

Auburn University Space Club

Officially recognized as of Fall 2014, the Space Club is an Auburn University-affiliated club supported by the Alabama Space Grant Consortium. Space Club can be thought of as a "conglomerate" of interdisciplinary design teams, each of which will be detailed within this article. These design teams mostly develop systems for competitions, such as NASA's Robotic Mining Competition, NASA's Human Exploration Rover Challenge, NASA's University Launch Initiative, and recently added, the CanSat competition hosted by the American Institute of Aeronautics and Astronautics (AIAA) and the American Astronautical Society (AAS). Alongside these technical design teams, Club Europa has recently joined the group under the Space Club umbrella.

In addition to financial support from the Consortium, Space Club receives supplemental funding from the university and its affiliates. The Consortium grants funding to university groups that reflect a "workforce development program." This criterion is the key premise of any group within the club. The driving factor for the design teams is that each helps foster an environment that leads to the development of professional skills for the students involved. We These skills are needed for the careers available upon graduation. Skills include everything from working on teams comprised of people with various backgrounds, to technical skills students are not taught in classrooms.

Experience working on design teams gives students a chance to apply what they learn in the classroom, as well as an introduction to real world problems. Students bring different expertise and backgrounds, yet all must interface their design elements with those of the other members. Students are each given a specific portion of a design that they adopt and make their own. Students then come together at the end to make it all work. Our team introduces the aspect of working on a budget, as all teams have deadlines and budgets that must be met. Students are also taught valuable skills and trades that may not be

offered within their curriculum or a class within their major. These skills include technical writing and documentation, machining, soldering, PCB design, fabrication, etc.

In addition to the technical elements, projects include aspects such as public relations, grant writing, recruiting, and public speaking. Communication skills, both interpersonal and formal, are core aspects of a workforce. Being able to communicate with the people on your team, the public, colleagues, and potential donors is a skill developed in the projects. The team is now developing programs to introduce and attract primary and secondary education students to STEM fields.

Robotic Mining Competition

In May 2015, the Space Club participated in the 6th Annual Robotic Mining Competition hosted by NASA in Cape Canaveral, Florida. The purpose of this competition is to develop an autonomous mining system employing methods that are potentially applicable in an actual Martian mission. The competition entails a rover placed in a mining arena filled with roughly 30 cm of lunar simulant, BP-1 sulfate, laid atop roughly 30 cm of gravel. This regolith (BP-1) is the closest substance on earth to the composition of lunar soil. This mining arena is divided into three sections, the starting area, obstacle area, and mining area. On the outside of the starting area is a collection bin for excavated regolith. The objective is to, within ten minutes, make as many trips through the obstacle area, collect the regolith in the mining area, and to bring it back to the collection bin. The rover is allowed to make as many attempts as possible within the ten-minute window to collect as much regolith as possible.

There were many obstacles the team faced throughout the design for this competition. Most of the obstacles stemmed from the fact this was a new design team. None of the members had ever competed in this



Photo: Members of the Auburn University Robotic Mining Competition Team standing with the rover they designed and built before their first round of competition.

competition, nor were they aware of all that it entailed prior to arriving Florida. Performing as a new team meant members had to create a design entirely from scratch. While other teams had been competing for years, our team had to design an unfamiliar system. For a first-year team, we excelled. Where many of the teams, including veterans, were not able to move their rover, we were able to traverse the course and excavate. We are vastly more prepared to come back the next year.

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CanSat Competition

Starting fall 2015, the Space Club will sponsor another competition team from Auburn University to travel to Texas and compete against other universities from across the nation. The CanSat is similar to a Design-Build-Fly (DBF) competition. However, unlike a traditional DBF competition, the CanSat is the payload and not the vehicle itself. The intended outcome of the competition is to develop mission-feasible technologies and methodologies to implement on a Martian glider mission.

The team must build a passive descent system that is capable of taking atmospheric measurements and video images. All the collected data are reported to a group station in real-time. The other aspect of the competition is a strong influence of the systems engineering methodology used by major players in the aerospace industry.



Photo: Members of the Auburn University Rocketry Association carrying their rocket to a launch site.

The major obstacle to be overcome by this design team is the adolescence of the program. Trying to get any new project up and running is a major hurdle. Recruitment and training is a daunting task, especially when novice group of students is training a less experienced group of students to develop a system. Luckily, the forced emphasis on systems engineering provides a solid structure throughout the design and development process. The other advantage for the Auburn University team is a testing platform. Working closely with the students of the Auburn University Rocketry Association (AURA), the CanSat design team will be able to test their system on a vehicle similar to actual system.

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Auburn University Rocketry Association (AURA)

Every May at the Marshall Space Flight Center, Auburn University sends a team of students to compete at the NASA University Student Launch Initiative Program. Auburn University has been selected to compete in the 2016 Rocket Launch Challenge. For this competition, the team will participate in a Design-Build-Fly project, where a vehicle will be designed to carry payloads in a mission feasible manner for the Space Launch System (SLS) currently being developed by NASA.

Every year poses a different challenge for the team. NASA releases a "Request for Proposals" at the beginning phase of each annual competition. Each request focuses on a different issue, such as a payload, a target altitude, or new methods for developing a ground station for instructing the vehicle. This changing objective means that every year the team must pivot the focus of their design.

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Club Europa

One of the big obstacles of Space Club is emphasis on technology. Club Europa allows for students who do not want to get involved with a technical design but wish to share their passion for space with like-minded individuals. Club Europa encourages fellowship for all students interested in everything from astronomy, emerging space technology, and brainstorming concepts for future space missions and projects. Activities hosted by this group are industry guest speakers, star gazes, field trips, and outreach initiatives.

Human Exploration Rover Challenge

Annually held in Huntsville, Alabama, is the Human Exploration Rover Challenge competition hosted by NASA. This team designs what we affectionately refer to as the "Moonbuggy." The Moonbuggy is effectively a four-wheeled tandem bicycle. Two riders pedal the system across an obstacle course in competition with other universities throughout the country. Much like the mining competition, the goal is to develop feasible methodology for extraterrestrial missions. Students on this team spend the entire year designing, machining, and fabricating a unique structure.



Photo: An Auburn University Student driving the human-powered rover at a competition in Huntsville, Alabama.

New rules with the most recent event posed a unique challenge for the team. The wheels were to be five inches across and non-pneumatic. The developed system required students to learn about new techniques for using materials that are not standard in a classroom. Carbon fiber and Kevlar were found to be valuable resources for the developed system. The team was able to create wheels that are like the loosely woven tires seen on regular vehicles. Through this design, the team was honored with the Neil Armstrong Design Award for ingenuity. The team ultimately placed 13th in the 2015 competition.

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More than technology

Space Club is a university organization based on principles of workforce development, interdisciplinary collaboration, and passion for space. We provide an environment where students are able to combine their passions for space technologies and sciences while also being able to develop professional skills and experience. This emphasis allows Auburn University graduates to enter the professional world with an advantage over other potential candidates. Learning aspects from technical trades to communication skills and networking, students who participate in our programs have an added level of investment in their future that will open them to a world of opportunities.