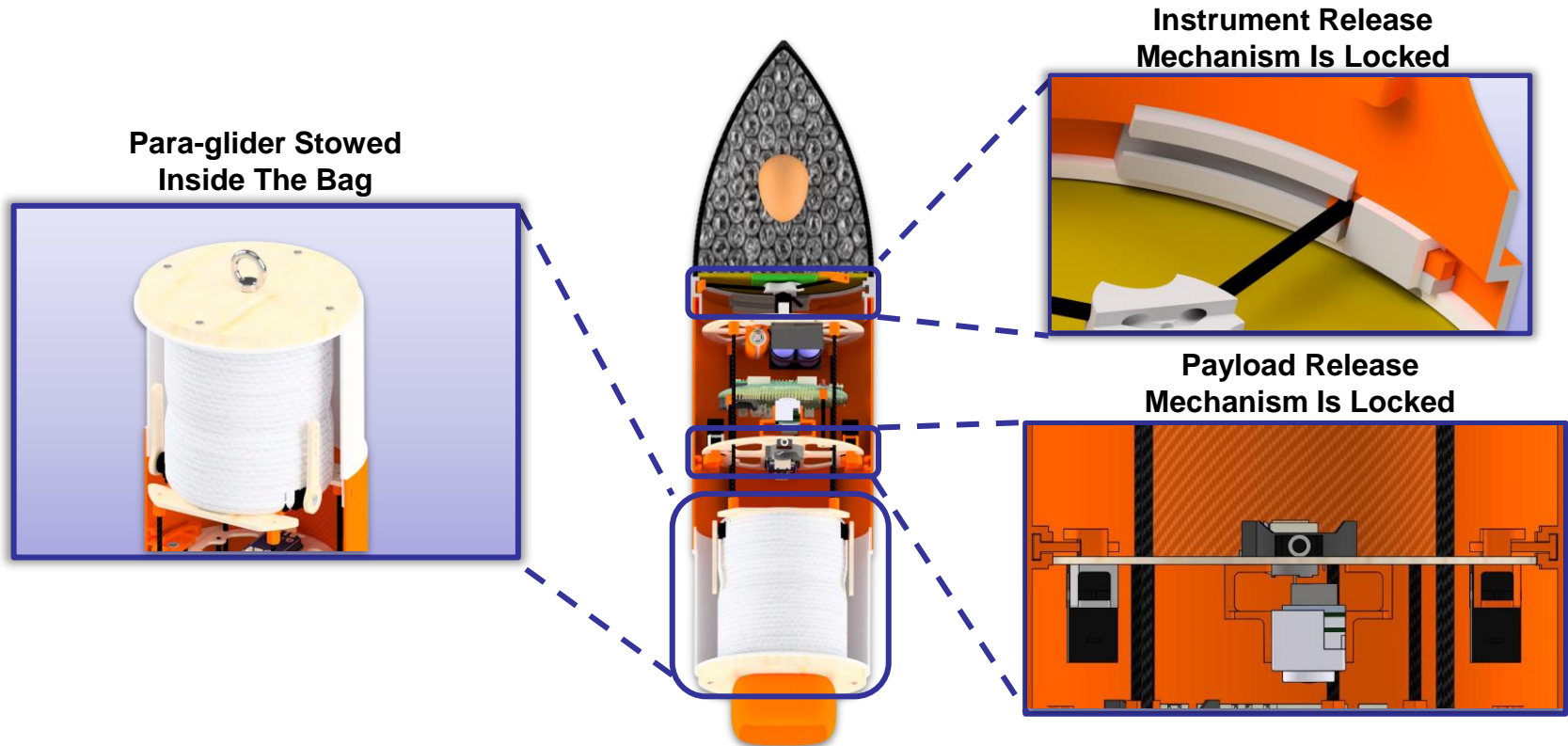
Verification For Proper Fit



Information

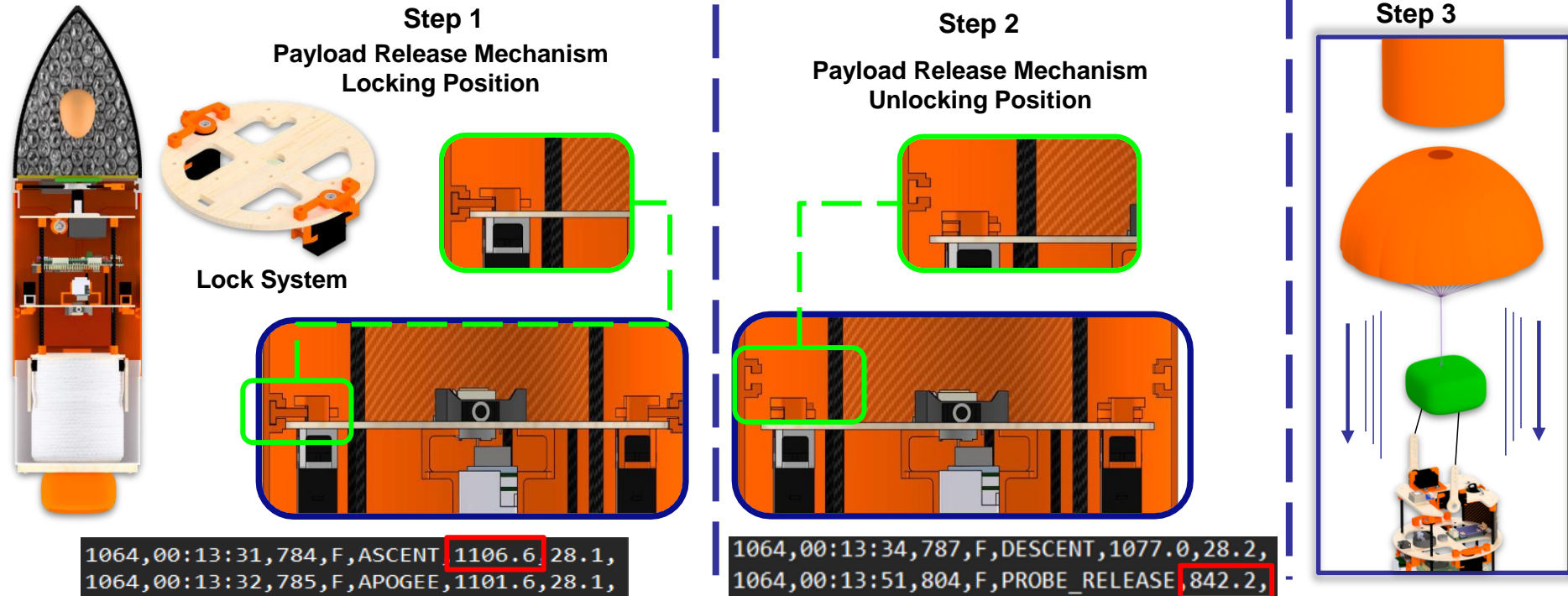
The prototype rocket we used for the proper fit test had an inner diameter of 136 mm.

Payload Pre-Deployment



Information

The release mechanism is used to hold the payload from being released, which consists of a 3D printed arm connected to servo motor. The para-glider will be folded and stowed using para-glider's bag. While the nose cone is locked by circular pin that connect to the servo.

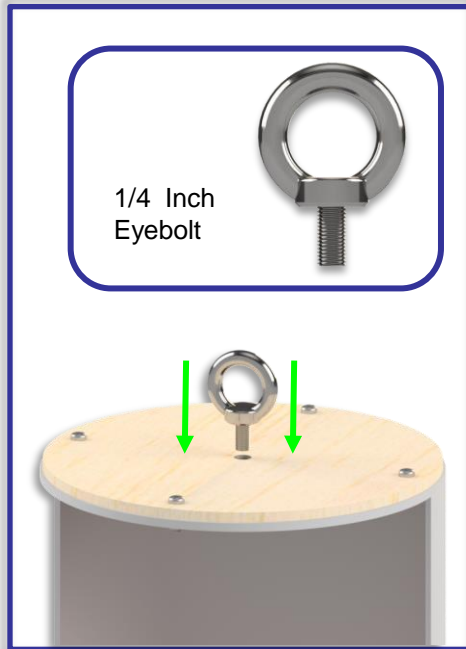


Information

| | |
|---------------|---|
| Step 1 | The payload is placed inside the container in a steady position. The payload is held by servo motor connected to a 3D printed arm. This allows the payload to be stored and locked properly in the container. |
| Step 2 | The payload release mechanism activates when the rocket reaches 80% of peak altitude. At this point, a servo motor drives the arm to unlock the payload from the container. |
| Step 3 | Then the payload will start separate from the container. |

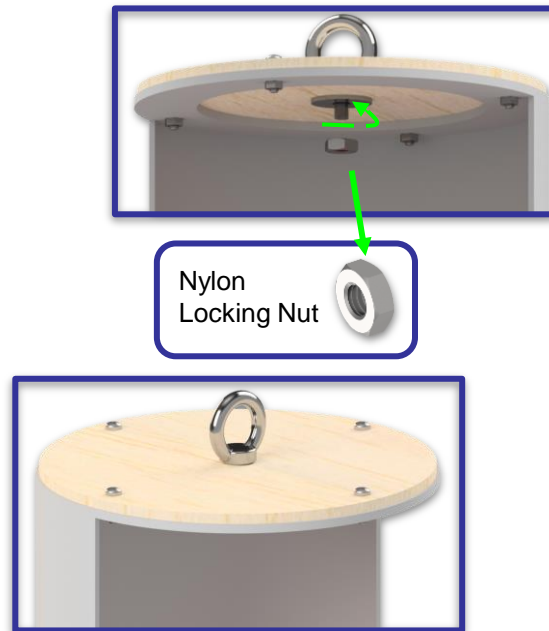
**No change to the payload mechanisms and/or structures
after payload release.**

Step 1

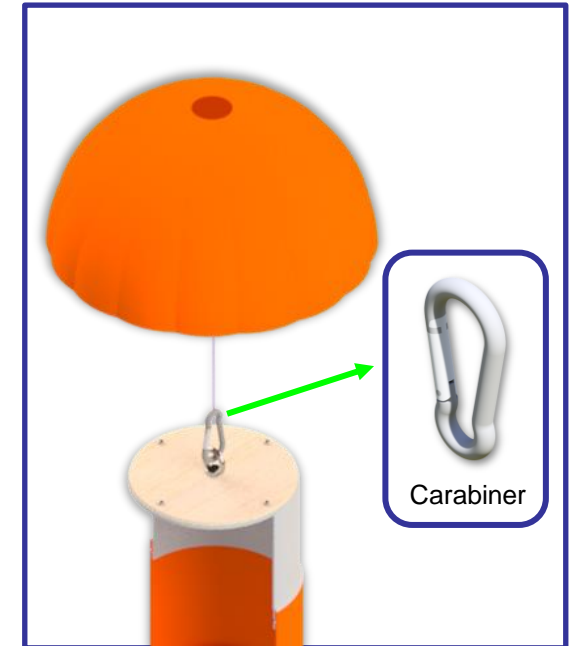


Parachute Attachment

Step 2



Step 3



Information

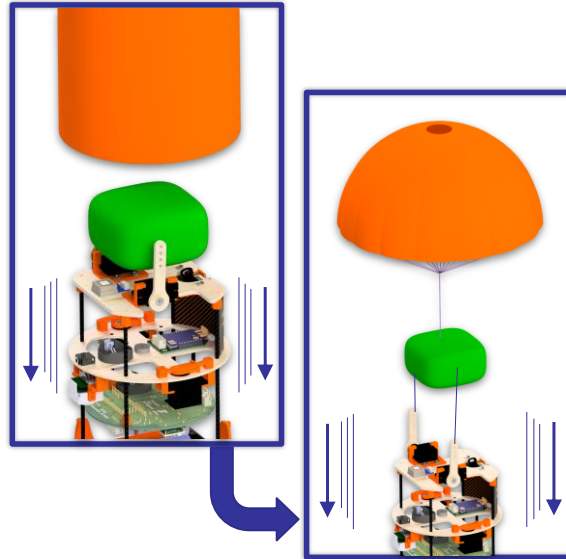
- | | |
|---------------|--|
| Step 1 | 1/4 inch eye bolt is installed on 8 mm balsa composite using a washer |
| Step 2 | The eyebolt is secured to the balsa composite using a washer and a nylon locking nut on the other side |
| Step 3 | The parachute that connected to the carabiner can be attached to the eyebolt |

Step 1



Para-glider Stowed Position

Step 2



Payload Transition From Para-Glider Stowed Position

Step 3



Para-glider Deployment

Information

Step 1

The para-glider is placed inside the bag that will be inserted into the container in stowed position. The payload is held by a payload release mechanism. This allows the para-glider to be stored and the payload to be securely locked in the container.

Step 2

The payload release mechanism will activated at 80% of the apogee. After the payload separates from the container, the drogue-chute will deploy and attract the stowed para-glider.

Step 3

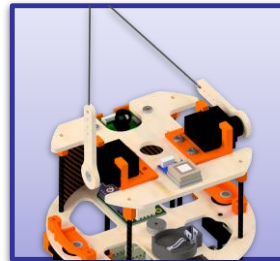
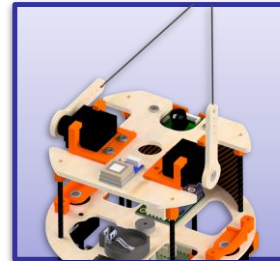
Then, the para-glider will deploy.

Step 1

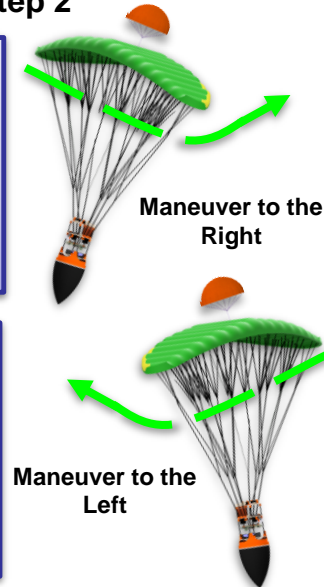


Para-glider Release

Step 2



**Para-glider Control Mechanism
Maneuver Payload Direction**



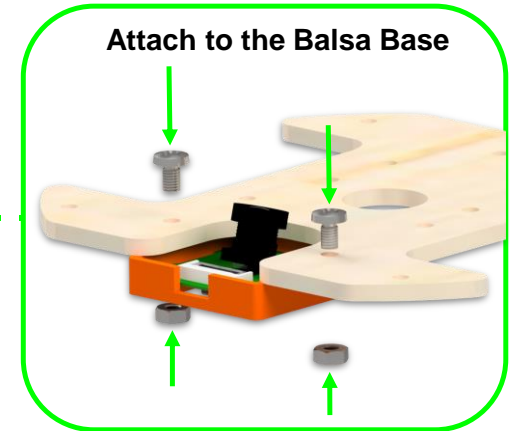
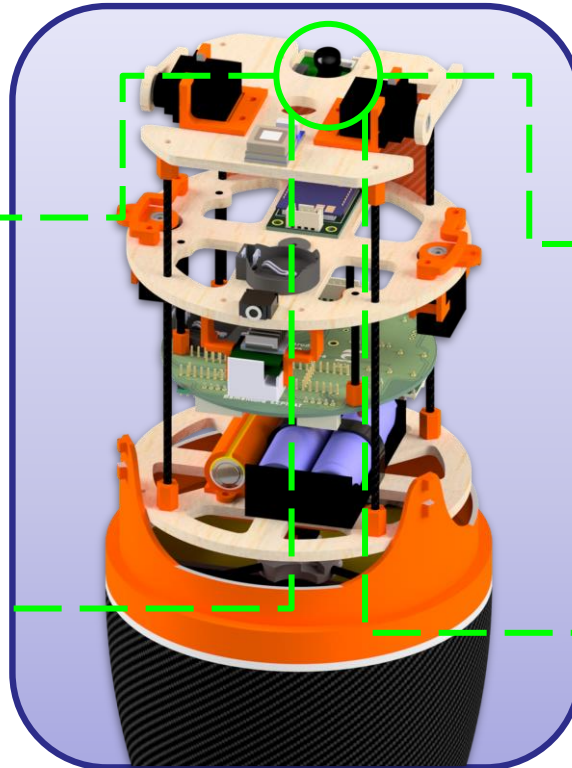
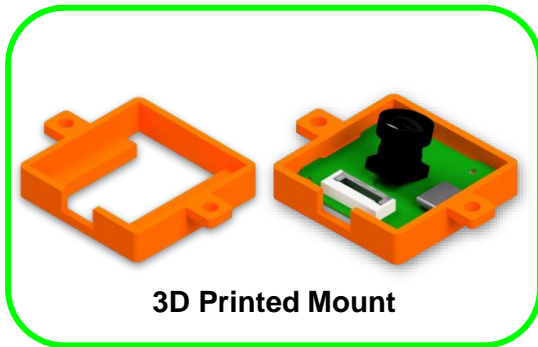
Step 3



**Para-glider Deployment
Toward Target Area**

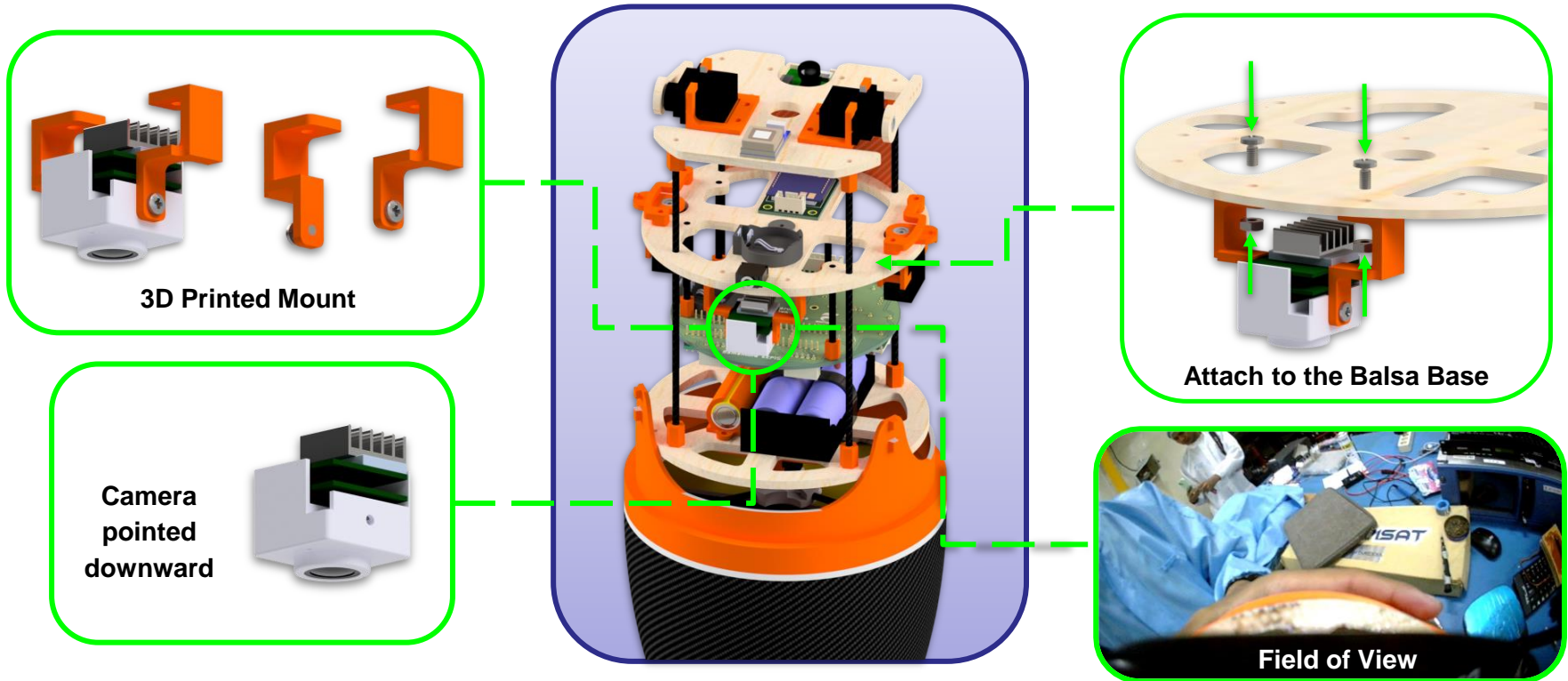
Information

| | |
|---------------|---|
| Step 1 | The para-glider being release and during deployment its influenced by the air force and the drogue-chute. |
| Step 2 | Therefore the direction of its para-glider is driven by para-glider control mechanism, both sides, left and right that are going to retract the rope by servo arm determined the direction. |
| Step 3 | Then, the para-glider will deploy and carry the payload to the target area. |



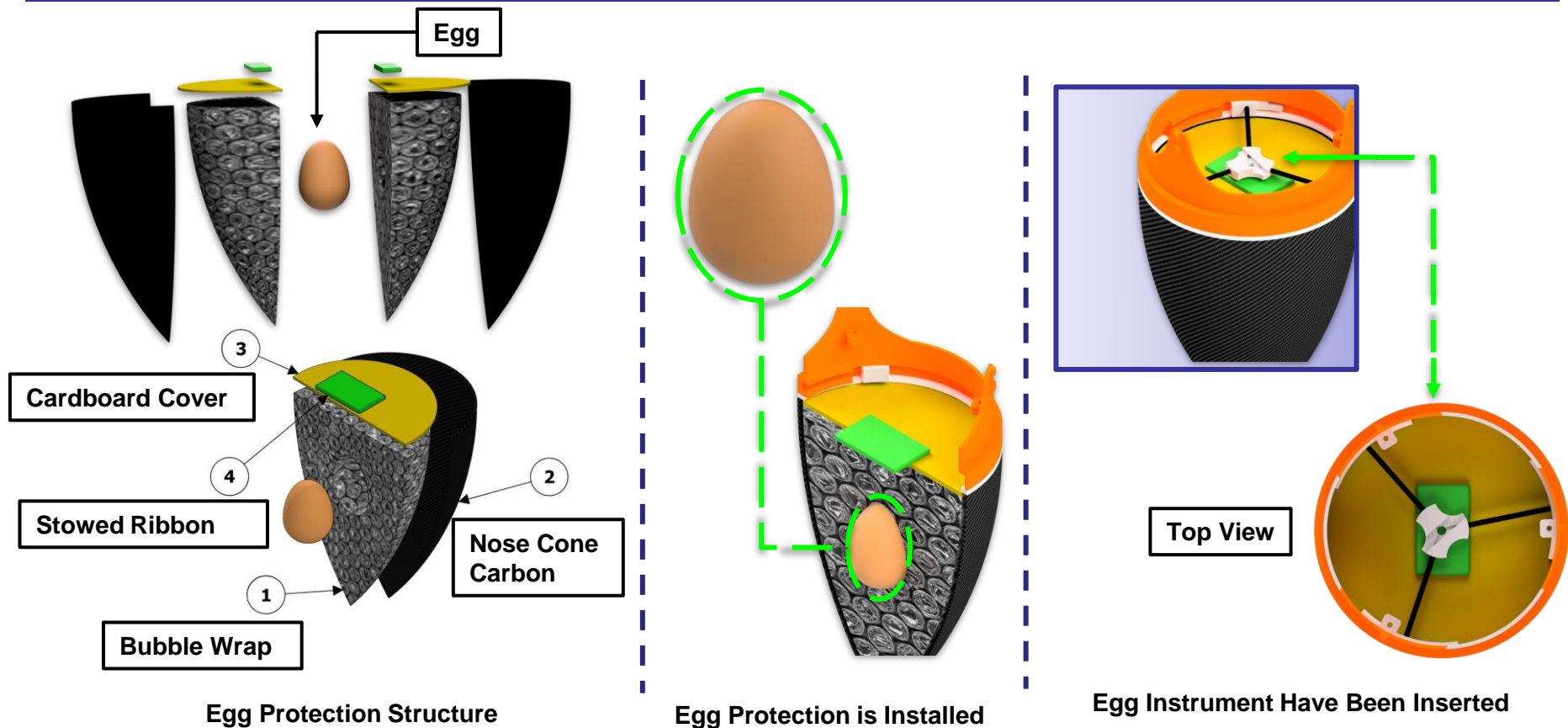
Information

The bracket holds the camera at a passive tilt of up to 15° to get a better view of the para-glider control mechanism and is attached to the top of payload with bolts and nuts. The camera is placed inside the bracket.



