THE UNIVERSITY OF
WAIKATO
Te Whare Wānanga o Waikato

CANSAT NZ2025

CANSAT Competition Guide

2025

Planetary Probe Instrument Mission

Version 1.1
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Table of Contents

Revisions

Date	Changes
30/1/25	Initial guide

1. Introduction

The CANSAT competition is a design-build-fly competition that provides teams with an opportunity to experience the design life-cycle of an aerospace system. The CANSAT competition is designed to reflect a typical aerospace program on a small scale and includes all aspects of an aerospace program from the Prototype Design Report to post flight review. The mission and its requirements are designed to reflect various aspects of real world missions including telemetry, communications, and autonomous operations. Each team is scored throughout the competition on real-world deliverables such as schedules, Prototype Design Report presentations, and demonstration flights.

1.1 Competition Description

To control the size of the competition, only one team per school is allowed to apply to the competition. It is recommended that schools hold internal design competitions to determine the team to apply. The school can appoint other teams as a reserve team. If more than one team from a school applies, the first application received will be accepted.

The competition is in four phases.

Phase one is the application phase. Teams must submit an application and a $50 competition fee that is non-refundable. The fee is used to offset the cost of rocket motors and other materials. Applications must be submitted by 11th April 2025. Payments must be paid by 28th April 2025.

Phase two is the protype phase. Teams are to develop designs, prototype, test concepts and generate a Prototype Design Report (PDR). Teams will have a half hour to discuss their PDR. Teams will finalize their design and start ordering components, manufacturing parts, test subsystems and start developing the flight unit. Teams will generate a PDR slide package using the provided template. Teams will submit PDR slides by the designated due date. The printed slides will only be accepted in PDF format.

After the PDR, a maximum of 12 teams will be invited to the competition. Ten (10) teams will be allowed to fly their CANSAT, the other two teams will be in reserve in case one of the 10 flying teams cannot compete. The other teams may have an opportunity to “fly” their CANSATS by means of a drone release flight.

Phase three is the launch weekend. On the week before flight operations, the teams will present their completed CANSAT for flight readiness review via teleconference. The shall take a maximum of 30 minutes. The CANSAT must be ready to launch at this time and be completely assembled and flight ready. Each team will be scored during the flight readiness review. CANSATs must pass a drop test, sabot fit check, and battery verification in order to fly. Multiple attempts at the drop test are allowed until the flight readiness reviews are completed.

Sunday (to be confirmed) is the launch day where teams will perform final preparations and conduct flight operations. Launch times will be assigned on the day. Launches will start at 11:00 hours local time and continue until all launches are completed. There will be no second flights unless the fault is of the launch provider and there are spare rockets and rocket motors.

Phase four is the Post Flight Review (PFR). Post Flight Review is a 15 minute presentation of the flight results and 5 minutes for questions. Also a copy of the flight data should give given to the judges. Awards will be presented at the end of all the post Flight Reviews.

For teams to receive certificates of accomplishment and be considered for awards, they must complete all phases of the competition.

All scoring and judging results are final. Scoring is set up to be quantitative with little qualitative scoring to minimize any biases.

While the competition is operated by University of Waikato, it is assisted by dedicated volunteers who spend their own time supporting various phases of the competition. Some volunteers spend their own funds to attend and support the competition while others are graciously supported by their employers. The competition is designed to provide teams a great educational experience and to minimize the time of the volunteers. Strict due dates, file templates, and file name formats are required. Please follow all due dates and all submission requirements.

1.2 Team Selection

Since the competition is sponsored by NZ organizations, the competition is limited to teams from New Zealand.

2. Mission Overview

The 2025 mission simulates a space probe (CANSAT) entering a planetary atmosphere. The CANSAT shall contain the electronics, and an aerobraking system. The operation sequence shall be:

1. The CANSAT is launched to an approximate altitude of 1,000 meters above the launch site and is deployed from the rocket when the rocket drogue parachute ejection charge fires. The CANSAT shall measure the speed of the rocket during ascent and of itself during descent. Orientation of the CANSAT during deployment is not controlled by the CANSAT and is most definitely violent.

2. Once the CANSAT is deployed from the rocket, the CANSAT shall deploy an aero-braking system. The descent rate shall be between 10 to 30 meters/sec. The aero-braking CANSAT must maintain a stable orientation with the heat shield facing the direction of descent. Tumbling is not allowed. Active control surfaces or other mechanisms can be used to maintain orientation. Stability shall be verified with a tilt sensor.

3. At an altitude of 150 meters, the CANSAT shall deploy a parachute to reduce the descent rate to less than 12 meters/sec.

4. The CANSAT shall land intact.

The CANSAT shall include sensors for tracking altitude using air pressure, internal temperature, battery voltage, GPS position and a tilt sensor for stability verification during descent. A pitot tube shall be included to measure the ascent speed and descent speed. A video recording camera shall be included capturing the horizontal view during ascent and landing. During descent, the camera shall point in one direction and maintain that direction.

