BSLI

at The Ohio State University

The Buckeye Space Launch Initiative Newsletter

Inside This Edition

May 2019 • Pre-Competition Launch Issue • Volume 4

BSLI
at The Ohio State University

Table of Contents

Project Team Updates

Project Team Updates

30k Looks to Spaceport, 10k Finishes Strong, and HAP Changes Direction

30k Project Team

– James Dai, Project Manager

The current state of 30k is in a good position. The test rocket performed well despite a CATO we experienced during our April test launch. All events fired and the rocket was almost entirely intact except for the lower body tube which only broke off because of a weaker stiffener tube we used to expedite construction. Because many of our components will be reused in the 30k competition rocket, the workload for our months leading to Spaceport will be less than that of previous years.

Moving forward, we will focus on finishing all required work a lot earlier so that we can place the main focus on integration. The goal is to arrive on the field in New Mexico on the first day, insert a few components, and then launch within hours. We can accomplish this by integrating many times before competition and ironing out our procedures fully. I'm excited to see how this month and a half turns out!

High Altitude Project Team

– Alan Spiers, Project Manager

The High Altitude Project team made strides in liquid propulsion designs and has decided to convert to a liquid engine development team. The team participated in Phase 1 of the Base 11 Space Challenge and was able to get far into the design process. Half way through the Spring semester, the team decided to shift gears to create a proposal for OSU to have the capability to conduct liquid propulsion research.

Going forward, the High Altitude Project will mainly focus on expanding liquid propulsion capabilities at The Ohio State University. The goal for this coming year is to develop and conduct a static fire test of a liquid engine by next summer. This will be done by working with university officials to lay the groundwork for future testing of liquid engines as well as continuing to develop our current designs for a liquid rocket engine.

10k Project Team

- Harrison Kearby, Project Manager

The 10k team performed two test launches during the year. The completed rocket weighed in over 60 lbs and was 10 feet long, making it the largest rocket ever built by the Buckeye Space Launch Initiative. The first launch went very well. The main chute deployed early, but the rocket was recovered. The launch featured both an upward and downward cameras, and the footage can be found on the team's YouTube channel. During the second launch, the upper launch button was stripped, resulting in a bad angle of the rocket off the rail. This resulted in a crash, but the team was encouraged to look at it as a learning experience. Each subteam made large strides during the year as well.