Information

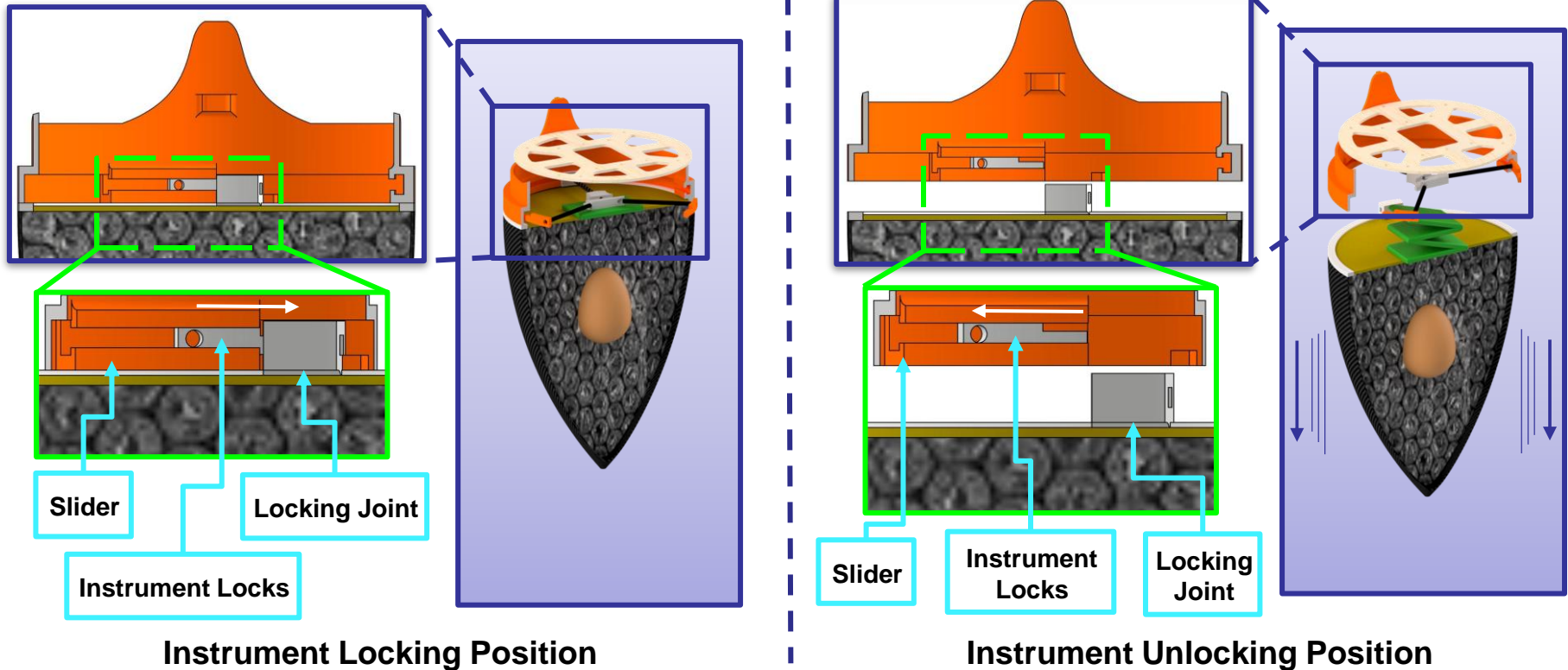
The ground camera will mount on 3D printed bracket facing the ground that attach into a balsa base, its direct refer to below direction. Utilize bolt and thread where act as a nut to ensure that bracket is strongly enough to hold its bracket.



Information

The instrument is protected by two primary layers: the first is bubble wrap that secures the egg, while the second is a carbon fiber nose cone enclosing it. Additionally, a cardboard cover is placed on top to prevent the egg from falling out due to vibrations during launch.

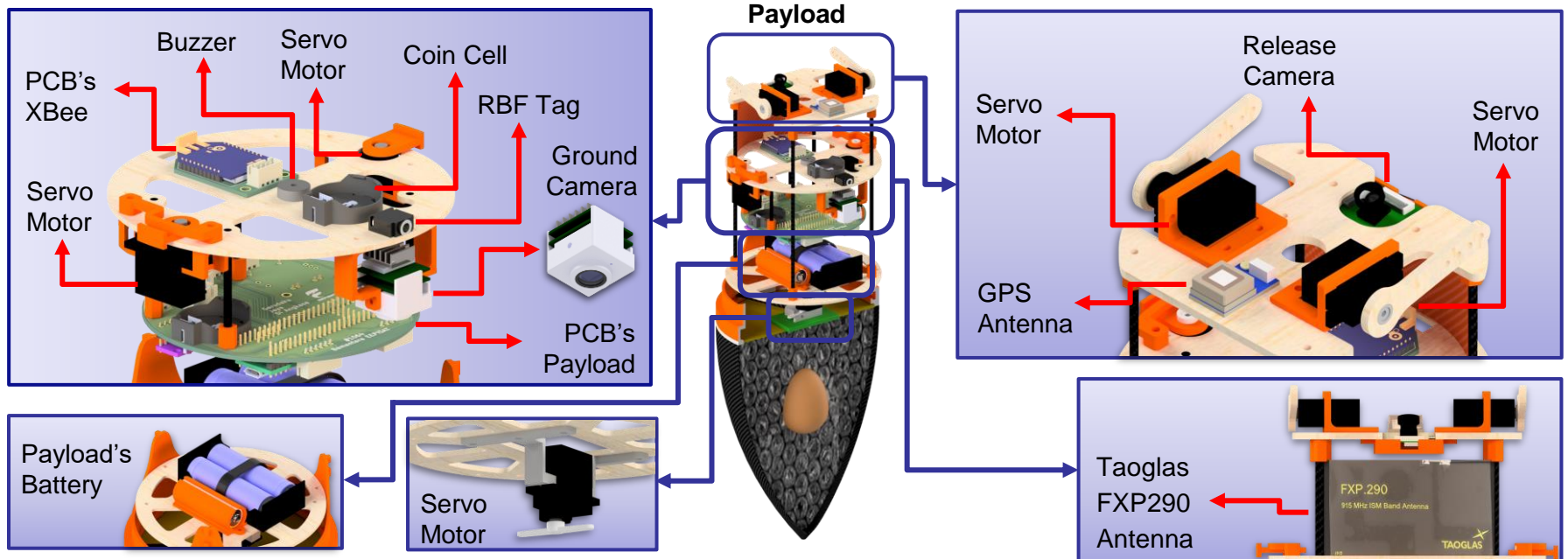
Twistlock- Instrument Release Mechanism



Information

In the locked position, the instrument locks engage with holes in the locking joints, securing the nose cone. When the locks are rotated by the servo, the joints disengage as they are no longer held from the inside. The locks then move along their tracks, guided by the sliders.

Materials: Easy ABS, Carbon Composite



Mounting Method

1. PCB's Payload is placed under the payload release mechanism, secured by the carbon rod and screw.
2. PCB's XBee is secured by the bolt and nut.

Enclosures

1. Payload's PCB will be fully enclosed inside its structural body.
2. The battery payload will be secured by a holder and held in place by a zip tie that keeps the battery safe.

Connection

1. Connectors of electronic components will be soldered and hot glued to the PCB.
2. Payload batteries, camera, taoglas FXP290 antenna, and servo motor will be jumpered and secured to the electronic components and modules.

Descent Control Attachment

1. The descent of the payload will be done by the active mechanism of the paraglider, which uses two servos to control the direction.
2. To release the payload, two motor servo MG90s will be used.

Acceleration and Shock Forces Requirements

Documentation



Requirement

CanSat survived the given acceleration and shock force from 61 cm attached to cord. No electrical mounts disconnected, no parts falling off and no separation.

Testing

1. Attach 61 cm cord to the top of container.
2. Add a floor mat or pillow below the test fixture.
3. Drop the CanSat.
4. Observe if any parts of the CanSat fall apart.

Results

The CanSat did not lose power. Don't have any damage, or detached parts and the telemetry is still being received.

| First Part of Payload-Electrical Component | | | | | |
|--|----------|---------------|---------------|--------------|-------------|
| Component | Quantity | Determination | Mass Unit (g) | Mass (g) | Margins (g) |
| Samsung INR18650-25R Battery | 2 | Measured | 49.5 | 99 | |
| Teensy 4.1 | 1 | Measured | 9 | 9 | |
| MG90S Servo Motor | 5 | Measured | 13.2 | 66 | |
| Soshine ICR14500 3.7V | 1 | Measured | 19.1 | 19.1 | |
| XBee Pro S3B | 1 | Measured | 6.3 | 6.3 | |
| BMP280 | 1 | Measured | 4.8 | 4.8 | |
| BNO055 | 1 | Estimated | 3 | 3 | 0.6 |
| Taoglas FXP290 Antenna | 1 | Estimated | 1.5 | 1.5 | 0.3 |
| Buzzer | 1 | Measured | 5 | 5 | |
| On/Off Switch | 1 | Measured | 1.6 | 1.6 | |
| VL53L1X | 1 | Measured | 1.1 | 1.1 | |
| Total Mass of First Part Payload-Electrical Component | | | | 216.4 | 0.9 |

Note: Due to the complexity of overall system, mass estimation is derived from the 20% of its estimated value.

| Second Part of Payload-Electrical Component | | | | | |
|---|----------|---------------|-------------------------|-------------|-------------|
| Component | Quantity | Determination | Mass Unit (g) | Mass (g) | Margins (g) |
| PCB | 1 | Measured | 39 | 39 | |
| SD Card Module | 1 | Measured | 1.5 | 1.5 | |
| 3 mm LED | 1 | Estimated | 0.4 | 0.4 | 0.08 |
| Coin Cell Battery | 2 | Measured | 4 | 8 | |
| U-blox SAM M10Q | 1 | Measured | 10 | 10 | |
| INA219 | 1 | Measured | 1.9 | 1.9 | |
| 3.3V Buck Converter | 1 | Measured | 0.5 | 0.5 | |
| 5V Buck Converter | 1 | Measured | 2 | 2 | |
| Turbowing Cyclops 3 V3 | 1 | Measured | 10.3 | 10.3 | |
| Remove Before Flight Tag | 1 | Measured | 1 | 1 | |
| EYESEC X6D | 1 | Measured | 4.1 | 4.1 | |
| Total Mass of Second Part Payload-Electrical Component | | | | 78.7 | 0.08 |
| Total Mass of Payload-Electrical Component | | | | | |
| First Part of Payload-Electrical Component | | | 216.4 g ± 0.9 g | | |
| Second Part of Payload-Electrical Component | | | 78.7 g ± 0.08 g | | |
| Total Mass of Payload-Electrical Component | | | 295.1 g ± 0.98 g | | |

Note: Due to the complexity of overall system, mass estimation is derived from the 20% of its estimated value.

| Payload-Structural Component | | | | | |
|---|----------|---------------|---------------|--------------|-------------|
| Component | Quantity | Determination | Mass Unit (g) | Mass (g) | Margins (g) |
| Nose Cone | 1 | Measured | 92 | 92 | |
| Shoulder Nose Cone | 1 | Measured | 77.4 | 77.4 | |
| Instrument Release Mechanism | 1 | Measured | 8.3 | 8.3 | |
| Payload Release Mechanism | 1 | Measured | 16.6 | 16.6 | |
| Para-glider Control Mechanism | 1 | Measured | 15.4 | 15.4 | |
| Battery Holder | 1 | Measured | 16.5 | 16.5 | |
| Battery Holder Frame | 1 | Measured | 8.4 | 8.4 | |
| Para-glider | 1 | Measured | 79.5 | 79.5 | |
| Camera Bracket | 2 | Measured | 5 | 10 | 2 |
| Carbon Rod M3 x 45 mm | 4 | Measured | 0.4 | 1.6 | |
| Carbon Rod M3 x 50 mm | 3 | Measured | 0.5 | 1.5 | |
| Carbon Rod M3 x 135 mm | 4 | Measured | 1.4 | 5.6 | |
| Bolt | 30 | Estimated | 0.35 | 10.5 | 2.1 |
| Payload Antenna Bracket | 1 | Measured | 9.7 | 9.7 | |
| Total Mass Structural Component of Payload | | | | 353 | 4.1 |
| Container-Structural Component | | | | | |
| Component | Quantity | Determination | Mass Unit (g) | Mass (g) | Margins (g) |
| Container | 1 | Measured | 171.4 | 171.4 | |
| Container Shoulder | 1 | Measured | 97.5 | 97.5 | |
| Parachute | 1 | Measured | 14.2 | 14.2 | |
| Eyebolt | 1 | Measured | 56.1 | 56.1 | |
| Balsa Plate | 1 | Measured | 13.5 | 13.5 | |
| Total Mass Structural Component of Container | | | | 352.7 | |

Note: Due to the complexity of overall system, mass estimation is derived from the 20% of its estimated value.

S1: Total mass of the CanSat shall be 1000 grams ± 10 grams being installed.

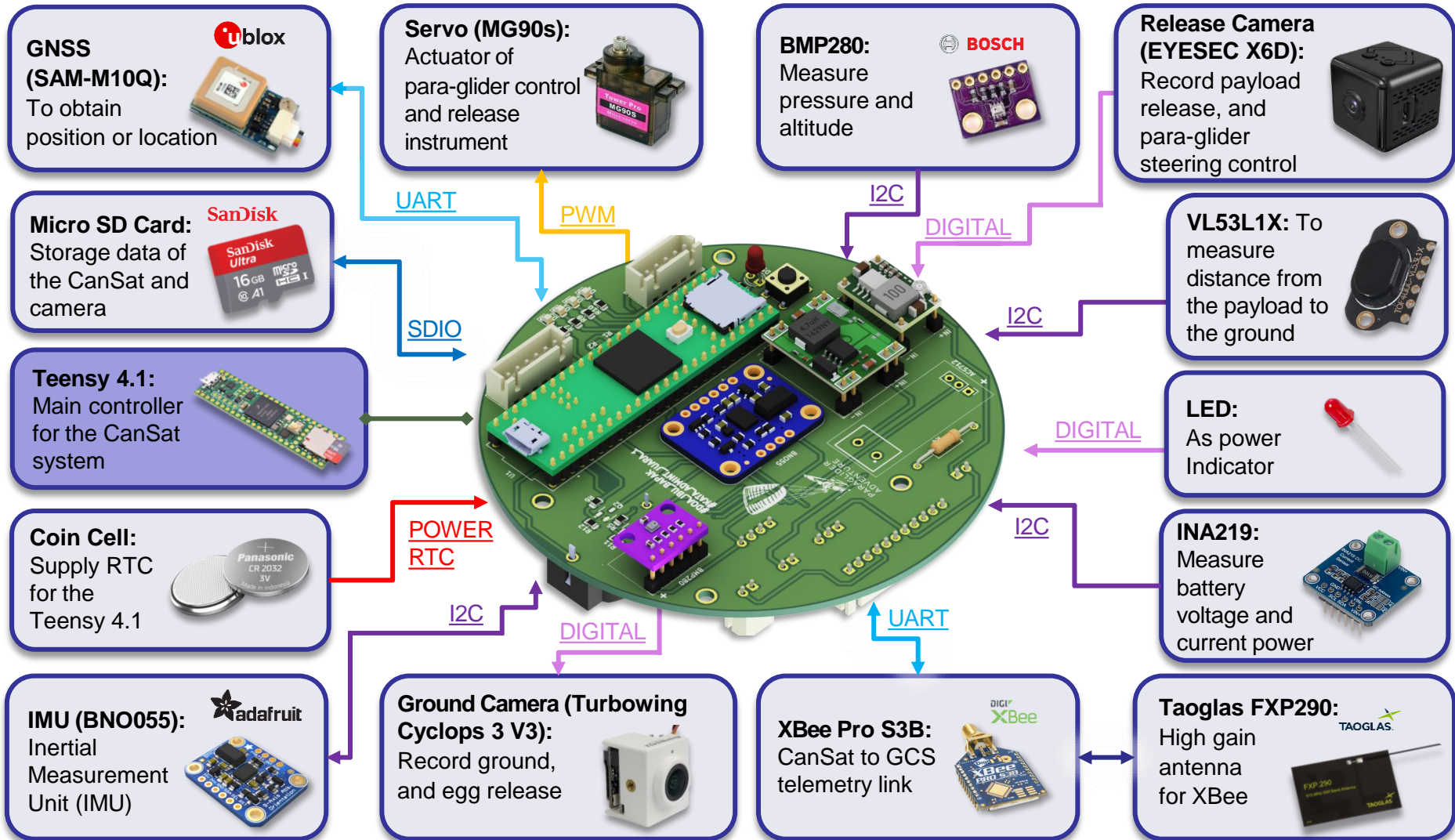
| Total Mass | |
|---------------------------------|--|
| Container | 352.7 g |
| Payload | 648.1 g |
| Total Mass of All System | 1,000.8 g ± 5.08 g |

| Margin |
|---|
| Mass Competition Requirement – Total Mass of All System = Margin 1,000 – 1,000.8 = - 0.8 g (Fulfill Mass Tolerance) Uncertainties = ± 5.08 g |

| Correction Method (Margin Competition ± 10 g) | |
|---|---|
| If total mass system < 990 grams | We will increase the mass of materials using higher infill density of 3D printed material for the CanSat. |
| If total mass system > 1,010 grams | We will change the material with lighter material such as composite that has lower density for the CanSat |

Communication and Data Handling (CDH) Subsystem Design

Ax'I Nurrahim



CDH Changes Since PDR

| Part | PDR | CDR | Rationale |
|---------------------------------|---|---|--|
| Payload Telemetry Format | Match with mission guide without additional fusion roll, and pitch data for 3D model. Also, incorrect placement of the checksum command | Added roll and pitch data to telemetry. And the command checksum position has been corrected at the end of the telemetry format | To improve the visualization of the CanSat 3D model in the GCS. Also, to ensure that the checksum command can properly read and verify the entire received data packet |

1064,15:26:09,1,F, LAUNCH_PAD,1.1,31.3,101.3,7.9,0.08,0.1,-0.1,0.1,
0.2,0,9.5,15:26:09,24.0,-7.2758,112.7942,4,CAL, 37,106.6,_PG_OFF,1.5,5,



CHECKSUM

1064,15:26:09,1,F, LAUNCH_PAD,1.1,31.3,101.3,7.9,0.08,0.1,-0.1,0.1,-
0.2,0,9.5,15:26:09,24.0,-7.2758,112.7942,4,CAL, 0.4 -1.4,106.6,_PG_OFF,1.5,5, 37

Roll Pitch

CHECKSUM

- = Roll
- = Pitch
- = CHECKSUM

| Model | Processor | | | | Interfaces | | | | | |
|------------|-------------------|------------|----------|----------------|------------|----------|----------|------|-----|-----|
| | Clock Speed [MHz] | Flash [kB] | RAM [kB] | Boot Time [ms] | I/O Pins | ADC Pins | PWM Pins | UART | SPI | I2C |
| Teensy 4.1 | 600 | 8192 | 1024 | 500 | 55 | 18 | 35 | 8 | 3 | 3 |

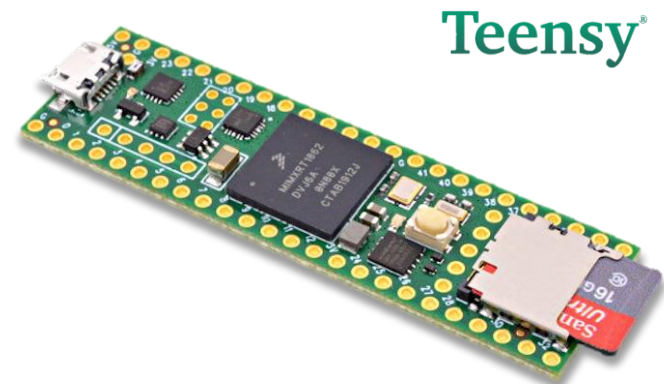
| Data Bus Width (bit) | Power Consumption (mW) | Size ¹ [mm] | Mass [g] | Supply Voltage [V] | Price ² [USD] |
|----------------------|------------------------|------------------------|----------|--------------------|--------------------------|
| 64 & 32 | 500 | 61 x 17.8 x 1.57 | 9 | 5 | 56.97 |

Selected Payload Processor : **Teensy 4.1** ✓

Reasons :

- High speed processor
- Has more pins than other microcontrollers
- Larger memory capacity
- Fast boot time

1. Size of our sensor is in the form of a module.
2. Price references are obtained from local stores.



| Model | Interface | Memory [GB] | Data transfer rate | | Price ¹ [USD] |
|------------------------|-------------------|-------------|--------------------|------------------|--------------------------|
| | | | Write (MB/s) | Read (MB/s) | |
| SanDisk Ultra Micro SD | SD Card Interface | 16 | 98 | Minimum speed 10 | 11.32 |

The CanSat utilizes three SD cards: one for the Teensy 4.1 and two for the cameras. The configuration follows the memory selection shown in this slide, with the only difference being the storage capacity.