3. Requirements

Operational Requirements

Requirement Number	Requirement
C1	The CANSAT shall be deployed from the rocket when the ejection charge fires at apogee
C2	During the intial descent, and aerobrake shall be deployed which limits the descent rate to between 10 to 30 m/s.
C3	At 150 meters, the CANSAT shall deploy a parachute
C4	Upon landing, the CANSAT shall activate an audio beacon.
C5	At 100 meters, the CANSAT shall have a descent rate of less than 12 m/s
C6	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.

Structural Requirements

Requirement Number	Requirement
S1	The CANSAT should have a maximum mass of 400grams , excluding the parachute
S2	The sabot can be used to restrain any deployable parts of the CANSAT but allows the Sabot to slide out of the payload section freely.
S3	The rocket airframe or Sabot can be used as part of the CANSAT operations.
S4	All electronics and mechanical components shall be hard mounted using proper mounts such as standoffs, screws, or high performance adhesives.

Mechanism Requirements

Requirement Number	Requirement
M1	No pyrotechnical or chemical actuators are allowed.
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.
M3	All mechanisms shall be capable of maintaining their configuration or states under all forces.
M4	Spring contacts shall not be used for making electrical connections to batteries. Shock forces can cause momentary disconnects.
M5	The CANSAT shall deploy an aerobrake after deploying from the rocket.
M6	At 150 meters, the CANSAT shall release a parachute to reduce the descent rate to less than 12 m/s.

Electrical Requirements

Requirement Number	Requirement
E1	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.
E2	Easily accessible power switch is required
E3	Power indicator is required
E4	The CANSAT shall operate for a minimum of two hours when integrated into the rocket.

Communications Requirements

Requirement Number	Requirement
X1	Arduino based 2.4 GHz transmitters shall be used
X2	The channel/frequency in use must be registered with the organsiers.
X3	The CANSAT shall transmit telemetry packet once every two seconds.
X4	The CANSAT telemetry shall include altitude, air speed, CANSAT state, and GPS latitude, longitude, altitude and number of satellites tracked.

Sensor Requirements

Requirement Number	Requirement
SN1	CANSAT shall measure its speed duringg ascent and descent.
SN2	CANSAT shall measure its altitude using air pressure.
SN3	CANSAT shall obtain GPS cordinates.
SN4	OPTIONAL : The CANSAT may include a video or still camera
SN5	OPTIONAL : A video camera may record the flight of the CANSAT from launch to landing.

Flight Software Requirements

Requirement Number	Requirement
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.
F2	The CANSAT shall maintain mission time throughout the whole mission even with processor resets or momentary power loss.
F3	The CANSAT shall have its time set to within one second UTC time prior to launch.

Ground Station Requirements

Requirement Number	Requirement
G1	The ground station shall generate csv files of all sensor data as specified in the Telemetry Requirements section.
G2	Telemetry shall include mission time with 2 second or better resolution.
G3	Each team shall develop their own ground station.
G4	Configuration states such as zero altitude calibration shall be maintained in the event of a processor reset during launch and mission.
G5	All telemetry shall be displayed in real time during descent on the ground station.
G6	All telemetry shall be displayed in engineering units (meters, meters/sec, Celsius, etc.) and the units shall be indicated on the displays.
G7	The ground station shall include one laptop computer with a minimum of two hours of battery operation, a radio receiver tuned to the CANSAT transmitter and an antenna.
G8	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.
G9	The ground station shall use a table top or handheld antenna.
G10	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.
G11	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.

3.1 Selectable Bonus Objective

A video camera may be integrated into the CANSAT and point aft of the CANSAT. The camera shall capture the CANSAT being deployed from the rocket and the release of the parachute. Video shall be in colour with a minimum resolution of 640x480 pixels and a minimum of 30 frames per second. The video shall be recorded and retrieved when the CANSAT is retrieved.

3.2 Telemetry, and Command Requirements

3.2.1 Telemetry

The telemetry system on the rocket shall only be activated when the rocket is on the launch pad and is ready for flight. Upon power up, the CANSAT shall collect the required telemetry at a rate of one sample every two seconds and transmit the telemetry data to the ground station.

The ASCII format of the telemetry packets are described below. Each telemetry field is delimited by a comma, and each telemetry packet is terminated by a single carriage return character. No comma (‘,’) characters should be part of the data fields -- commas are delimiters only.

