2023 STUDENT ROCKET LAUNCH PROGRAM

Request for Payload Proposals

ULA

Ball

Calling K-12 Rocket Scientists!

The Student Rocket Launch is an annual event presented by United Launch Alliance (ULA) and Ball Aerospace. It provides a unique educational opportunity to students from kindergarten through graduate school. The event offers participants hands-on experience designing and building their own payloads (devices, objects, experiments, instruments, etc.) to fly on three high-power sport rockets, which are built by ULA interns. The 2023 launch is planned for July in Pueblo, Colorado.

Program Objectives

- Provide students hands-on design, analysis, build, test and engineering experience
- Allow students and interns to be involved in launching rockets
- Provide a fun and enriching experience that inspires students to pursue careers in science, technology, engineering, arts and math (STEAM)

We encourage all participants to attend the launch. Check out a video of a recent launch.

Plans for 2023 Launch

Sport Rockets Launch with Payloads

- ULA interns will build three high-power sport rockets that will fly approximately 5,500 feet above ground level.
- K-12 student teams based in the United States have an opportunity to design and build payloads to launch on the sport rockets.

Payload Design Process

- K-12 student teams will provide payload design proposals for possible launch on a rocket. These payloads may serve any purpose within the guidelines included with this request for proposals (RFP).
- ULA will select payloads to be integrated and flown on a high-power sport rocket.
- All payload teams will participate in a series of design reviews and will be scored on a rubric provided to the teams in advance. The three highest scoring teams will earn donations for their school or other associated nonprofit. Teams outside of the top three who launch their payloads will be entered into a drawing for a small cash donation to their nonprofit.

Wanted

- Elementary, middle and high school student teams interested in designing and building a payload.
- Teams should be led by a teacher or mentor associated with the school or organization.
- ULA or Ball Aerospace employees will mentor teams as needed.

Important Dates

- ASAP: Teams should notify studentrocketlaunch@ulalaunch.com of their intent to participate
- January 23, 2023*: Team leaders submit a simple payload proposal to ULA
- January 30, 2022: ULA notifies teams of their status
- Mid May 2023: Critical design review with ULA executives and program team
- Mid June 2023: ULA check-in to review payload production process, and ensure design is suitable for integration with launch vehicle.
- July 10, 2023**: Fit check and open house at ULA warehouse in Centennial, Colorado (outside of Denver)
- July 15, 2023**: Planned launch

See the proposal form for detailed instructions about how to participate.

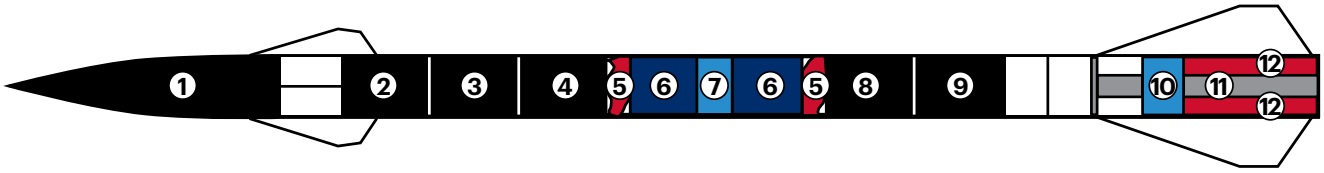
* Please notify ULA if your team is unable to provide a RFP on this date, and we will try to accommodate.
** Dates are tentative, ULA will notify teams when dates are finalized

Design Overview

No. of Payloads: 6 per rocket
No. of Rockets: 3
Height: 19.6 ft

Engine: 1 x CTI 03400
• **Average Thrust:** 768 lbf
• **Burn Time:** 6.16s
Expected Flight Time: 107s

Expected Altitude: 5,500 ft above ground level
Static Margin: 1.95



1 Ball, STEM, and/or partner payload area
2 Payload 1
3 Payload 2
4 Payload 3
5 10-ft Parachutes
6 Chute Piston
7 Payload Avionics
8 Payload 4
9 Payload 5
10 Engine Bay Avionics
11 Engine
12 Drogue Chutes

Figure 1

2023 K-12 Payload Accommodation Plan

The 2023 intern-built rockets will carry payloads inside the three nose cones and rocket bodies. Teams submitting for this RFP will have their payloads integrated into the rocket bodies, noted as payloads 1-5 in Figure 1.

