CanSat Regulations at ARLISS

Constituted by UNISEC-Japan and UNISEC Student Organization (UNISON)

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Contents

1 Regulations for all CanSat at ARLISS

All CanSats at ARLISS shall follow this section's regulations.

1.1 Configuration

The CanSat shall meet the mass and size requirements listed in Table 1 at launch. This includes all appendages such as parachutes. In addition, the CanSat should be easily released out of the cylindrical carrier. Modifying of the carrier is prohibited. Nothing should be left in the carrier.

1.2 Countermeasures against lost

The CanSat shall be trackable and locatable at all times after it has been released from the rocket. Any parts of CanSat should not be left in the desert after the mission.

Table 1: Restrictions of CanSat mass and size (including all appendages)

Class	Mass	Size
Open Class	1050 g or less	Diameter: 146 mm or less Height: 240 mm or less
350-ml Class	350 g or less	Diameter: 66 mm or less Height: 240 mm or less

1.3 Deceleration mechanism

The CanSat shall descend near the ground at the following terminal velocities.

Terminal velocity: 4 – 6 m/s

1.4 Strength against launch load and parachute opening shock

The CanSat shall maintain its functionality after experiencing launch load and parachute opening shock. These loads comprise the quasi-static load, vibration, and shock. Tests should be conducted in all cases. The following are only recommended test conditions. Each team should perform the test under the conditions appropriate for them.

Recommended test conditions

Load direction: vertical

Quasi-static acceleration: 10 G, 10 sec

Sinusoidal sweep : 15 G from 30 Hz to 2000 Hz, or equivalent random vibration

Shock load: 40 G

Load direction: depends on the way of fitting the parachute

Shock load: 50 G

1.5 Wireless communication device setting at the time of launch

The CanSat shall stop transmitting radio waves off with either software control or hardware switch while it is mounted on a rocket.

1.6 Radio channel adjustment

All wireless communication device(s) used in the project shall be able to change frequency channels. A team that uses wireless communication device(s) should submit the communication device specifications including frequency to the ARLISS coordinators. The ARLISS coordinators arrange the wireless communication device settings between all teams; all the teams must obey the adjustment.

Note:

During the ARLISS period, around the launch site in Black Rock Desert will be a special district where any kind of radio frequency is available. Therefore, it is possible to use wireless communication devices which are not certified by the FAA. However, it is unacceptable for the team which failed the quality examination to launch a rocket.

1.7 Maintenance after loading

The CanSat shall be designed to perform its mission without requiring any maintenance after being loaded onto the launch vehicle. In particular, The CanSat should be able to provide enough power to carry out its mission. A enough power is calculated taking into account the following note.

Note:

After the CanSat is packed for launch, a regulation check is carried out. Next, the CanSat is load in the launch vehicle. There may be a waiting period of several hours between a regulation check and load in the launch vehicle, depending on the launch vehicle status and weather. During this period, the CanSat undergo a re-regulation check if its battery is replaced. Once a CanSat is stored in the launch vehicle, it cannot be unloaded. However, the following situations are excluded. If the weather suddenly changes after the CanSat has been stored in the carrier, and the launch has not been performed for more than one hour.

1.8 Loaded item

The CanSat shall not carry any items designated as Hazardous Materials under the Japanese Fire Service Act. lithium polymer batteries and lithium ion batteries are excluded. However, measures against over-discharge and over-charge should be taken.The CanSat shall be designed to prevent liquid leakage.

1.9 FAA rules

The CanSats shall land on the ground by parachute. During this time, the CanSat is not permitted to provide induction, whether automatic or manual. In addition to this, the CanSat that takes off and flies after landing should meet the additional regulations for UAS given in Chapter 3.

2 Additional regulations for Comeback Competition at ARLISS

The CanSat entering Comeback Competition shall be follow this section's regulations.

2.1 Autonomous control

The CanSat shall be completely autonomously controlled. Two-way communication (up-link and/or down link) between a ground station and a CanSat is permitted as long as there is no human intervention on both sides.

2.2 Control record submission

The team shall submit the control record of the CanSat by the deadline set by the ARLISS conductor. The control record consists of the following two files, both of which should be submitted. All times shall be stated in local time (PDT, GMT-7h in Sep.).

2.2.1 A visualized control record

A visualized control record should contain the trajectory and control command vector visualized. Figure 1 shows an example of a visualized control record.