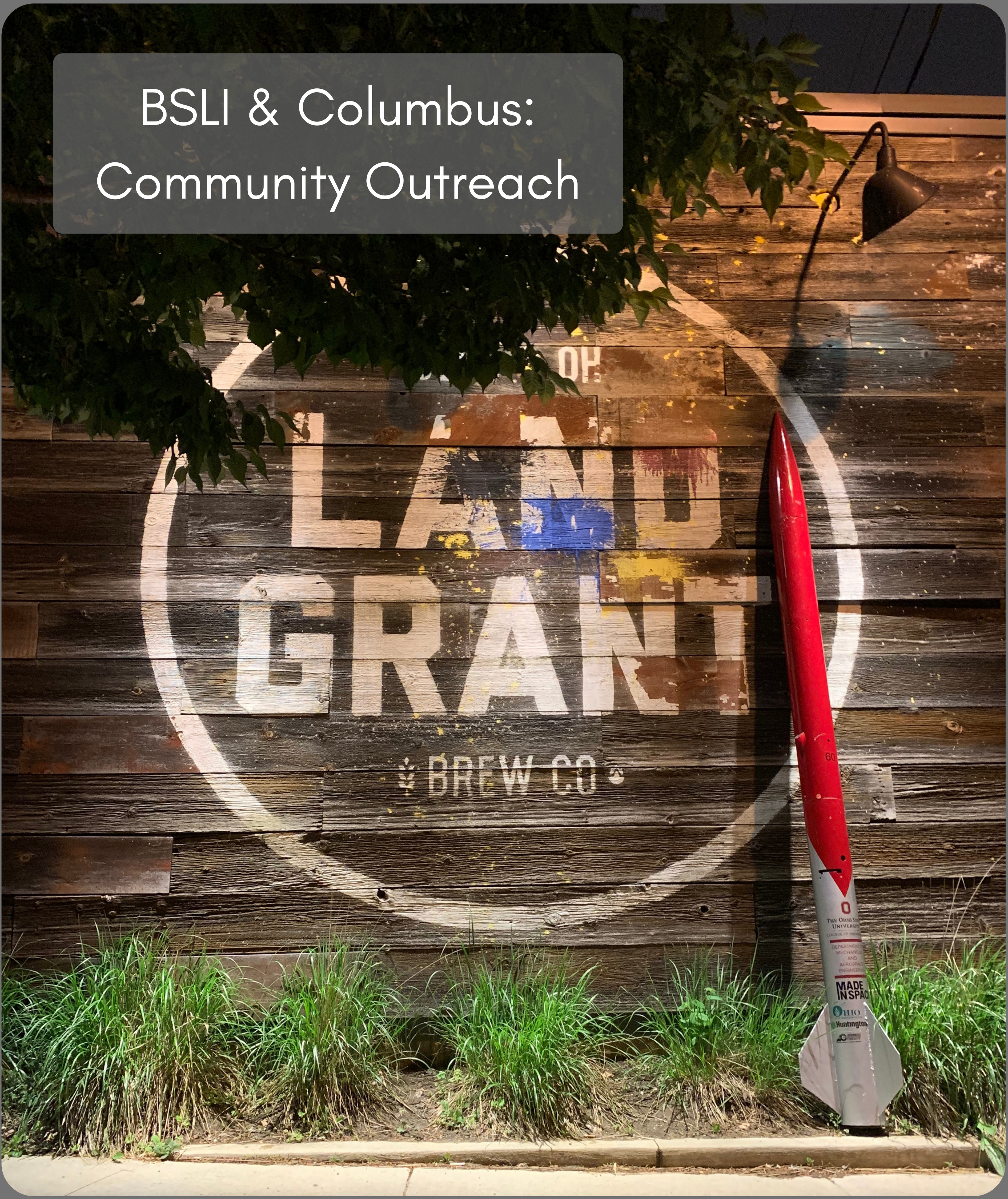
The Active Drag System (ADS) made large improvements in validation testing. On the physical side the ADS team was set to validate the CFD values used in the code with a wind tunnel test, however this effort was cut short when the wind tunnels went down for maintenance. The use of Hardware In a Loop (HIL) testing in the development of the code controlling the ADS allowed for rapid debugging and testing. Overall the system was refined to a point where the team believes that the ADS would function properly given an overpowered launch.

The Avionics team completed their custom electronics systems. The system was designed to be modular to allow easier integration of various components which sat in a strong and lightweight aluminum frame. They also successfully developed a remote Bluetooth® arming system for both the flight computer circuitry and the two onboard cameras.

During the 2018-2019 school year, the payload team increased the size of their housing unit in order to fit 6 CubeSats. The team continued their partnership with SEDS, and improved its high school payload program with the help of BSLI's outreach chair.
This year the recovery subteam taught new team members the core details of a dual deployment system. Also, the group laid the foundation for researching and manufacturing a C02 ejection system for future launch projects.

In this upcoming year, the 10k team will begin working toward a new competition, the NASA Student Launch. Last year's flywheel project has moved beyond the 10k rocket, and has been accepted to the International Astronautical Congress where it will be presented. Research, such as simulation and flight testing, is being performed throughout the summer to analyze the dynamics of a flywheel system on sounding rockets in preparation for presentation.

BSLI & Columbus: Community Outreach



Outreach

BSLI Outreach Team ignites Columbus's interest in Rocketry & Science

– Ada Kanapskyte, Outreach Lead

This year, BSLI has officially established a new branch of the team devoted to outreach. With an abundance of talented individuals across varying engineering and STEM majors, it is important that the team not only uses their talents and knowledge for project work, but also for the surrounding community. Our main focus has been primarily on doing outreach activities with elementary, middle, and high school students, however, the team has also partnered with local Columbus organizations to participate in community events.

Throughout the year, BSLI has collaborated closely with COSI, the Center of Science and Industry in Columbus, specifically with the COSI Academy. This is a program that gives high schoolers an opportunity to explore STEM more in depth by completing design challenges and visiting local science organizations. In March, the students came to visit OSU and took part in a "college panel." Here, the high schoolers were given an opportunity to connect with BSLI members and ask any questions they had about college. The discussions ranged from topics about engineering to simply what living in a dorm is like. Afterwards, the students were given a tour of Knowlton, the School of Architecture, the High Voltage Laboratory, and they engaged in another discussion with Dr. Newton, the director of the Battelle Center for Science, Engineering and Public Policy. At the end of the day, the students left with a greater understanding of STEM in real life and hopefully more inspiration to pursue a career in STEM in the future!

