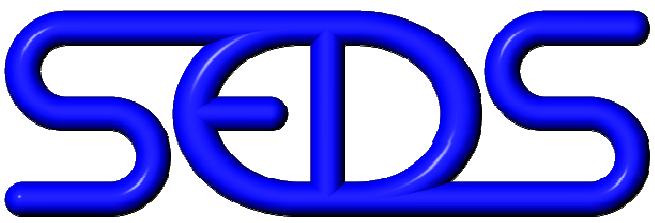
# Students for the Exploration and Development of Space

# 2014 University Student Rocketry Challenge



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**SEDS 2014 University Student Rocketry Challenge**

Students for the Exploration and Development of Space, USA, is pleased to announce the 2014 University Student Rocketry Challenge (USRC). The USRC challenges students to design, build, and launch a rocket with a standardized 3.00lb payload to an altitude of 10,000 feet.

**Competition Overview**

The USRC is open to teams of students from any university in the United States. Teams are scored on design, engineering, and manufacturing processes in addition to the flight of the rocket. A panel of aerospace industry professionals will serve as judges. As part of the competition, teams are challenged to develop a scientific payload or custom-built ("research") propulsion system to integrate and launch on their rocket.

The competition will involve three engineering reviews with the judging committee. The first review will be a design review and will focus on the design of the rocket. The second review will be a pre-flight review, to be completed after the rocket is built. The third review will be a post-flight review to assess the results of the rocket's flight. Reports must be submitted prior to each review. Guidelines for each report will be released at a later date.

The first place team, as determined by the competition judges, will be awarded a $1000 cash prize from SEDS-USA and competition sponsors. Additional prizes and funding opportunities may be added throughout the course of the competition as they become available.

In order to make the competition as accessible as possible, there will be several ways in which a team can launch their rocket for a competition flight. Teams may launch at a field local to their university and have the flight certified by an independent party. Depending on geographic proximity, teams from different universities may organize a regional launch in cooperation with SEDS-USA. Additionally, if there is sufficient interest, there is a possibility of a national launch set for the summer of 2014 to be held at a major national rocketry event. Details on a national launch, if scheduled, will be forthcoming in the spring.

**Competition Timeline**

Please note the following applicable dates for the challenge. At the request of teams, these dates may be advanced to an earlier date (e.g., if a team may submit a manufacturing report and complete the manufacturing review in April in order to support an earlier launch date).

- February 28, 2014 – Letter of intent and team rosters must be submitted to usrc@seds.org
- March 28, 2014 – Design report due
- April 2014 – Design reviews will be scheduled and design report feedback provided
- May 30, 2014 – Manufacturing report due
- June 2014 – Manufacturing reviews will be scheduled and manufacturing report feedback provided
- September 29, 2013 – Launch window closes; all launches must be completed
- October 6, 2013 – Final launch reports are due, all documentation must be received by SEDS-USA
- October 2014 – Post-launch reviews and judging by panel
- November 2014 – Competition winner announced and prize awarded at SpaceVision 2014 conference in Chapel Hill, NC.

