2022 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 2022 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 the 2021 launch.

Plans for 2022 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
- Feb. 14, 2022: Team leaders submit a simple payload proposal to ULA
- Feb. 21, 2022: ULA notifies teams of their status
- Late May 2022: Critical design review with ULA executives and program team
- Late June 2022: ULA check-in to review payload production process, and ensure design is suitable for integration with launch vehicle.
- July 18, 2022: Fit check and open house at ULA warehouse in Centennial, Colorado (outside of Denver)
- July 23, 2022: Planned launch

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

Design Overview

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

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 Smoky Hill 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

2022 K-12 Payload Accommodation Plan

The 2022 intern-built rockets will carry payloads inside the three nose cones and rocket bodies. Teams submitting for this RFP will be 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 8 or 16 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 2022. 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

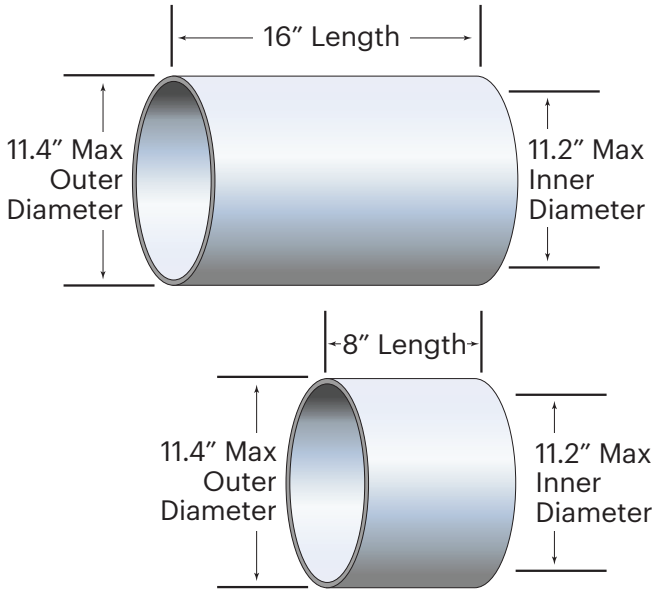


Figure 2

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

1. Payloads may not utilize any active aerial control systems to guide the payload during descent. Passive control (i.e. fins, deployable wings, etc.) is allowable provided payloads do not have any autonomous or remote-control systems. Payloads using passive control must descend in a spiral flight pattern.

2. Payloads may not include live animals, explosives, flammable liquids, bio-hazards or nuclear materials. Small pyrotechnics for device actuation are permissible with approval from ULA.

3. All payloads will be deployed from the rockets.

4. Estimated maximum acceleration during flight = 10 Gs.
   - In other words, make your payload sturdy. A good test to see if your payload is sturdy enough is to drop it from a height of 10 inches onto a 0.5-inch-thick carpeted floor several times, dropping it from vertical and horizontal positions. If it survives this drop test, it should survive the rocket flight and jettison events.

5. ULA will provide each payload team with a tube as noted above.

6. Payload installation in the rocket must be complete with no further access at least 120 minutes (preferably 120-180 minutes) prior to launch. Some lessons learned from previous launches:
   - Test your payload to ensure it has adequate battery life and/or memory, if applicable.
   - Test your payload to ensure it does not auto-power-off after 120 minutes or less of inactivity, darkness, quiet, etc.
   - Temperature of payloads in the rocket prior to launch may reach 130° F or higher depending on weather; make sure your payload can handle such temperatures.

7. If a payload plans to transmit radio frequency (RF) signals, transmissions must be coordinated in advance with ULA. Due to possible interference with rocket system electronics, payloads may not transmit RF signals until after the payload has been ejected from the rocket. Additional restrictions governing RF transmissions and unmanned ground vehicles (UGVs) will be provided in the spring. No unmanned aerial systems (UASs) are allowed.

8. Payloads are planned to be ejected from the rocket after apogee while descending at approximately 30-40 miles per hour between approximately 3,500 to 4,500 feet above ground.

9. Each team must include a descent mechanism (e.g. parachute, streamer) to ensure payload descends at less than 20 miles per hour. Payloads with very slow descent speeds are likely to land in inaccessible areas, with little chance of recovery. Ensure parachute is properly sized for payload weight.

10. All teams will complete a requirements compliance matrix prior to launch and submit it to ULA for review.

11. If payload uses any liquid, payload cavity shall remain leak-proof. Liquids must remain contained within payload cavity.

12. All teams must meet (in person or virtually) with ULA at end of June to show progress of their build and identify potential integration issues with the rocket.

13. The table to the right identifies maximum mass allowed for payloads. The mass limit includes the weight of the ULA-provide modules, tubes, or parachutes. Contact ULA if you need to exceed these mass limits.

Payload Tube Size	Allowable Mass
16” Length	8.6 lbs
8” Length	4.3 lbs

14. Teams must complete a critical design review with ULA prior to the launch; these are planned for mid-May 2022.
   - Teams will receive a design review outline in the spring.
   - Students — not mentors — must present at the design review.