Selected Memory

SanDisk Ultra Micro SD ✓

SanDisk

Reasons :

- Stable data transfer rate
- High reliability
- High speed data transfer



1. Price references are obtained from local stores.

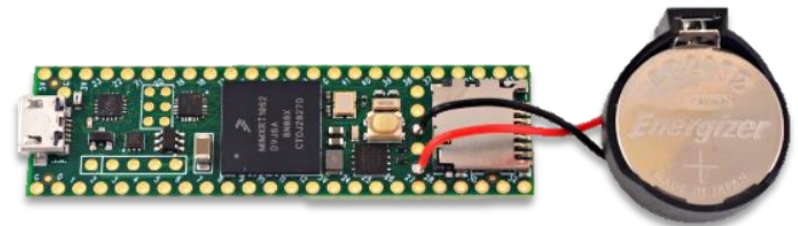
| Model | Operating Voltage [V] | Operating Current [μ A] | Reset Tolerance | Accuracy (ppm) | Price ¹ [USD] |
|-------------------------|-----------------------|------------------------------|---|----------------|--------------------------|
| Teensy 4.1 Internal RTC | 3 | 30 | Under reset conditions, the software retrieves the recent data stored in the RTC registers. | ± 20 | 0 |

Coin cell for the internal RTC is completely separated from the CanSat power supply.

Selected Real Time Clock : **Teensy 4.1 Internal RTC** ✓

Reasons :

- **Included in our microcontroller board (COTS)**
- Simplifies our PCB (no need to route extra modules)
- 3V compatible power supply



1. Price references are obtained from local stores.

| Model | Range ¹ [Km] | Frequency [MHz] | Gain [dBi] |
|----------------|-------------------------|-----------------|------------|
| Taoglas FXP290 | 11.67 | 915 | 1.5 |

| Connector | Size [mm] | Weight [g] | Price [USD] |
|-----------|-----------|------------|-------------|
| Micro FL | 75.4 x 45 | 1.5 | 17.05 |

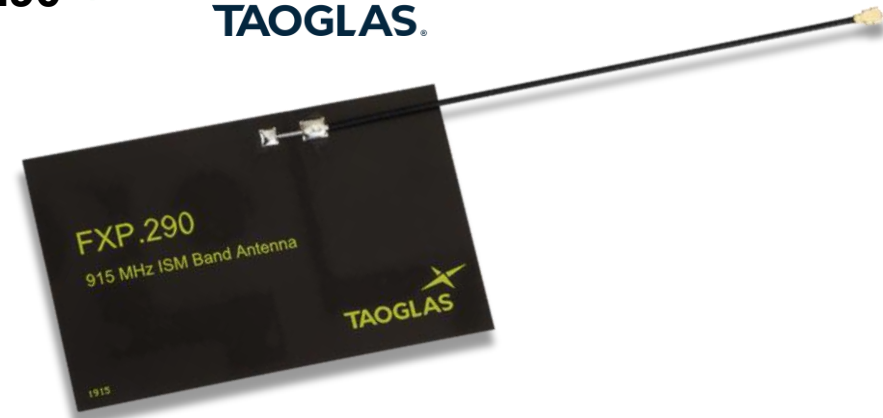
Selected Payload Antenna

■ **Taoglas FXP290** ✓



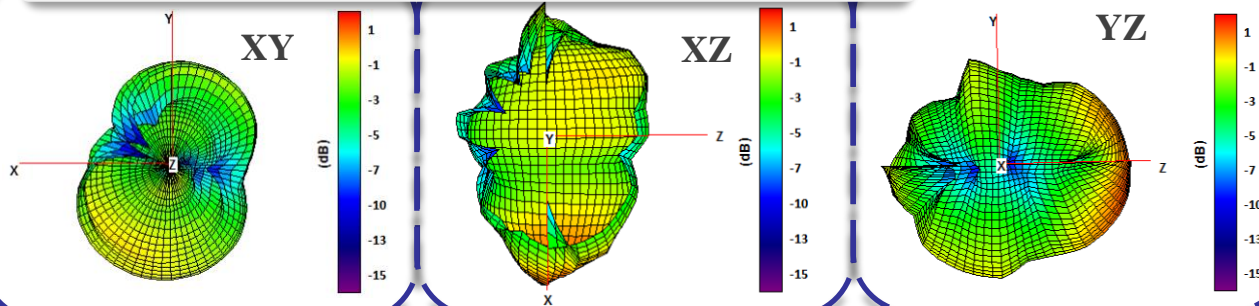
Reasons :

- Compact & flexible form factor
- Small board-level connector
- Lightweight
- Long effective working range



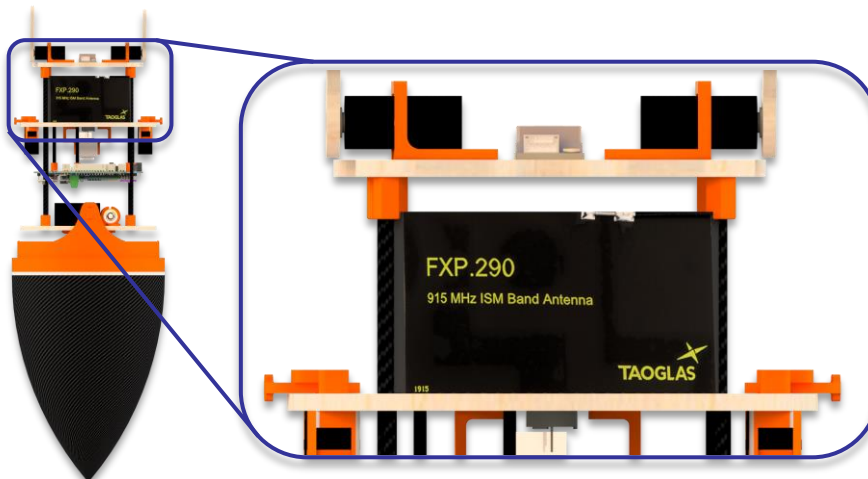
1. The range data is based on information provided in the datasheet

Radiation Patterns of Taoglas FXP290 Antenna



Placement of Taoglas FXP290 Antenna

The location of the FXP290 antenna is under the para-glider steering control mechanism, and it is positioned facing outward to achieve maximum signal coverage.



Testing



We have already test this antenna using several methods such as range test using vehicle. As the results are got 2 km on average.

| Model | Range ¹ [Km] | Frequency | Receive Current [mA] | Transmit Current [mA] |
|--------------|-------------------------|-----------|----------------------|-----------------------|
| XBee PRO S3B | 6.5 | 915 MHz | 26 | 215 |

| Operating Voltage [V] | Sensitivity [dBm] | Antenna Connector | RF Data Rate [Kb/s] | Price [USD] |
|-----------------------|-------------------|-------------------|---------------------|-------------|
| 3 ~ 3.6 | -107 | Micro FL | 200 | 55.66 |

Selected Payload Radio

XBee PRO S3B ✓

Reasons :

- Longest range connection
- High sensitivity
- Low receive and transmit current
- Meets the required specifications



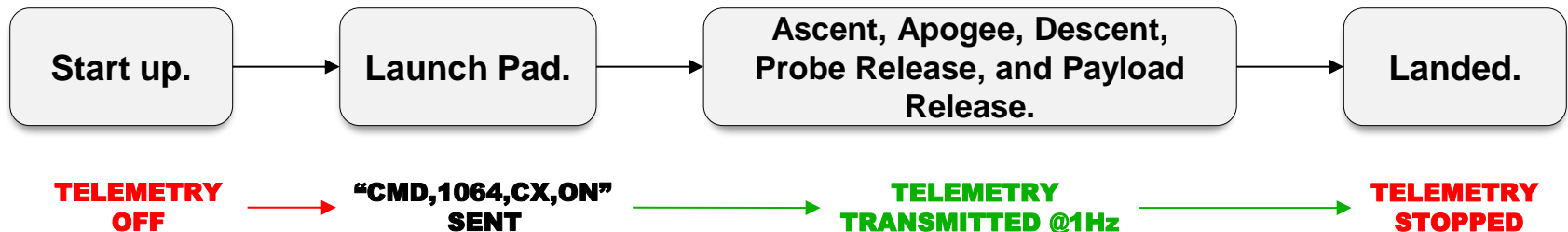
1. The range data is based on information provided in the datasheet

Overview of Radio Configuration

- As shown in the slide above, we use an **XBee Pro S3B** as the radio communication device between the CanSat and the GCS.
- We are using NETID 1064 because our team ID is 1064.**
- XBee will not be set to Broadcast mode.

Transmission Control

- The CanSat **telemetry** data will be **transmitted** to the GCS **@1Hz**.
- The CanSat will start sending data when commanded by GCS using command “**CMD,1064,CX,ON**”.
- The transmission of CanSat packet data will commence at the CanSat’s **LAUNCH_PAD** state. Before **LAUNCH_PAD** state the CanSat remains idle.
- If somehow the Teensy 4.1 runs into reset, it will recover the last packet count from SD Card, so the packet counting doesn’t reset.



| CanSat Telemetry Data | | |
|-----------------------|-------------|---|
| Data Format | Sample Data | Description |
| <TEAM_ID> | 1064 | The assigned four digit team identification number. Our team ID is 1064 |
| <MISSION_TIME> | 15:26:09 | UTC time in format hh:mm:ss, where hh is hours, mm is minutes, and ss is seconds. E.g., '15:26:09' indicates 3:26:09 PM. |
| <PACKET_COUNT> | 1 | The total count of transmitted packets since turned on, which is to be reset to zero by command when the CanSat is installed in the rocket on the launch pad at the beginning of the mission and maintained through processor reset |
| <MODE> | F | The ASCII character 'F' for flight mode and 'S' for simulation mode |
| <STATE> | LAUNCH_PAD | The operating state of the software |
| <ALTITUDE> | 1.1 | The altitude in units of meters and must be relative to ground level at the launch site. The resolution must be 0.1 meters |
| <TEMPERATURE> | 31.3 | The temperature in degrees Celsius with a resolution of 0.1 degrees. |
| <PRESSURE> | 101.3 | The air pressure of the sensor used. Value must be in kPa with a resolution of 0.1 kPa. |

| CanSat Telemetry Data | | |
|-----------------------------|--------------|---|
| Data Format | Sample Data | Description |
| <VOLTAGE> | 7.9 | The voltage of the CanSat power bus with a resolution of 0.1 volts. |
| <CURRENT> | 0.08 | The current from the battery with a resolution of .01 amperes. |
| <GYRO_R, GYRO_P, GYRO_Y> | 0.1,-0.1,0.1 | The gyro readings in degrees per second for the roll, pitch, and yaw axes. |
| <ACCEL_R, ACCEL_P, ACCEL_Y> | -0.2,0,9.5 | The accelerometer readings in degrees per second squared for the roll, pitch and yaw axes. |
| <GPS_TIME> | 15:26:09 | The time from the GPS receiver. The time must be reported in UTC and have a resolution of one second. |
| <GPS_ALTITUDE> | 24.0 | The altitude from the GPS receiver in meters above mean sea level with a resolution of 0.1 meters. |
| <GPS_LATITUDE> | -7.2758 | The latitude from the GPS receiver in decimal degrees with a resolution of 0.0001 degrees North. |
| <GPS_LONGITUDE> | 112.7942 | The longitude from the GPS receiver in decimal degrees with a resolution of 0.0001 degrees West. |

| CanSat Telemetry Data | | |
|-----------------------------|-------------|--|
| Data Format | Sample Data | Description |
| <GPS_SATS> | 4 | The number of GPS satellites being tracked by the GPS receiver. This must be an integer number |
| <CMD_ECHO> | CAL | The fixed text command id and argument of the last received command with no commas |
| Optional Data Separator | '' | Zero or more additional fields the team considers important following two commas, which indicates a blank field |
| <ROLL,PITCH> | 0.4,-1.4 | To provide orientation roll and pitch data for the 3D model in Ground Control Station |
| <HEADING_ERROR> | 106.6 | To evaluate the angular deviation between the CanSat heading and the landing target direction, the data will be formatted in degrees |
| <PG_STATE> | _PG_OFF | To observe the real-time status of the para-glider control mechanisms. |
| <DISTANCE_TO_TARGET> | 1.5 | To measure the current distance of the CanSat from the landing zone, the data will be formatted in meters. |
| <GROUND_DETECTION_ALTITUDE> | 5 | To measure the distance from the CanSat to the ground. |
| <CHECKSUM> | 37 | To verify and validate the quantity of valid and invalid data transmitted or received through telemetry. |

Telemetry Format :

TEAM_ID,MISSION_TIME,PACKET_COUNT,MODE,STATE,ALTITUDE,TEMPERATURE,PRESSURE,VOLTAGE,CURRENT,GYRO_R,GYRO_P,GYRO_Y,ACCEL_R,ACCEL_P,ACCEL_Y,GPS_TIME,GPS_ALTITUDE,GPS_LATITUDE,GPS_LONGITUDE,GPS_SATS,CMD_ECHO,,ROLL,PITCH,HEADING_ERROR,PG_STATE,DISTANCE_TO_TARGET,GROUND_DETECTION_ALTITUDE,CHECKSUM

Example Data :

1064,15:26:09,1,F,LAUNCH_PAD,1.1,31.3,101.3,7.9,0.08,0.1,-0.1,0.1,-0.2,0,9.5,15:26:09,24.0,-7.2758,112.7942,4,CAL,,0.4,-1.4,106.6,_PG_OFF,1.5,5,37

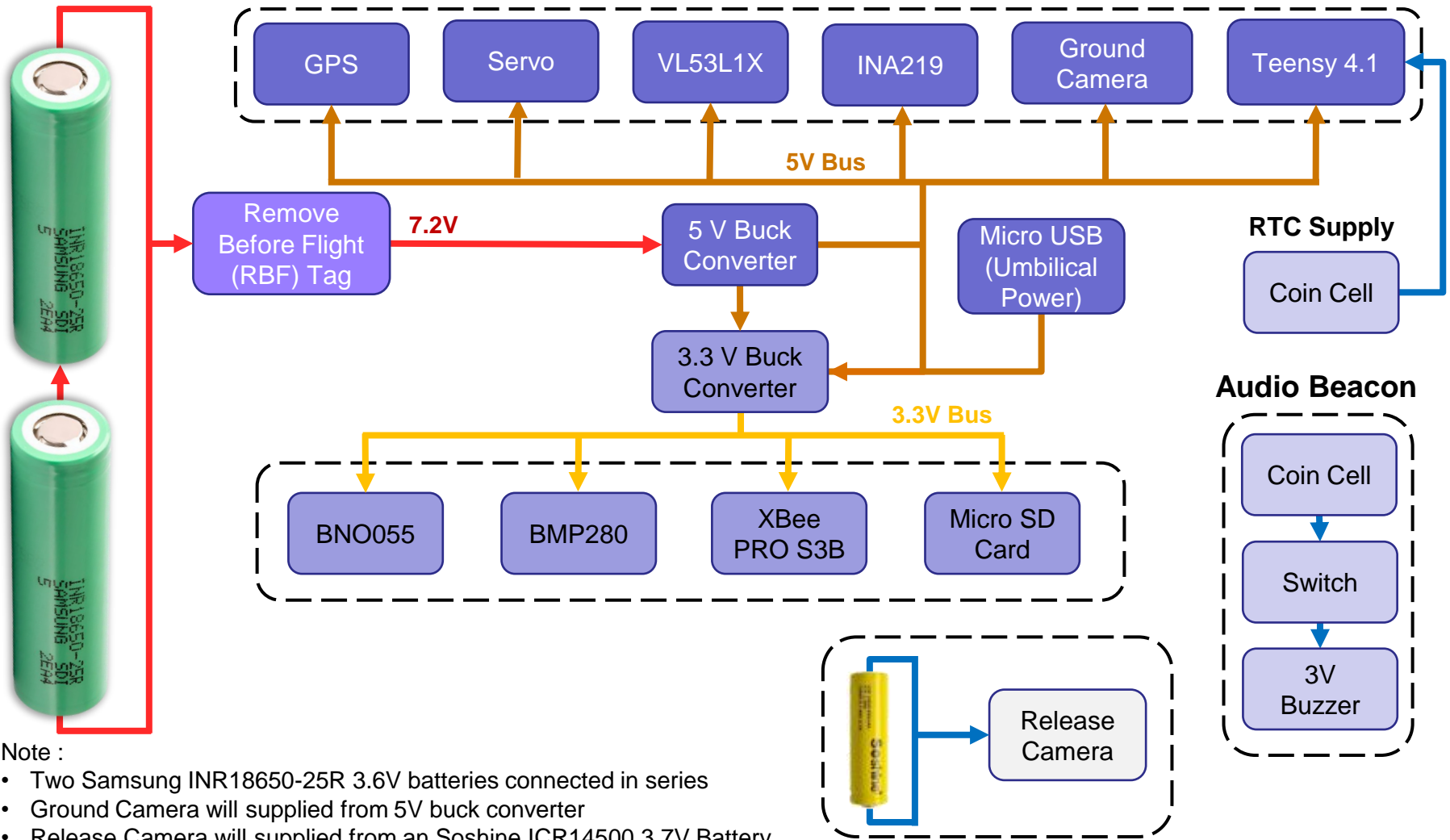
| Type of Command | Command Format | Description | Example Data |
|--|---|--|---|
| CX: Payload Telemetry On/Off Command | CMD, <TEAM_ID>, CX, <ON_OFF> | <ol style="list-style-type: none"> 1. CMD and CX are static text 2. <TEAM_ID> is the assigned team identification 3. <ON_OFF> is the string 'ON' to activate the CanSat transmissions. and 'OFF' to turn off the transmissions | The command CMD,1064,CX,ON activates payload telemetry transmission, CMD,1064,CX,OFF will stop payload telemetry transmission |
| ST: Set Time | CMD, <TEAM_ID>, ST, <UTC_TIME> GPS | <ol style="list-style-type: none"> 1. CMD and ST are static text 2. <TEAM ID> is the assigned team identification 3. <UTC_TIME> GPS is UTC time in the format hh:mm:ss or 'GPS' which sets the flight software time to the current time read from the GPS module | The command CMD,1064,ST, 13:35:59 sets the mission time to the value given and the command CMD,1064,ST,GPS sets the time to the current GPS time. |
| SIM: Simulation Mode Control Command | CMD, <TEAM_ID>, SIM, <MODE> | <ol style="list-style-type: none"> 1. CMD and SIM are static text 2. <TEAM_ID> is the assigned team identification 3. <MODE> is the string 'ENABLE' to enable the simulation mode, 'ACTIVATE' to activate the simulation mode, or 'DISABLE' which both disables and deactivates the simulation mode | Both the CMD,1064,SIM,ENABLE and CMD,1064,SIM,ACTIVATE commands are required to begin simulation mode |

| Type of Command | Command Format | Description | Example Data |
|--|---|---|---|
| SIMP: Simulated Pressure Data (to be used in Simulation Mode only) | CMD, <TEAM_ID> , SIMP, <PRESSURE> | <ol style="list-style-type: none"> 1. CMD and SIMP are static text 2. <TEAM ID> is the assigned team identification 3. <PRESSURE> is the simulated atmospheric pressure data in units of pascals with a resolution of one Pascal | CMD,1064,SIMP,101325 provides a simulated pressure reading to the payload (101325 Pascals = approximately sea level). Note: this command is to be used only in simulation mode |
| CAL: Calibrate Altitude to Zero | CMD, <TEAM_ID> , CAL | <ol style="list-style-type: none"> 1. CMD and CAL are static text 2. <TEAM ID> is the assigned team identification | The command CMD,1064,CAL will calibrate the telemetered altitude to 0 meters |
| MEC: Mechanism actuation command | CMD,<TEAM ID>, MEC,<DEVICE> , <ON_OFF> | <ol style="list-style-type: none"> 1. CMD and MEC are static text 2. <TEAM_ID> is the assigned team identification 3. <DEVICE> is defined by the team to identify the specific mechanism 4. <ON_OFF> is the string 'ON' to activate the mechanism and 'OFF' to turn off the mechanism | The MEC command is to be sent to activate a specific mechanism DEVICE is defined by the team to identify the specific mechanism |

Electrical Power Subsystem Design

Ax'I Nurrahim

| Component | Purpose |
|----------------|--|
| Power | <ul style="list-style-type: none"> Two Samsung INR18650-25R 3.6V batteries connected in series as main supply of the payload. 3V coin cell battery is used to supply the internal RTC of the MCU. The 3.5 mm jack SJ1-3525N acts as a Remove Before Flight (RBF) main supply switch. 5V buck converter will step down the main supply to 5V for the MCU, sensors, and actuators. 3.3V buck converter will step down the main supply to 3.3V for the sensors, and radio module. A 3 mm LED indicates the main power and is supplied from the 5V bus with a resistor. Micro USB as an umbilical power source for use in testing and safety inspection. |
| MCU | <ul style="list-style-type: none"> Teensy 4.1 will operate all actuators and collect all sensor data. It will be connected to 5V bus. Micro SD Card will save all sensor data. |
| Sensors | <ul style="list-style-type: none"> BMP280 will collect air pressure and temperature data, It will be connected to 3.3V bus. BNO055 will collect orientation data. It will be connected to 3.3V bus. U-blox SAM-M10Q to obtain CanSat location. It will be connected to 5V bus. INA219 will measure current battery and voltage battery data. It will be connected to 5V bus. VL53L1X will measure the distance from the payload to the ground. It will be connected to 5V bus |
| Actuators | <ul style="list-style-type: none"> Two servos MG90s control the para-glider swing and are connected to the 5V bus. One servo MG90s operates the instrument release mechanism and is connected to the 5V bus. Two servo MG90s releases the payload from the container and is connected to the 5V bus. Release camera will record payload release and para-glider steering control. It will be connected to ICR14500 3.7V Soshine battery Ground camera will record ground and instrument release. It will be connected to 5V buck converter. A buzzer is used as an audio beacon to help find the payload after landing. It will be connected to a 3V coin cell separated from the CanSat system. |
| Communications | <p>Data will be sent and received by XBee Pro S3B. The 3.3V buck converter will provide 3.3V to power it.</p> |



Note :

- Two Samsung INR18650-25R 3.6V batteries connected in series
- Ground Camera will supplied from 5V buck converter
- Release Camera will supplied from an Soshine ICR14500 3.7V Battery

EPS Changes Since PDR (1/2)

| Part | PDR | CDR | Rationale |
|----------------|--------------|----------|---|
| Battery Holder | Velcro Strap | Zip Ties | Due to limited space in the CanSat, Velcro straps are difficult to use, whereas zip ties provide a lighter, simpler, and more secure fastening with better impact resistance. |



Velcro Straps



Zip Ties

| Part | PDR | CDR | Rationale |
|----------------|--------------------|-----------------------|--|
| Camera Battery | Blackcell 14500 2s | Soshine ICR14500 3.7V | The Soshine battery supplies enough power for two hours while being lighter and more compact, helping reduce the overall mass of the CanSat. |

