

2023 Argonia Cup

SUMMARY

The goal for the 2023 Argonia Cup competition is to launch a two-stage rocket powered vehicle containing one golf ball payload in the sustainer to a sustainer altitude in excess of 9,000' AGL and to recover the payload safely to a predetermined location on the rocket range.

RULES

1. There must be at least one (1) TRA certified Level 2 member per team. This team member must be present at the competition and will be considered the flyer of record of the rocket. All team members must currently be enrolled at the competing university or college. Multiple teams from the same university or college are permitted.
2. The maximum installed impulse for this competition will be 5,120 Newton Seconds. All motors must be certified. Spark emitting motors (Skidmark type motors) are prohibited.
3. Any deployable payload shall limit the descent velocity to less than 30 FPS below 300' AGL.
4. Any propulsion/steering system designed to recover the payload cannot be used to boost the payload to the target apogee.
5. A commercially available, altitude recording altimeter with onboard data storage shall be used for altitude determination and may be used for payload deployment and/or rocket recovery. If two or more altimeters are used, the averaged apogee height of each altimeter will be used for determination of rocket apogee.
6. Ignition of the sustainer motor will utilize commercially manufactured electronics capable of inhibiting sustainer ignition if the flight is not vertical. See sustainer Motor Inhibit Logic section below for details.
7. Launch vehicles shall be launched at an elevation angle between 83 and 85 degrees (5 to 7 degrees off vertical). All flights will be angled away from the flight line regardless of wind direction.
8. All flights must have a minimum of a 5:1 thrust to weight ratio at liftoff.
9. Launch configuration flight stability shall be achieved by maintaining a minimum CP/CG static margin of no less than 1 body caliber during flight.
10. Apogee must occur at or above 9000' AGL (field elevation is approximately 1249' MSL). Any flight not reaching this altitude will be disqualified. Each team may make up to three flight attempts with the closest qualified landing score being their official flight.
11. All launch vehicle components must be recovered in a "re-flyable condition" after flight.

SUSTAINER MOTOR INHIBIT LOGIC

Sustainer motor ignition will be inhibited in the event the flight is not vertical. This can be done in one of two ways.

1. Use flight computers capable of inhibiting sustainer motor ignition based on tilt angle.
 - Examples include the Altus Metrum Telemega and EasyMega. Other devices also exist which can sense tilt angle and use this information as a check prior to igniting the upper stage.
 - The following logicals should all be true before firing the upper stage:
 - Tilt angle less than 22 degrees.
 - Velocity greater than 400 ft/sec
 - Time since liftoff less than (intended staging time + 4 sec)
 - Altitude greater than (65% of the intended staging altitude)

2. Time/altitude lockout

- Devices without tilt measurements are allowed, but should follow the following guidelines:
- Velocity greater than 500 ft/sec
- Time since liftoff less than (intended staging time + 3 sec)
- Altitude greater than (75% of the intended staging altitude)

The sustainer recovery system should be sized to allow a safe descent of the sustainer in the event that it does not ignite. Keep in mind that unburned propellant will make the rocket heavier. A descent rate of no more than 35 ft/sec will be allowed under the main parachute with an unburned rocket motor.

Teams will be required to submit sustainer ignition logic information for approval 30 days before the competition.

VIDEO

Each team will be required to produce a video (six (6) minutes or longer, hosted on YouTube) introducing each member of the team and providing a detailed overview of the project with an emphasis on the payload recovery system. This video must be submitted to the launch organizers on or before March 10, 2023.

LAUNCH OPERATIONS

1. TRA Unified Safety Code will be followed for all launch activities.
2. The launch organizers will provide all launch pads, launch rails, and the launch control system. All rockets must utilize 1.5" x 1.5" (commonly known as 1515) rails. The rails provided will be 12' in length. A minimum of two (2) rail guides must be used.

3. All rockets will be subjected to a rocket safety inspection before the teams will be cleared to fly their projects. Any safety of flight issues noted in this inspection will be resolved before flight. These safety inspectors have the final say regarding any project's suitability for flight.

SCORING

Prior to the start of any launch activities, the location of the landing target will be clearly marked and will be available for inspection by the competing teams. The landing target will be established by the launch organizers and will be within line-of-site and not more than 300' from any launch pad location. At the completion of each flight, the distance from the center of the payload to the center of the target will be measured by the launch organizers before the teams are allowed to remove their payloads. The point of initial touchdown will be used if it can be determined in the event of the payload skipping across the surface. The winner will be the team with the highest contest altitude

The final score will be determined using the following formula:

Contest Altitude = Sustainer altitude (in feet) – (the payload landing distance from the target (in feet) times 20).