**Official Rules**

1. This competition is open to participation at no cost to any team of students from universities within the United States.
2. The objective of the competition is to design, build, and launch a rocket to an altitude of 10,000 feet above ground level (AGL) and recover the rocket intact. To compensate for the effects of launches at high-altitude launch sites, 0.0002 times the elevation of the launch site above sea level, in feet, will be subtracted from the recorded altitude (in feet) and is defined as the adjusted altitude. This offsets the reduced engine/vehicle mass necessary to achieve the 10,000 ft. AGL target height at these higher altitudes. Scoring will be based on the team's adjusted altitude.
3. All rockets must carry a standardized payload provided by SEDS-USA. The payload will be cylindrical in shape, weigh 3.00 lb., and will measure no larger than 2.14 inches in diameter and 6.00 inches in length. The payload must not detach from the rocket at any point during flight and must be recovered intact and returned to SEDS-USA. The interface for this payload will be standard and further information will be provided at a later date. Tampering with the payload outside of normal operating procedures (as defined by SEDS-USA) is prohibited and will result in disqualification from the competition.
4. The provided payload will contain a standardized altimeter and data logger which will be used by all teams. Official data used in the competition scoring will be obtained only from this payload. Teams may use additional altimeters, sensors, and data loggers but only the data collected by the provided payload will be considered official. Note that this clause applies to only the flight score; additional devices may be used in the research portion of the competition.
5. Destruction of the provided payload (whether intentional or unintentional) will result in no flight score being awarded to the team.
6. All altitude gain must be achieved through rocketry, no specialty launch systems (e.g., rockets launched from weather balloons and projectile launchers) will be permitted.
7. Propulsion systems must not exceed 5120.00 Newton-seconds of impulse.
8. The competition will be scored as follows:
    a. Documentation
        i. Design report (14 points)
        ii. Manufacturing report (18 points)
        iii. Post-flight report (8 points).

        Reports scores will be scored based on the comprehensiveness and completeness of the report. Sample reports will be provided to teams upon request
    b. Flight Score
        i. Altitude (15 points) – A maximum of 15 points will be awarded based on the adjusted altitude reached by the rocket during flight. 0.0015 points will be awarded per foot of adjusted altitude as measured by the provided payload.
        ii. Time to apogee (7 points) – A maximum of 7 points will be awarded based on the time it takes for the rocket to reach apogee, as measured by the provided payload. This score will be normalized across all participants, with the quickest

time to apogee being awarded 10 points and the slowest time being awarded 0 points.

iii. 10,000 foot altitude bonus (5 points) – 5 points will be awarded to teams who achieve an adjusted altitude of 10,000 feet or higher. No points will be awarded to teams who do not reach this altitude.

iv. Deployment bonus (4 points) – 4 points will be awarded to teams who experience successful recovery device deployment.

v. Recovery bonus (4 points) – 4 points will be awarded to teams whose rocket is recovered without damage. "Without damage" is defined as a rocket that could be flown again if the propulsion system is reloaded and the recovery devices re-packed, without any further repairs to the rocket.

c. Payload Score

i. Scientific payload (20 points) – A maximum of 20 points may be awarded to the team for flying a scientific payload or a research propulsion system. This score will be awarded at the discretion of the judging panel.

ii. Cameras and multimedia documentation (5 points) – A maximum of 5 points will be awarded for video documentation of the rocket flight. 2 points will be awarded for high definition video taken from a camera onboard the rocket, and 2 points will be awarded for high definition video or high resolution images taken of the launch from the ground. An additional point will be awarded if photos and videos submitted by teams are well processed and presented.

9. All competing flights must be certified by one of the following:
   a. The USRC Project Manager, Development Manager, or their designee
   b. Prefects, members of the Technical Advisory Panel, or Board of Directors of the Tripoli Rocketry Association, Inc. (TRA).
   c. An officer or trustee of the National Association of Rocketry (NAR) or a NAR section.

   Should none of these options be available, the team must contact the USRC Project Manager to arrange an alternate solution.
10. All launches must abide by local, state, and federal laws and regulations. This includes but is not limited to FAR 101. It is the responsibility of the team to understand and abide by all applicable regulations. By entering this competition, teams agree that SEDS-USA shall not be held liable for any violations committed by the team. Teams must also follow any rules set forth by the Launch Director, Range Safety Officer, or other launch organizing authority.
11. All teams are required to carry insurance, whether through their university, TRA, NAR, or elsewhere. By entering this competition, teams agree that SEDS-USA shall not be held liable in any way for injuries or damages that may occur as a result of participation in the competition. It is the responsibility of the teams to understand the inherit risks present in high-powered rocketry and to take adequate safety measures to mitigate these risks.

## Project Team

Feel free to submit any questions about the SEDS University Student Rocket Challenge to usrc@seds.org One of our team members will get back to you.

