SapSat Competition Guide 2025

Reentry Probe

1. Introduction

The SatSap competition is a design-build-fly competition that provides teams with an opportunity to experience the design life-cycle of an aerospace system. The SatSap competition is designed to reflect a typical aerospace program on a small scale and includes all aspects of an aerospace program from the preliminary design review 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 will be scored on real-world deliverables such as schedules, design review presentations, and demonstration flights.

1.1 Competition Description

The competition is divided in 4 simple phases:

Phase 1 is the *PDR*, each team shall develop a design to fulfill all the mission tasks and objectives, to succesfully complete phase 1 the teams shall redact a (PDR) *Preliminary Design Review* document, using the provided Template.
Slide will only be accepted in a PDF format.
The judges will evaluate the contents of the document, it will be reviewed for completeness and potential errors, if the document is accepted by the judges a time slot will be scheduled to discuss the document. Each team shall present the contents of the document in a 30 min time window.
If the document is deemed insufficient the team will be asked to submit a better one.
Once the PDR is completed teams will move directly to the prototyping phase, where each design proposed design shall be implemented until a full prototype is complete.
If major design changes appear during this phase, the team shall write a brief document (*CDR*) *Critical Design Review*, containing only the major changes of the original design.

Phase 2 Finally to move to the launch phase the team shall pass the enviromental tests.
The SapSat built by each team must survive 3 tests:
Vacuum Test, Drop Test, Fit Test

Phase 3 Launch day

Phase 4 is the Post Flight Review (PFR), it is a 15 minute presentation of the flight results and 5 minutes for questions.

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.

2. Mission Overview

Design a SapSat that consists of payload for a rocket. The payload shall deploy from the rocket when the rocket reaches peak altitude and the rocket motor ejection forces a separation.
The payload shall descend at a rate of no more than 20 meters/second deploying an heatshield that automatically deploys at separations.
At 200 meters the payload release a parachute and the descend rate shall be 5 meters/second.

The SapSat shall collect sensor data during ascent and descent in an SD card.

The sensor data shall include interior temperature, battery voltage, altitude, acceleration, rate, angular rate, magnetic field.

Bonus tasks:
- The SapSat shall collect sensor data during ascent and descent in an external memory (no SD).
- The SapSat trasmit telemetry to the ground station.
- A video camera shall show the descend of the payload.

3. Score Evaluation

The work will be evaluated by judges using a score associated with various aspects of the mission, such as:

- PDR
- Presentations
- Environmental tests
- Launch
- Post flight review
- Nice name
- Bonus

4. Requirements

Operational Requirements

Requirement Number	Requirement
1	Total mass of the SatSap shall be 500 grams +/- 10 grams.
2	SapSat shall fit in a cylindrical envelope of 90 mm diameter x 300 mm length. Tolerances are to be included to facilitate container deployment from the rocket fairing.
3	The payload shall not have any sharp edges to cause it to get stuck in the rocket payload section which is made of cardboard.
4	The probe shall be solid and fully enclose the science probes. Small holes to allow access to turn on the science probes are allowed. The end of the probe where the probe deploys may be open.
5	The rocket airframe shall not be used to restrain any deployable parts of the SapSat.
6	The rocket airframe shall not be used as part of the SapSat operations.
7	0 altitude reference shall be at the launch pad.
8	All structures shall be built to survive 15 Gs of launch acceleration
9	All structures shall be built to survive 30 Gs of shock
10	All electronics and mechanical components shall be hard mounted using proper mounts such as standoffs, screws, or high performance adhesives.

Requirement Number	Requirement
11	All mechanisms shall be capable of maintaining their configuration or states under all forces.
12	Mechanisms shall not use pyrotechnics or chemicals.
13	Mechanisms that use heat (e.g., nichrome wire) shall not be exposed to the outside environment to reduce potential risk of setting vegetation on fire.
14	The probe shall be labeled with team contact information including email address.
15	Cost of the SapSat shall be low. Ground support and analysis tools are not included in the cost. Equipment from previous years shall be included in this cost, based on current market value.
16	The probe shall include an easily accessible power switch that can be accessed without disassembling the cansat and science probes and in the stowed configuration.
17	The shall include a power indicator such as an LED or sound generating device that can be easily seen or heard without disassembling the cansat and in the stowed state.
18	An audio beacon is required for the probe. It shall be powered after landing.