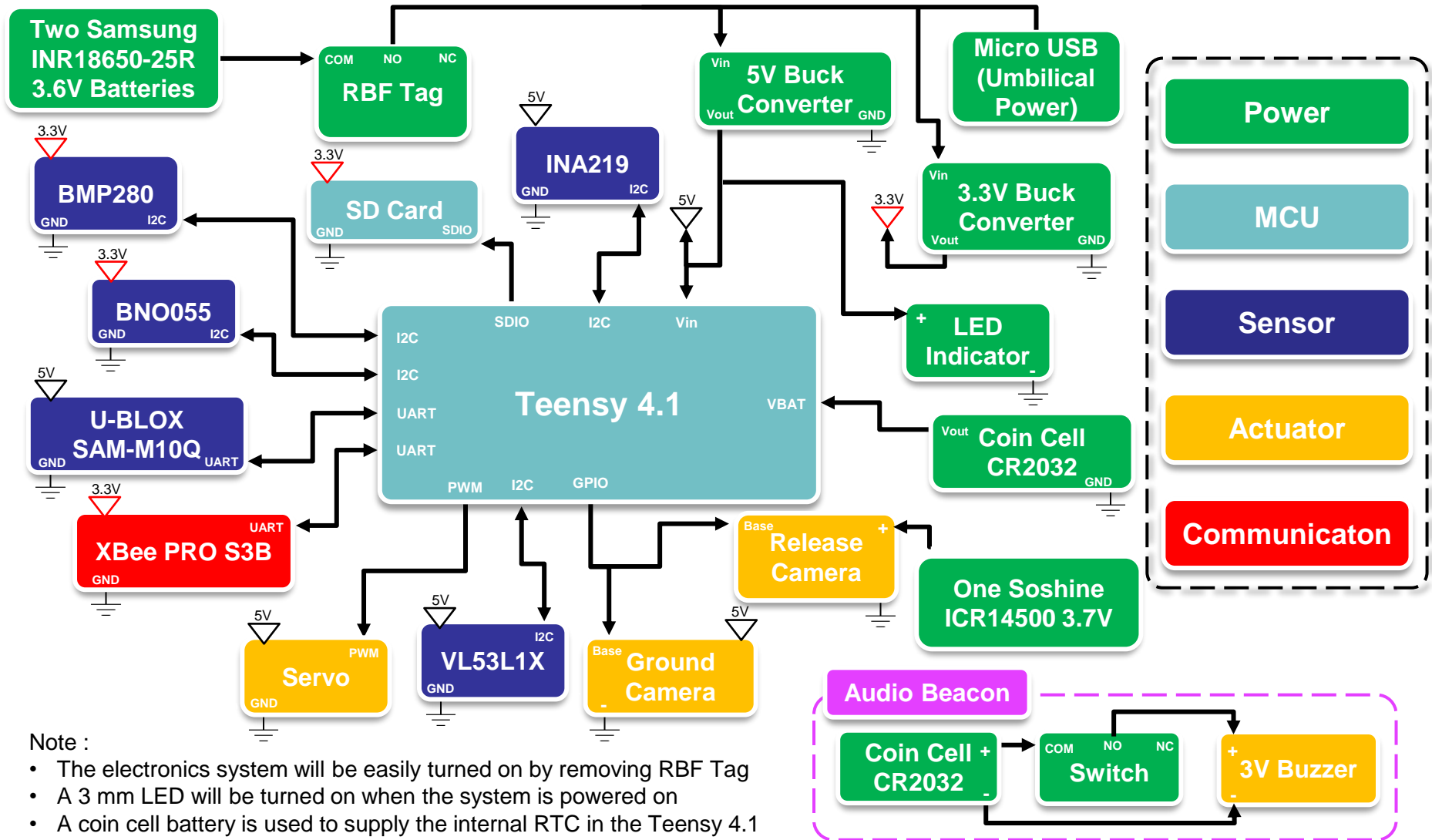


Blackcell 14500 2s



Soshine ICR14500 3.7V

Payload Electrical Block Diagram




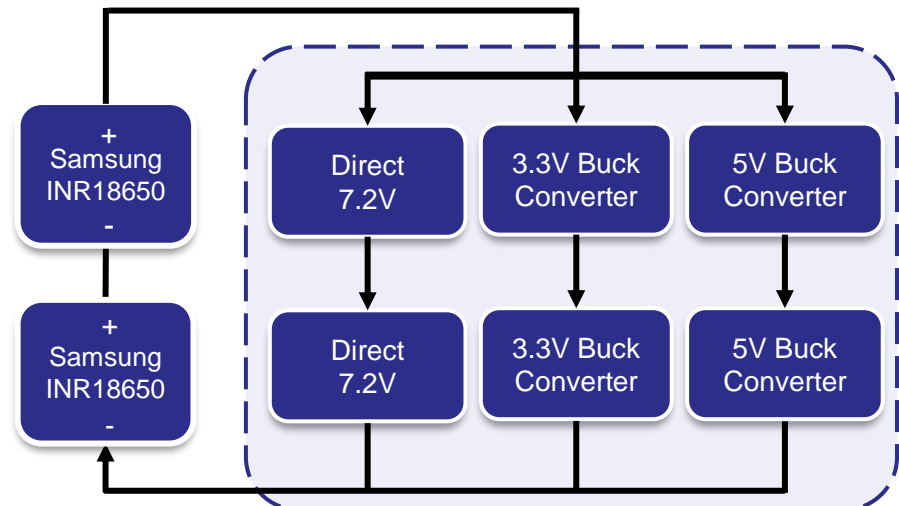
- Note :
- The electronics system will be easily turned on by removing RBF Tag
 - A 3 mm LED will be turned on when the system is powered on
 - A coin cell battery is used to supply the internal RTC in the Teensy 4.1

| Model | Battery Type | Voltage [V] | Weight [g] | Battery Capacity [mAh] | Maximum Discharge Current [A] | Dimension [mm] | | Price [USD] |
|---------------------|--------------|-------------|------------|------------------------|-------------------------------|----------------|----------|-------------|
| | | | | | | Height | Diameter | |
| Samsung INR18650-25 | Lithium Ion | 3.6 | 49.5 | 2500 | 20 | 64.9 | 18.3 | 3.68 |

Battery Configuration :


Two Samsung INR18650-25R batteries will be connected in series to supply 3 rail voltage for electrical components.

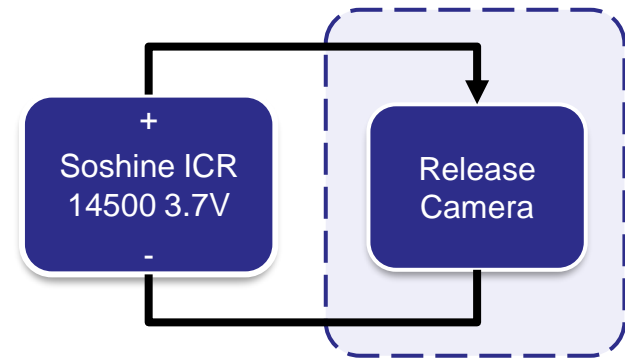
| Reasons | Battery |
|--|--|
| <ul style="list-style-type: none"> • Provide the payload with enough power to run for 2 hours. • Highest maximum discharge • High capacity. | <p>Samsung INR 18650-25R</p>  |

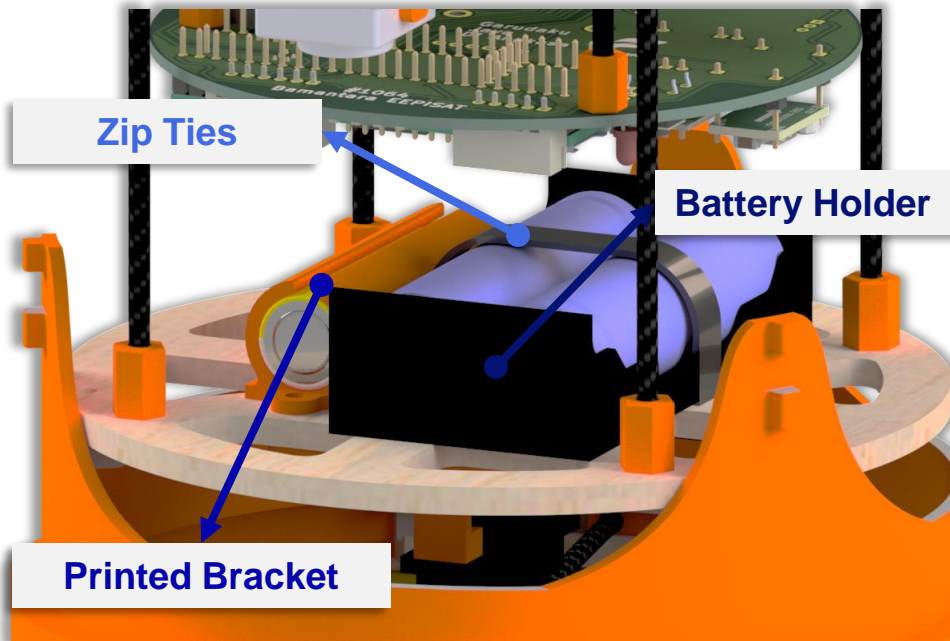


| Model | Battery Type | Voltage [V] | Weight [g] | Battery Capacity [mAh] | Maximum Discharge Current [A] | Dimension [mm] | | Price [USD] |
|------------------------|--------------|-------------|------------|------------------------|-------------------------------|----------------|----------|-------------|
| | | | | | | Height | Diameter | |
| Soshine ICR 14500 3.7V | Lithium Ion | 3.7 | 20 | 900 | 2.7A | 50 | 14 | 3.48 |

One Soshine ICR14500 3.7V battery will be used to supply Release Camera, we are using smaller battery like Soshine battery because to reduce CanSat mass.

| Reasons | Battery |
|---|--|
| <ul style="list-style-type: none"> Lighter than the previous selected battery Enough to supply Release camera for 2 hours. Smaller size than the previous selected battery | <p>Soshine ICR14500 3.7V</p>  |





Battery Mounting

Two Samsung INR18650-25R battery will be installed in the battery holder and a Soshine ICR14500 3.7V battery will be installed in 3D printed bracket near the CanSat PCB to match the target Center of Mass. The terminals on the battery holder will connect the batteries in series. Zip Ties will be used to make the battery mounting more secure and impact resistant.

Main Power Supply : Samsung INR18650-25R

| Component | Quantity | Source | Current (mA) | Voltage (V) | Duty Cycles in 1 Hour (%) | Power Consumption (Wh) |
|--------------------------------|----------|-----------|--------------|-------------|---------------------------|------------------------|
| Teensy 4.1 (include RTC) | 1 | Datasheet | 100 | 5 | 100 | 0.5 |
| XBee Pro S3B | 1 | Datasheet | 215 | 3.3 | 100 | 0.7095 |
| BMP280 | 1 | Datasheet | 0.0027 | 3.3 | 100 | 0.00000891 |
| BNO055 | 1 | Datasheet | 12.3 | 3.3 | 100 | 0.04059 |
| Servo MG90s | 5 | Measured | 250 | 5 | 50 | 3.125 |
| SD Card | 1 | Datasheet | 20 | 3.3 | 100 | 0.066 |
| 3mm LED | 1 | Estimated | 3 | 5 | 100 | 0.015 |
| Voltage Divider | 1 | Estimated | 0.24 | 7.2 | 100 | 0.001728 |
| U-blox SAM-M10Q | 1 | Datasheet | 12 | 5 | 100 | 0.06 |
| INA219 | 1 | Datasheet | 13 | 5 | 100 | 0.065 |
| Ground Camera | 1 | Datasheet | 250 | 5 | 100 | 1.25 |
| VL53L1X | 1 | Datasheet | 40 | 3.3 | 50 | 0.066 |
| Total | | | | | | 5.898827 |
| Consumption for 2 Hours | | | | | | 11.79765 |

Separate Power Supply

| Battery | Component | Quantity | Source | Current (mA) | Voltage (V) | Duty Cycles in 1 Hour (%) | Power Consumption (Wh) | Total Consumption for 2 Hours (Wh) |
|-----------------|----------------|----------|-----------|--------------|-------------|---------------------------|------------------------|------------------------------------|
| Coin Cell | 3V Buzzer | 1 | Datasheet | 30 | 3 | 100 | 0.09 | 0.18 |
| Soshine Battery | Release Camera | 1 | Measured | 137 | 3.3 | 100 | 0.452 | 0.904 |



| Power Supply : Two Samsung INR18650-25R | | Energy |
|---|--|-----------|
| Available Power | | 18 Wh |
| Power Consumption (2 hours) | | 11.797 Wh |
| Margins | | 6.203 Wh |



| Power Supply : One Soshine ICR14500 3.7V | | Energy |
|--|--|----------|
| Available Power | | 3.33 Wh |
| Power Consumption (2 hours) | | 0.904 Wh |
| Margins | | 2.426 Wh |



| Power Supply : Coin Cell CR2032 | | Energy |
|---------------------------------|--|---------|
| Available Power | | 0.66 Wh |
| Power Consumption (2 hours) | | 0.18 Wh |
| Margins | | 0.48 Wh |

Flight Software (FSW) Design

Adam Kandias

CanSat FSW Tasks

CanSat will collect data from sensors and transmit the data to GCS from launch pad until landed. When the rocket reaches peak altitude, the container with the payload will deploy from the rocket and deploy a parachute at separation. At 80% of peak altitude, the payload will release from the container and descend using a para-glider descent control system until landing.

The payload will steer toward a target location to drop an egg instrument at 2 meters above the ground, ensuring it lands safely.

There are two main cameras in the payload. The release camera is oriented 15° upward to capture the payload separation and the para-glider control mechanism. The ground camera pointed downward, capturing the ground view during descent and instrument release.