3.2.1.1 Telemetry Information

The CANSAT telemetry packet format to be transmitted at one packet every two seconds. The telemetry data fields should include:

1. **TEAM_ID** is the assigned four digit team identification number. E.g., imaginary team ‘1000’.
2. **MISSION_TIME** is UTC time in format **hh:mm:ss**, where hh is hours, mm is minutes, and ss is seconds. E.g., ‘13:14:02’ indicates 1:14:02 PM.
3. **PACKET_COUNT** is the total count of transmitted packets since turn 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.
4. **STATE** is the operating state of the software. (e.g., LAUNCH_WAIT, ASCENT, ROCKET_SEPARATION, DESCENT, HS_RELEASE, LANDED, etc.). Teams may define their own states. This should be a human readable description as the judges will review it after the launch in the .csv files.
5. **ALTITUDE** is the altitude in units of meters and must be relative to ground level at the launch site. The resolution must be 0.1 meters.
6. **AIR_SPEED** is the air speed in meters per second measured with the pitot tube during both ascent and descent

7. **GPS_LATITUDE** is the latitude from the GPS receiver in decimal degrees with a resolution of 0.0001 degrees North.

8. **GPS_LONGITUDE** is the longitude from the GPS receiver in decimal degrees with a resolution of 0.0001 degrees West.

9. **GPS_SATS** is the number of GPS satellites being tracked by the GPS receiver. This must be an integer.

10. **[,,OPTIONAL_DATA]** are zero or more additional fields the team considers important following two commas, which indicates a blank field. This data must follow the same format rules (including use of comma characters ‘,’) to facilitate review of the CSV files by the judges after the mission.

3.3.1.2 Telemetry Data Files

The received telemetry for the entire mission shall be saved on the ground station computer as comma separated value (.csv) files that will be examined by the competition judges in Excel. The CSV format should be the same as used by export from Excel.

Teams shall provide the CSV file to the judges immediately after the launch operations via USB drive.

The CSV files shall include a header specifying the name of each field/column of data in the file.

The telemetry data files shall be named as follows:

- **Flight_<TEAM_ID>.csv**

where the team_id is the four digit team id number. For example: Flight_1000.csv is the required file name for imaginary team 1000.

The ground software shall produce the files, with the correct name, easily from the ground system user interface, and save them to the provided USB memory stick, which is to be given to judges before leaving the launch area.

3.2.2.3 On-board Telemetry Storage

It is suggested that teams make use of onboard data storage as backup in case of radio failure. Only the transmitted telemetry is examined and scored on flight day; however, the backup data can be used when preparing the Post Flight Review presentation.

3.3 Banned Materials and components

1. No foam based beads or other similar bits of foam material that can be dropped and lost on the ground. This material is dangerous to the livestock that occupy this area.
2. No lithium polymer batteries. The battery is relatively easy to damage and a fire hazard. We want to avoid setting any parts of the field on fire.

3.4 Environmental Tests

Two tests are to be conducted to test the construction quality and material performance. To verify test results, teams should provide: 1) Environmental Test Document based on the provided template file. 2) Videos of the tests performed as specified in the template document. If using a phone camera, orient the phone sideways for wider video view.

1. Drop Test - This test is designed to verify that the parachute and attachment point will survive the deployment. Component mounts and battery mount will also be tested. The drop test generates about 30 Gs of shock to the system.

a. Drop Test Description - This test requires a 61 cm non-stretching cord. The test was developed with a 1/8 thick kevlar cord. One end is secured to an eyebolt attached to a fixed point, such as ceiling or rigid structure with enough clearance to accommodate the cord, CANSAT, and free space so the CANSAT does not hit the ground. The other end is tied to the parachute. A floor mat or pillow may be placed under the CANSAT for the drop test. The structure must not flex during the drop test. This test cannot be performed by holding the cord. The cord must be secured to a solid structure.

b. Drop Test Procedure -

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.

2. Vacuum Test - This test is designed to verify deployment operation of the payload(s). A vacuum chamber can be simply constructed using a bucket or pail of 18+ litres. A lid can be used or a 6+ mm thick sheet of polycarbonate can be placed on top of the bucket. Do not use acrylic as that can shatter. A vacuum cleaner or shop vacuum can be used to pull a vacuum.

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.

This aim of this test is to simulate a complete flight cycle.

4. Team Composition

Students currently enrolled in in Secondary Schools or in home study groups, students who are sitting Secondary exams.

4.1 Team Size

Each team shall consist of between 3 and 10 students from a secondary school or homeschool group.

Teams from the same school must develop their designs independently and **not** copy from other teams. Bulk purchasing of materials is allowed such as batteries and raw materials for construction. Sharing tools and services are allowed. Designs must originate from within the team.

There shall be no more than one team from any one school.

4.2 Faculty Advisor

Each team must have a faculty advisor. The role of the faculty advisor is to:

- Provide a point of contact for the team, both with the university and the competition.
- Aid teams with logistics such as arranging conference rooms, laboratory resources,etc.
- Providing general guidance throughout the competition.

