Princeton Rocketry Club is an organization of ~85 students who are deeply passionate about space sciences and space technologies and is committed to creating a community of space enthusiasts on Princeton's campus. We have grown exponentially since our founding in 2015, and have now become one of the largest engineering/science student organizations on campus. While we have close ties to the Department of Mechanical and Aerospace Engineering, Keller Center for Innovation in Engineering, and the Council on Science and Technology on campus, our members stem from all academic backgrounds - engineering, natural sciences, social sciences, and humanities.

We typically have several project teams which work on different interest areas each semester. Some of our past projects have included SpaceShot (a two stage sounding rocket capable of crossing the Karmen line), Project Nebula (a competition rocket which ranked 7th at SA Cup 2019), and being finalists at NASA's Micro-g NeXT competition. We have also had a long standing process of getting our members L1 and L2 licenses in High Power Rocketry from the NAR. Over 15 of our members have secured licenses over the past 3 years.

Although we were working remotely this past Fall, we’ve successfully carried out several of our projects. We have shipped Raspberry Pi kits to 15 of our members and High Power Rocketry kits to 8 of our members as part of our L1 certification program. We have completed a proposal for a laser-based automated lunar dust mitigation mechanism and initialized our design for the NASA RASC-AL challenge 2021. We have also elaborated upon our design for 30,000ft rocket for the next SA Cup competition and began work on developing our own student researched and developed motor.

The Princeton Rocketry Club is also devoted to serving the university community and the surrounding Princeton area. We have done several workshops teaching a wide variety of topics such as Arduino. We have invited several speakers such as George Whiteside to discuss space policies and technologies. We have also continued to assist local schools such as the Pennington School with STEM education virtually.

If you have any questions regarding the Princeton Rocketry Club and our projects, please contact us at rockets@princeton.edu.
Sponsorship Information

To support our ambitious goals, the Princeton Rocketry Club is seeking sponsors for the 2020-2021 school year. In return for monetary and in-kind donations, PRC provides several sponsorship packages to help thank our sponsors. If you would like to provide in-kind donations such as hardware or materials for our projects, we can attribute the value of those donations to the appropriate sponsorship level. Additionally, If you’d like to sponsor a specific project, please let us know.

As a student organization within Princeton University, PRC is a 501(c)3 Nonprofit. All donations are tax deductible. University W-9 forms can be provided if requested.

### Sponsorship Levels

<table>
<thead>
<tr>
<th>Level</th>
<th>Amount (USD)</th>
<th>Benefits (Cumulative)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bronze</td>
<td>1,000</td>
<td>Logo on website, use of club media for marketing.</td>
</tr>
<tr>
<td>Silver</td>
<td>2,500</td>
<td>Logo on all club vehicles.</td>
</tr>
<tr>
<td>Gold</td>
<td>5,000</td>
<td>Access to resume booklet. Sponsor shout-out post on social media pages.</td>
</tr>
<tr>
<td>Platinum</td>
<td>10,000</td>
<td>Access to high-profile speaker events, recognition at all speaker events.</td>
</tr>
<tr>
<td>Title Sponsor</td>
<td>25,000</td>
<td>Large logo on all vehicles, sponsor explicitly mentioned in all press releases and University publications.</td>
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</tbody>
</table>

If you are interested in sponsoring Princeton Rocketry Club, please send an email to rockets@princeton.edu.
In our fifth year of existence, the PRC team completed several long-term projects, each one testing our technical skills and affirming that our young organization can compete on an international stage. For the coming year, we have planned an ambitious set of projects that will further develop our expertise and push the boundaries of what a student aerospace team is capable of.

**SpaceShot**

Designed, built, and launched the smallest sounding rocket ever designed with the capability to reach 150 km into outer space. Obtained Federal approval for space launch from Federal Aviation Administration Office of Commercial Space Transportation.

**Skills**
CAD, 3D Printing, Finite element analysis, advanced manufacturing techniques

**Tools**
State-of-the-art composite lab, 3D printer, CNC mill

**Results**
1st rocket was successfully launched from Spaceport America in May 2018, reaching an altitude of 47,610 ft but had a second-stage ignition failure. 2nd rocket was successfully launched from Spaceport America in May 2019. Preliminary data showed that the rocket did reach the Karman line successfully.
Competition to build rocket payloads for aerospace applications.

2017 Challenge: Build a solar-powered Venus glider for atmospheric sampling which would be launched on a high-power rocket for an Earth-based test.