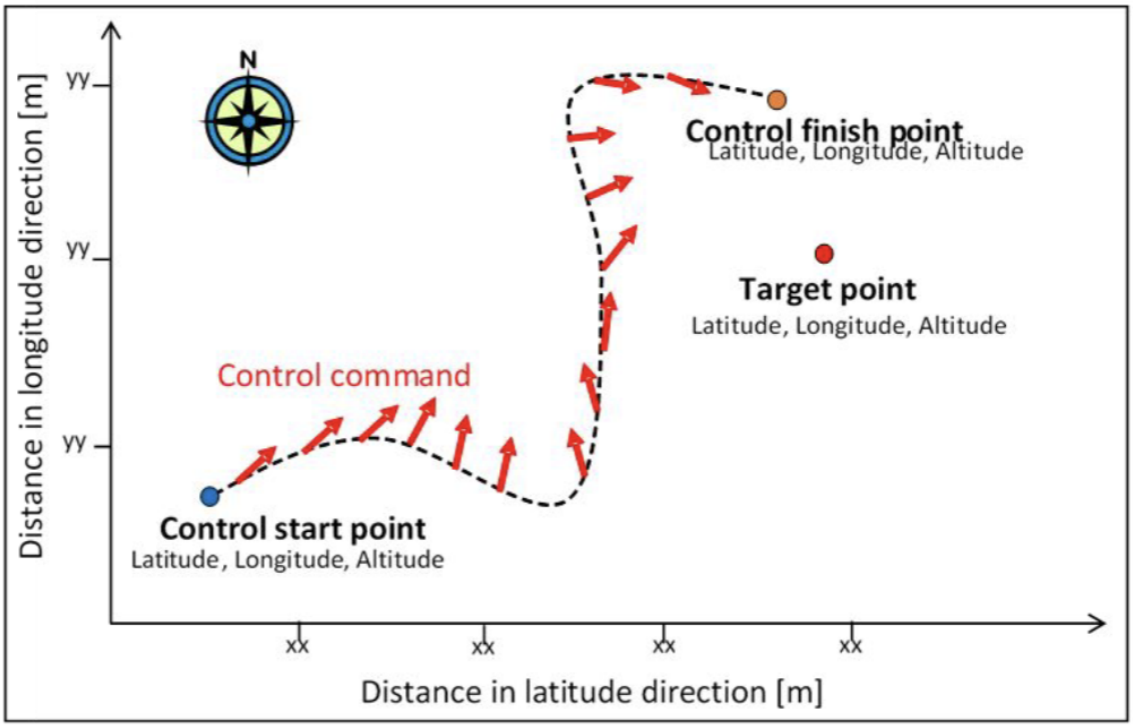

Figure 1: A visualized control record

2.2.2 A control record report

A control record report consists of the following items.

1. Brief description of the control algorithm
2. Time and position at which control was initiated

3. Time and position at which the control ended

4. All control history

The following is an example of a control record report. Submissions in Japanese as well as English are permitted.

Brief description of the control algorithm:
This CanSat is controlled using the relative positions of the current location and the goal. The data used are the current position acquired using the GNSS receiver, the pre-set goal information, and the azimuth angle that the CanSat is facing, acquired from the magnetic field sensor. Using these, the CanSat determines its travel time and direction of travel. By repeating this process several times, the CanSat travels autonomously to the goal.

Time and position at which control was initiated:
11:32:10(PDT), N40.873930, W119.104668

Time and position at which the control ended:
11:55:16(PDT), N40.900490, W119.079100

Time	Travel	Direction
11:32:10	30 sec	10 deg
11:32:40	30 sec	5 deg
11:33:10	30 sec	2 deg
11:33:40	30 sec	-3 deg
11:34:10	30 sec	0 deg
11:34:40	30 sec	-1 deg
:	:	:

2.3 Information for Comeback Competition

2.3.1 Launch opportunity

The results of the first two launches are recorded. Additional launch results are also recorded if the ARLISS conductor approves, e.g., due to rocket launch problems.

2.3.2 Goal

AeroPAC prepares the goal for ARLISS every year. For your reference, the goal of ARLISS 2022 is the picture below.

Figure 2: The goal of ARLISS 2022

2.3.3 Measuring distances

The distance from the center point of the goal cone to the nearest point of the CanSat is the result. If the CanSat and the goal cone are in contact, it is recorded as 0.00 m. The CanSat to be measured should be a controllable part. For example, separated objects such as strings or balls are not subject to measurement.

3 Additional regulations for UAS at ARLISS

Small unmanned aircraft means an unmanned aircraft weighing less than 55 pounds on takeoff, including everything that is on board or otherwise attached to the aircraft.[1]
All CanSats that are considered UASs shall follow this section's regulations.

3.1 Registeration for FAA

The CanSat that is considered as UAS shall be FAA register. FAA register should be obtained by the team and submitted on request by the ARLISS conductor.

3.2 Flight altitude

The CanSat that is considered as UAS shall not go any higher than an altitude of 400 ft.

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[1] 14 CFR Part 107 §107.3, https://www.ecfr.gov/current/title-14/chapter-I/subchapter-F/part-107