FUTURE HEAVY FLIES AGAIN IN 2020

ULA

The Student Rocket Launch is an annual event presented by United Launch Alliance (ULA) and Ball Aerospace that 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 the Future Heavy Super Sport rocket. The rocket, built by ULA interns, will fly approximately 5,000 feet above ground level carrying payloads built by Ball Aerospace interns and K-12 students. The Future Heavy Super Sport rocket launch is planned for July 2020 in Colorado.

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

We encourage all participants to attend the launch. Check out a video of last year's launch.

PLANS FOR 2020 LAUNCH

MARS ROVER COMPETITION!
- In honor of ULA's upcoming launch of NASA's Mars 2020 rover, students can compete by designing their own rovers and navigating to a ground-based target. Teams will submit project proposals to ULA, and ULA will select up to 20 teams to participate in the competition. The top three teams will earn prizes.

NON-COMPETITION PAYLOADS
- At least five payload compartments will be reserved for teams not wanting to participate in the rover competition. Get creative – just stay within the requirements provided in this document.

Wanted: Elementary, middle and high school student teams interested in forming a team to design and build 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

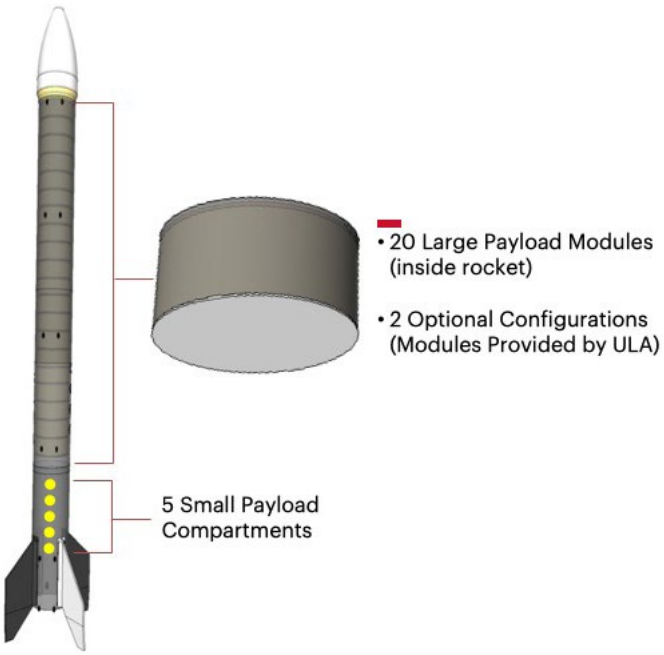

Figure 1. K-12 Payload Module Concept for 2020

- **Important dates:**
  - o **As soon as possible:** Interested teams should notify Sreyas Krishnan at ULA of their intent to participate
  - o **Feb. 21, 2020:** Team leaders submit a simple payload proposal to ULA
  - o **Week of Feb. 24, 2020:** ULA notifies teams of their status
  - o **Early July 2020:** Open house and demo day
  - o **Mid-July 2020:** Planned launch

ULA reserves the right to cancel or modify the launch based on inclement weather; unforeseen circumstances; government action or inaction; or for any reasonable cause.

See the proposal form at the end of this presentation for detailed instructions and requirements.

2020 K-12 PAYLOAD ACCOMMODATION PLAN
The 2020 Future Heavy Super Sport rocket will carry up to 20 large and five small payloads (Figure 1). Competition payloads must fly in the large payload modules to ensure every team is given the same chance of success. Non-competition payloads may fly in either large or small compartments.