Programming Languages



C/C++

Development Environments



Visual Studio Code



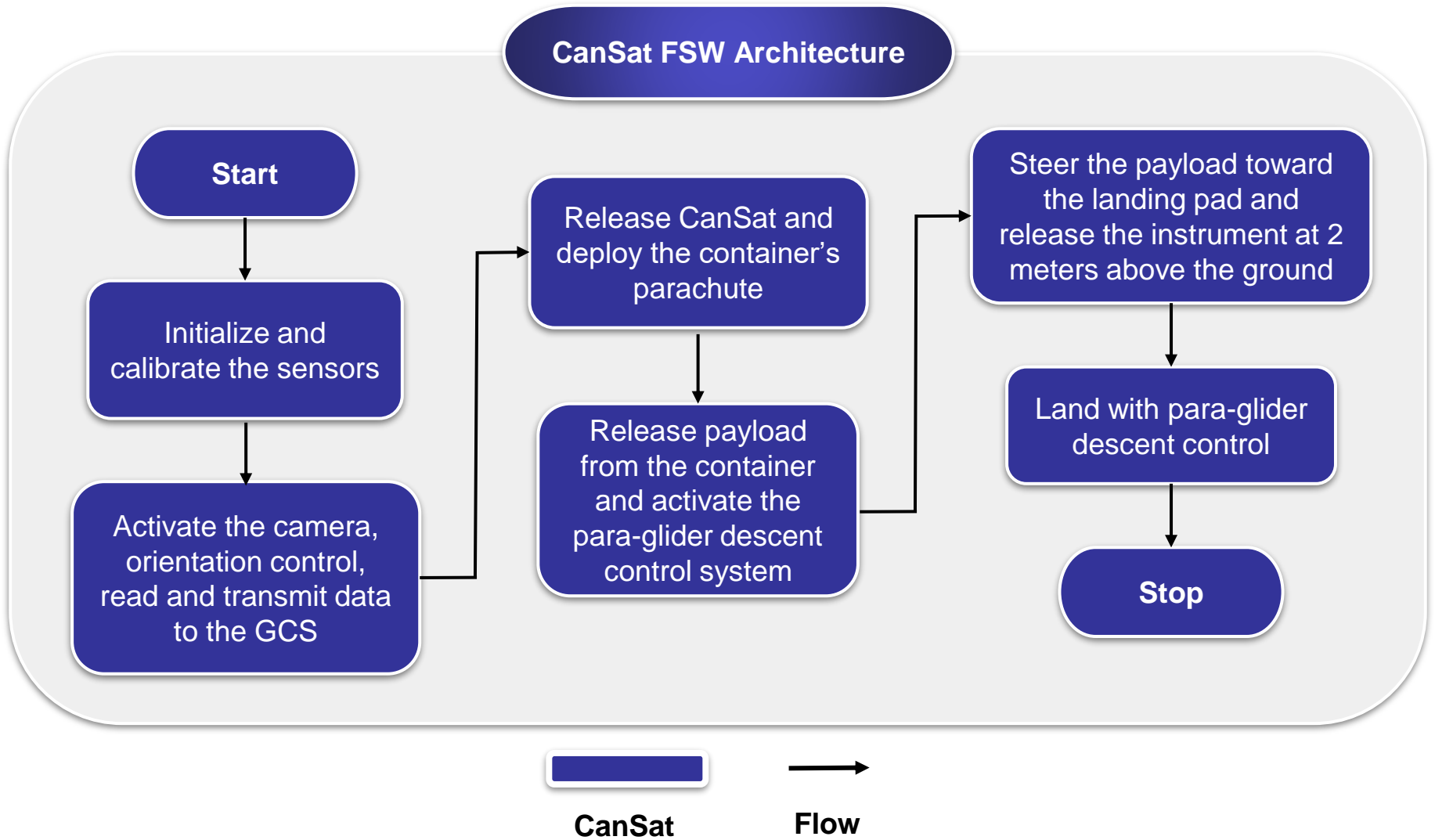
PlatformIO



XCTU



hTerm

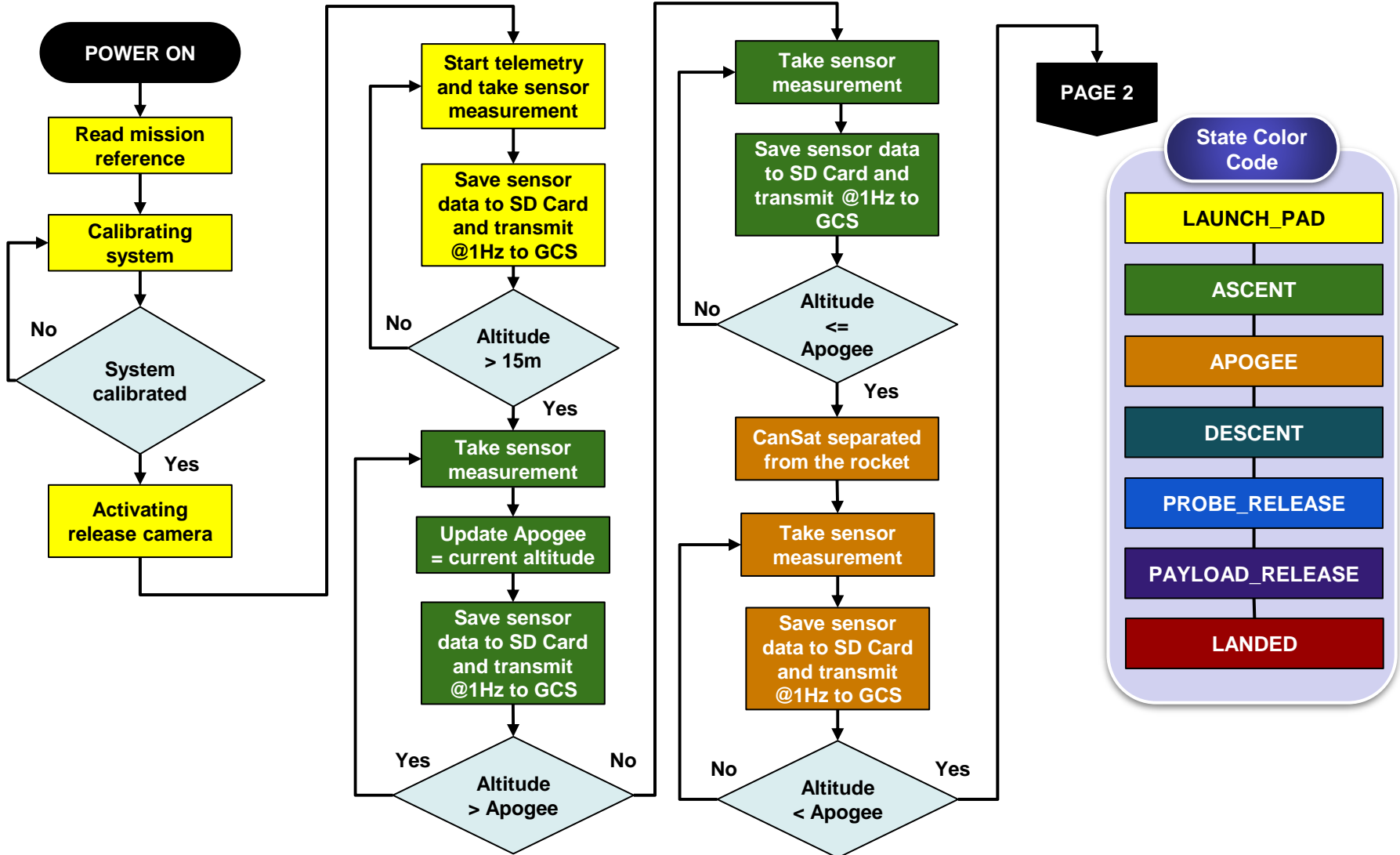


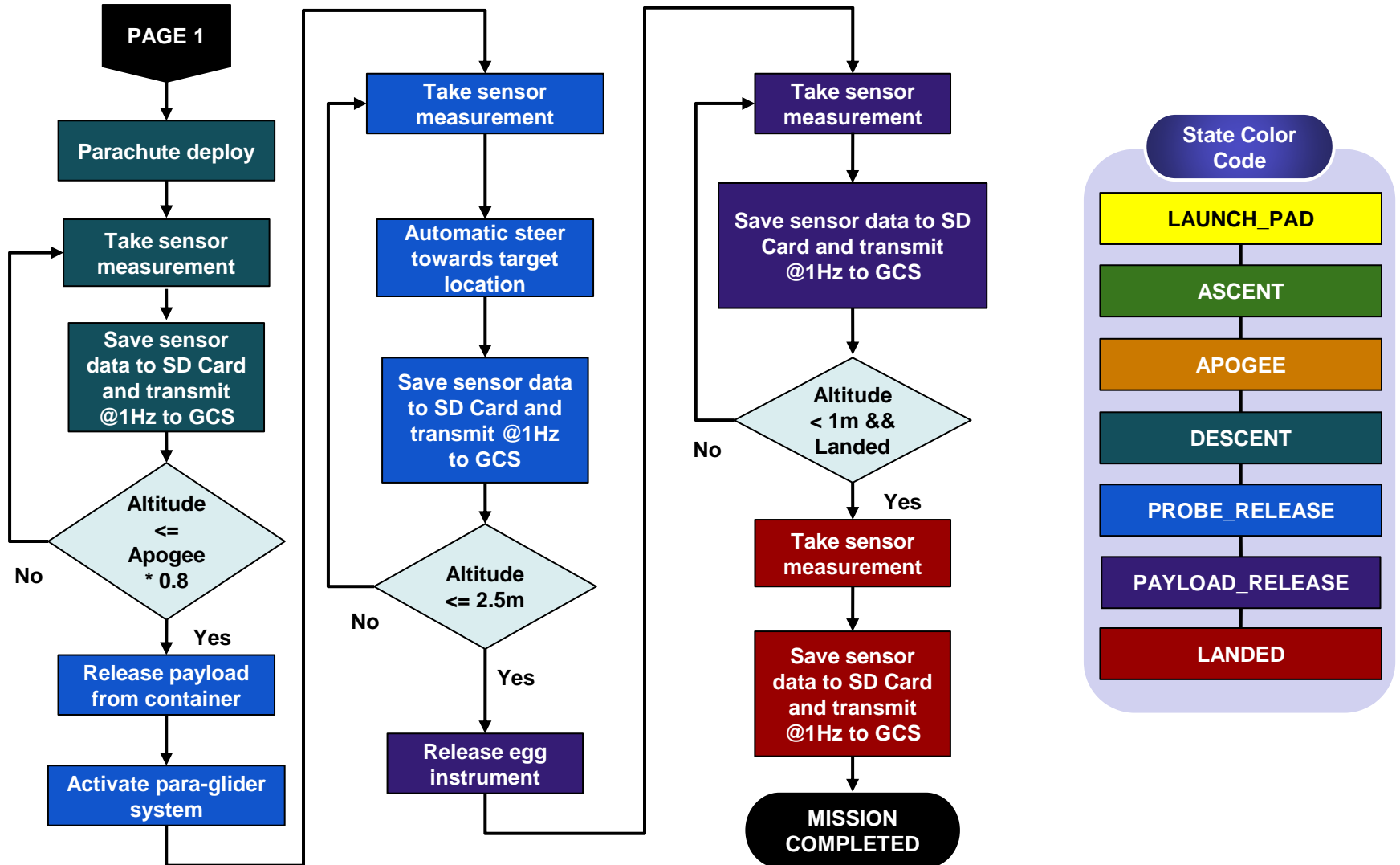
CanSat FSW Tasks

1. The CanSat will set the new mission reference when receiving **CAL** from the GCS and save the calibration data to the SD Card.
2. The CanSat FSW mode will read from the SD Card on the Teensy 4.1. The GCS default mode is flight mode, and when the CanSat receives commands **SIM ENABLE** and **SIM ACTIVATE** from the GCS, the CanSat will enter the simulation mode.
3. When the CanSat enters the **LAUNCH_PAD** state, it will wait for launch and continue transmitting telemetry to the GCS.
4. When the CanSat enters the **ASCENT** state, it will collect sensor data packets and save them to the SD Card, then transmit them @1Hz to the GCS via XBee Pro S3B.
5. When the CanSat reaches peak altitude, the state will change to **APOGEE**, and the container with the payload will separate from the rocket and deploy a parachute. Then the system changes into the **DESCENT** state.
6. At 80% of peak altitude, the payload will release from the container and the state will change to **PROBE_RELEASE**. Then, the payload will activate the para-glider descent control system and steer toward the target position.
7. At 2 meters above the ground, the payload will release the instrument, and the state will change to **PAYLOAD_RELEASE**. After touchdown, the CanSat will enter the **LANDED** state.
8. The Mission will be completed

FSW CHANGES SINCE PDR

| Part | PDR | CDR | Rationale |
|--|-----|-----|-----------|
| There were no changes to the Flight Software Design | | | |





Mechanism Activation

At launch pad:

- The Teensy 4.1 will activate the release camera, facing 15° upward, to record the payload release and para-glider descent control mechanism.
- The ground camera will be activated manually and will be pointed downward to record the ground view and instrument release.

At 80% of peak altitude, the servo system will activate:

- Payload release mechanism for separating the payload from the container.
- Para-glider descent control system, allowing steering toward the landing pad.

At 2 meters above the ground:

- The instrument release mechanism will activate to release the egg.

Major Decision Points in The Logic

The altitude will be the major decision parameter among other parameters used as consideration.

Data Storage

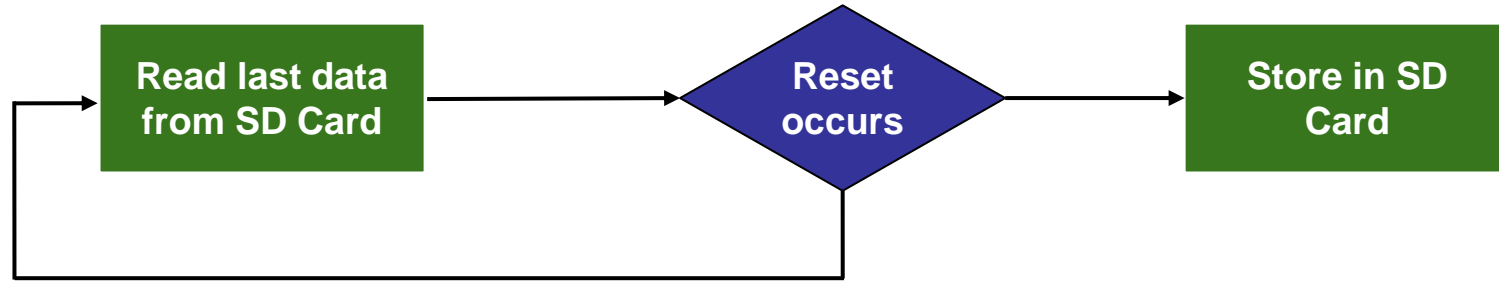
- Video and backup telemetry data will be stored on the SD card.
- SD card is used for recovery after reset.

Sampling of Sensors

The data sensor will be sampled @1 Hz (1000ms).

Communications

- Communicates using the Taoglas FXP290 Antenna and transmits data to the ground station.
- All commands and telemetry will be included in CDH.



Payload Data Recovery

Teensy 4.1 will recover (stored in SD Card):

- Packet count
- Last state
- Command echo
- Reference altitude

Reason for reset:

Temporary power loss occurs.

Power Management:

The payload system is powered by two Samsung INR18650 25R 2500mAh batteries, capable of sustaining the system for over two hours of operation including telemetry and para-glider control system.

SIMULATION MODE

- Simulation mode is used for testing, pre-flight demonstration, and contingency conditions, when launch operations are not possible. The telemetered pressure sensor data shall reflect the commanded simulation values, not the actual sensor readings.
- To activate the simulation mode, the GCS must send **SIM ENABLE** followed by **SIM ACTIVATE** to the CanSat.
- The values other than pressure and altitude (calculated from the pressure values) will remain actual sensor readings. The relayed CanSat telemetry will contain actual sensor values.
- The barometric pressure data will be read from a .csv file in the GCS and transmitted to the CanSat at a rate of 1 data per second (1 Hz).
- After simulation mode is active, the flight software will receive barometric pressure sensor commands (**SIMP**) from the GCS and use the received values as if they were actual barometric pressure readings. These simulated values will be used in the altitude calculation and determination of software states.
- After the GCS sends **SIM DISABLE**, the flight software will switch back to flight mode.

SIMULATION MODE COMMAND

CMD,<TEAM_ID>,SIM,<MODE>

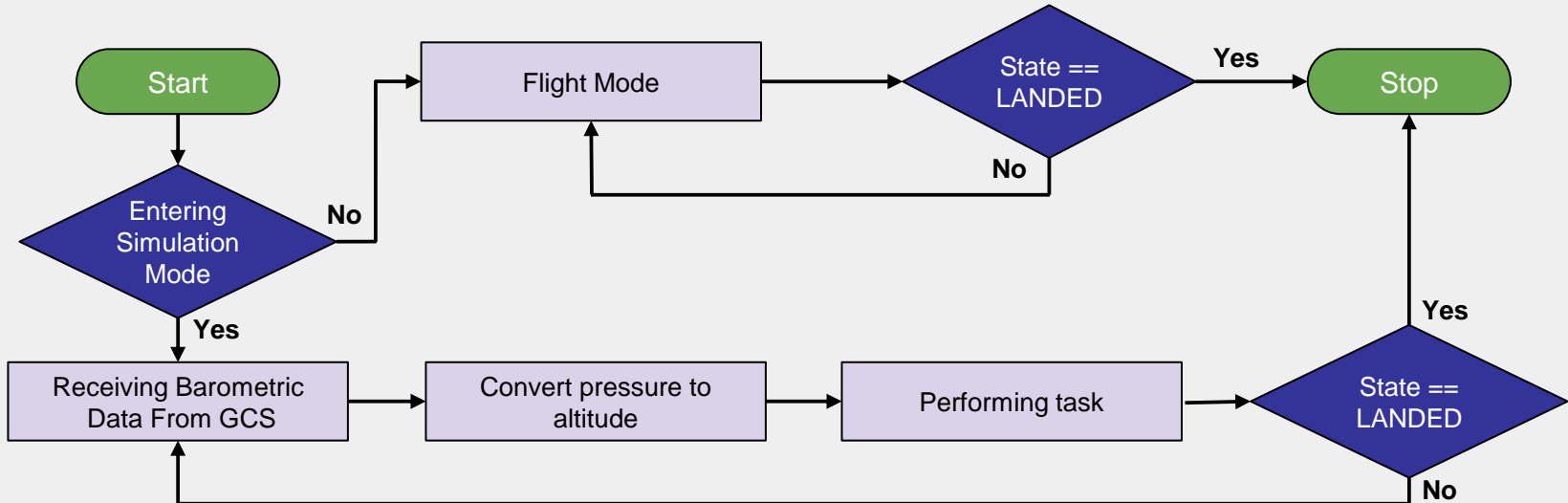
<MODE> consists of :

- 'ENABLE' to enable simulation mode;
- 'ACTIVATE' to activate simulation mode; or
- 'DISABLE' to disable and deactivate simulation mode.

CMD,<TEAM_ID>,SIMP,<PRESSURE>

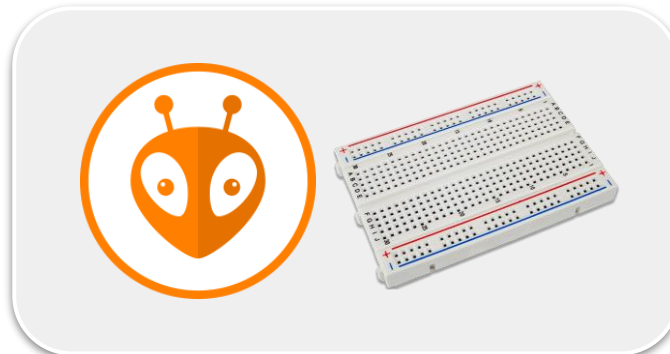
- This command provides a simulated pressure reading to the CanSat.
- <PRESSURE> is the simulated atmospheric pressure data in units of pascals with a resolution of one Pascal.

SIMULATION MODE FLOWCHART



PROTOTYPING PROCEDURE AND PROTOTYPING ENVIRONMENT

| Subject | Prototyping Environment | Prototyping Procedure |
|------------|-------------------------|---|
| Teensy 4.1 | PlatformIO | Programming and debugging are done in Platform IO and the data will be monitored in hTerm |
| Sensors | Breadboard and PCB | Each sensor is tested on the breadboard separately |



SOFTWARE SUBSYSTEM DEVELOPMENT SEQUENCE

| Subsystem | Development Sequence |
|-------------------------------|---|
| Sensors | <ul style="list-style-type: none"> • Sensor trade and selection - select the best sensors for our application. • Individual sensor programming - program CanSat sensor with PlatformIO. |
| State Mechanism | Integrate all sensors and test it in the state mechanism. |
| XBee Telemetry | Testing GCS and CanSat communication - configure and test all CanSat sensors to ensure telemetry data is transmitted successfully to the GCS. |
| Para-glider Control Mechanism | Program and test the para-glider descent control system, including steering control to ensure payload toward the landing pad. |
| Instrument Release Mechanism | Program and test the instrument release mechanism, ensuring accurate release at 2 meters above ground level. |
| Integrate all | Integrate all software subsystems to ensure proper functionality and seamless operation of the entire system |
| Development Team | |
| 1. Ax'l Nurrahim | 2. Adam Kandias |

TEST METHODOLOGY

1. Necessary software is installed such as Visual Studio Code and PlatformIO to help the software development
2. Telemetry software tests are simulated using XCTU
3. Sensors and hardware were tested separately
4. Test the state mechanism for the CanSat
5. Test the system recovery for the CanSat
6. Test the telemetry data and communication commands using hardware
7. Test the flight mode software using GCS
8. Test the simulation mode software using GCS
9. Check whether the FSW meets the competition requirements
10. Test integrated sensors and hardware according to the mission

PLANS TO REDUCE THE RISK OF LATE SOFTWARE DEVELOPMENT

- Apply sprint-based development for each subsystem and test software as soon as possible.
- Weekly meeting to review and check progress also identify and fix issues quickly.
- Using collaboration tools for easy collaboration and tracking progress.

USED TOOLS



GITHUB

Centralized code repository, version control, and issue tracking.



NOTION

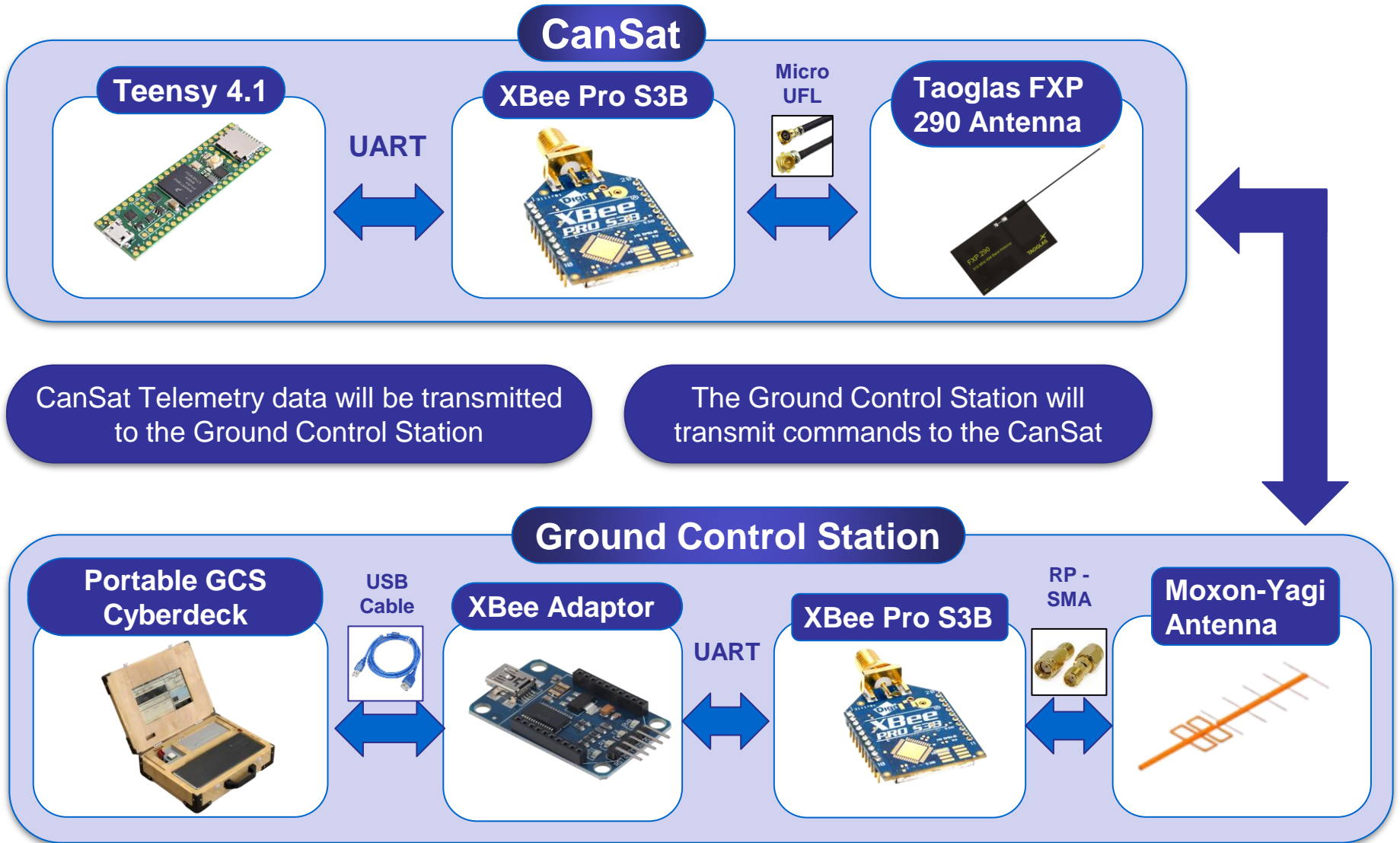
Kanban board for task management, documentation, and milestone tracking.

Progress Since PDR

1. Sensors were calibrated and tested.
2. CanSat flight software states has been tested.
3. CanSat is able to receive commands from GCS properly
4. CanSat is able to send data to the GCS properly.
5. CanSat data recovery was tested
6. Simulation mode has been tested with GCS.
7. CanSat software development has been made based on mission guide.

Ground Control System (GCS) Design

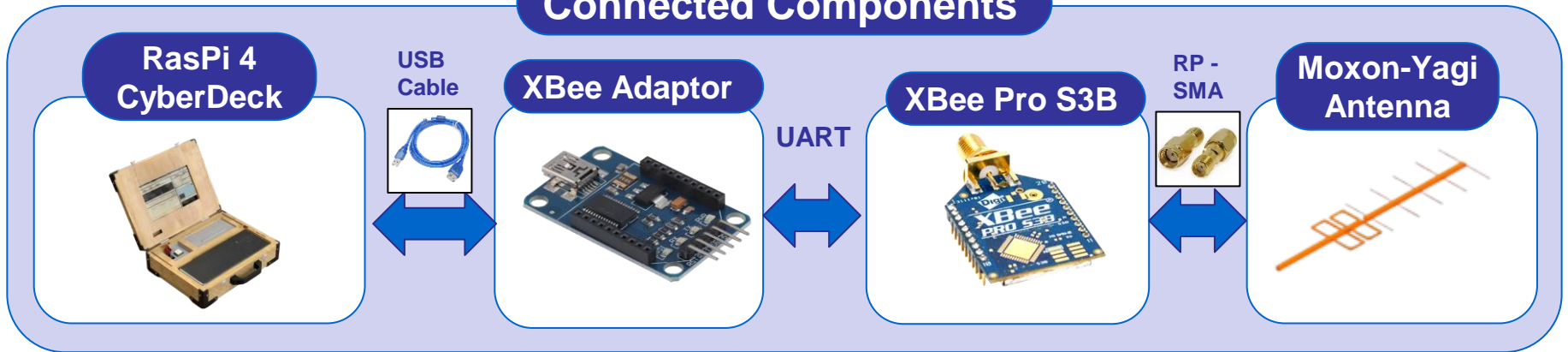
Adam Kandias



GCS CHANGES SINCE PDR

| Part | PDR | CDR | Rationale |
|--|-----|-----|-----------|
| There were no changes to the Ground Control System Design | | | |

Connected Components



Specifications

Battery

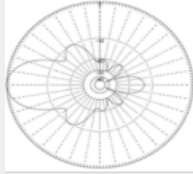
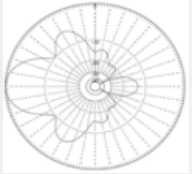
The CyberDeck GCS can run for 3 hours on battery when fully charged

Overheating Mitigation

To prevent overheating, a cover enclosure will be attached to shield the CyberDeck from direct sunlight. Additionally, added internal fan to make sure the air circulation work properly.

Auto Update Mitigation

Use Linux especially Ubuntu Linux based, so there's no auto update feature.

| Model | Frequency Rate (MHz) | Gain (dBi) | Beamwidth (Horizontal/ Vertical) | Direction | Range (km) | Cost (\$) | Antenna Pattern | |
|--------------------|----------------------|------------|----------------------------------|-------------|------------|-----------|---|---|
| | | | | | | | Horizontal | Vertical |
| Moxon-Yagi Antenna | 915 | 10.5 | 40°/45° | Directional | ~3.5 | 5.88 |  |  |

Selected Mounting Antenna (Handheld)

The antenna will be handheld to aid targeting and minimize data loss, as the payload height will be constantly dynamic and varying.