To bring rocketry to life on a smaller scale, BSLI also visited the Columbus PAST Innovation Lab, an educational R&D prototyping facility for students, and Tallmadge Elementary school. Here, the basics of rocket science were brought to life as BSLI members helped middle and elementary school students build their own, Alka-Seltzer powered rockets.

Lastly, this year BSLI participated in two City-wide Star Parties, which were community events organized as part of the first ever COSI Science Festival. The team partnered with CAS, a division of the American Chemical Society and Land Grant Brewery. At both events, BSLI members showcased competition rockets and had the opportunity to share and inspire a curiosity for rocketry in the Columbus community. The Land Grant Brewery also provided BSLI with a fundraising opportunity, and across the two events and with the contributions of many generous donors, BSLI raised a total of $220!

The Buckeye Space Launch Initiative Newsletter

BSLI Tech

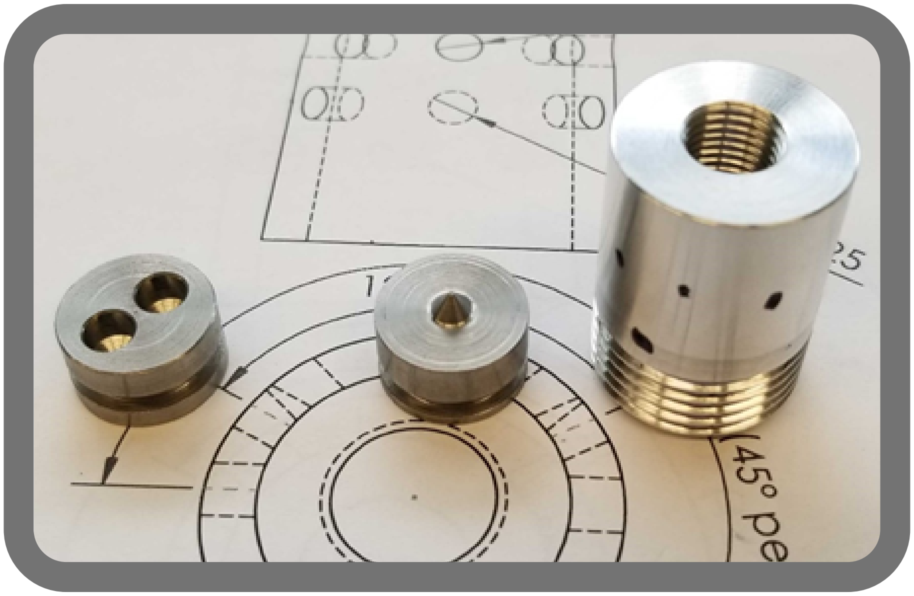
May 2019 • Pre-Competition Launch Issue • Volume 4

BSLI Recovery Systems

- Lauren Klenk, 30k Recovery Lead

This past year has been all about research and development of a new CO2 ejection system to deploy the parachutes in lieu of the current all black powder system. This change will serve to make the system safer and more reliable as in higher altitudes black powder will not burn as thoroughly, which can result in an ejection system failure. The challenge has been to find a mechanism that will release the gas quick enough to provide enough pressure difference to separate the nosecone.

Preliminary testing with a solenoid as the puncturing mechanism looked promising but it required more power than the flight computers could give. Currently, research is now being done using the ROUSE-TECH CD3 unit. This is a commercial unit designed for all levels of rockets and has been flight proven in many rockets. However, the size of the unit with the CO2 cartridge is too large to fit on the bulkhead of our rocket and therefore modifications were made, and a new unit was machined as shown below. Preliminary testing looks promising and the team is currently working on improving the unit further to release the CO2 quicker for a more forceful nosecone separation. Some changes included changing the tip of the plunger that punctures the canister and changing the number of holes and size of holes that the gas is released through. Unfortunately, the current configuration is not dependable enough to put on the rocket for this year, but this research will continue to next year.