Requirement Number	Requirement
19	An easily accessible battery compartment shall be included allowing batteries to be installed or removed in less than a minute and not require a total disassembly of the SapSat.
20	If spring contacts are used for making electrical connections to batteries, make sure they do not disconnect. Shock forces can cause momentary disconnects.
21	The SapSat shall operate during the environmental tests .
22	The SapSat shall operate for a minimum of one hour when integrated into the rocket.
23	The probe shall release after the apogee.
24	The probe shall deploy a heat shield after leaving the rocket.
25	The heat shield shall be used as an aerobrake and limit the descent rate to 20 m/s or less.
26	At 200 meters, the probe shall release a parachute to reduce the descent rate to 5 m/s +/- 1m/sec
27	The probe telemetry shall include altitude, internal temperature, battery voltage, rate, angular rate, acceleration, magnetic field.
28	The SatSap shall have a funny name, inspired by an animal. (exp: ParaonoidSalamander, MeticolousFerret, TiburonBorracho) the coiche of the name and language shall be explained in detail to the jury

3.3 Environmental Tests

Four 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. Only one submission will be accepted. Late submissions will not be scored.

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 61cm 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. Holding any part of the test structure is not valid.

    b. Drop Test Procedure:

        i. Power on SapSat.
        ii. Raise SapSat by the attached cord, so that the attachment points of the cord, on the eye bolt and the parachute, are at the same height.
        iii. Release the SapSat.
        iv. Verify the SapSat did not lose power.
        v. Inspect for any damage, or detached parts.
        vi. Verify telemetry is still being received.
        vii.

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 5 gallons or 18+ litres. A lid can be used or a ¼ inch or 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 SapSat 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 SapSat.
    v. Make the saved telemetry available for the judges to review.
    vi. Show in video that all mechanisms activated based on altitude changes.

5 Deliverable documents

Material Due	Required Filename Format	Due Date
PDR	SapSat2024_XXXX_pdr_vYY.pdf	End of December
CDR	SapSat2024_XXXX_cdr_vYY.pdf	On a case to case basis*
EnvironmentalTest Document	SapSat2024_xxxx_env.pdf	Before launch
FlightTelemetryData	Flight_XXXX_.csvforScience Payload.	After launch
PFR	Cansat2024_XXXX_pfr_vYY.pdf	After launch

XXXX is the team number. YY is the revision number. Use this file format or your team will be removed from the competition. Files are to be in PDF format. No other formats will be accepted. Any submission after the deadline will be ignored.

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

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:

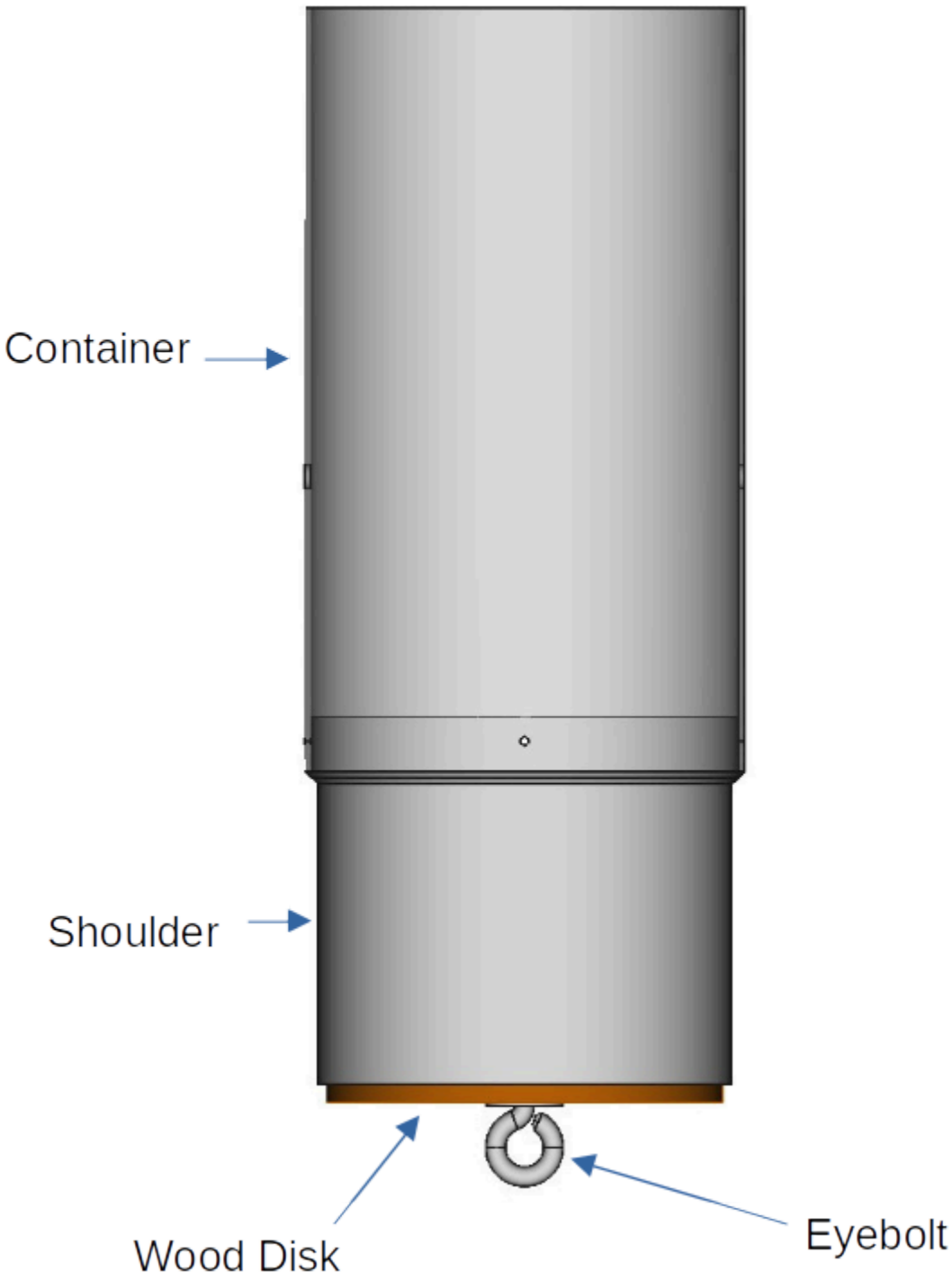
Mission Control Officer - This is a single person who is responsible for managing the team at the time of the launch. This person must verify with the ground station crew everything is ready. This person will do the countdown starting at 5. The rocket will be launched after the count reaches 1.