Selected Antenna (Moxon-Yagi Antenna)

- Offers more directional beamwidth range
- Easy to carry and handle
- More affordable and easy to hold
- More proven performance in previous competitions



Free-Space Path Loss Calculation

$$\begin{aligned}
 FSPL &= 20 \log_{10}(d) + 20 \log_{10}(f) + 20 \log_{10} \left(\frac{4\pi}{c} \right) - G_T - G_R \\
 &= 12.04 + 59.22 + 32.44 - 1.5 - 10.5 \\
 &= \mathbf{91.7 \text{ dB}}
 \end{aligned}$$

Distance = 4 km (predicted)

Link Budget Calculation

$$\begin{aligned}
 P_{RX} &= P_{TX} + G_{TX} - L_{TX} - L_{FS} - L_M + G_{RX} - L_{RX} \\
 &= 24 + 1.5 - 0 - 91.71 - 5 + 10.5 - 0 \\
 &= \mathbf{- 60.71 \text{ dBm}}
 \end{aligned}$$

All of losses are ignored, except L_{FS} and L_M

Miscellaneous Losses = 5 dB (estimated)

$$\mathbf{- 60.71 \text{ dBm} > - 107 \text{ dBm}}$$

Free-Space Path Loss Formula Information

$FSPL$ = Free-Space Path Loss (dB)
 d = Distance between the antennas (km)
 f = Frequency (MHz)
 G_T = Transmitter Gain (dBi)
 G_R = Receiver Gain (dBi)

Link Budget Formula Information

P_{RX} = Received Power (dBm)
 P_{TX} = Transmitted Power Output (dBm)
 G_{TX} = Transmitter Antenna Gain (dBi)
 L_{TX} = Losses from Transmitter (dB)
 L_{FS} = Free-Space Path Loss (dB)
 L_M = Miscellaneous Losses (dB)
 G_{RX} = Receiver Antenna Gain (dBi)
 L_{RX} = Losses from Receiver (dB)

Information



CanSat Transmitter Gain = **1.5 dBi**

GCS Receiver Gain = **10.5 dBi**




XBee Receiver Sensitivity (19200 baudrate) = **-107 dBm**

Our margin is **46.29 dBm** which can provide a reliable operation and it's sufficient for the requirement

| | |
|--|--|
| Telemetry Display Prototypes | <p>The Ground Station will display real time telemetry data from CanSat through labels, chart, 3D models, and a map.</p> |
| Commercial Off The Self (COTS) Software Packages Used | <ul style="list-style-type: none"> ● Visual Studio Code ● Flutter ● XCTU |
| Real-Time Plotting Software Design | <p>Telemetry data from serial port will be transferred to the Portable GCS Cyberdeck through USB port, processed in Flutter with libserialport library and fl_chart for display the telemetry data in charts.</p> |
| Command Software and Interface | <p>There will be a command text box that will allow to send commands to start telemetry communication, calibrate all telemetry data, and a dropdown that contains command header.</p> |
| Telemetry Data Recording and Media Presentation | <p>The judges will be given media data recorded from the CanSat using the camera along with screenshots of the interface, and CanSat telemetry data in the form of a .csv file via a USB memory storage device.</p> |
| Describe .csv Telemetry File Creation | <ul style="list-style-type: none"> ● All telemetry data will be saved as .csv (Comma Separated Value) files, where data is separated by comma. ● CSV file name will be Flight_<TEAM_ID>.csv |
| Simulation Mode Description | <p>The GCS will control the CanSat using SIM ENABLE and SIM ACTIVATE commands, then read the barometric pressure data from the CSV file and communicate it to the flight software with interval of one second via the Simulated Pressure data Command.</p> |

BAMANTARA EEPISAT GROUND CONTROL STATION
 POLITEKNIK ELEKTRONIKA NEGERI SURABAYA

| | | | | | | | | |
|------------------------|---------------------------------|---------------------------|------------------------|-------------------------|----------------------|--------------------------------------|---------------------------------|------------------------------------|
| Team ID 1064 | Mission Time 00:01:58 | Mode SIMULATION | State LANDED | Cmd Echo SIMP | GPS Sats 8 | CS Battery 3.9/8.4 V (46%) | GCS Status In Service | CanSat Status In Service |
|------------------------|---------------------------------|---------------------------|------------------------|-------------------------|----------------------|--------------------------------------|---------------------------------|------------------------------------|

Serial Log Data

```
5b,34,b,-1.275774,112.794309,1,SIMP,1,0,0,6,-13.9,_PG_APPROACH,758.8,34.6,161
[13:49:13] ✓ Pressure sim #94/95: CMD,1064,SIMP,100853
[13:49:14] ✓ Packet #94: 1064,00:01:57,94,S,LANDED,39.4,14.7,100.9,3.8,0.38,-0.2,0.7,0.5,0.3,-0.4,9.8,00:01:57,
36.2,-7.275774,112.794286,12,SIMP,0.8,-1.6,-1.0,_PG_APPROACH,460.9,39.4,228
[13:49:14] ✓ Pressure sim #95/95: CMD,1064,SIMP,100830
[13:49:15] ✓ Packet #95: 1064,00:01:58,95,S,LANDED,41.3,33.0,100.8,3.9,0.25,-0.8,0.2,1.8,-0.0,-0.0,10.0,00:01:
58,44.3,-7.275689,112.794333,8,SIMP,1.3,1.9,-1.2,_PG_APPROACH,746.2,44.2,8
```


Packets Received: **95** Valid Data : **95** Corrupt/Lost Data : **0** Total Data : **95**

| CanSat Data | | Accelerometer | |
|--------------|------------------|---------------|-------------------------------|
| Altitude | 41.3 m | R | -0.000 m/s² |
| Temperature | 33.0 °C | P | -0.000 m/s² |
| Pressure | 100.8 kPa | Y | 10.000 m/s² |
| Voltage | 3.90 V | Gyrometer | |
| Current | 0.25 A | R | -0.800 rad/s |
| Packet Count | 95 | P | 0.200 rad/s |
| | | Y | 1.800 rad/s |

Command Box TCP: 127.0.0.1:9999 - Simulator (TCP) 115200 **Disconnect**

SIMP Enter command... **Send**


Maps Distance: 13.0m Direction: East Southeast (110.7°)




GPS Time: 00:01:58
 GPS Altitude: 44.3 m
 GPS Latitude: -7.275689
 GPS Longitude: 112.794333

Realtime Data Graph

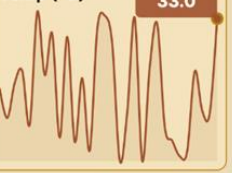
Altitude (m) **41.3**




Voltage (V) **3.9**




Temp (°C) **33.0**



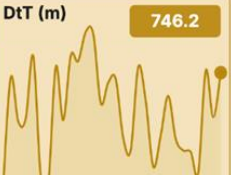
Pressure (kPa) **100.8**



Current (A) **0.25**

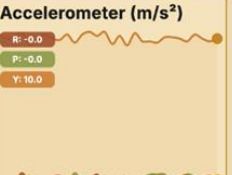


DtT (m) **746.2**



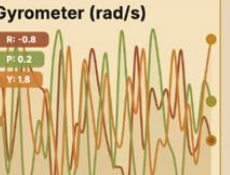
Accelerometer (m/s²)

R: -0.0 P: -0.0 Y: 10.0

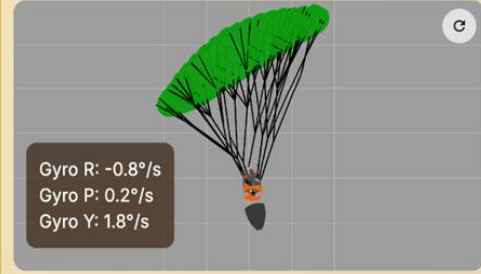


Gyrometer (rad/s)

R: -0.8 P: 0.2 Y: 1.8



3D Navigation



Gyro R: -0.8°/s
 Gyro P: 0.2°/s
 Gyro Y: 1.8°/s

- Header
- Status Bar
- Serial Log Data
- CanSat Data
- Command Box
- Maps
- Data Graph
- 3D Model View

Mission Progress

LAUNCH PAD ASCENT APOGEE DESCENT PROBE RELEASE PAYLOAD RELEASE LANDED

Data Table SIMULATION DATA CANSAT DATA [↔ Change Imported File \(95 points\)](#) [↓ Export CSV](#)

| Team ID | Mission Time | Packet Count | Mode | State | Altitude | Temperature | Pressure | Voltage | Current | Gyro R | Gyro P | Gyro Y | Accel |
|---------|--------------|--------------|------|------------|----------|-------------|----------|---------|---------|--------|--------|--------|-------|
| 1064 | 00:00:24 | 1 | S | LAUNCH_PAD | 39.5 | 28.3 | 100.9 | 4.1 | 0.28 | -0.8 | -1.8 | -1.4 | -0.2 |
| 1064 | 00:00:25 | 2 | S | ASCENT | 41.1 | 8.0 | 100.8 | 3.9 | 0.26 | 0.5 | -0.1 | 0.8 | -0.1 |
| 1064 | 00:00:26 | 3 | S | ASCENT | 235.1 | 15.5 | 98.5 | 3.9 | 0.25 | -0.2 | 1.6 | -0.3 | -0.2 |
| 1064 | 00:00:27 | 4 | S | ASCENT | 335.8 | 34.3 | 97.4 | 3.9 | 0.20 | 0.0 | -0.7 | 0.0 | -0.1 |
| 1064 | 00:00:28 | 5 | S | ASCENT | 447.6 | 19.6 | 96.1 | 4.2 | 0.12 | 1.7 | 1.6 | 1.7 | 0.2 |
| 1064 | 00:00:29 | 6 | S | ASCENT | 536.5 | 18.0 | 95.0 | 3.8 | 0.11 | -1.8 | -0.1 | 0.1 | -0.1 |
| 1064 | 00:00:30 | 7 | S | ASCENT | 608.6 | 5.9 | 94.2 | 4.0 | 0.30 | 1.6 | 1.6 | -1.9 | -0.3 |
| 1064 | 00:00:31 | 8 | S | ASCENT | 663.5 | 21.5 | 93.6 | 3.7 | 0.36 | -0.8 | -0.3 | 1.6 | 0.1 |
| 1064 | 00:00:32 | 9 | S | ASCENT | 705.2 | 13.6 | 93.1 | 3.8 | 0.23 | 0.7 | -1.1 | -0.3 | 0.2 |

🕒 GCS Time 13:50:02
 📍 GCS Location -7.2756462, 112.7942188
 📍 GCS to CanSat 13 meters to E
 📶 TX Status Connected
 🔧 Memory Used 2048 MB
 📊 CPU Usage 15.0%
 🔋 Battery Status 70% Charging

Mission Progress

Data Table

Footer

Progress Since PDR

1. The Ground Control Station (GCS) is capable of transmitting all commands to the Flight Software (FSW).
2. The GCS can receive and display all telemetry data in real-time using labels, charts, and maps.
3. The GCS can store telemetry data as .csv files for the CanSat.
4. In simulation mode, the GCS can read a .csv file containing barometric pressure data and transmit it to the CanSat at a frequency of 1 Hz (one-second interval).
5. The Moxon-Yagi antenna has been successfully built and tested, yielding satisfactory results.
6. The 3D model has been fully completed and can move according to the CanSat telemetry data.
7. The GCS Portable successfully build and tested

CanSat Integration and Test

Lintang Arum Sari

Subsystem Level

- Sensors
- CDH
- EPS
- Radio communications
- FSW
- Mechanical
- Descent Control

Integrated Level Functional

- Descent testing
- Communications
- Mechanisms
- Deployment

Environmental

- Drop test
- Thermal test
- Vibration test
- Fit Check
- Vacuum test

Simulation

- GCS
- Flight Software

Preparing of Required Test Condition



Component Testing of Each Subsystem



Subsystem Level Testing



Integrated Level Functional Testing



Environmental Testing

Subsystem Level Testing Details

Sensors: All sensors will be mounted on the PCB along with a microcontroller to begin processing data, and the resulting output will be shown on the serial monitor of the Platform IO.

CDH: The XBee configuration will be tested on the PCB, and the XCTU software will be utilized to verify that no errors have occurred during data transmission.

EPS: To ensure a duration of 2 hours of operation, all electronic components will be linked to two batteries.

Radio Communications: Communication range testing with an XBee and an antenna.

FSW: State and recovery tests were performed to confirm that the software worked properly.

Mechanical: Mechanisms such as servo motor will be checked to ensure they fulfill competition requirements.

Descent Control: The descent rate of the CanSat will be evaluated at specific altitudes.

Integrated Level Testing Details

Descent Testing: The CanSat's descent rate will be assessed in order to verify the accuracy of the calculations that have been performed.

Communications: Antenna tests will be performed on XBee communication through GCS-CanSat to ensure that telemetry data complies with competition requirements.

Mechanisms: All of the mechanisms will be repeatedly tested to ensure that the mechanical components can survive the required force limits.

Deployment: The Servo motor will be tested to verify that the parachute and the heat shield is released from the CanSat.

Simulation: Flight Software and GCS simulation mode testing.

Environmental Testing Details

Drop Test: The CanSat will be attached to a fixed bar at a height of 2 meters using a 61 cm cord, and subsequently, a drop test will be performed to inspect the power, components, and mountings of the CanSat.

Thermal Test: The CanSat will be placed inside DIY insulated thermal chamber, and heat will be generated using a hot air gun to maintain a temperature range of 55-60°C for a period of 2 hours.

Vibration Test: A vibration test will be conducted using RK3000 Vertical Vibration Meter to ensure the mounting integrity of all components, mounting connections, structural integrity, and battery connections.

Fit Check: The dimensions of the CanSat will be measured using vernier calipers, a ruler, and tape.

Vacuum Test: The CanSat will be placed inside a vacuum chamber to start collecting data in telemetry format once it reaches its peak altitude.

Simulation Testing Details

GCS: The GCS simulation command will be tested to ensure it works properly and is able to read .csv files provided by the judges.

Flight Software: A simulation command can activate the microprocessor to process data received from the GCS.

Subsystem Level Testing Plan

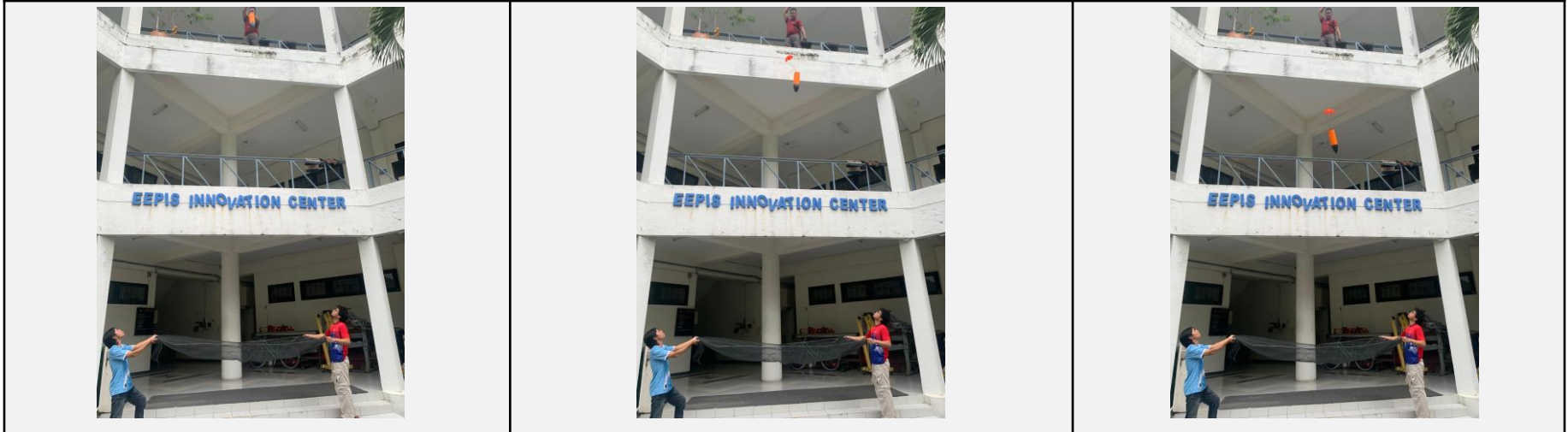
| | |
|-----------------------------|--|
| Sensors | <ul style="list-style-type: none"> ▪ Functional tests of the sensors on the breadboard ▪ High-accuracy sensor calibration |
| CDH | <ul style="list-style-type: none"> ▪ XBee data transfer range and configuration ▪ Verify the data's accuracy and speed of transmission to the ground station ▪ Ensure that the data format follows the mission guide |
| EPS | <ul style="list-style-type: none"> ▪ Testing each component to ensure proper operation ▪ Testing that power can fulfill the demand for electronic components ▪ The watt-hour capacity of the battery will be measured to determine the margin |
| Radio Communications | <ul style="list-style-type: none"> ▪ Antenna range test ▪ Beam and stability of communication testing |
| FSW | <ul style="list-style-type: none"> ▪ Accuracy of the data received from sensors and camera ▪ Maintain recovery data in case of a microcontroller resets ▪ Flight Algorithm test ▪ State testing |
| Mechanical | <ul style="list-style-type: none"> ▪ CanSat release mechanism test ▪ Ensure the component of CanSat can survive when it's launched ▪ Ensure the CanSat with the egg land intact ▪ Servo motor will be inspected carefully to ensure freedom of operation |
| Descent Control | <ul style="list-style-type: none"> ▪ CanSat stability drop test ▪ Parachute system test ▪ CanSat Para-glider test |

Integrated Level Functional Test Plan

Descent Testing

- The purpose of this test is to ensure that CanSat descends at the speed defined in the mission guide.
- We will drop a CanSat with mass of 1000 ± 10 grams without the egg being installed from the top of the buildings using a parachute to test its descent rate.

Documentations

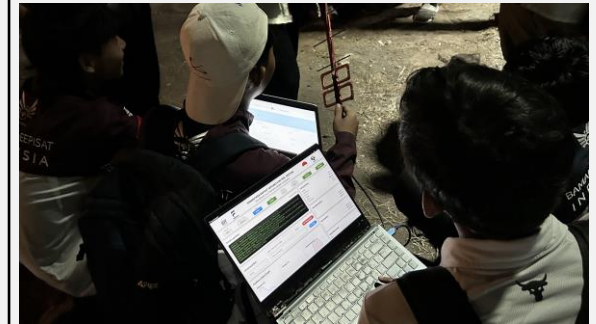


Integrated Level Functional Test Plan

Communications

- The purpose of this test is to ensure that the communication system is functional.
- We will use flight software to communicate with the XBee at 1Hz for the CanSat at various ranges. The data must be shown in the GCS monitor.
- This test will be performed in a crowded area to ensure that the signal is not interrupted.

Documentations



Integrated Level Functional Test Plan

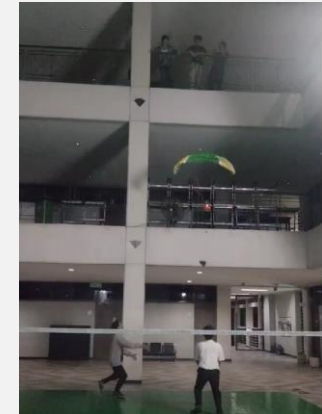
Mechanisms

- The purpose of this test is to ensure that the CanSat can be released from the rocket and the parachute mechanism operates correctly.
- Verify that the CanSat parachute mechanism is succeed.
- Ensure the CanSat release the payload and simultaneously deploy a para-glider at 80% of peak altitude.
- Verify all mechanisms doesn't breaks when tested under all forces and The CanSat land with the egg intact.

Payload Release

- Para-glider deployment will be tested at various altitude.
- CanSat deployment at various altitude.
- Check for any sharp edges and obstacles that could prohibit CanSat from being deployed.
- Test the CanSat release mechanism using simulated altitude triggering.

Documentations



Integrated Level Functional Test Plan

Simulation

- This test is designed to verify if the Ground Station is capable of reading a .csv file of barometric pressure data that simulates the mission profile and transmitting the values to the CanSat at a rate of one data per second (1 Hz) via commands.
- We will put it to the test by preparing barometric data in .csv file.
- Test if GCS is able to transmit the pressure value at one second interval (1Hz) to flight software.

Documentations



Drop Test

This test is designed to verify that the CanSat parachute and attachment point will survive the deployment from the rocket section which can be very violent.

- I. Power on CanSat.
- II. Verify telemetry is being received.
- III. Raise CanSat by the attached cord, so that the attachment points of the cord, on the eye bolt and the parachute, are at the same height.
- IV. Release the CanSat.
- V. Verify the CanSat did not lose power.
- VI. Inspect for any damage, or detached parts.
- VII. Verify telemetry is still being received.

(CanSat mission guide)



Drop Test Frame

Thermal Test

This test is to verify the CanSat can operate in a hot environment. The heat source will be provided by a thermal chamber and a hot air gun.

- I. Place CanSat into a thermal chamber.
- II. Turn on the CanSat.
- III. Close and seal the thermal chamber.
- IV. Turn on the heat source.
- V. Monitor the temperature and turn off the heat source when the internal temperature reaches 60 °C and turn on the heat source when the temperature drops to 55 °C.
- VI. Maintain the test conditions for two hours.
- VII. Turn off the heat source and perform visual inspection and any functional tests to verify the CanSat survived the thermal exposure and can operate as expected.
- VIII. With the CanSat still hot, test any mechanisms and structures to make sure the integrity has not been compromised. Take precautions to avoid injury.
- IX. Verify epoxy joints and composite materials still maintain their strengths.

(CanSat mission guide)



EEPISAT's Thermal Chamber

Vibration Test

This test is designed to verify the mounting integrity of all components, mounting connections, structural integrity, and battery connections. The vibration will be tested with a RK3000 Vertical Vibration Meter.

- I. Power on the CanSat.
- II. Verify accelerometer data is being collected.
- III. Power up the vibration machine.
- IV. Once the vibration machine is up to full speed, wait 5 seconds.
- V. Power down the vibration machine to a full stop.
- VI. Repeat steps iii to v four more times.
- VII. Inspect the CanSat for damage and functionality.
- VIII. Verify accelerometer data is still being collected.
- IX. Power down CanSat.

(CanSat mission guide)



**RK3000 Vertical
Vibration Meter**

Fit Check

This test is designed to verify if the CanSat is able to fit in the rocket. To ensure that CanSat fits in the rocket and reduces the possibility of deployment failure, we use vernier caliper to control the accuracy of CanSat's diameter with a margin of error.

(CanSat mission guide)



Vernier Caliper

Vacuum Test

This test is designed to verify deployment operation of the CanSat.

- I. Suspend the fully configured and powered CanSat in the vacuum chamber.
- II. Turn on the vacuum to start pulling a vacuum.
- III. Monitor the telemetry and stop the vacuum when the peak altitude has been reached.
- IV. Let the air enter the vacuum chamber slowly and monitor the operation of the CanSat.
- V. Collect and save telemetry.
- VI. Make the saved telemetry available for the judges to review.