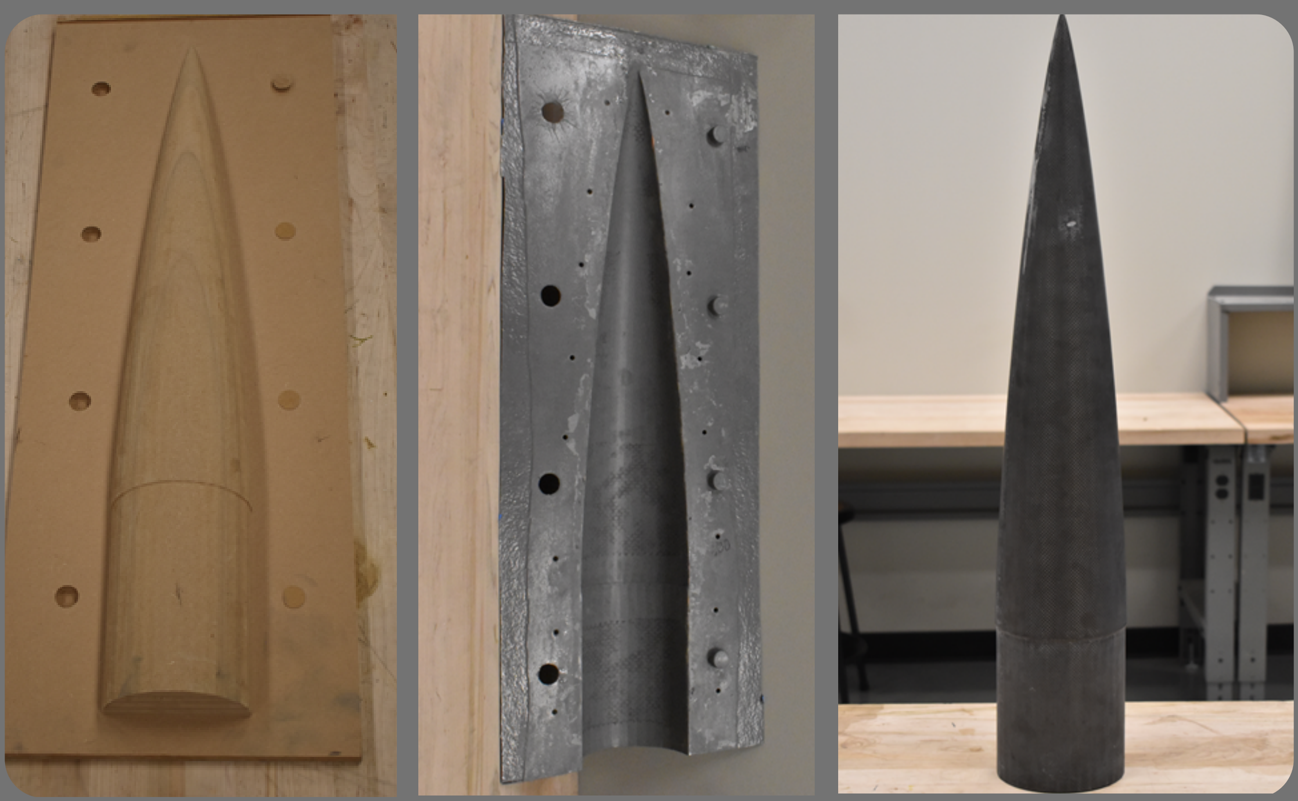
In addition to the ejection system research, all 3 parachutes (main, pilot, and drogue) were designed and built by hand. The design factored in the weight of the rocket, the environment it would fly in, and the expected apogee. The dual-deployment system was flight tested at 30k's test launch on April 27 where the new line configuration (which reduced the length of the lines resulting in more space within the nosecone) worked perfectly, and all parachutes were able to deploy. The team has put in hard work and we expect the system to perform nominally during the competition this June!

Composite Structure Manufacturing at BSLI

– Anu Timple, 30k Structures Lead

For the Buckeye Space Launch Initiative, our structures team works to continue pushing the boundaries of what college teams are capable of in the world of composite manufacturing. As opposed to simply buying commercially made parts, we don't back away from the challenge of creating custom made parts that take on complex shapes. This year, we have a design that involves several composite parts which together attach to form the rocket.

As a team, we have been working to perfect our manufacturing techniques for complex shaped parts. One such technique, first requires the team to model our desired part in a CAD program such as Solidworks. Next we use a a CNC machine to create a plug made of high density wood. One such plug that we had used for our nosecone is displayed below. From this plug, we then layer sheets of fiberglass and special mold fabricating epoxy to create a mold for our custom piece.