15. The design review outline will be used as the scorecard and rubric for the review.
16. Payloads will be ejected from the airframe after apogee to float down individually.
17. Payload positioning within the airframe will be randomly assigned.
18. No sharp edges are allowed.
19. Teams must be made up of K-12 students.
20. Collaborative team projects are prioritized over individuals.
21. Mentorship is encouraged; however, the majority of the design and construction of the payload must be conducted by students.
22. 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)	**Total Impulse:**	21,062 N-s (4735 lb*sec)
Width:	11.7 in (30 cm) diameter	**Performance:**	0 to 325 mph in 5 sec (0 to 523 kph in 5 sec)
Liftoff Mass:	225 lbs (102.1 kg)		
Initial Thrust:	1,067.9 lbs (4,750.3 N)	**Altitude Target:**	4,200 ft (1280.2 m)
Average Thrust:	768.1 lb (3416.7 N)	**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

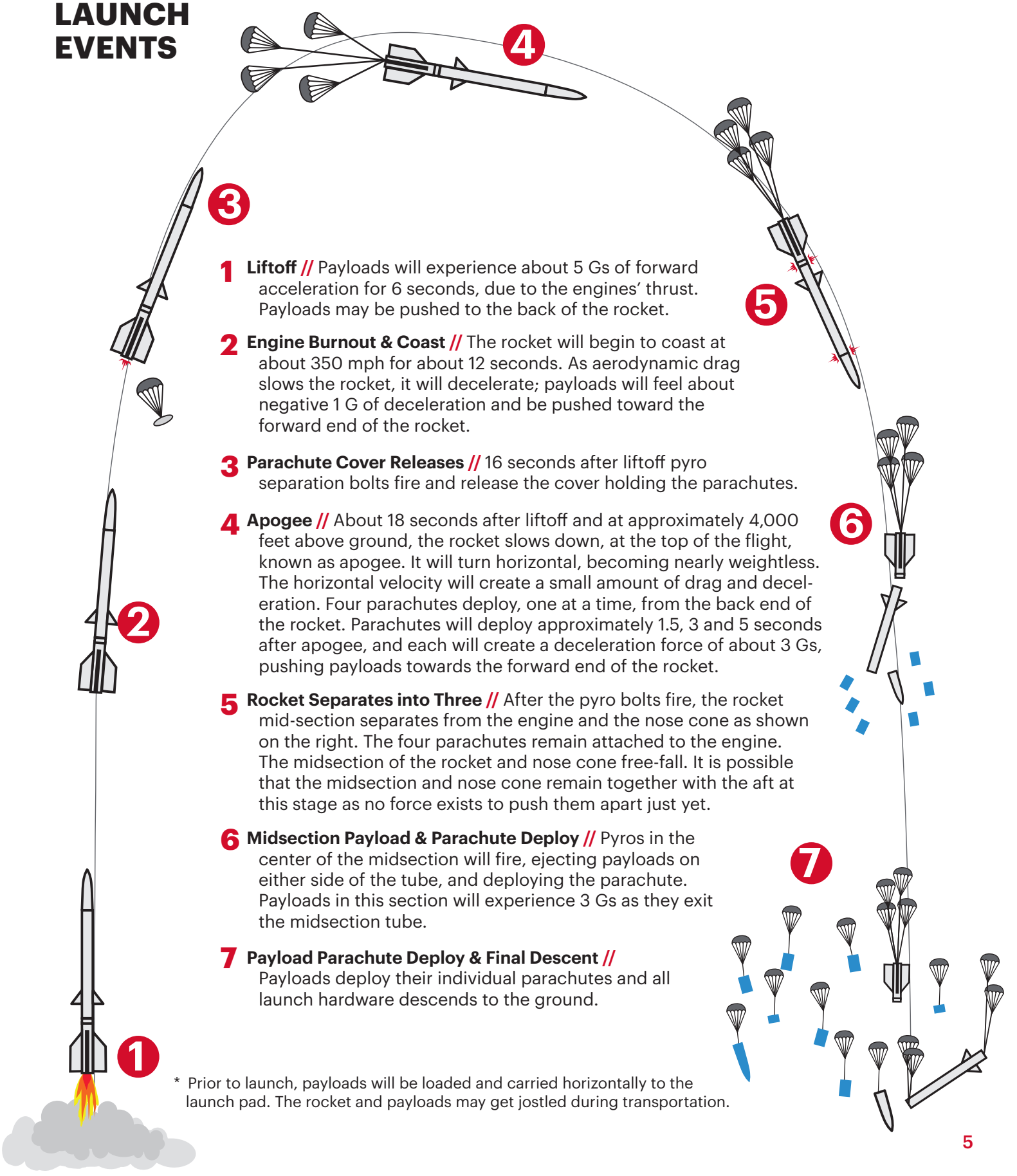
Qualifying teams that provide a payload to fly on the day of launch will be entered in to a drawing, and five teams will receive a cash donation for their school or other associated nonprofit.

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.

2022 Payload Proposal Form

To build a payload and participate in the 2022 Student Rocket Launch, please complete the form below.

Instructions:

1. Complete the information requested below.
2. Notify ULA (contact info below) of your intent to participate as soon as possible, so that we can gauge interest in the program.
3. Submit this proposal form to StudentRocketLaunch@ulalaunch.com by February 14, 2022.
4. Proposal team leaders will be notified by February 21, 2022 if ULA has selected their payloads.
5. 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.
6. There is no cost to the school to fly on the rocket, but teams are responsible for payload and travel costs.
7. 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.
8. This form may be expanded to multiple pages, multiple pages with illustrations, if desired.
9. ULA and Ball engineers can be available to consult with payload teams during the development of the payloads.
10. Submit questions, notification of intent to participate and proposals to StudentRocketLaunch@ulalaunch.com

Payload Proposal Form

Payload or Payload Team Name:

Team Leader Name and Contact Info:

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?**

Test Program:

Requests (optional):

Sell Your Project/Team Here:

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