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.

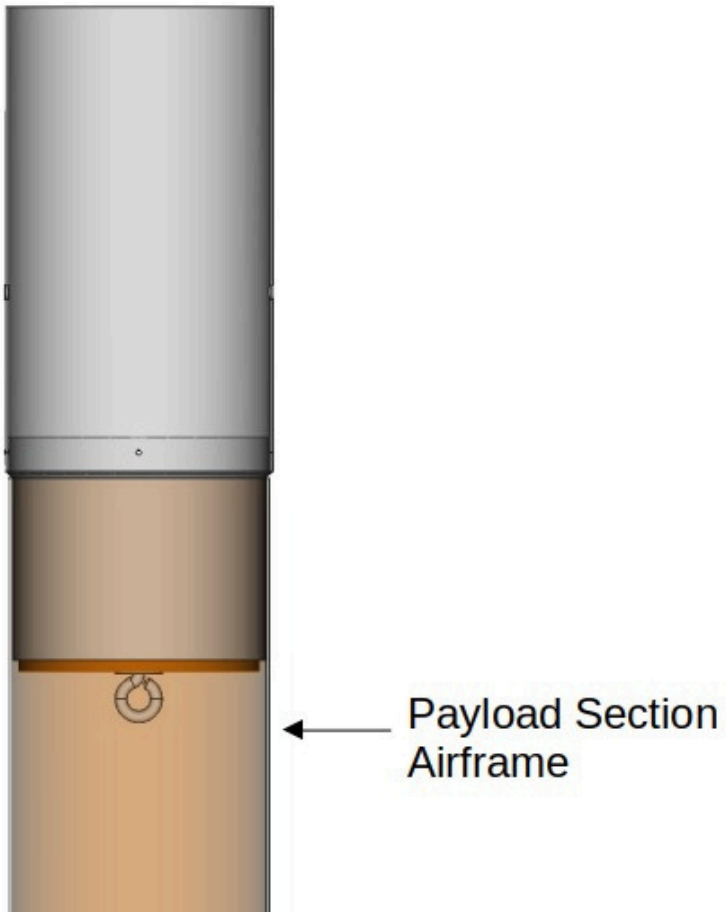
Recovery Crew - This is one or two persons only responsible for tracking the Cansat and going out into the field for recovery. The recovery crew is responsible for returning the Cansat to the judges at check-in with any required payload still inside. The Cansat cannot be disassembled before presenting 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.



Container Design



Container Installed in Payload Section of Rocket

Link to the rocket kit:

https://locprecision.com/collections/rocket-components/products/payload-bays?variant=39778637545663