The faculty advisor shall not:

- Make design decisions or direct recommendations.
- Participate in more than an oversight role during reviews.

5. Deliverable Items

Teams will be evaluated based on a series of deliverable items provided at various stages of the development. The deliverable items are selected to provide representative real-world milestones for tracking the CANSAT development and ensuring team success.

5.1 The Entry Form

Teams In the Entry Form, it should include

1) Who is in your team and what roles do they have?
2) What are your mission objectives?
3) What systems will be used in the CANSAT? Will you be using an Arduino? And what Arduino modules will be used? What sensors will be used? What components will be required for your CANSAT.
4) What is your initial budget?
5) A provisional timeline.

This information is about the initial concepts, not the final product that will be built.

5.2 Prototype Design Report

The PDR is the initial design plans and concepts which will be developed later into a detailed design. It should briefly show that the team can meet the stated performance requirements within cost (program budget), schedule (program schedule), risk, and other system constraints". The CANSAT PDR shall demonstrate:

1) What are your mission objectives?
3) What systems will be used in the CANSAT? Will you be using an Arduino? And what Arduino modules will be used? What sensors will be used? What components will be required for your CANSAT.
4) What is the initial physical design? Remember, this has to fit into a 60mm tube.
5) What are the various phases of flight. What operations will your CANSAT perform in each phase? When will you be deploying parachutes, etc? Flowcharts may be useful here.
6) What is your power supply?
7) How much will the components cost and the CANSAT weigh?
8) How will your telemetry system work and what will your ground station consist of.?

The PDR should not take more than 2 weeks at most. It is about initial concepts, not the final product that will be built.

Design Concept Review interviews shall be conducted via teleconference coordinated by the team lead(s). The PDR presentations shall be less than 30 minutes in duration including time for questions. Presentation reviewers shall be permitted to ask questions during the presentation (i.e., questions are not held until the end of the presentation).

The PDR shall follow the presentation template posted on the CANSAT Competition website.

5.3 Pre Flight Review

The Pre Flight Review (PFR) is “a multi-disciplined technical review to ensure that the system under review can proceed into system fabrication, demonstration, and test; and can meet the stated performance requirements within cost (program budget), schedule (program schedule), risk, and other system constraints”. The PDR shall demonstrate:

- All PDR level requirements shall be resolved
- Refinement of the initial CANSAT design
- Results of the Environmental Tests
- Overview of mission operations
- Preliminary launch day sequence of events
- Revised budget

Pre-Flight Reviews shall be conducted via teleconference coordinated by the team lead(s). The PFR presentations shall be less than 30 minutes in duration including time for questions. Presentation reviewers shall be permitted to ask questions during the presentation (i.e., questions are not held until the end of the presentation).

The PFR shall follow the presentation template specified in the "CANSAT PFR Outline" document available on the CANSAT Competition website. Extra material in the form of backup slides is permitted.

Each section of the PFR shall be scored in accordance with the values listed in the outline. The PFR shall contribute to the total evaluation of the CANSAT design according to the values listed in the section Evaluation and Scoring.

5.4 Final Project Review

The Final Project Review (FPR) provides an assessment of flight operations and results of the demonstration flight. The FPR provides an assessment of successful and unsuccessful flight operations. The FPR shall provide:

- Overview of mission objectives and CANSAT design
- Comparison of planned and actual designs
- Raw and processed data from flight operations
- Failure analysis and assessment (for unsuccessful mission objectives)

The Final Project Review shall be conducted the week following the demonstration flight activities, unless flight operations are cancelled due to weather. Presentations shall be limited to 30 minutes, including questions.

Each section of the FPR shall be scored in accordance with the values listed in the outline. The FPR shall contribute to the total evaluation of the CANSAT design according to the values listed in the section Evaluation and Scoring.

FPR presentations shall be submitted by 5PM on the Friday following the flight to the judges.

5.5 Deliverable Submissions and Scheduling

All deliverable items shall be submitted to the competition email by the dates listed in Table 1.

All deliverable items shall be submitted in PDF format using the naming convention listed in Table 1 where # corresponds to the assigned team number for each team and v# is a unique revision number for the review package that can be used to track revisions. For example, a submission for imaginary team number 1000 of version 2 of the PDR package would be named **`CANSAT2025_1000_pdr_v02.pdf`**. Note that adherence to the filename and format specification is scored during the competition.

If you resubmit your presentation, you must increment the version number otherwise the previous version may be used. If so, scoring will reflect the previous version. With a large number of submissions and resubmissions, it is not possible to track correctly without using the version numbers.

Presentations will be scheduled after submission of the document. A calendar of available time slots will be sent to all teams. Each team is to send to the competition email a list of three time slots. The team will be notified of which time slot they are assigned.