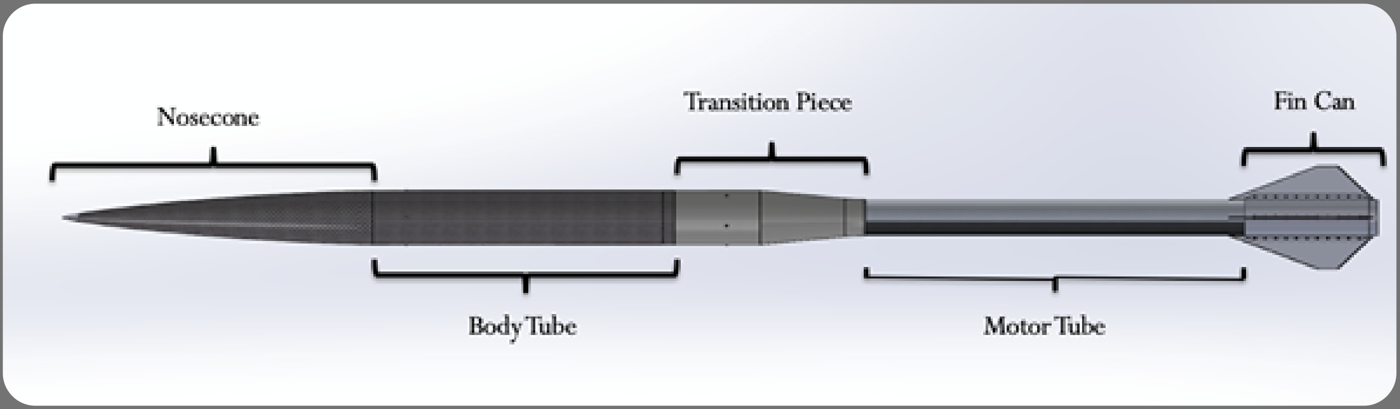
Plug Mold Final Product

After creating two pieces for a whole complete mold, we then create the actual piece. For example for the nosecone, we add layers of carbon fiber wetted with epoxy to each side of mold. Then we combine these pieces, vacuum seal the piece into the mold so as to ensure that the carbon fiber layers are conforming to the mold, and allow it to cure in an oven we built designed to cure pieces at 120˚F. We additionally have been experimenting with aerospace grade materials such as nomex honeycomb. One area we use such materials is on our molds so as a solution for preventing the bending of the mold when curing the actual piece.

We follow the same process for our other special geometry piece, the transition piece which has the difference of being the only piece of the rocket composed entirely of fiberglass. We always try to use carbon fiber for the majority of our rocket body because of how strong it is for its weight. The main issue lies that the transition piece is supposed to house antennas for the transition piece. Carbon fiber is not radio frequency transparent, leading to the problem that any housing composed of carbon fiber would block any signals from being received by the antenna. But fiberglass is radio frequency friendly, and its manufacturing process makes it advantageous for use in complex shaped objects.

After these pieces, a similar method is used for our more simple shaped components such as our body tube. For simple cylindrical pieces we obtain a hollow cylindrical mandrel, wrap wetted carbon fiber around the mandrel and then wrap the body with perforated heat shrink tape so as to squeeze out excess epoxy since a vacuum bag cannot be sealed well around such a mandrel.

Throughout the year we have worked to improve our composite material crafting techniques with improvements seen in the finish of the pieces such as a reduction in wrinkles or bumps that were sometimes found in pieces due to a lack of curing pieces conforming to the mold or issues from how we laid our composites around a mandrel. Yet through every mistake we gain a little more knowledge for creating flawless composite pieces.



MADE IN SPACE®

ARCONIC
Innovation, engineered.

BOEING

ADVANCED CIRCUITS | 4PCB

GATEWORKS
INNOVATIONS FOR EMBEDDED DESIGNS

RADIOBRO CORPORATION

OHIO SPACE GRANT CONSORTIUM

PipeValves

Huntington

DEPARTMENT OF MECHANICAL AND AEROSPACE ENGINEERING

THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

Department of
Electrical and Computer Engineering

BATTELLE CENTER FOR SCIENCE, ENGINEERING, AND PUBLIC POLICY

A Special Thanks to All of Our Sponsors!

BSLI

at The Ohio State University

The Buckeye Space Launch Initiative Newsletter

Keep an eye out for our Post-Competition Issue for an inside look at our 30k team's performance at the Spaceport America Cup!