(CanSat mission guide)



EEPISAT's Vacuum Chamber

| Test Proc | Test Description | RN | Pass/Fail Criteria | Status |
|-----------|--|---------|--|--------|
| 1 | Air Pressure Sensor Test | X5 | The altitude data refers to the actual altitude. | Pass |
| 2 | Air Temperature Sensor Test | X5 | Temperature data and actual temperature are similar. | Pass |
| 3 | GPS Sensor Test | X5 | Showing correct time and location. | Pass |
| 4 | Voltage Sensor Test | X5 | Voltage data is similar to the Avometer calculation. | Pass |
| 5 | Camera Test | SN7-SN9 | Result of video capturing with minimum resolution of 640x480 pixels and 30 fps. | Pass |
| 6 | Tilt Sensor Test | X5 | Measured angle is similar with actual angle. | Pass |
| 7 | Power Consumption Test | E5 | Actual power consumption is similar with calculation result measured using Avometer. | Pass |
| 8 | XBee Communication Test and Antenna Range Test | X1, G9 | Communication data sent and received by GCS from a distance of 1 km. | Pass |
| 9 | Data Transmission at 1Hz Test | G12 | The data must be in the correct order at 1 Hz rate. | Pass |
| 10 | FSW State Test | F4-F6 | State changes along as altitude increases and descends that calculated from pressure. | Pass |
| 11 | Testing of Data Recovery Algorithm | F1-F3 | The data (altitude reference, packet count, states, coordinate, etc) will be recovered from SD card and process will continue. | Pass |

| Test Proc | Test Description | RN | Pass/Fail Criteria | Status |
|-----------|---|-------------|---|-------------|
| 12 | GCS Interface Test | G5-G8 | The GCS interface displays all telemetry data received (graph and labels). | Pass |
| 13 | GCS Device Battery Test | G9 | GCS device is still operational after 2 hours of usage. | Pass |
| 14 | GCS Data Inspection and Data Format Save Test | F4, G2, G12 | The data is automatically presented in engineering units and saved into a .csv file. | Pass |
| 15 | GCS Communication Test | G1 | GCS is able to send commands to the CanSat to start send the telemetry data and calibrate the altitude. | Pass |
| 16 | CanSat Descent Test | C4, C7 | CanSat descends at descent rate of 12-18 m/s with parachute and 2-8 m/s for CanSat para-glider. | Pass |
| 17 | CanSat Para-glider Steering Control Test | C8 | The CanSat is able to steer and landed into the target location. | In Progress |
| 18 | CanSat Parachute Deployment Test | C4 | CanSat parachute capable of deploying during descent. | Pass |
| 19 | CanSat Egg Protection Test | M8 | The Cansat shall protect a hens egg from damage during all portions of the flight. | Pass |

| Test Proc | Test Description | RN | Pass/Fail Criteria | Status |
|-----------|------------------|-----------------------|---|--------|
| 20 | Drop Test | S9, Section 3.3 | CanSat survived a drop from 2 feet attached to cord. No parts falling off, no separation. | Pass |
| 21 | Thermal Test | Section 3.3 | No CanSat materials warp, weaken, change characteristics, or fail to function. | Pass |
| 22 | Vibration Test | S8, Section 3.3 | All mounting integrity of all components, mounting connections, structural integrity, and battery connections survived. | Pass |
| 23 | Fit Check | S1-S14 | Total Mass of CanSat 1000±10 grams and dimensions of CanSat shall comply with Appendix F | Pass |
| 24 | Vacuum Test | Section 3.3 | FSW is able to detect the altitude from pressure changes inside the vacuum chamber. | Pass |

GCS

This test is designed to verify if the Ground Station is capable of reading a .csv file of barometric pressure data that simulates the mission profile and transmitting the values to the CanSat at a rate of one data per second (1 Hz) via commands. We will put it to the test by preparing barometric data in .csv file. The **Simulated Pressure Data** command will read data containing a barometric pressure value and transmit it to the flight software at one second interval (1 Hz) to start simulating altitude. GCS will receive the converted altitude value from the flight software.

Flight Software

This test is designed to verify that the GCS barometric pressure data will be converted into altitude. We will enable simulation mode with **ENABLE** command from GCS. After that, we begin the simulation mode with **ACTIVATE** command to stop reading pressure from the sensor system. Substituting the data of the sensor with .csv file from the committee and make sure it is transmitted to GCS as altitude data. At 101325 Pascals (approximately sea level) barometric data will be saved to SD Card as an altitude ground level reference.

Mission Operations & Analysis

Lintang Arum Sari

1. Arrival

- Team arrival at the launch site.
- GCS and antenna setup.
- Check for any damages that may occur during travel.

2. Pre-Launch

- Communication inspection.
- Mechanism inspection.
- Assembly of the CanSat.
- Check the CanSat dimension and weight.

3. Rocket Integration

- Final CanSat inspection completed before launch.
- Turn on the CanSat, integrate it into the rocket, and ensure communication with GCS.

4. Mission

- CanSat in a rocket launch.
- Flight monitoring.
- Display GCS to the judges and collect telemetry data during the mission.
- Recovery crew preparation.

5. Recovery

- CanSat recovery by location from last telemetry and buzzer.
- Inspection of CanSat damage.
- Retrieve data from SD Card in the CanSat.

6. Data Analysis

- GCS data analysis and acquisition.
- Deliver SD Card and telemetry data to judges for scoring.
- Evaluation team for launch day.
- PFR preparation.

Mission Control Officer

Personnel:

Lintang Arum Sari

(Responsible for informing the Flight Coordinator when the team and their CanSat is ready to be launched)

Ground Station Crew

Personnel :

Adam Kandias

(Responsible for monitoring the ground station for telemetry reception and issuing commands to the CanSat)

Recovery Crew

Personnel :

Rafida Azis Al Habib, Muhammad Tsaqif Mukhayyar

(Responsible for tracking the CanSat and going out into the field for recovery and interacting with the field judges)

CanSat Crew

Personnel :

Muhammad Rizky, Ax'I Nurrahim

(Responsible for preparing the CanSat, integrating it into the rocket, and Verifying its status)

Antenna Construction and Ground System Setup

The Ground Control Station will use the Moxon-Yagi antenna and the XBee Pro S3B via an USB adapter for quickly execute the communication with CanSat on the launch day. We will use an umbrella for overheat mitigation and prevent the screen from sun glare.

CanSat Assembly and Test

Right before the CanSat turn in, we will perform the sensor and communication testing, mechanism testing, and simulation testing at the launch site to ensure the system working properly.

| Mission Operations Manual | Description |
|------------------------------|---|
| Ground Station Configuration | <ul style="list-style-type: none"> ▪ Portable GCS and antenna preparation ▪ Communication check and testing |
| CanSat Preparation | <ul style="list-style-type: none"> ▪ CanSat assembly ▪ Sensor calibration ▪ Mass and size checking ▪ Calibration system by command from GCS |
| CanSat Integration | <ul style="list-style-type: none"> ▪ Fit check ▪ Drop test ▪ Battery verification |
| Launch Preparation | <ul style="list-style-type: none"> ▪ Final communication check ▪ Check CanSat stowed state inside the rocket |
| Launch Procedure | <ul style="list-style-type: none"> ▪ Pre-launch checks ▪ Verify with the ground station that the ground station is ready for launch |

Development Status

- There will be two (2) Mission Operations Manual will be assembled into a three-ring binder. It consists of five sections and each section will start on its own page according to mission guide of CanSat.
- Each member will familiarize themselves with the manual before launch day. The safety of each person on launch day is crucial.
- Mission Operations Manual has been downloaded from the CanSat competition website. It will be updated as we encounter changes before the launch day.

CanSat Recovery

- ❖ Recovery crew will maintain visual contact with the CanSat to aid recovery.
- ❖ We will provide team details on CanSat's outside construction.
- ❖ We also use GPS to track the CanSat.
- ❖ The color of the CanSat and parachute is orange.
- ❖ CanSat has a buzzer that will continuously buzz when it lands.



CanSat COMPETITION 2026
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East Java, Indonesia

*This address labeling will be placed on our CanSat's body

Ground System Radio Link Check

Rehearsed on March 24th 2026

- Ensure that GCS receives data properly from XBee
- Command testing and calibration from GCS

Powering On/ Off CanSat

Rehearsed on April 15th 2026

- Turn on CanSat by removing RBF Tag
- Visual verification of loose electronic components before turning on
- Ensure the serial sent to the ground station is correct

Launch Configuration Preparations

Rehearsed on April 20th 2026

- Assembly CanSat into operating configuration
- Fit Check
- Main mechanisms check

Loading CanSat in the launch vehicle

Rehearsed on April 25th 2026

- CanSat is placed inside a DIY rocket envelope with the dimensions as in the competition requirements
- Visual verification for sharp edges before loading into the rocket

Telemetry processing, archiving and analysis

Rehearsed on April 27th 2026

- Real-time graph check
- Ensure the data processed is saved into .csv file
- Analyze data displays on GCS GUI
- Deliver telemetry data to judges via USB

Recovery

Rehearsed on April 19th 2026


- Recovery will commence after telemetry is stopped
- Last GPS location and fluorescent color will ease recovery

Requirements Compliance


Fatma Aliea Wibowo

We designed and created CanSat by analyzing and identifying the CanSat Mission Guide 2026. The system will be tested in compliance with the CanSat Integration and Test section.

- We have complied with **84 requirements** based on the CanSat Mission Guide 2026.
- There are **3 partial compliances** that will require further testing. We need to build some prototypes in order to fully comply with these requirements that were only partially met.
- There are **not any requirements** that don't comply with our design.

 (Comply)

 (Partial)

 (No Comply)

| Operation Requirements | | | | |
|------------------------|--|------------|------------|-------|
| RN | Requirement | Compliance | Ref Slides | Notes |
| C1 | The CanSat payload shall function as a nose cone during the rocket ascent portion of the flight. | Comply | <u>18</u> | |
| C2 | The CanSat container shall be mounted on top of the rocket with the shoulder section inserted into the airframe | Comply | <u>24</u> | |
| C3 | The CanSat payload and container shall be deployed from the rocket when the rocket motor ejection charge fires. | Comply | <u>18</u> | |
| C4 | After deployment, the CanSat payload and container shall descend at 15 m/s using a parachute that automatically deploys. Error is +/- 3 m/s. | Comply | <u>58</u> | |
| C5 | At 80% flight peak altitude, the payload shall be released from the container. | Comply | <u>18</u> | |
| C6 | At 80% peak altitude, the payload shall deploy a para-glider descent control system. | Comply | <u>18</u> | |
| C7 | The payload shall descend at 5 m/s averaged over the entire descent within +/- 3 m/s with the para-glider descent control system. | Comply | <u>58</u> | |
| C8 | The payload shall steer toward a target location. | Comply | <u>18</u> | |
| C9 | The sensor telemetry shall be transmitted at a 1 Hz rate | Comply | <u>99</u> | |

| Operation Requirements | | | | |
|------------------------|--|------------|---------------------|-------|
| RN | Requirement | Compliance | Ref Slides | Notes |
| C10 | The payload shall record video of the release of the payload from the container and the deployment of the para-glider descent control system | Comply | 80 | |
| C11 | A second video camera shall point at the ground. | Comply | 81 | |
| C12 | The payload shall release a protected hens egg when the payload is 2 meters +/- 0.5 m above the ground without breaking the egg. | Comply | 82 | |
| C13 | The CanSat payload shall include an audible beacon that is turned on separately and is independent of the CanSat battery and electronics. | Comply | 108 | |
| C14 | Cost of the CanSat shall be under \$1000. Ground support and analysis tools are not included in the cost of the CanSat. Equipment from previous years shall be included in this cost, based on current market value. | Comply | 191 | |

| Structural Requirements | | | | |
|-------------------------|--|------------|-----------------------|------------------------|
| RN | Requirement | Compliance | Ref Slides | Notes |
| S1 | The CanSat and container mass shall be 1000 grams +/- 10 grams. | Comply | 89 | |
| S2 | The nose cone shall be symmetrical along the thrust axis. | Comply | 69-70 | |
| S3 | Nose cone radius shall be exactly 70 mm | Comply | 69-70 | |
| S4 | Nose cone shoulder length shall be a minimum of 50 mm | Comply | 69-70 | |
| S5 | The nose cone shall be made as a single piece. Segments are not allowed. | Comply | 69-70 | |
| S6 | The nose cone shall not have any openings allowing air flow to enter | Comply | 69-70 | |
| S7 | The nose cone height shall be a minimum of 76 mm. | Comply | 69-70 | |
| S8 | CanSat structure must survive 15 Gs vibration. | Partial | 153 | Theoretically Complies |
| S9 | CanSat shall survive 30 G shock. | Comply | 155 | |

| Structural Requirements | | | | |
|-------------------------|---|------------|-----------|-------|
| RN | Requirement | Compliance | Ref Pages | Notes |
| S10 | The container shoulder length shall be 90 to 120 mm. | Comply | <u>71</u> | |
| S11 | The container shoulder diameter shall be 136 mm. | Comply | <u>71</u> | |
| S12 | Above the shoulder, the container diameter shall be 140 mm | Comply | <u>71</u> | |
| S13 | The container wall thickness shall be at least 2 mm when 3D printed and must not flex or be deformed when under stress. | Comply | <u>71</u> | |
| S14 | The container length above the shoulder shall be 200 mm +/- 5%. | Comply | <u>71</u> | |
| S15 | The CanSat shall perform the function of the nose cone during rocket ascent. | Comply | <u>24</u> | |
| S16 | The CanSat container can be used to restrain any deployable parts of the CanSat payload but shall allow the CanSat to slide out of the payload section freely | Comply | <u>24</u> | |
| S17 | All electronics and mechanical components shall be hard mounted using proper mounts such as standoffs, screws, or high performance adhesives. | Comply | <u>84</u> | |
| S18 | The CanSat container shall meet all dimensions in section F | Comply | <u>19</u> | |

Structural Requirements

| RN | Requirement | Compliance | Ref Pages | Notes |
|-----|---|------------|------------|------------------------|
| S19 | The CanSat container materials shall meet all requirements in section F. | Comply | <u>19</u> | |
| S20 | If the nose cone is to separate from the payload after payload deployment, the nose cone shall descend at no more than 5 m/s. | Comply | <u>58</u> | |
| S21 | If the nose cone is to separate from the payload after payload deployment, the nose cone shall be secured to the payload until payload deployment with a pull force to survive at least 15 Gs acceleration. | Partial | <u>155</u> | Theoretically complies |

| Mechanism Requirements | | | | |
|------------------------|--|------------|---------------------------|------------------------|
| RN | Requirement | Compliance | Ref Pages | Notes |
| M1 | No pyrotechnical or chemical actuators are allowed. | Comply | 61 | |
| M2 | Mechanisms that use heat (e.g., nichrome wire) shall not be exposed to the outside environment to reduce potential risk of setting the vegetation on fire. | Comply | 61 | |
| M3 | All mechanisms shall be capable of maintaining their configuration or states under all forces. | Partial | 153 – 157 | Theoretically Complies |
| M4 | Spring contacts shall not be used for making electrical connections to batteries. Shock forces can cause momentary disconnects. | Comply | 114 | |

| Electrical Requirements | | | | |
|-------------------------|--|------------|---------------------|-------|
| RN | Requirement | Compliance | Ref Pages | Notes |
| E1 | Lithium polymer batteries are not allowed. | Comply | 112 | |
| E2 | Battery source may be alkaline, Ni-Cad, Ni-MH or Lithium. Lithium polymer batteries are not allowed. Lithium cells must be manufactured with a metal package similar to 18650 cells. Coin cells are allowed. | Comply | 112 | |
| E3 | An easily accessible power switch through the container is required | Comply | 66 | |
| E4 | The container shall have small access holes for power switches of no more than 10 mm. | Comply | 20 | |
| E5 | Power indicator is required. | Comply | 91 | |
| E6 | The CanSat shall operate for a minimum of two hours when integrated into the rocket. | Comply | 136 | |
| E7 | The audio beacon shall operate on a separate battery. | Comply | 108 | |
| E8 | The audio beacon shall have an easily accessible power switch through the container | Comply | 66 | |

Communication Requirements

| RN | Requirement | Compliance | Ref Pages | Notes |
|----|---|------------|------------|-------|
| X1 | XBee radios shall be used for telemetry. 2.4 GHz Series radios are allowed. 900 MHz XBee radios are also allowed. | Comply | <u>98</u> | |
| X2 | XBee radios shall have their NETID/PANID set to their team number | Comply | <u>99</u> | |
| X3 | XBee radios shall not use broadcast mode | Comply | <u>99</u> | |
| X4 | The CanSat shall transmit telemetry once per second. | Comply | <u>99</u> | |
| X5 | The CanSat telemetry shall include altitude, air pressure, temperature, battery voltage, command echo, and GPS coordinates that include latitude, longitude, altitude and number of satellites tracked. | Comply | <u>100</u> | |

Sensor Requirements

| RN | Requirement | Compliance | Ref Pages | Notes |
|-----|--|------------|-----------------------|-------|
| SN1 | CanSat payload shall measure its altitude using air pressure. | Comply | 30 | |
| SN2 | CanSat payload shall measure its internal temperature. | Comply | 32 | |
| SN3 | CanSat payload shall measure its battery voltage. | Comply | 36 | |
| SN4 | CanSat payload shall track its position using GPS. | Comply | 34 | |
| SN5 | CanSat payload shall measure its acceleration and rotation rates. | Comply | 37-38 | |
| SN6 | CanSat payload shall video record the deployment of the para-glider at 80% peak altitude. | Comply | 39 | |
| SN7 | CanSat payload shall video record the ground during descent. | Comply | 40 | |
| SN8 | The ground pointing camera shall capture video of the instrument (egg) being released and reaching the ground. | Comply | 40 | |
| SN9 | The video cameras shall record video in color and with a minimum resolution of 640x480. | Comply | 39-40 | |

Requirements Compliance (10/13)

| Sensor Requirements | | | | |
|---------------------|---|------------|-----------|-------|
| RN | Requirement | Compliance | Ref Pages | Notes |
| SN10 | CanSat payload shall measure its battery current. | Comply | <u>36</u> | |

Ground Station Requirements

| RN | Requirement | Compliance | Ref Pages | Notes |
|----|--|------------|-------------------------|-------|
| G1 | The ground station shall command the CanSat to calibrate the altitude to zero when the CanSat is on the launch pad prior to launch. | Comply | 104 | |
| G2 | The ground station shall generate csv files of all sensor data as specified in the Telemetry Requirements section. | Comply | 139 | |
| G3 | Telemetry shall include mission time with 1 second resolution | Comply | 100 | |
| G4 | Each team shall develop their own ground station. | Comply | 134 | |
| G5 | All telemetry shall be displayed in real time in text format during ascent and descent on the ground station. | Comply | 140-142 | |
| G6 | All telemetry shall be displayed in the International System of Units (SI) and the units shall be indicated on the displays. | Comply | 140-142 | |
| G7 | Teams shall plot altitude, battery voltage, battery current, accelerometer value and rotation rates in real time. | Comply | 140-142 | |
| G8 | Teams shall display mission time, temperature, GPS position, received packet count, lost packet count, and flight software state in real time. | Comply | 140-142 | |
| G9 | The ground station shall include one laptop computer with a minimum of two hours of battery operation, XBee radio and an antenna. | Comply | 133 | |

Ground Station Requirements

| RN | Requirement | Compliance | Ref Pages | Notes |
|-----|---|------------|-------------------------|-------|
| G10 | The ground station must be portable so the team can be positioned at the ground station operation site along the flight line. AC power will not be available at the ground station operation site. | Comply | 134 | |
| G11 | The ground station software shall be able to command the payload to operate in simulation mode by sending two commands, SIMULATION ENABLE and SIMULATION ACTIVATE. | Comply | 126-127 | |
| G12 | When in simulation mode, the ground station shall transmit pressure data from a csv file provided by the competition at a 1 Hz interval to the CanSat. | Comply | 126-127 | |
| G13 | The ground station shall use a table top or handheld antenna. | Comply | 137 | |
| G14 | Because the ground station must be viewed in bright sunlight, the displays shall be designed with that in mind, including using larger fonts (14 point minimum), bold plot traces and axes, and a dark text on light background theme. | Comply | 140-142 | |
| G15 | All data shall be shown simultaneously in the ground station GUI. Tabs are not allowed. | Comply | 142 | |
| G16 | The ground system shall count the number of received packets. Note that this number is not equivalent to the transmitted packet counter, but it is the count of packets successfully received at the ground station for the duration of the flight. | Comply | 140 | |
| G17 | The ground station shall be able to activate all mechanisms on command. | Comply | 140 | |

Flight Software Requirements

| RN | Requirement | Compliance | Ref Pages | Notes |
|----|---|------------|-------------------------|-------|
| F1 | The flight software shall maintain a count of packets transmitted which shall increment with each packet transmission throughout the mission. The value shall be maintained through processor resets. | Comply | 127 | |
| F2 | The CanSat shall maintain mission time throughout the entire mission even in the event of a processor resets or momentary power loss. | Comply | 127 | |
| F3 | The CanSat shall have its time set by ground command to within one second UTC time prior to launch. | Comply | 104 | |
| F4 | The flight software shall support simulated flight mode where the ground station sends air pressure values at a one second interval using a provided flight profile file. | Comply | 126-127 | |
| F5 | In simulation mode, the flight software shall use the radio uplink pressure values in place of the pressure sensor for determining the payload altitude. | Comply | 126-127 | |
| F6 | The flight software shall only enter simulation mode after it receives the SIMULATION ENABLE and SIMULATION ACTIVATE commands. | Comply | 126-127 | |
| F7 | The flight shall include commands to activate all mechanisms. These commands shall be documented in the mission manual. | Comply | 104 | |
| F8 | Configuration states such as zero altitude calibration software state shall be maintained in the event of a processor reset during launch and mission | Comply | 104 | |

Management

Fatma Aliea Wibowo

Mechanical Procurement

| Component | Quantity | Order | Receive | Status |
|---------------------------|----------|----------|----------|----------|
| Carbon Rod Solid 3mm | 10 | 03/07/26 | 03/10/26 | Received |
| Easy ABS | 3 | 10/19/25 | 10/23/25 | Received |
| Ripstop Nylon (1 x 1.5 m) | 1 | 11/02/25 | 11/08/25 | Received |
| Resin Epoxy | 1 | 01/29/26 | 31/01/26 | Received |
| Balsa 3mm | 4 | 10/06/25 | 10/08/25 | Received |
| Balsa 8mm | 1 | 10/06/25 | 10/08/25 | Received |
| Torsion Spring | 6 | 06/01/24 | 08/01/24 | Received |
| Fiberglass | 1 | n/a | n/a | In Stock |
| Carbon Tube 5mm | 1 | n/a | n/a | In Stock |
| Acrylic | 1 | n/a | n/a | In Stock |
| RBF Tag | 1 | n/a | n/a | In Stock |
| Battery Holder | 1 | 03/07/26 | 03/12/26 | Received |
| Zip Ties | 1 | n/a | n/a | In Stock |
| Bubble Wrap | 1 | n/a | n/a | In Stock |

Electrical Procurement

| Component | Quantity | Order | Receive | Status |
|------------------------|----------|----------|----------|---------------|
| BMP280 | 1 | 10/12/25 | 10/12/25 | Received |
| INA219 | 1 | 03/05/26 | 03/05/26 | Received |
| U-blox SAM-M10Q | 1 | 10/12/25 | 12/15/25 | Received |
| BNO055 | 1 | 10/12/25 | 10/12/25 | Received |
| EYESEC X6D | 1 | n/a | n/a | In Stock |
| Turbowing Cyclops 3 V3 | 1 | n/a | n/a | In Stock |
| SanDisk Ultra microSD | 1 | 10/12/25 | 10/12/25 | Received |
| Taoglas FXP290 | 1 | n/a | n/a | In Stock |
| Xbee Pro S3B | 1 | 03/09/26 | 03/12/26 | Received |
| Samsung INR18650-25R | 2 | 01/17/26 | 01/19/26 | Received |
| Servo MG90s | 5 | 03/02/26 | 03/05/26 | Received |
| PCB | 1 | 12/22/25 | 01/10/26 | Received |
| 3mm LED | 1 | 10/12/25 | 10/12/25 | Received |
| 3.3V Buck Converter | 1 | 10/12/25 | 10/12/25 | Received |
| Coin Cell Battery | 1 | 10/12/25 | 10/12/25 | Received |
| 5V Buck Converter | 1 | 10/12/25 | 10/12/25 | Received |
| 3V Buzzer | 1 | 10/12/25 | 10/12/25 | In Stock |
| On/Off Switch | 1 | 10/12/25 | 10/12/25 | Received |
| Soshine ICR14500 3.7V | 1 | - | - | Not Yet Order |
| VL53L1X | 1 | 10/27/25 | 10/29/25 | Received |