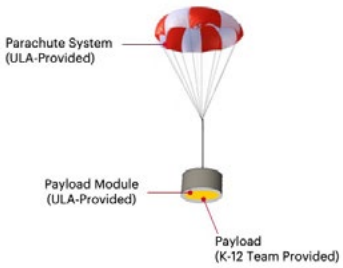

Figure 2. Parachute Concept

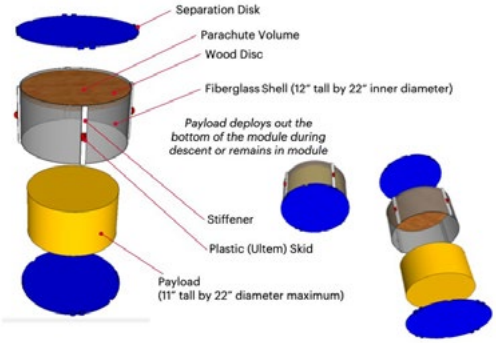

Figure 3. Payload Module Configuration Option 1

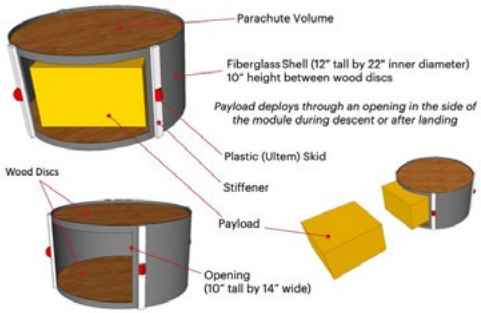

Figure 4. Payload Module Configuration Option 2

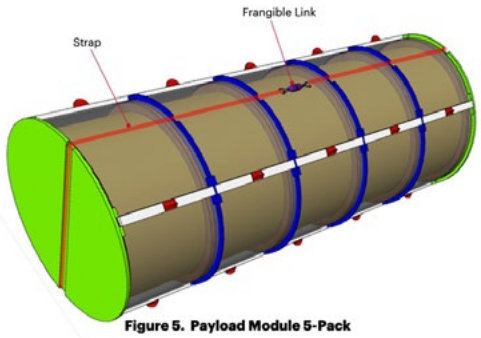

Figure 5. Payload Module 5-Pack

LARGE PAYLOAD ACCOMMODATION

Each large payload (up to 22 inches diameter and 11 inches tall) will be housed in a ULA-provided module. Each large payload module will consist of a fiberglass tube, wooden discs, separator discs and a parachute system. ULA will attach parachutes to the payload modules on launch day; teams will not receive them in advance. The ULA-provided parachute will remain attached to the payload module bulkhead.
(Figure 2)

If the payload separates from its module before landing, the payload team will need to provide an additional parachute.

THERE ARE TWO OPTIONAL PAYLOAD MODULE CONFIGURATIONS FOR LARGE PAYLOADS.

- Option 1: The payload deploys through the bottom of the module during descent. (Figure 3)
- Option 2: The payload deploys through an opening in the side of the module before or after landing. The payload can be attached temporarily or permanently inside the module. (Figure 4)

The large payload modules deploy from the rocket in groups of five (Figure 5). After deployment, the modules will separate from each other via spring action, and ULA-provided parachutes will deploy to control the descent rate of each module (Figure 2). Payloads can separate from the module in flight or remain inside the tube all the way to the ground. Payloads that will separate from the module must include an attachment mechanism that releases the payload in flight. More details regarding payload module deployments will be provided as the design and fabrication of the payload modules mature. Payload modules are expected to be provided to payload teams by April 1, 2020.

SMALL PAYLOAD ACCOMMODATION

Small payloads must fit inside a 6-inch-diameter by 15-inch-long payload tube. ULA will provide phenolic-reinforced cardboard tubes; they are open-ended cylinders. These smaller payloads will be ejected out the side of the rocket as most payloads have done at past launches; however, these payloads can request to not be ejected if desired. ULA will provide the tubes by April 1, 2020. Small payloads must provide their own parachutes that must also fit inside the payload tube with the payload.
Teams can use the payload tube in several ways or choose to not use them at all. 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.

Teams can choose not to use the tube as part of the payload but should still use it for a fit check; if your payload fits in the tube, it will fit in the rocket.

PAYLOAD REQUIREMENTS

1. Payloads may not utilize any active aerial control systems to guide the payload during descent. Passive control, e.g., fins, deployable wings, etc., are allowable provided that they do not have any autonomous or remote-control systems.
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. Non-competing payload teams using the smaller payload compartments may choose to deploy their payloads from the rocket or have them remain inside the rocket during descent.
4. Estimated maximum acceleration during flight is 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. Each payload team will be provided with either a large payload module or a small payload tube as noted above. Large payloads must use the large payload modules. Use of the tubes is optional for small payloads.
6. Large payloads that separate from their module during descent must provide an additional parachute or other mechanism to ensure the payload does not descend at more than 20 mph.
7. Payload installation in the rocket must be complete with no further access at least 120 minutes (preferably 150 minutes) prior to launch. Some lessons learned from previous launches:
• Test your payload (if applicable) to ensure it has adequate battery life and/or memory.
• Test your payload to ensure it does not auto-power-off after 90 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.
8. 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 early 2020. No unmanned aerial systems (UASes) are allowed.
9. Payloads are planned to be ejected from the rocket after apogee while descending at approximately 20 miles per hour at an altitude between 3,500 and 4,500 feet above ground.
10. Maximum allowed mass for small payloads is 3 lbs. Maximum mass for large payloads is 7 lbs. These mass limits do not include the weight of the ULA-provide modules, tubes, or parachutes. Contact ULA if you need to exceed these mass limits.

PAYLOAD COMPETITION INFORMATION
The goal of the payload competition is to encourage students to design, build and operate a payload that is capable of landing and driving to a target – inspired by NASA's Mars 2020 rover. Other concepts for reaching the target are acceptable provided that they meet all of the aforementioned payload requirements.

Judging will be based on a rubric that considers the design phase, testing phase and the payload performance towards reaching the target during launch.

First, second and third place winners will be selected based on a weighted total score with detailed factors and weighting to be announced.