Payload Accomodation

Payloads must fit inside a tube that is 11.4 inches in diameter by 7 or 14 inches long. (Figure 2). ULA will provide phenolic-reinforced cardboard tubes; they are open-ended cylinders. All payloads will be ejected out of the rocket. ULA will provide the tubes in spring 2023. Payloads must provide their own parachutes, which must fit inside the payload tube with the payload (see supplement for useful details relating to parachutes).

Payload Tube Specifications

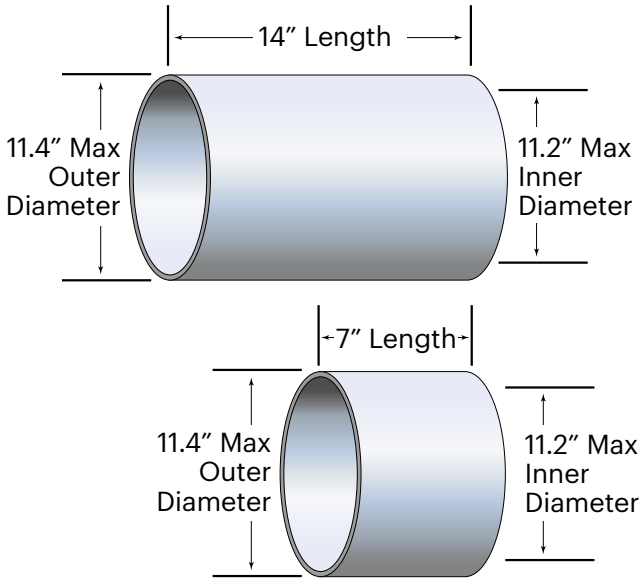


Figure 2

Teams must include estimated dimensions (length, width and height) for their payload in inches. Teams should consider possibility of sharing their payload tube with another team's payload – known as "rideshare." ULA will determine payload tube size for each team during RFP decision phase and coordinate rideshare opportunities.

Teams can use the payload tube in several ways. For instance:

- The tube can be used as the outer structure of the payload, i.e., items can be attached to the inside of payload tube.
- The tube can be split into two 180-degree half shells that surround and protect the payload during jettison and then fall away after payload deployment.
- ULA will provide GPS trackers that payload teams must integrate into their system.

Payload Requirements

To be filled out by team leader, not required for submitting your application.

Requirements	Compliance
Payloads shall not utilize any active aerial control systems. If payloads utilize passive control systems, they shall descend in a predictable flight path	☐
Payloads shall not include live animals, explosives, flammable liquids, bio-hazards or nuclear materials	☐
Payloads shall be able to deploy from rockets	☐
Payloads shall be sturdy enough to withstand 10Gs. Suggested test: drop your payload from a height of 10 inches onto a 0.5 inch thick carpeted floor in several positions	☐
Payload shall fit in appropriate tube	☐
Payload shall be able to be in the rocket for 120-180 minutes before launch without access. Suggested test: test battery life, power life, and temperature up to 130 degrees	☐
If payload plans to transmit RF, transmissions shall be coordinated with ULA	☐
Payload shall include a descent mechanism to descend at less than 20 miles per hour	☐
If payload includes liquid, the payload cavity shall remain liquid proof, and liquids shall be in the payload cavity	☐
If payload is in a 14" tube, the mass shall be below 8.6 lbs. If payload is in a 7" tube, the mass shall be below 4.3 lbs.	☐
Teams shall complete a critical design review with ULA prior to the launch, currently planned for May 2023. Students shall present at the design review and provide a self-assessment	☐
Payloads shall be able to be in any position within the airframe, as they are randomly assigned	☐
Payloads shall not include sharp edges	☐
Teams shall be made up of K-12 students	☐

ADDITIONAL CONSIDERATIONS

- Collaborative team projects are prioritized over individuals.
- Mentorship is encouraged; however, the majority of the design and construction of the payload must be conducted by students.
- ULA reserves the right to alter the criteria or disqualify any team at any time for ignoring these requirements or failing to meet the educational spirit of this competition.

Rocket Technical Specs

Height: 19 ft, 6 in (5.94 m)
Width: 11.7 in (30 cm) diameter
Liftoff Mass: 225 lbs (102.1 kg)
Initial Thrust: 1,067.9 lbs (4,750.3 N)
Average Thrust: 768.1 lb (3416.7 N)

Total Impulse: 21,062 N-s (4735 lb*sec)
Performance: 0 to 325 mph in 5 sec (0 to 523 kph in 5 sec)
Altitude Target: 4,200 ft (1280.2 m)
Liftoff Forward Axial Accel.: 5 Gs

Program Objective and Payload Competition

The goal of the Student Launch Program is to encourage students to design, build and operate a payload that is deployed from one of the intern-built rockets.