2018 Challenge: Build a probe that deploys an aero-braking heat shield that descends at a target velocity.

**Skills**
- CAD
- 3D Printing
- PCB design and manufacturing
- RF communications design
- Fluid mechanics analysis
- Microcontroller programming

**Tools**
- Creo
- KiCAD
- EAGLE
- Fritzing
- Arduino
- Stratasys and MakerBot 3D printers
- Epilog laser cutter
- Electronics shop tools
- Machine shop tools
- Wind tunnel

**Results**
- Placed 25th out of 87 teams in international competition (2017)
Past Projects

**Spaceport America Cup**

Successfully designed and built PRC’s first ever competitive rocket that was launched at Spaceport America Cup 2019. The 10ft tall, 50lb rocket reached over 10,000 ft and was judged based on design, execution, project report, and flight success.

**Skills**
- CAD, 3D Printing, PCB design and manufacturing, RF communications design, flight trajectory simulations, microcontroller programming, control systems design

**Tools**
- Creo, QGroundControl, MAVLink, PX4 flight stack, electronics shop tools, machine shop tools

**Results**
- Placed 7th out of 46 teams in the 10k COTS division and 14th out of 104 teams overall in the competition.
The Micro-g Neutral Buoyancy Experiment Design Teams competition addresses 3 current space exploration challenges. The Princeton Micro-g NExT team has chosen the Mini-Arm End-Effector challenge, which is related to potential missions to ocean worlds like Europa where a robotic arm would handle ice underwater.

We have designed a soft robotic gripper that uses a neoprene bag filled with small granules that can go between malleable and rigid states to grip objects for the competition. If selected, the team will travel to the Neutral Buoyancy Lab at the Johnson Space Center in Houston to test it in a simulated microgravity environment.

**SKILLS**  
CAD, 3D printing, PCB design and manufacturing, microcontroller programming, mechanical design, control systems design

**TOOLS**  
PTC CREO, laser cutter, electronic shop tools, waterproof enclosures

**RESULTS**  
Successfully submitted proposal to NASA.
ThinSat is organized by Virginia Space, in partnership with Twiggs Space Lab, Orbital ATK, and NASA Wallops Flight Facility. We plan to launch several types of rapid prototype circuit boards into space and determine which ones are able to function in the extreme environment of open space.

**SKILLS**
- CAD, 3D Printing, PCB design and manufacturing, RF communications design, fluid mechanics analysis, microcontroller programming

**TOOLS**
- Creo, KiCAD, EAGLE, Fritzing, Arduino, laser cutter, 3D printer, electronics shop, machine shop

**RESULTS**
Successfully completed the hardware build of ThinSat payload. Presented design to the ThinSat program. Our ThinSat is planned to be launched into low earth orbit in February 2021.
High-Power Rocketry

The Princeton HPR project has been PRC’s longest project lasting for over 4 years. It is a great introduction to rocketry for those who want to take ownership of a hands-on project as soon as possible. With the mentorship of several experienced rocketeers, 15+ members have already gained Level 1 rocketry certification through the NAR. This year, the HPR team is the biggest it has ever been with 16 members. These members will also be leading project subteams tasked with building the electronics payload. The payload will have the goal of collecting flight data and transmitting it to a ground station in real time. Most of the work is being conducted remotely with students working on their own rockets with shipped supplies.

LEADS  Gavin Cotter (MAE '23), Kasey Shashaty (ELE '23)
BUDGET  $6,000
SKILLS  CAD, 3D Printing, PCB design and manufacturing, mechanical design, GUI/data transmission, Arduino, Raspberry Pi
TOOLS  PTC Creo, KiCAD, electronics shop tools, machine shop tools, Python
The SA Cup team will be designing and building a fiberglass rocket to be launched to 30,000 feet at Spaceport America in June, 2022. The rocket will feature an 8.8lb payload containing a custom refrigeration unit, a 3D camera, and a Wilson cloud chamber to detect energetic charged particles. The rocket will also feature a student researched and developed motor which will be fully designed and built in-house with a custom propellant. The team also plans on building their own test stand to test the rocket motor. Most of the work being conducted currently is conceptual and design based, but construction will begin when possible.

