



BEST Robotics



# *2024 Competition Game Day*



*November 16, 2024*

*Trojan Arena*

*Troy University*

*Troy, AL*

# Welcome

TROY University's BEST Robotics Planning Committee, would like to welcome all students, teachers, coaches, mentors, parents, and sponsors to the 2024 TROY University BEST Robotics competition. The mission of BEST is to inspire students to pursue careers in science, technology, engineering, and mathematics through participation in a competitive robotics program that fosters knowledge, teamwork, and communication. Students learn to work through the engineering design plan, develop strong communication skills, effective leadership and teamwork abilities, understand the entrepreneurial process, and comprehend the global business environment.

The theme of this year's competition is "Low G". BEST Robotics has partnered with space agencies to develop robots for lunar exploration and preparation for human habitation on the moon. Students are afforded the opportunity to design, build, and test robots to navigate the challenging low-gravity environment, complete tasks from previous missions, and construct the Hoberman Habitat in the Central Basin Crater. This mission is an essential step towards establishing a multi-planetary civilization, and success depends on the innovative capabilities of each team's robot.

On behalf of TROY University BEST Robotics, and with sincere gratitude, we extend a special thank you to all of our sponsors for making TROY University BEST Robotics possible.

Good luck teams!

----- *TROY University BEST Robotics Planning Committee*

OFFICE OF THE GOVERNOR

KAY IVEY  
GOVERNOR



STATE CAPITOL  
MONTGOMERY, ALABAMA 36130

(334) 242-7100  
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## STATE OF ALABAMA

November 16, 2024

Greetings:

I would like to welcome you to the 2025 BEST Robotics Competition held on November 16, 2024 in collaboration with Troy University BEST, Wiregrass BEST, and Montgomery BEST Robotics on Saturday, November 16, 2024 at the Trojan Arena.



The State of Alabama is proud to host this exciting event and to welcome you with true Southern hospitality. I would like to congratulate the teams who are competing at this year's competition. I encourage you to continue your education and to make service to the state and nation a priority in your life. You represent America's bright and shining future.

During your stay, I hope you will take advantage of the many family oriented and fun-filled activities that your host city has to offer. Upon completion of the event, many of you will return to your homes. I wish you a safe and pleasant journey and hope you will come back to Alabama often.

Again, welcome to the Wiregrass BEST, Troy University BEST and Montgomery BEST Robotics Competition and best wishes for a memorable event.

Sincerely,

A handwritten signature in black ink that reads "Kay Ivey".

Kay Ivey  
Governor

KI/pb/aw

Office of the  
Chancellor

216 Adams  
Administration  
Building  
Troy, Alabama  
36082

334-670-3200  
334-670-3774 FAX



November 16, 2024

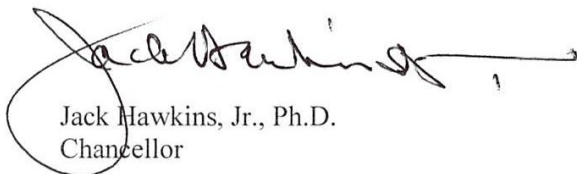
Dear Participants, Family, and Friends:

It is my pleasure to welcome each of you to the Troy University Wiregrass BEST Robotics Competition. TROY places a high value on the disciplines of science, technology, and mathematics. These areas are vital to the continued growth and progress of our region, state, and nation.

For 137 years, Troy University's mission has been to prepare leaders for Alabama, originally in education, and today in all disciplines and areas of service. Our founding motto, "Educate the mind to think, the heart to feel, and the body to act" is as true today as it was in 1887, and it captures perfectly the spirit of this competition.

Today's participants may one day develop technologies that will change our lives. Maybe dozens of groundbreaking ideas will have their genesis at the Troy University Wiregrass BEST Robotics Competition. Regardless, we want all competitors to have fun and enjoy their day at Troy University!

Sincerely,

A handwritten signature in black ink, appearing to read "Jack Hawkins, Jr.", written over a circular stamp or seal.

Jack Hawkins, Jr., Ph.D.  
Chancellor





Wiregrass BEST Robotics  
BOOSTING ENGINEERING, SCIENCE, AND TECHNOLOGY

Welcome Parents, Teachers, Students, and Community Members:

Welcome to the Trojan Arena for a day of going to the Moon. Low G has been innovative and creative for our hubs in BEST Robotics and for our students, even here in the Wiregrass.

On behalf of the Wiregrass BEST Robotics Board of Directors, we welcome you to our 2024 Game Day. We are excited to collaborate with TROY University BEST and Montgomery BEST for this game season and are thrilled to see what the students from all hubs have created.

Today, you will see the students' products and what they accomplished over the 56 days. It is impressive to see from even yesterday at the Marketing Presentations how much our students have learned about how robots operate in space.