Ground Station Procurement

| Component | Quantity | Order | Receive | Status |
|---------------------------|----------|----------|----------|----------|
| Moxon-Yagi Antenna | 1 | n/a | n/a | In Stock |
| XBee Pro S3B | 1 | 03/09/26 | 03/12/26 | In Stock |
| XBee Adapter | 1 | 03/09/26 | 03/12/26 | Received |
| USB Cable | 1 | n/a | n/a | In Stock |
| RP SMA Connector | 1 | n/a | n/a | In Stock |
| Raspberry Pi 4 | 1 | 01/22/26 | 01/24/26 | Received |
| Keyboard | 1 | 11/03/25 | 11/05/25 | Received |
| LED Monitor 10.1 inch | 1 | 11/11/25 | 11/12/25 | Received |
| SanDisk Ultra microSD | 1 | n/a | n/a | In Stock |
| GPS GEOX-M10 | 1 | 02/10/26 | 02/12/26 | Received |
| Power bank 20,000 mAh 20W | 1 | n/a | n/a | In Stock |
| DS1302 RTC Module | 1 | 02/10/26 | 02/12/26 | Received |
| Pilot Switch | 1 | 02/10/26 | 02/12/26 | Received |
| Plywood | 6 | 11/22/25 | 11/28/25 | Received |
| 5V Cooling Fan 30x30x10mm | 1 | n/a | n/a | In Stock |
| Hinge | 2 | 10/25/25 | 10/26/25 | Received |
| Briefcase Handle | 1 | 10/25/26 | 10/26/26 | Received |

Electrical Components

| Component | Quantity | Considerations | Unit Cost (\$) | Total Cost (\$) |
|--|----------|----------------|----------------|-----------------|
| BMP280 | 1 | Actual | 0.42 | 0.42 |
| INA219 | 1 | Actual | 0.95 | 0.95 |
| U-blox SAM-M10Q | 1 | Actual | 28.25 | 28.25 |
| BNO055 | 1 | Actual | 48.77 | 48.77 |
| EYESEC X6D | 1 | Actual | 11.64 | 23.28 |
| Teensy 4.1 | 1 | Actual | 56.97 | 56.97 |
| SanDisk Ultra microSD | 2 | Actual | 11.32 | 22.64 |
| Taoglas FXP290 | 1 | Actual | 17.05 | 17.05 |
| XBee Pro S3B | 1 | Actual | 55.66 | 55.66 |
| Samsung INR18650-25R | 2 | Actual | 3.68 | 7.36 |
| Servo MG90s | 5 | Actual | 1.90 | 9.50 |
| PCB | 1 | Actual | 29.91 | 29.91 |
| 3mm LED | 1 | Actual | 0.03 | 0.03 |
| 3.3V Buck Converter | 1 | Actual | 0.39 | 0.39 |
| Coin Cell CR2032 | 2 | Actual | 0.31 | 0.62 |
| 5V Buck Converter | 1 | Actual | 0.48 | 0.48 |
| 3V Buzzer | 1 | Actual | 0.12 | 0.12 |
| ON/OFF Switch | 1 | Actual | 0.03 | 0.03 |
| Turbowing Cyclops 3 V3 | 1 | Actual | 29.10 | 29.10 |
| Soshine ICR14500 3.7V | 1 | Actual | 3.48 | 3.48 |
| VL53L1X | 1 | Actual | 2.37 | 2.37 |
| Total Cost Electrical Components (\$) | | | | 337.38 |

Mechanical Components

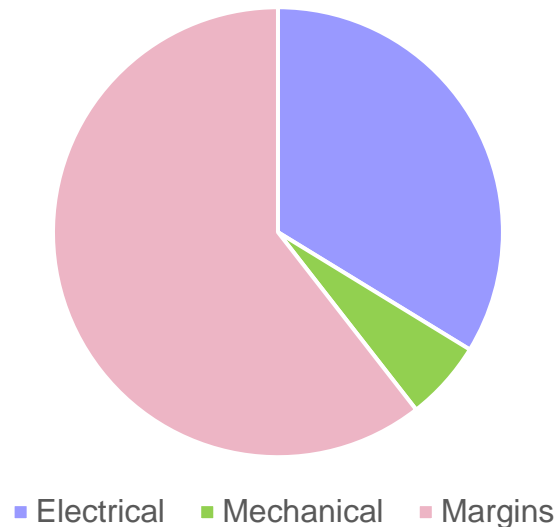
| Component | Quantity | Considerations | Unit Cost (\$) | Total Cost (\$) |
|--|----------|----------------|----------------|-----------------|
| Carbon Rod Solid 3mm | 8 | Actual | 0.81 | 6.48 |
| Easy ABS | 3 | Actual | 9.71 | 29.13 |
| Ripstop Nylon (1 x 1.5 m) | 1 | Actual | 1.40 | 1.40 |
| Resin Epoxy | 1 | Actual | 5.07 | 5.07 |
| Balsa 3mm | 4 | Actual | 0.89 | 3.56 |
| Balsa 8mm | 1 | Actual | 0.90 | 0.90 |
| Torsion Spring | 6 | Actual | 0.18 | 1.08 |
| Fiberglass | 1 | Actual | 0.89 | 0.89 |
| Carbon Tube 5mm | 1 | Actual | 1.10 | 1.10 |
| Acrylic | 1 | Actual | 1.79 | 1.79 |
| RBF Tag | 1 | Actual | 0.36 | 0.36 |
| Battery Holder | 1 | Actual | 0.6 | 0.6 |
| Zip Ties | 1 | Actual | 0.24 | 0.24 |
| Bubble Wrap | 1 | Actual | 4.72 | 4.72 |
| Total Cost Mechanical Components (\$) | | | | 57.32 |

CanSat Budget – Hardware (3/3)

| Component | Total Cost (\$) |
|-----------------------------------|-----------------|
| Total Cost Electrical Components | 337.38 |
| Total Cost Mechanical Components | 57.32 |
| Total Hardware Budget (\$) | 394.70 |

CanSat Requirement Cost – Hardware Budget = **Margins**

$$\$1000 - \$394.70 = \$ 603.30$$



Ground Control Station Cost

| Component | Quantity | Considerations | Unit Cost (\$) | Total Cost (\$) |
|---|----------|----------------|----------------|-----------------|
| Moxon-Yagi Antenna | 1 | Actual | 8.06 | 8.06 |
| XBee Pro S3B | 1 | Actual | 55.66 | 55.66 |
| XBee Adapter | 1 | Actual | 3.87 | 3.87 |
| USB Cable | 1 | Actual | 1.27 | 1.27 |
| RP SMA Connector | 1 | Actual | 1.14 | 1.14 |
| Raspberry Pi 4 | 1 | Actual | 148.99 | 148.99 |
| Keyboard | 1 | Actual | 5.96 | 5.96 |
| LED Monitor 10.1 inch | 1 | Actual | 71.52 | 71.52 |
| SanDisk Ultra microSD | 1 | Actual | 11.32 | 11.32 |
| GPS GEOX-M10 | 1 | Actual | 11.36 | 11.36 |
| Power bank 20,000 mAh 20W | 1 | Actual | 15.45 | 15.45 |
| DS1302 RTC Module | 1 | Actual | 1.47 | 1.47 |
| Pilot Switch | 1 | Actual | 0.96 | 0.96 |
| Plywood | 6 | Actual | 1.24 | 7.44 |
| 5V Cooling Fan 30x30x10mm | 1 | Actual | 0.89 | 0.89 |
| Hinge | 2 | Actual | 0.29 | 0.58 |
| Briefcase Handle | 1 | Actual | 0.88 | 0.88 |
| Total Ground Control Station Cost (\$) | | | | 346.82 |

Others Cost

| Component | Quantity | Considerations | Unit Cost (\$) | Total Cost (\$) |
|-------------------------------|----------|----------------|----------------|------------------|
| Registration | 1 | Actual | 200 | 200 |
| Prototyping | 1 | Estimated | 388.85 | 394.70 |
| Round Trip CGK-IAD Ticket | 8 people | Estimated | 1,352 | 10,816 |
| Round Trip Train Ticket | 8 people | Estimated | 23.85 | 190.8 |
| Visa | 8 people | Estimated | 160 | 1,280 |
| Uniform | 8 people | Actual | 16.10 | 128.8 |
| Mobile Wi-Fi | 1 | Actual | 56.37 | 56.37 |
| Hotel | 7 nights | Estimated | 196 | 1,372 |
| Round Trip Bus Ticket | 8 people | Estimated | 84.64 | 677.12 |
| Ground Control Station Cost | 1 | Actual | 346.82 | 346.82 |
| Total Other Costs (\$) | | | | 15,462.61 |

Sources of Income

| Sources of Income | Total Cost (\$) |
|--------------------------|------------------|
| PENS Funding | 4,469.98 |
| Sponsorship | 11,000.00 |
| Total Income (\$) | 15,469.98 |

Program Schedule Overview

Cansat 2026

Project Start Date: 19-Sept-25
Project Leader: Rafida Azis Al Habib

PM=Project Manager MC=Mechanical RnD=Research and Development
AD=Administration HW=Hardware BT=Branding
SS=Sponsorship SW=Software

| Task | Assign | Start | End | Days | Status | % Complete | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun |
|---------------------------------------|------------|-----------|-------------|------|-----------|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Summary | | | | | | | | | | | | | | | | |
| Team Member Recruitment | ALL | 1-Sep-25 | 19-Sep-25 | 18 | Completed | 100% | █ | | | | | | | | | |
| Internal Funding | AD | 19-Sep-25 | 19-Sep-25 | 1 | Completed | 100% | █ | | | | | | | | | |
| Middle 1st Semester Exam | ALL | 29-Sep-25 | 3-Oct-25 | 4 | Exam | 100% | | █ | | | | | | | | |
| PDR Preparation | ALL | 6-Oct-25 | 26-Jan-26 | 112 | Completed | 100% | | █ | █ | █ | █ | █ | █ | █ | █ | █ |
| Procurement of Components & Materials | HW, MC, SW | 10-Oct-25 | 23-Mar-26 | 164 | Completed | 100% | | █ | █ | █ | █ | █ | █ | █ | █ | █ |
| Sponsorship | AD, SS, BT | 10-Oct-25 | 22-May-26 | 224 | On-going | 75% | | █ | █ | █ | █ | █ | █ | █ | █ | █ |
| EEPISAT's Website Developing | RnD | 14-Oct-25 | 23-Mar-26 | 160 | Completed | 100% | | █ | █ | █ | █ | █ | █ | █ | █ | █ |
| Registration | PM | 16-Nov-25 | 16-Nov-25 | 1 | Completed | 100% | | | █ | | | | | | | |
| Final 1st Semester Exam | ALL | 17-Nov-25 | 21-Nov-25 | 4 | Exam | 100% | | | █ | | | | | | | |
| Team Member Vacation | ALL | 25-Dec-25 | 4-Jan-26 | 10 | Completed | 100% | | | | █ | █ | | | | | |
| PDR Submission | PM | 26-Jan-26 | 26-Jan-26 | 1 | Completed | 100% | | | | | █ | | | | | |
| CDR Preparation | ALL | 1-Feb-26 | 27-Mar-26 | 54 | Completed | 100% | | | | | █ | █ | █ | █ | █ | █ |
| System Integration | ALL | 16-Feb-26 | 29-March-26 | 41 | Ongoing | 95% | | | | | | █ | █ | █ | █ | █ |
| System Improvement | ALL | 16-Feb-26 | 5-April-26 | 48 | Ongoing | 82% | | | | | | | █ | █ | █ | █ |
| CDR Submission | PM | 27-Mar-26 | 27-Mar-26 | 1 | Completed | 100% | | | | | | | | █ | | |
| Mid 2nd Semester Exam | ALL | 13-Apr-26 | 17-Apr-26 | 4 | Exam | 0% | | | | | | | | | █ | |
| Final 2nd Semester Exam | ALL | 2-June-26 | 6-June-26 | 4 | Exam | 0% | | | | | | | | | | █ |
| Enviromental Test Submission | ALL | 22-May-26 | 22-May-26 | 1 | Upcoming | 0% | | | | | | | | | | █ |
| CanSat Shipping | ALL | 2-June-26 | 2-June-26 | 1 | Upcoming | 0% | | | | | | | | | | █ |
| FRR | ALL | 5-Jun-26 | 5-Jun-26 | 1 | Upcoming | 0% | | | | | | | | | | █ |
| Competition | ALL | 4-Jun-26 | 7-Jun-26 | 4 | Upcoming | 0% | | | | | | | | | | █ |
| PFR | PM | 7-Jun-26 | 7-Jun-26 | 1 | Upcoming | 0% | | | | | | | | | | █ |

█ (Completed)
█ (Exam)

█ (On-going)
█ (Upcoming)



Overall Accomplishment: 71%



Detailed Program Schedule (1/3)

| Task | Assign | Start | End | Days | Status | % Complete | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun |
|--------------------------|--------|-----------|-----------|------|-----------|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Mechanical | | | | | | | | | | | | | | | |
| Mission Guide Study | MC | 19-Aug-25 | 19-Sep-25 | 31 | Completed | 100% | | | | | | | | | |
| Middle 1st Semester Exam | ALL | 29-Sep-25 | 3-Oct-25 | 4 | Exam | 100% | | | | | | | | | |
| Prototype Manufacturing | MC | 19-Sep-25 | 1-Nov-25 | 43 | Completed | 100% | | | | | | | | | |
| Material Trade | MC | 19-Sep-25 | 31-Oct-25 | 42 | Completed | 100% | | | | | | | | | |
| Cansat 1st Design | MC | 6-Oct-25 | 5-Dec-25 | 60 | Completed | 100% | | | | | | | | | |
| Procurement of Materials | MC | 6-Oct-25 | 27-Mar-26 | 172 | Completed | 100% | | | | | | | | | |
| Prototype Testing | MC | 20-Oct-25 | 5-Dec-25 | 46 | Completed | 100% | | | | | | | | | |
| Cansat 2nd Design | MC | 3-Nov-25 | 25-Dec-25 | 52 | Completed | 100% | | | | | | | | | |
| Final 1st Semester Exam | ALL | 17-Nov-25 | 21-Nov-25 | 4 | Exam | 100% | | | | | | | | | |
| Team Member Vacation | ALL | 25-Dec-25 | 4-Jan-26 | 10 | Completed | 100% | | | | | | | | | |
| Mass Budget Calculate | MC | 5-Jan-26 | 10-Jan-26 | 5 | Completed | 100% | | | | | | | | | |
| System Integrating | MC | 1-Mar-26 | 23-May-26 | 83 | Ongoing | 32% | | | | | | | | | |
| Mid 2nd Semester Exam | ALL | 13-Apr-26 | 17-Apr-26 | 4 | Exam | 0% | | | | | | | | | |
| System Improvement | MC | 3-Apr-26 | 23-May-26 | 50 | Upcoming | 0% | | | | | | | | | |
| System Testing | MC | 15-Apr-26 | 29-Apr-26 | 14 | Upcoming | 0% | | | | | | | | | |
| Final 2nd Semester Exam | ALL | 2-June-26 | 6-June-26 | 4 | Exam | 0% | | | | | | | | | |

Assign to: Muhammad Rizky (MC)

Overall Accomplishment: 71%

 (Completed)
 (Exam)

 (On-going)
 (Upcoming)

 (Mechanical)

| Task | Assign | Start | End | Days | Status | % Complete | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | June |
|---------------------------|--------|-----------|-----------|------|-----------|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| Hardware | | | | | | | | | | | | | | | | |
| Mission Guide Study | HW | 19-Aug-25 | 19-Sep-25 | 31 | Completed | 100% | | | | | | | | | | |
| Middle 1st Semester Exam | ALL | 29-Sep-25 | 3-Oct-25 | 4 | Exam | 100% | | | | | | | | | | |
| Component Trade | HW | 19-Sep-25 | 1-Nov-25 | 43 | Completed | 100% | | | | | | | | | | |
| Procurement of Components | MC | 6-Oct-25 | 27-Mar-26 | 172 | Completed | 100% | | | | | | | | | | |
| Payload PCB Design | HW | 6-Oct-25 | 5-Dec-25 | 60 | Completed | 100% | | | | | | | | | | |
| XBEE Communication Test | HW | 20-Oct-25 | 3-Nov-25 | 14 | Completed | 100% | | | | | | | | | | |
| Electrical Prototype Test | HW | 3-Nov-25 | 25-Dec-25 | 52 | Completed | 100% | | | | | | | | | | |
| Component Testing | HW | 12-Nov-25 | 25-Nov-25 | 13 | Completed | 100% | | | | | | | | | | |
| Final 1st Semester Exam | ALL | 17-Nov-25 | 21-Nov-25 | 4 | Exam | 100% | | | | | | | | | | |
| Flight Algorithm | HW | 24-Nov-25 | 24-Dec-25 | 30 | Completed | 100% | | | | | | | | | | |
| Team Member Vacation | ALL | 25-Dec-25 | 4-Jan-26 | 10 | Completed | 100% | | | | | | | | | | |
| Camera Tracking Test | HW | 17-Feb-26 | 1-Mar-26 | 12 | Completed | 100% | | | | | | | | | | |
| System Integrating | HW | 1-Mar-26 | 23-May-26 | 83 | Ongoing | 32% | | | | | | | | | | |
| Mid 2nd Semester Exam | ALL | 13-Apr-26 | 17-Apr-26 | 4 | Exam | 0% | | | | | | | | | | |
| System Improvement | HW | 3-Apr-26 | 23-May-26 | 50 | Upcoming | 0% | | | | | | | | | | |
| System Testing | HW | 15-Apr-26 | 29-Apr-26 | 14 | Upcoming | 0% | | | | | | | | | | |
| Final 2st Semester Exam | ALL | 2-June-26 | 6-June-26 | 4 | Exam | 0% | | | | | | | | | | |

Assign to: Ax'l Nurrahim (HW)

Overall Accomplishment: 72%

(Completed)
 (Exam)

(On-going)
 (Upcoming)

(Hardware)

Detailed Program Schedule (3/3)

| Task | Assign | Start | End | Days | Status | % Complete | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | June | |
|--------------------------|--------|-----------|-----------|------|-----------|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|--|
| Software | | | | | | | | | | | | | | | | | |
| Mission Guide Study | SW | 19-Aug-25 | 19-Sep-25 | 31 | Completed | 100% | | | | | | | | | | | |
| GCS Design | SW | 19-Sep-25 | 17-Nov-25 | 59 | Completed | 100% | | | | | | | | | | | |
| Middle 1st Semester Exam | ALL | 29-Sep-25 | 3-Oct-25 | 4 | Exam | 100% | | | | | | | | | | | |
| Antenna Trade | SW | 19-Sep-25 | 15-Nov-25 | 57 | Completed | 100% | | | | | | | | | | | |
| Improve Antenna Design | SW | 17-Nov-25 | 12-Dec-25 | 25 | Completed | 100% | | | | | | | | | | | |
| Final 1st Semester Exam | ALL | 17-Nov-25 | 21-Nov-25 | 4 | Exam | 100% | | | | | | | | | | | |
| Team Member Vacation | ALL | 25-Dec-25 | 4-Jan-26 | 10 | Completed | 100% | | | | | | | | | | | |
| Antenna Manufacturing | SW | 17-Feb-26 | 1-Mar-26 | 12 | Completed | 100% | | | | | | | | | | | |
| System Integrating | SW | 1-Feb-26 | 23-Mar-26 | 50 | Completed | 100% | | | | | | | | | | | |
| Antenna Range Test | SW | 8-Feb-26 | 23-Mar-26 | 43 | Completed | 100% | | | | | | | | | | | |
| System Improvement | SW | 3-Apr-26 | 23-May-26 | 50 | Upcoming | 0% | | | | | | | | | | | |
| Mid 2nd Semester Exam | ALL | 13-Apr-26 | 17-Apr-26 | 4 | Exam | 0% | | | | | | | | | | | |
| System Testing | SW | 15-Apr-26 | 29-Apr-26 | 14 | Upcoming | 0% | | | | | | | | | | | |
| Final 2st Semester Exam | ALL | 2-June-26 | 6-June-26 | 4 | Exam | 0% | | | | | | | | | | | |

Assign to: Adam Kandias (SW)

Overall Accomplishment: 71%

(Completed)
 (Exam)


(On-going)
 (Upcoming)

(Software)

Transportation

| | | | |
|--------|--|--|--|
| Person | <p>Surabaya – Jakarta: Indonesian Train Jakarta – Washington, D.C.: American Airlines Washington, D.C. – Monterey: Bus</p> |  | <p>American Airlines</p>  |
|--------|--|--|--|

Shipping

| | | |
|------------------|--|---|
| CanSat and Tools | <p>Surabaya – Charlotte: Cargo (FedEx) Shipping Address 1: Committee Office Shipping Address 2: Indonesian Embassy in Washington, D.C.</p> |  |
|------------------|--|---|

Notes:

- In order to minimize trouble for transporting the tools and CanSat, we will send one set of the CanSat and tools using cargo service and another set carried along with us aboard.

| Division | Major Accomplishments | Major Unfinished Work | Testing to Complete |
|------------------------------|---|---|--|
| Mechanical | <ul style="list-style-type: none"> Major mechanism has been tested Several environmental test has been completed | <ul style="list-style-type: none"> Overall system integration | <ul style="list-style-type: none"> Environmental test |
| Hardware | <ul style="list-style-type: none"> All sensors have been tested XBEE Communication test completed | <ul style="list-style-type: none"> Overall system integration | - |
| Software | <ul style="list-style-type: none"> GUI Design Completed Antenna has been built and tested Flight software status has been developed and tested | <ul style="list-style-type: none"> Overall system integration | - |
| Administration & Sponsorship | <ul style="list-style-type: none"> Sponsorship and partnership contracted Travel and shipment plans have been established | <ul style="list-style-type: none"> Waiting for other sponsors | - |
| Branding & RnD | <ul style="list-style-type: none"> Official social media still active New generation website development | <ul style="list-style-type: none"> Developing the social media and website promotion | - |



Partnership

The official team has already partnership with several companies to support our development and travel for CanSat Competition 2026.



Bamantara EEPISAT Are Ready to Proceed to The Next Stage of Development

- Critical Design Phase is completed for mechanical, software, and electronic systems.
- Major mechanisms has been tested and there will be further improvements to make sure all mechanisms works well.
- Travel and shipment plans have been established for competition day in Monterey, VA.