Updated presentations will not be accepted after the deadline. It is understood and expected that changes will occur between document submission and the presentation time. The scoring is based on the quality of the presentation and understanding of the competition requirements. There will be no point loss due to changes in the design between document submission time and the presentation time.

Table 1: Deliverable item due dates

Material Due	Required Filename Format	Due Date
Entry	CANSAT2025_XXXX_ENT_vYY.pdf	20MAY25
DCR	CANSAT2024_XXXX_DCR_vYY.pdf	21JUN25
PFR	CANSAT2024_xxxx_PFV.pdf	29AUG25
Flight Telemetry Data	Flight_XXXX_.csv	7SEP25*
FPR	CANSAT2025_XXXX_FPR_vYY.pdf	12SEP25*

XXXX is the team number. YY is the revision number. *Based on 7SEP25 Provisional Launch date. Files are to be in PDF format.

At the end of the competition, the PDR, PDR, and PFR packages may be placed on the website for reference in subsequent years.

5.6 Slide Format Guidelines

The following guidelines shall be used when developing the presentation material:

- Use the template made available.
- All slides shall have simple white backgrounds. This helps reduce the file sizes and makes the slides easier to read.
- All slides shall have page numbers in the footer. This is to allow for easier referencing of material during the reviews.
- No embedded files or movies shall be included in the presentations. Not all reviewers will be able to access or view movies during the reviews due to network security settings at the various organizations involved.
- Each line-item in the review outlines shall correspond to a dedicated slide. This may result in slides with single bullets on them, however, this makes it easier for the reviewers to follow the presentation.

6. Launch Weekend

6.1 Schedule

All times are referenced to New Zealand time. The provisional launch date is the 7th of September 2025, with the 14th of September 2025 as a reserve date.

The flight component starts Sunday morning. The preflight briefing will be held Sunday, before flight operations start.

A Final Flight Readiness review and safety inspection will occur on Sunday before flight operations, unless weather causes a postponement.

6.2 Pre Flight Review

On the week before flight operations, teams are required to have their CANSATs inspected for flight worthiness. Each team will be assigned a one half hour time slot to present their CANSAT. This means the CANSAT must be completed, built and ready to launch at the Pre Flight Review (PFR). A ball of wires and boards does not constitute flight ready. To emphasize, when presented at the Flight Readiness Review (FRR), it must be in a state where it can be turned on and placed into a rocket for immediate launch and be fully operational.

6.2.1 PFR Sequence of Events

Teams must be prepared to demonstrate the ground station.

The first test at the FRR will be the drop test. The CANSAT must be in flight configuration and will be subjected to the drop test. If the test fails, the team must make repairs before being allowed to fly. The CANSAT must pass the drop test in order to be launched.

The second test will verify communications with the CANSAT and demonstrate the ground station software. The ground station software operations will be scored at this time. The ground station must show data being plotted in real time.

The CANSAT will then be inspected for safety. The structure will be reviewed and determined if it is flight worthy. The mounting of the electronics and sensors will be reviewed. Mechanisms will be reviewed. Hazards will be identified such as heating elements exposed to the outside, etc. If any CANSAT is determined to not be flight ready, the team has until their flight the next day to make repairs and modifications. This is done to make sure your CANSAT is completed before coming to the competition and for the safety of all people on the field.

Safety is the highest priority. Any CANSAT deemed not flight worthy will not be flown. The

team will lose all flight day points.

Crew assignments must be submitted at the flight readiness review in the Mission Operations Manual. The mission control officer will be given an identification so the flight coordinator and launch control officer knows who the mission control officer is. The mission operations manual will be reviewed at the FRR.

6.3 Team Member Launch Operations Crew Assignments

Crew assignments must be submitted at the flight readiness review. The mission control officer will be given an identification so the flight coordinator and launch control officer knows who the mission control officer is.

The mission operations manual will be reviewed at the flight readiness review.

Team Member Launch Operations Crew Assignments

In order to have a successful launch, teams need to coordinate among themselves and with the flight coordinator. Team members need to be assigned to specific tasks and develop a checklist for a successful flight. The following task assignments must be delegated:

Mission Control Officer - This is a single person who is responsible for managing the team at the time of the launch. This person must verify with the ground station crew everything is ready. This person will do the countdown starting at 5. The rocket will be launched after the count reaches 1.

Ground Station Crew - This is one or more persons who is responsible for monitoring the ground station for telemetry reception and issuing commands to the CANSAT. Only the ground station crew should be at the ground station since there is limited space.

Recovery Crew - This is one or two persons only responsible for tracking the CANSAT and going out into the field for recovery. The recovery crew is responsible for returning the CANSAT to the judges at check-in with any required payload still inside. The CANSAT cannot be disassembled before presenting the CANSAT to the judges for review and scoring or no points will be awarded.