We invite you to enjoy this day and look at all the exhibit booths, talk with all the students, and see what they have learned from this experience. For any social media post, we ask you to use the hashtags #thanks2BESTRobotics, #LOWG2024, and #BESTRobotics2024.

Concessions are also available for you, and the Dorthy Adams Student Center has its food vendors also open.

Again, my board and I welcome you, and we hope you will enjoy your day here at the Trojan Arena.

Sincerely,

*Stephen L. Tsukuda*

Stephen L. Tsukuda  
Executive Director  
Hub Director



**Montgomery BEST Robotics  
BOOSTING ENGINEERING, SCIENCE, AND TECHNOLOGY**

Dearest Parents, Teachers, Students, and Community Stakeholders:

Welcome to the 2024 BEST Robotics Game Day Competition at Trojan Arena on the beautiful Troy University campus. The Montgomery, Troy and Wiregrass hubs collaborated to bring you an experience that we hope will leave a lasting impression. This year's theme "LOW G" is fitting, as we will try to bring you an "out of this world" experience as you observe our teams compete for a chance to participate in the upcoming South's BEST Regional Championship.

Please take the time to visit all of the team exhibits and witness all of the hard work and creativity that each team displays in making this event a reality. While there is a finite amount of time that the students have to work on all tasks from brainstorming, designing, building, and marketing, the impact that this experience has on all of us is infinite. The Montgomery BEST Hub would like to recognize Amazon and Honda for financial support for this year's competition and look forward to continuing this relationship in the future. On behalf of the Montgomery BEST Robotics Hub located at Alabama State University, I would like to encourage you to enjoy the present moment as we focus on building the future.

Sincerely,

A handwritten signature in black ink, appearing to read "Robert L. Green".

Dr. Robert L. Green  
Hub Director  
Montgomery BEST Robotics

## Saturday, November 16, 2024

8:00 AM – 8:15 AM	Team Registration – <i>Trojan Arena Back Lobby Box Office</i>
8:15 AM – 9:15 AM	Compliance Check-in – <i>Pit/ Trojan Arena Floor</i> <b>***Team registration must be completed before teams may participate in compliance check. [Will have 2 compliance stations]</b>
8:30 AM – 10:00 AM	General Public Registration – <i>Trojan Arena Lobby</i>
9:15 AM – 9:45 AM	Drivers/ Spotters/ Mentors Meeting - <i>Pit/ Trojan Arena Floor</i>
9:45 AM	Line up for Parade of Robots - <i>Pit/ Trojan Arena Floor</i>
10:00 AM	Opening Ceremony <ul style="list-style-type: none"> <li>- Welcome</li> <li>- Pledge of Allegiance</li> <li>- National Anthem</li> <li>- Recognition of Sponsors</li> <li>- Parade of Robots</li> </ul>
10:30 AM – 1:00 PM	Competition Matches <b>Seeding Rounds [5 matches per team]</b>  <i>Montgomery BEST Teams [7 Teams; 5 matches per team]</i> <i>Troy University BEST Teams [10 Teams; 5 matches per team]</i> <i>Wiregrass BEST Teams [3 Teams; 5 matches per team]</i>
10:30 AM – 4:00 PM	Team Exhibits Fair – <i>Trojan Arena Lobby</i>
1:00 PM – 1:45 PM	Lunch Break
1:45 PM – 3:15 PM	Competition Matches <b>Semi-Final Rounds [3 matches per team]</b> <b>TROY University BEST Robotics Teams Only</b>
3:15 – 4:45 PM	Competition Matches <b>Final Rounds [3 matches per team]</b> <i>Montgomery BEST Teams [7 Teams]</i> <i>Wiregrass BEST Teams [3 Teams]</i>
4:00 PM	Team Exhibits may be dismantled
4:45 – 5:45 PM	Competition Matches <b>Final Rounds [3 matches per team]</b> <b>TROY University BEST Robotics Teams</b>
5:45 PM – 6:15 PM	Break
6:15 PM – 7:00 PM	Awards Ceremony
7:15	Teams Advancing to South’s BEST Competition Meeting - <i>Pit/Trojan Arena Floor</i>





## BEST Robotics

### 2024 Participating Teams

Team Number	School Name	Sponsor	Competition Type
#2251	Abbeville High School	Mr. Alvin Wiggins	Head-to-Head
#2254	CA3L	Mrs. Kim Sellers	BEST Award
#2280	Clark-Shaw Magnet School	Mrs. Angela Atchison Mrs. Renae Brewer	BEST Award
#2285	MACH	Mrs. Stephanie Maples	BEST Award
#2289	Pleasant Home School	Mrs. Kim Sellers	Head-to-Head
#2288	St. Luke's Episcopal School	Dr. Eric West	BEST Award
#2279	St. Paul's Episcopal School	Dr. Stacey Burt	BEST Award
#2267	Thurgood Marshall Middle School	Mrs. Patricia Radford	BEST Award
#2282	WP Davidson High School	Mr. Michael Fletcher Mr. Phillip Brewer	BEST Award
#2269	Zion Chapel School	Mr. Kimberly Braisted	Head-to-Head