LEADS  Yousuf Tariq-Shuaib (MAE '22), Miles Simpkins (MAE '22)
Douglas Chin (MAE '21), Roger Hou (MAE '21)

BUDGET  $15,000

SKILLS  CAD, 3D Printing, PCB design and manufacturing, mechanical design, advanced fabrication, simulation/trajectory estimations, fin simulations, motor simulations, stress simulations

TOOLS  PTC Creo, BurnSim, MATLAB, electronics shop, composites lab, OpenRocket, Fritzing, machine shop
The 2021 NASA BIG Idea Challenge harnesses student innovation to develop technologies for upcoming NASA missions. As America returns to the Moon in 2024 to lay the groundwork for a more permanent human presence, dust mitigation technologies are in great demand. Lunar dust can cause electrical shortages in spacesuits, rovers, and landers, cause respiratory problems to astronauts, make it difficult for a spacecraft landing on the moon to see its target, and other issues. A successful proposal for a novel lunar dust mitigation technology in the fall can win our BIG Idea Challenge team between a grant to begin building a prototype in the spring semester. Our team has designed LIGHTSABER, an automated robotic system that uses lasers to ablate lunar dust from the surface of astronaut suits to assist in a future manned mission to the moon.

LEADS
Abhinav Agarwal (MAE ’23), Benjamin Benjadol (MAE ’23)
Thomas Dhome-Casanova (ELE ’23) 

BUDGET
$100

SKILLS
CAD, mechanical design, particle and laser simulations, systems engineering

TOOLS
Autodesk Fusion 360, Autodesk Inventor, LaTeX, EKSPLA laser simulations
NASA’s RASC-AL Challenge is a design competition where teams develop new concepts that leverage innovation to improve NASA’s ability to operate in space and on distant bodies. This year’s themes range from preparing for the next steps of NASA’s return to the Moon, to innovating solutions for a mission to Mars, to designing architectures to visit Venus and Ceres. Our proposal will address novel and robust applications to support expanding humanity’s ability to thrive beyond Earth. The team has been working on creating a durable, low-mass lunar habitat that fits various requirements. We have split into various sub-teams to tackle different challenges such as power generation and the air/water cycle. We are currently working on getting our overall habitat design finalized before moving forward with more specific aspects of the project. Our goal is to create a design proposal and video to submit by March.

**LEADS**
Polina Zhilkina (MAE ’22), Cindy Li (ELE ’22)

**BUDGET**
$500

**SKILLS**
CAD, engineering design, research

**TOOLS**
PTC Creo
Community Engagement

Monthly Community Rocket Launches

Before the pandemic, we held several launches open to the University community as well as the Princeton community at large. Additionally, we had launches with local home school groups where all the students had the opportunity to launch a rocket that they had made. In the previous years, we have taught over 100 people about the basics behind rocket science through demonstrations and launches. This year, we are continuing to support the University community through virtual events such as workshops and tutorials. We hope to continue having launches and demonstrations as soon as it is possible.

Visiting Local Schools

We have reached out to over 300 elementary school students through launches and demonstrations at the Wilberforce School and at Riverside Elementary School as part of their annual Science Day. We are currently assisting the Pennington School start their own Aerospace Club by providing rocketry resources. We hope to continue our support for these local schools and others through a virtual environment.

Media/Press Coverage

PRC has been featured in the following publications:
Princeton University ODUS newsletter: https://tinyurl.com/yczmsz5k
VICE Motherboard: https://tinyurl.com/y8fxx2uw
Spaceport America: https://tinyurl.com/y9cc45yg
Princeton University: https://tinyurl.com/yyux2ff5
Community Engagement

Inviting Speakers to Our Club

We have invited several major speakers to give a public lecture to our club over the years. This year, we had George Whiteside discuss space travel and the future of the space industry to our club. In addition, we had Prof. Luigi Martinelli talk about computational aerodynamics and how it can be used in the design of space and aircraft. We hope to host many more speakers in the future - potentially on campus if the situation permits.

Workshops

We hold rocket-building workshops for the Princeton University community every week and hold occasional workshops for a local homeschool group. We've helped over 20 people construct low-power rockets as a way to teach them about aerospace engineering. This year, we hope to host additional virtual workshops for the university community and expand on our previous work.

Collaboration with SWE

We have a strong relationship with the Princeton chapter of the Society of Women Engineers, and for the past few years we have worked with them at their event for high school students each semester. Through presentations, demonstrations, launches, and activities we have taught over 400 high school girls about aerospace engineering.
LETTER FROM THE PRESIDENT

Princeton Rocketry Club is the leading aerospace student club at Princeton. We have approximately 80 members who are passionate about all things space related: from rockets that can reach a height of 100 km to solutions for Mars and Lunar exploration. We welcome students with all levels of experience and all academic backgrounds. We have access to stellar mentors via Princeton professors and staff, and our members leverage our club's excellent experience, legacy, and expertise as they go on to take positions in the aerospace industry, research, and space policy.