CANSAT Crew - This is one or more persons responsible for preparing the CANSAT ,integrating it into the rocket, and verifying its status.

Team members can take on multiple roles except for the Mission Control Officer. The Mission Control Officer should be coordinating all efforts and interacting with the flight coordinator as needed. It is highly recommended that a checklist be developed that steps the crews through the preparation, integration, and flight operations.

Crew assignments must be submitted at the flight readiness review.

6.4 Mission Operations Manual

Each team is required to assemble a mission operations manual. The mission operations manual includes five checklists/operations procedures to be created by the team. The checklists are for configuring the ground station, preparing the CANSAT, and integrating the CANSAT into the rocket. The launch preparation procedures, launch procedure, and removal procedure are to be provided. Additional steps can be added by the team. The document is available for download and modification. Each section of the mission operations manual must start on its own page. Pages should be numbered and a table of contents is to be included. The team must have the mission operations manual assembled into a binder or clear file folder.

6.5 Launch Schedule

All times are local time.

The launch times will be confirmed at a later date, but usually start at start at 10am local time. All CANSATs are to be submitted for inspection before being prepared for launch. Teams cannot be in line while working on the CANSAT. The CANSAT must be in the stowed configuration and off when submitted.

The launch are proposed to start after 10am will be done in groups of five. Each team will be assigned a round which will be scheduled in one half hour increments. 15 minutes before the launch round, the teams assigned to the round shall retrieve their CANSAT, turn it on and insert it into the rocket payload. CANSATs shall not be disassembled at this stage. The CANSAT must be flight ready and the only thing that can be done to the CANSAT is to turn on the CANSAT with the power switch. Each team will be given a USB thumb drive to upload their ground station data after they have completed their flight operations. The thumb drive must be submitted to the judging table before leaving the field.

6.6 Competition Operations and Sequence of Events

Details of flight day operations shall be provided at the Pre-Flight Brief. An overview of the flight day operations include the following activities:

1. Arrive at launch site
2. Flight Readiness Review
2. Prepare CANSAT for turn in. Make it flight ready and perform any tests.
3. Turn in CANSAT at the check-in table at its assigned time. It will be weighed and fit checked and stored in the stowed configuration in the off state until rocket preparation time.
4. Upon the team round, the team will collect their CANSAT and load it into a rocket.
5. Verify the CANSAT is communicating with the ground station.
6. Take the rocket with the ground station to the assigned launch pad. A staff member will install the rocket on the launch pad.
7. When it is time to launch, a judge will come by the ground station to monitor the ground station operation.
8. The team mission control officer will go to the launch control table and execute the launch procedures with the flight coordinator providing oversight.
9. Ground station crew will perform all required flight operations.
10 .After all CANSATs have launched for the current half hour round, team recovery personnel can head out to recover.
11. Ground station crew must clear out of the ground station area to allow the next round ground stations to set up.
12. Ground station crew must turn in the thumb drive with any ground station data to the ground station judge. The thumb drive shall contain only the telemetry received from the ground station. Videos are to be presented at PFR.
13. Recovery crew must return the CANSAT to check-in to complete the final judging requirements.

6.7 Second Flight Rules

Second flights are rare but do occasionally happen. The following conditions will qualify for a second flight.

1. Rocket engine failure, engine failure causes CANSAT not to deploy.
2. CANSAT deployment failure. CANSAT never deployed from the rocket due to organisers fault.

A team whose CANSAT is destroyed due to a rocket failure will receive all launch day points only if they passed the drop test, the fit check, received all points on the FRR test, and had telemetry during the whole flight which includes ascent and descent or until a catastrophic rocket failure.

CANSATs that do not deploy from the rocket are not qualified for a second fight or all launch day points. It is up to the team to make sure their CANSAT can deploy from the payload section of the rocket.

6.8 Weather Delays

If the Saturday launch gets rained out, CANSAT demonstrations shall be performed Saturday using the launch schedule. The demonstration will require the drop test followed by the simulation demonstration where simulated pressure data is transmitted to the CANSAT.

If the following Saturday is clear, the launches will be performed and the PFR will be cancelled.

If that Saturday is rained out, the launch will be on the following Saturday.

if in three weekends no flight operations are possible, then judging will be conducted based on the work that has been completed.

Appendix A Field Safety Rules

1. Consumption of alcohol is not allowed.
2. Smoking is only allowed at designated areas. If anyone is caught smoking where it is not allowed, the landowner can throw you off the field.
3. Do not catch rockets or CANSATs out of the air.
4. Stay behind the designated range line unless the range safety officer (RSO) or launch control officer (LCO) or flight coordinator has given permission for you to put your rocket on your assigned pad.
5. Pay attention at all times. Every launch is potentially hazardous.
6. If a “heads up” launch is announced, you must be standing and facing the launch pad.
7. Do not retrieve a rocket from the range unless the LCO has given you permission to do so.
8. Everyone must be alert when a “heads up!” is called and be ready to move.
9. Do not litter. Do not throw trash on the ground anywhere on the field. We have been invited to use the land owner's field and should treat it with respect. Any team caught throwing trash on the ground anywhere will be disqualified from the competition and the school will be notified of the disqualification. The landowner can order the team to leave the property and enforce the order.
10. No student or team drones or flying vehicles are allowed.