## 2024 Participating Teams

<b>Team Number</b>	<b>School Name</b>	<b>Sponsor</b>	<b>Competition Type</b>
<b>#1351</b>	<b>Saraland High School</b>	<b>Chelsea Deese</b>	<b>BEST Award</b>
<b>#1352</b>	<b>Beulah Middle School</b>	<b>Danielle O'Connor Kenneth Atkinson</b>	<b>BEST Award</b>
<b>#1355</b>	<b>Houston Academy</b>	<b>Andrew Kirk</b>	<b>BEST Award</b>



## 2024 Participating Teams

<b>Team Number</b>	<b>School Name</b>	<b>Sponsors</b>	<b>Competition Type</b>
#0607	Eastwood Schools	Lee Sumner	BEST Award
#0608	Evangel Christian School	Stephen Daniels	BEST Award
#0611	Tallassee High School	William Taylor	BEST Award
#0617	Saraland Middle School	Paul LePiane Tracy LePiane Barbara McDaniel	BEST Award
#0622	McKee /BTW /PJHS	Jennifer Julius Telisa Warren Jessica Johnson	BEST Award
#0625	Wetumpka High School	Virginia Valardi	BEST Award
#606	Navarre High School	Tami McConnell	BEST Award

# 2024 “Low G” Animation

[BestRobotics HD v3.mp4 - Google Drive](#)