Judging will be based on a rubric that considers the design phase, testing phase and the payload performance. Winners will be selected based on a weighted total score with detailed factors and weighting to be announced. The rubric will be provided to all teams so everyone will understand the grading scheme. The top three scoring teams will earn a cash donation for their school or other associated nonprofit.

Prizes

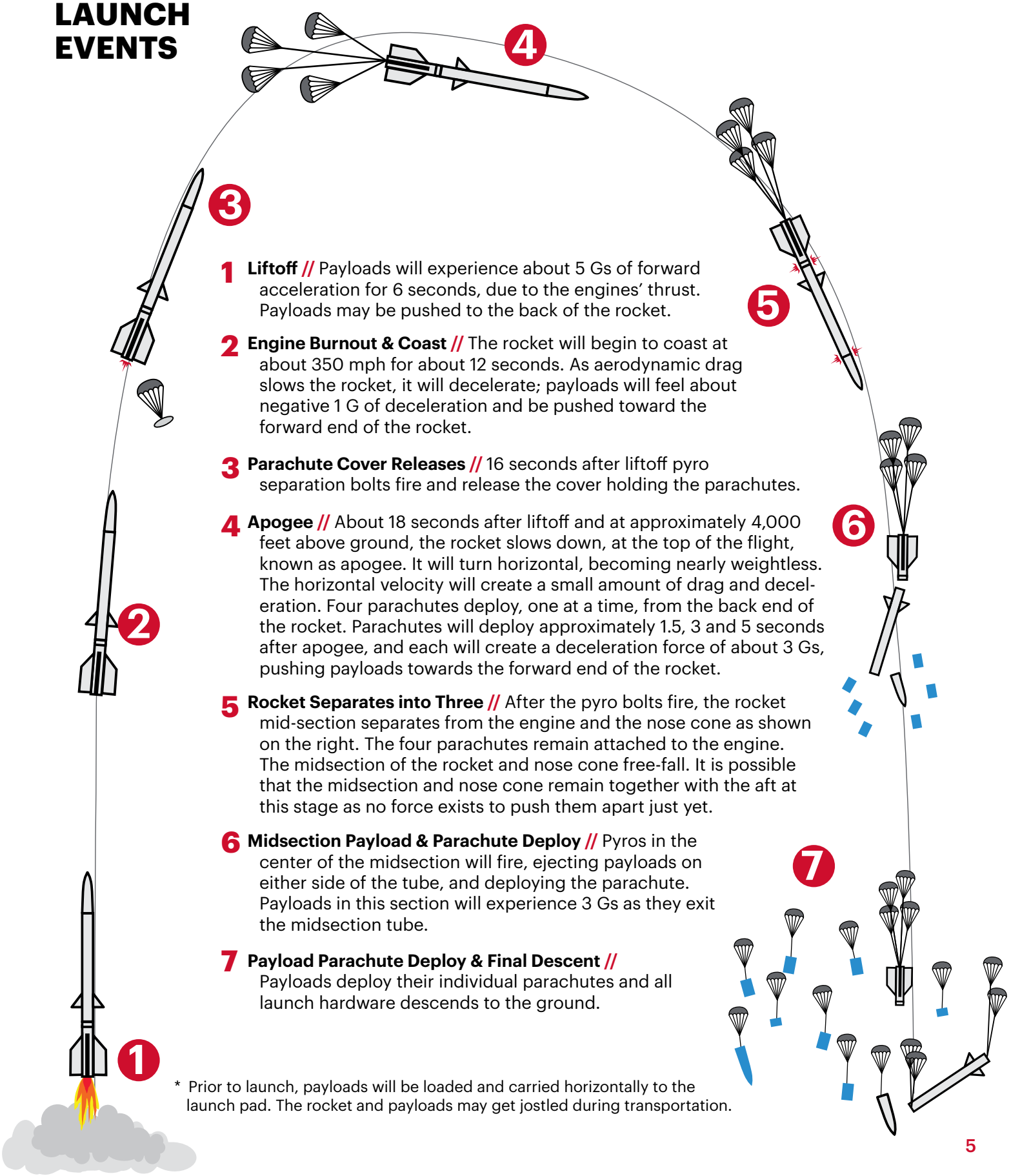
Qualifying teams that provide a payload to fly on the day of launch will be entered in to a drawing, and five teams will receive a cash donation for their school or other associated nonprofit.