- Abhinav Agarwal

Abhinav Agarwal - President

Abhinav Agarwal (MAE’23) is the current President of Princeton Rocketry Club and the co-lead for the BIG Idea Challenge Team. He also enjoys exploring physics and computer science. He loves reading about aircrafts, spends his free time on flight simulators, is one of the biggest Star Trek fans, and occasionally debates for Princeton.

Yousuf Tariq-Shuaib - Treasurer

Yousuf Tariq-Shuaib (MAE '22) is the current treasurer and team lead for the 30k SRAD Spaceport America team and the payload lead for the 30k COTS Spaceport America team. In addition to his work in the rocketry club, he has various other interests ranging from biomechanics to propulsion systems.

Douglas Chin - President Emiritus

Douglas Chin (MAE ’21) is a co-lead of the Spaceport America Cup 30k team. He hopes to help mankind achieve its interstellar potential. He has his L2 certification and co-built PRC’s 2019 SA Cup rocket, and has designed and tested flight hardware for orbital launch vehicles at Astra.
Jacob Essig (SPI '22) is a Students for the Development and Exploration of Space (SEDS) officer. He has co-led the NASA RASC-AL competition team, participated in the NASA Micro-g NExT competition team, and formerly served as the club’s social officer. He is interested in public policy and philosophy, and how they apply to the realm of space exploration and development.

Mina Musthafa (NEU '22) is a Students for the Development and Exploration of Space (SEDS) officer. She has co-led the High-Powered Rocketry team and is working towards her L2 certification while also participating in the IREC team. Additionally, she is interested in medicine and engineering biology, as well as data analysis and public scholarship literature focused around public/global health issues.

Benjamin Benjadol (MAE '23) is the Launch Operations Lead, Speaker Officer, and the NASA BIG Idea Challenge Team Co-Lead in the Princeton Rocketry Club. Apart from all things space, he enjoys learning about aviation, geography, Android, and planetary science.

Gavin Cotter (MAE '23) is the Social Media and Website Development officer in the Princeton Rocketry Club. Gavin has interests in robotics, space exploration, and economics. Gavin recently earned his L1 rocketry certification through the Princeton Rocketry Club and served as one of the electrical sub-team leads for that launch.
Edoardo Contente (PHY ’23) is the Business Development Officer and participating in the BIG Idea Challenge Team. He loves all oscillatory phenomena, from learning fundamental physics, surfing waves, speaking new languages to composing some fusion music, hence his involvement with the Princeton Undergraduate Composers Collective.

Jaebyeok Yoon (MAE ’23) is the Training and Technology officer. He was mechanical sub team for High Power Rocketry Project last year. He is excited to share all the good professional and tech tips this year!

Thomas Dhome-Casanova (ELE ’23) leads software engineering for PRC’s NASA Big Idea Challenge 2021 team. He is studying Electrical Engineering and is passionate about robotics. Thomas has worked on software to predict the orbits of asteroids and developed the electrical systems of Firefly Racing’s electric racing cars. In his free time he climbs and plays tennis for Princeton Club Tennis.

Polina Zhilkina (MAE ’22) was part of the ThinSat team and co-lead RASC-AL competition team last year. She speaks 6 languages and is passionate about theater.
Cindy Li - RASC-AL Team Lead

Cindy Li (ELE ‘22) is a co-lead for the RASC-AL team. She is studying Robotics and Cyber-Physical Systems track. Outside of Rocketry Club, she is also involved in the Princeton Questbridge community.

Kasey Shashaty - HPR Team Lead

Kasey Shashaty (ELE ‘23) is a co-lead for the High Powered Rocketry Level 1 Certification Project. Last year, she was on the mechanical sub-team for HPR. She is passionate about bioengineering. Kasey also rows for Princeton Lightweight Crew and runs the PRC TikTok account.

Roger Hou - SA Cup Team Lead

Roger Hou (MAE ‘21) is a co-lead of the Spaceport America Cup 30k team. He is interested in the structures and materials aspects of all things that go into space. He helped to build Princeton’s 2019 IREC rocket. He had previously worked as a fluid systems intern at Firefly Aerospace.