Appendix B Presentation Recommendations

The following recommendations for presentation content and layout are being provided based on past experiences of the judges. These recommendations are not required to be followed but make it easier for the judges to review the material presented.

1. Use a consistent table format throughout the various subsystems when presenting requirements, component trades, and changes since previous reviews. Using a standard table format makes it easier for the judges to find the information in the table quickly since all tables are formatted the same.
2. During the PDR, the Changes Since PDR slides should use a table that contains a discussion of what the state of the design was at PDR, what it is at PDR, and what the rationale of the change was. Details of the change can be discussed in subsequent slides so an in-depth discussion is not always necessary.
3. Include the class year (freshman, sophomore, etc.) and major of each team member for reference. This doesn't play into the scoring of the team, however, it is often nice for the reviewer to know the status of the team members.
4. Be sure to follow the PDR and PDR outlines very carefully. Provide at least one chart for each scored item in the outline; this makes it easier for the judges to follow the presentation and confirm the required information is provided. In the presentation, be sure to address the questions and topics listed in the "description" column of the presentation outline -- those are the key points the judges are looking for.
5. Be clear which optional requirements, if any, are to be included in the design.
6. Be detailed in test descriptions. Identify specific tests, what is going to be done, and the pass/fail criteria.

Appendix C Payload Deployment Description

The CANSAT will be mounted inside payload section airframe which is above the of the motor. No part of the CANSAT is exposed to the outside, but several small holes will be installed in the payload section so that the pressure inside the payload will be the same as the external pressure.

The CANSAT will be deployed by a black powder charge when the rocket is at the top of the flight. The rocket will experience between 10 to 20 Gs of acceleration when under thrust and the CANSAT may momentarily experience 30+ Gs of acceleration when the ejection charge fires.

Appendix D Acronyms

A	Analysis
CONOP	Concept of Operations
D	Demonstration
DCS	Descent Control System
FRR	Flight Readiness Review
GCS	Ground Control Station
HW	Hardware
HWR	Hardware Review
I	Inspection
LCO	Launch Control Officer
PDR	Prototype Design report
PFB	Pre-Flight Briefing
PFR	Pre Flight Review
RPM	Revolutions Per Minute
RSO	Range Safety Officer
SOE	Sequence of Events
T	Test
TBD	To Be Determined
TBR	To Be Resolved
VM	Verification method

Appendix E Definitions

Analysis	Verification method that utilizes evaluation of data generated by accepted analytical techniques or simulations under defined conditions to show the item will meet the specified requirements.
PDR	A multi-disciplined technical review to ensure that the system under review can proceed into system fabrication, demonstration, and test; and can meet the stated performance requirements within cost (program budget), schedule (program schedule), risk, and other system constraints.
CONOP	Describes what the system will do and the way the system works from the operator's perspective. The CONOP is a high level description that should include a top-level block diagram.
Demonstration	Verification method that utilizes a qualitative exhibition of functional performance, usually accomplished with no or minimal instrumentation.
Inspection	Verification method that utilizes an examination of the item against applicable documentation to confirm compliance with requirements.
Need Date	Latest date a component or element (software, etc.) must be received or completed in order to not impact the end completion date.
PDR	A Prototype review of the CANSAT design and the initial estimates of the cost (program budget), schedule (program schedule), and CANSAT construction..
Shall	Verb used to indicate a requirement is binding. All shall statements require verification.
Should	Verb used to define a goal or non-mandatory provision.
Test	Verification method utilizing operation of all or part of the item under controlled conditions, either real or simulated, to determine that the quantitative design or performance requirements have been met.
To Be Determined	An item or parameter that has not been specified at the time of document release.
To Be Resolved	An item or parameter that is preliminary or uncertain at the time of document release and for which a final value is to be specified at a later time.
Validation	Confirms that the system, as built (or as it will be built), satisfies the user's needs. Confirmation you built the right thing.
Verification	Confirms that the system, its elements, its interfaces, and incremental work products satisfy their requirements. Confirmation you built the system right.
Will	Verb used to reference a binding or hard requirement elsewhere in the document text.