Students groups must provide proof of nonprofit status to receive donations. Groups who are unable to provide non-profit status will win a ULA-branded prize pack.

Questions

We are here to help and encourage questions! Send them to StudentRocketLaunch@ulalaunch.com. We will do our best to communicate with all teams the responses to any questions or concerns associated with the launch or competition that are relevant to all.

LAUNCH EVENTS



1 Liftoff // Payloads will experience about 5 Gs of forward acceleration for 6 seconds, due to the engines' thrust. Payloads may be pushed to the back of the rocket.

2 Engine Burnout & Coast // The rocket will begin to coast at about 350 mph for about 12 seconds. As aerodynamic drag slows the rocket, it will decelerate; payloads will feel about negative 1 G of deceleration and be pushed toward the forward end of the rocket.

3 Parachute Cover Releases // 16 seconds after liftoff pyro separation bolts fire and release the cover holding the parachutes.

4 Apogee // About 18 seconds after liftoff and at approximately 4,000 feet above ground, the rocket slows down, at the top of the flight, known as apogee. It will turn horizontal, becoming nearly weightless. The horizontal velocity will create a small amount of drag and deceleration. Four parachutes deploy, one at a time, from the back end of the rocket. Parachutes will deploy approximately 1.5, 3 and 5 seconds after apogee, and each will create a deceleration force of about 3 Gs, pushing payloads towards the forward end of the rocket.

5 Rocket Separates into Three // After the pyro bolts fire, the rocket mid-section separates from the engine and the nose cone as shown on the right. The four parachutes remain attached to the engine. The midsection of the rocket and nose cone free-fall. It is possible that the midsection and nose cone remain together with the aft at this stage as no force exists to push them apart just yet.

6 Midsection Payload & Parachute Deploy // Pyros in the center of the midsection will fire, ejecting payloads on either side of the tube, and deploying the parachute. Payloads in this section will experience 3 Gs as they exit the midsection tube.

7 Payload Parachute Deploy & Final Descent // Payloads deploy their individual parachutes and all launch hardware descends to the ground.

* Prior to launch, payloads will be loaded and carried horizontally to the launch pad. The rocket and payloads may get jostled during transportation.

2023 Payload Proposal Form

To build a payload and participate in the 2023 Student Rocket Launch, please complete the form below.

Instructions:

1. Notify ULA (contact info below) of your intent to participate as soon as possible, so that we can gauge interest in the program.
2. Submit this proposal form to StudentRocketLaunch@ulalaunch.com by Jan. 23, 2023.
3. Proposal team leaders will be notified by Jan. 30, 2023 if ULA has selected their payloads.
4. Chances of being awarded a payload spot on the rocket depend on the number of proposals submitted. Proposals will be judged based on creativity, credibility and completeness.
5. There is no cost to the school to fly on the rocket, but teams are responsible for payload and travel costs.
6. Teams may submit more than one proposal; however, no team will be awarded more than one payload spot on the rocket unless there are more spots available than proposals received.
7. This form may be expanded to multiple pages, multiple pages with illustrations, if desired.
8. ULA and Ball engineers can be available to consult with payload teams during the development of the payloads.
9. Submit questions, notification of intent to participate and proposals to StudentRocketLaunch@ulalaunch.com

Payload Proposal Form

Payload or Payload Team Name:

Team Leader Name:

Team Leader Phone Number:

Team Leader Contact Address:

Payload Concept Description:

Team Description:

Are any members of your team planning to attend the launch in person?

◯ Yes ◯ No How many people plan to attend?

Which payload tube size does your team prefer?

◯ 14" length ◯ 7" length

Test Program:

Requests (optional):

Sell Your Project/Team Here:

Do you plan for your payload to include liquid??

◯ Yes ◯ No

Do you plan to include RF signals?

◯ Yes ◯ No

Do you plan to test your payload for battery life, power, temperature, and acceleration as applicable?

◯ Yes ◯ No

Additional Information
ULA Intern Rocket Home Page
https://www.ulalaunch.com/explore/intern-rockets

Questions, Comments and Proposal Form Submission
United Launch Alliance
StudentRocketLaunch@ulalaunch.com