Andrew Dianetti, *University at Buffalo Aerospace Engineering M.S. 2015*

*USRC Project Manager*

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Christopher Nie, *University of Colorado Boulder Aerospace Engineering B.S. 2014*

*USRC Development Manager*

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Christopher Ogden *University at Buffalo, Economics B.A. 2013*

*Project Advisor*

*christopher.ogden@seds.org*

**Phone numbers available on request*

About SEDS:

Students for the Exploration and Development of Space USA (SEDS USA), is a 501c3 nonprofit 100% volunteer organization based across the United States. SEDS USA focuses on science technology, engineering and math (STEM) educational outreach at the university and secondary levels in the United States. SEDS strives to facilitate a dialogue regarding the state of the space industry between students, commercial space companies and the government. More importantly we believe today's students can become tomorrow's leaders through excellence in space focused STEM projects. We accomplish this by providing students with accessible opportunities to work on engaging STEM projects which still in school.

# *2014 USRC Scoring Criteria*

| Scoring Component | Possible Points | Notes |
|---|---|---|
| ***Documentation Scoring*** | ***40*** | Reports scores will be scored based on the comprehensiveness and completeness of the report. Sample reports will be provided to teams upon request |
| Design Report | 14 | Scoring for these sections is determined by the judging panel based on the deliverables submitted, by the deadline for each report. |
| Build Report | 18 | |
| Post-flight Report | 8 | |
| ***Flight Scoring*** | ***35*** | |
| Altitude | 15 | A maximum of 15 points will be awarded based on the adjusted altitude reached by the rocket during flight. 0.0015 points will be awarded per foot of adjusted altitude as measured by the provided payload. |
| Time to apogee | 7 | A maximum of 10 points will be awarded based on the time it takes for the rocket to reach apogee, as measured by the provided payload. This score will be normalized across all participants, with the quickest time to apogee being awarded 7 points and the slowest time being awarded 0 points. |
| 10,000 foot altitude bonus | 5 | 5 points will be awarded to teams who achieve an adjusted altitude of 10,000 feet or higher. No points will be awarded to teams who do not reach this altitude. |
| Deployment bonus | 4 | 4 points will be awarded to teams who experience successful recovery device deployment. |
| Recovery bonus | 4 | 4 points will be awarded to teams whose rocket is recovered without damage. "Without damage" is defined as a rocket that could be flown again if the propulsion system is reloaded and the recovery devices re-packed, without any further repairs to the rocket. |
| | | |
| ***Payload Scoring*** | ***25*** | |
| Scientific payload | 20 | A maximum of 20 points may be awarded to the team for flying a scientific payload or a research propulsion system. This score will be awarded at the discretion of the judging panel. |
| Cameras and multimedia documentation | 5 | A maximum of 5 points will be awarded for video documentation of the rocket flight. 2 points will be awarded for high definition video taken from a camera onboard the rocket, and 2 points will be awarded for high definition video or high resolution images taken of the launch from the ground. 1 point is awarded to teams who have high production and presentation quality of their pictures and video. |
| **Total Possible Points** | **100** | |

***The judging committee reserves final judgment on all competition scoring component.***

**Adjusted Altitude Rules - In order to compensate for the effects of launches at high-altitude launch sites, .0002 times your launch altitude in feet will be subtracted from your Recorded altitude and defined as your Adjusted Altitude. This offsets the much reduced engine/ vehicle mass necessary to achieve the 10,000-feet above ground level target height at these higher altitudes.