ADDITIONAL AWARDS
Three additional awards will be presented as follows. Competing or non-competing payloads are eligible to win these prizes.
• Best team spirit
• Best video documenting the payload design, manufacturing and test phases
• To be announced

Footage from exceptional videos also may be used, with proper attribution, in the ULA Student Rocket Launch highlights video released after the event. Teams who provide video footage to ULA certify they have the rights to all of the images and sounds in the video and authorize the company to use the footage publicly. Teams are responsible for ensuring that everyone and everything in the videos is approved for public release. Please note that making a video is optional and not a factor in the primary competition rubric. Submitted videos should be filmed in landscape orientation.

ADDITIONAL REQUIREMENTS FOR PAYLOAD COMPETITION TEAMS
In addition to the standard payload requirements above, teams interested in the payload competition must abide by the following:

1. Teams must complete and conduct a design review with ULA prior to the launch
• Design review outline and example will be given to competitors in spring 2020.
• Design review must be presented by students, not mentors.
2. Teams will bring their payloads to an open house at ULA approximately one week before launch. Payloads must navigate to a target in simulated launch terrain. Results will be part of the overall scoring rubric. Details to be announced in spring 2020.
3. Teams who are unable to attend the demo day may submit a video documenting their demo results in similar conditions (e.g. uneven dirt field with bushes and grass between the start and end areas) to what will occur at ULA. Please work with Sreyas Krishnan to ensure your demo is acceptable.
4. A detailed scorecard and rubric will be released in spring 2020.
5. Payloads will be ejected from the airframe after apogee, in packs of five from the forward end of the rocket and then will separate from the pack to float down individually.
6. Payload positioning within the airframe and 5-packs will be randomly assigned.
7. No weaponry will be allowed in the payload design (you can't shoot down other competitors).
8. No sharp edges are allowed.
9. Competing teams must be made up of K-12 students with the following requirements:
• If the 2020 prizes include a financial component, they must be paid out to U.S.-based 501(c)3 nonprofit organizations; teams that do not fit this requirement may still design a payload without competing, or they may compete, but are not eligible to receive any prize money.
• Collaborative team projects are prioritized over individuals.
10. Mentorship is encouraged; however, the majority of the design and construction of the payload must be conducted by students.
11. 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.
12. Ask questions – we are here to help!
• 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.
• ULA reserves the right to modify and add to these requirements as needed.
• Due to weather; unforeseen circumstances; government action or inaction; or for any reasonable cause, ULA reserves the right to alter the criteria, cancel or modify the launch, or disqualify any team at any time.
• Send all inquiries to Sreyas Krishnan.

2020 PAYLOAD PROPOSAL FORM

To build a payload and participate in the 2020 Student Rocket Launch, please complete the form below.

INSTRUCTIONS

1. Complete the information requested below
2. If you think your school wants to participate in the July 2020 launch event, please notify Sreyas Krishnan of your intent to participate as soon as possible, so that we can gauge interest in the program.
3. Submit this proposal form to Sreyas by Feb. 14, 2020.
4. Proposal team leaders will be notified by Feb. 21, 2020, if their payload has been selected to fly on the ULA rocket.
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 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. Teams may submit additional pages if desired.
9. ULA and Ball engineers can be available to consult with payload teams during the development of the payloads.

Submit questions, notification of intent to participate and proposals to Sreyas Krishnan at Sreyas.Krishnan@ulalaunch.com.

Payload or Payload Team Name:

Team Leader Name and Contact Info:

Name:

School/Organization:

Phone:

E-mail Address:

Mailing Address, City, State, ZIP:

Payload Concept Description:
Describe your payload, including how it will work and materials included. Provide as much information as you know. It is OK to add sketches, photos, etc. if you have them.

Team Description:
Describe who will work on the project with the team leader (for example, third-grade class, eighth-grade Earth science class, school rocket club, etc.). Describe resources available to the team (work facility, tools, etc.)

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

◯ Yes ◯ No

Do you wish to compete in the rover competition?

◯ Yes, we want to compete

◯ No, we want to build something different

Which size payload compartment are you requesting?

◯ Small (6" diameter by 15" long)

◯ Large (22" diameter by 11" tall)

- ☐ Option 1
- ☐ Option 2

Note: Competition payloads must be in a large compartment, but you can let us know now or later if you prefer the Option 1 or Option 2 Module configuration

Test Program:

Describe how you intend to test your payload. (Drop/drive tests, benchtop electronics testing, sensor testing, etc.)

Requests (optional):

Do you have any equipment requests to be integrated into the ground-based target? (i.e., audio/visual beacons, RF signals). Or do you have any other special requests?

Sell Your Project/Team Here:

Tell us why you want to do this. Convince us that you can achieve your objectives. Tell us you will be dedicated to deliver a product that has a reasonable chance of working. What sets your team apart?

Additional Information

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

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