Appendix F - Payload Section

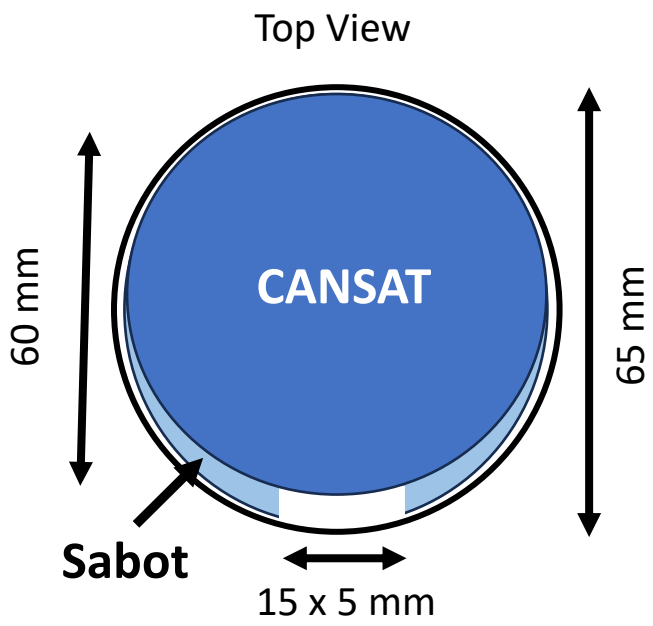
This information is provided to allow teams to build a test rocket payload section.

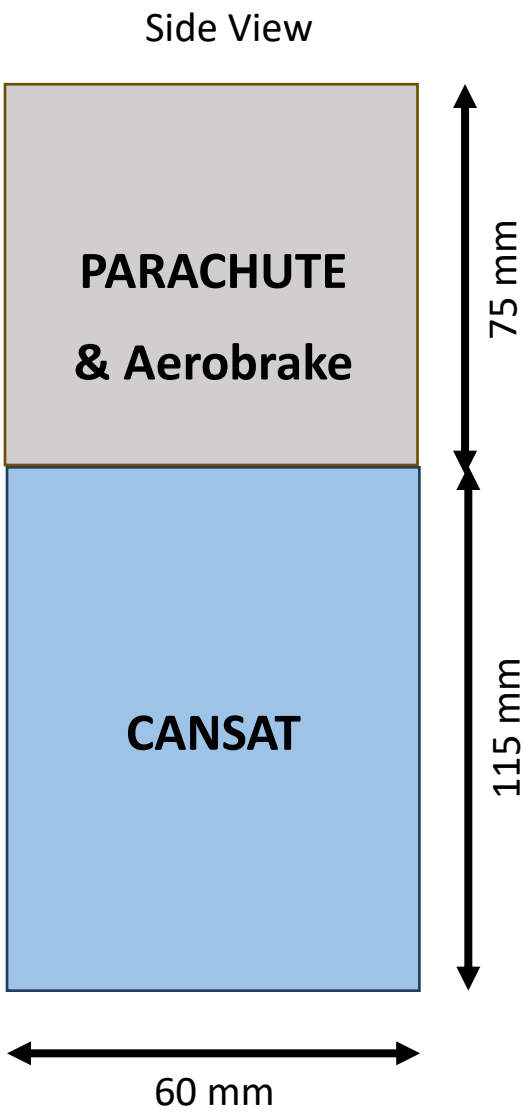
The payload section consists of a minimum 750 mm long fiberglass airframe tube, a coupler that slides into the air frame, a bulkhead plate and an eyebolt.

The bottom of the payload section is the motor. Between the motor and the coupler is where the CANSAT is inserted. The base of the payload section is the opposite end where the coupler is secured and the bulk plate is secured with the eyebolt.

The CANSAT must be able to fit inside the airframe tube which has an internal diameter of 65 mm. The CANSAT must allow for a cord of 15mm by 4mm to pass from above the CANSAT to below it. The maximum length of the CANSAT shall be 115mm and the CANASAT can have an addition section up to 55mm for housing a parachute or other recovery device.

Please note, a CANSAT with a diameter of 60mm will meet the requirements for fitting inside the airframe. A sabot (holder) can be supplied that will hold a 60mm CANSAT in the tube. with the correct dimensions.





Appendix G

Competition Calendar

For Provisional Launch Date - 7 September 2025

Date	Action
7 APR 25	Provisional Competition Guide is posted.
28 APR 25	Application is open to teams.
20 MAY 25	Applications close at 11:59 pm
18 JUL 25	DCR documents due by 11:59pm
21 JUL – 25 JUL 25	DCR Presentations
29 AUG 2025	PFR Documents due by 11.59
1 SEP – 5 SEP 2025	PFR presentations
7 SEP 2025	Provisional Launch Date (Weather permitting)
14 SEP 2025	Provisional Reserve Launch Date (Weather permitting)
13 & 14 SEP 2025	Final Project Reviews
8 & 9 OCT 2025	Final Project Reviews – Reserve Dates
15 SEP 2025	Awards
10 OCT 205	Awards – Reserve date