# *2014 USRC Deliverables & Deadlines*

## **Please submit all Deliverables to usrc@seds.org**

| Deliverable | Document # | Requirements | Due Date |
|---|---|---|---|
| ***Letter of Intent & Team Roster*** | | ***Teams must submit a letter of intent to compete to SEDS USA. Please email the letter of intent to usrc@seds.org*** | ***Friday, February 28, 2014*** |
| ***Design Review Deliverables*** | | ***Please submit all of the following deliverables by 5:00pm Eastern time on this date*** | ***Friday, March 28, 2014*** |
| Launch Dates | DR 1 | Please submit location of launch site, FAA waiver information, launch site organization & 3 possible launch dates from April 9th, 2013-Septmeber 1st,2013. | ***Friday, March 28, 2014*** |
| Rocket Design Drawings | DR 2 | Please submit design drawings of the rocket. | ***Friday, March 28, 2014*** |
| Launch Simulations | DR 3 | Please submit launch simulations of the rocket's flight | ***Friday, March 28, 2014*** |
| Payload Drawings and Schematics | DR 4 | Please submit drawings and schematics for the payload | ***Friday, March 28, 2014*** |
| Construction Plan | DR 5 | Please submit a document outlining assembly of the rocket | ***Friday, March 28, 2014*** |
| Recovery System Schematics | DR 6 | Please submit schematics for the onboard recovery systems, including but not limited to system schematics, wiring diagrams, & parachute calculations. | ***Friday, March 28, 2014*** |
| Design Review with panel | | One hour review of deliverables with industry experts via Microsoft Lync or Google Hangout | ***To be scheduled based on availability during April 2014*** |
| ***Manufacturing Review Deliverables*** | | ***Please submit all of the following deliverables by 5:00pm Easterntime on this date*** | ***Friday, May 30, 2014*** |
| Build Process Validation (BR-1) | MR 1 | Please submit a document recapping the build process of your rocket. Include details of the construction of the Propulsion System, Propulsion System Integration/Motor Mount, Fins, Payload Bay, and airframe. Pictures and videos are recommended. | ***Friday, May 30, 2014*** |
| Launch Ready Rocket | MR 2 | Please submit a picture of your rocket showing construction is reasonably complete. | ***Friday, May 30, 2014*** |
| Electronics Testing | MR 3 | Please submit proof the electronic systems have been tested | ***Friday, May 30, 2014*** |
| Manufacturing Review with panel | | One hour review of deliverables with industry experts via Microsoft Lync or Google Hangout | ***To be scheduled based on availability during June 2014*** |
| ***Launch Deadline*** | ***LR 8*** | ***Teams must submit proof of launch to SEDS USA in the form of video or pictures*** | ***Monday, September 29, 2014*** |
| | | | |
| ***Launch Review Deliverables*** | | ***Please submit all of the following deliverables by 5:00pm Eastern time on this date*** | ***Monday, October 06, 2014*** |

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|---|---|---|---|
| Launch Narrative | LR 1 | Please submit a complete narrative of the launch, flight and recovery operations | ***Monday, October 06, 2014*** |
| Flight Data | LR 2 | Please submit charts of Altitude vs. time, velocity vs. time and acceleration vs. time. Also please submit a map with the flight path and position of the rocket. | ***Monday, October 06, 2014*** |
| Launch Prep Checklists | LR 3 | Please submit copies of preparation and safety checklists | ***Monday, October 06, 2014*** |
| Rocket Preparation Summary | LR 4 | Images of Engine Prep, Engine Retention, Payload (standalone), Payload (Integrated into the Rocket), Packed Recovery Systems, Rocket on Pad | ***Monday, October 06, 2014*** |
| Recovery Operations Summary | LR 5 | Images of undisturbed rocket at the landing site, deployed parachutes, airframe, & any damage. | ***Monday, October 06, 2014*** |
| Flight Verification Form | LR 6 | The person certifying your flight must verify the flight and sign the flight certification form. | ***Monday, October 06, 2014*** |
| Raw Altimeter Data | LR 7 | Please upload the raw data from all on board altimeters and sensors | ***Monday, October 06, 2014*** |
| Launch Review with panel | | One hour review of deliverables with industry experts via Microsoft Lync or Google Hangout | ***To be scheduled based on availability during October 2014*** |
| ***IMPORTANT: Teams will be assessed a penalty of 10 points per missing deliverable.*** | | | |