# Field Layout

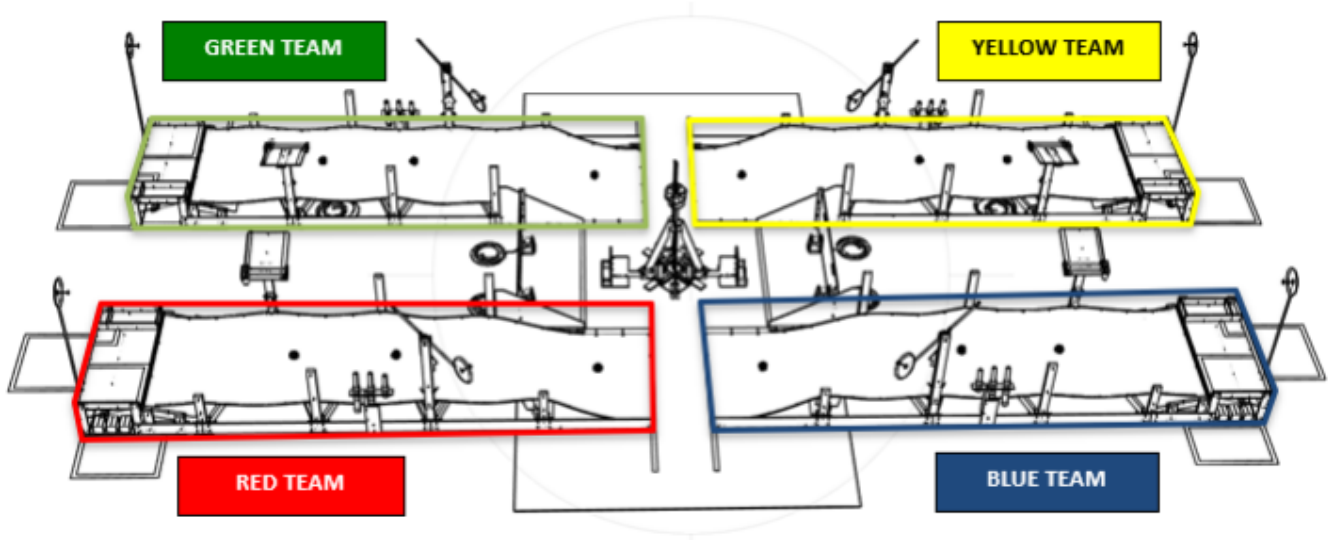


Figure 3.1 Game Field Top View

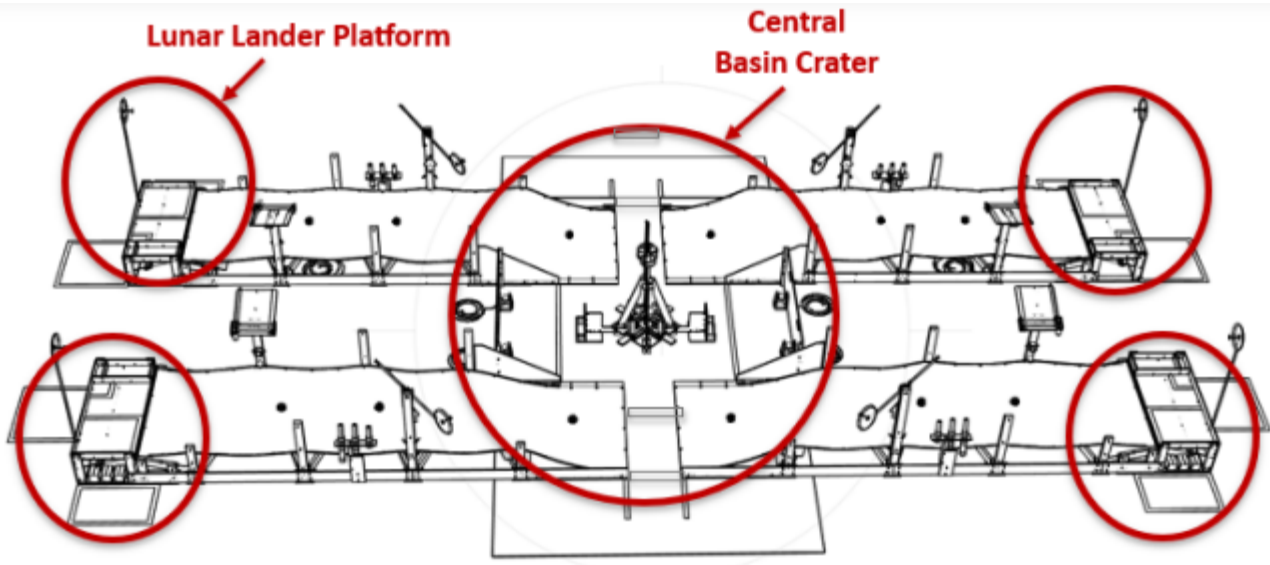


Figure 3.2 Lunar Lander Platforms and Central Basin Crater

Figure 3.3 provides a top view of one team landing site and the Central Basin Crater. Note that field quadrant pairs are reflections of one another; *i.e.*, the location and orientation of components on red and green quadrants are mirror images of each other.

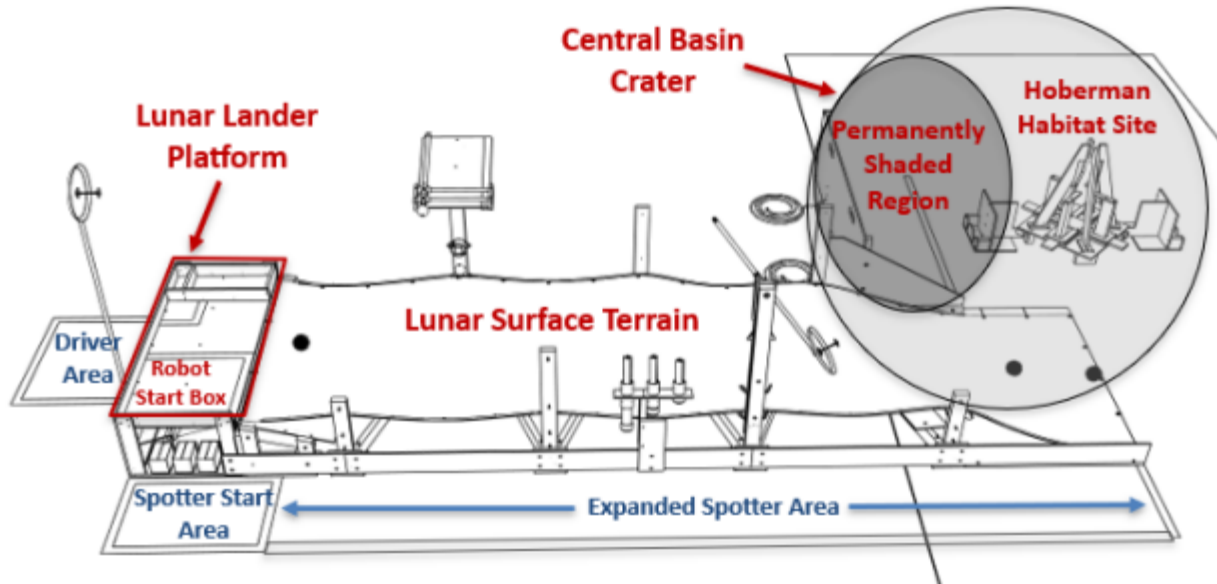


Figure 3.3 (Red) Team Landing Site

# How to Score Points

Table 3.5 Scoring Summary

Task Completed	End of Match Location/Condition	Points Each	Max # Possible Per Team	Max Pts Per Team
<b>Lunar Surface Tasks (easy setting)</b>				
Moon Rock Collected	Resting on the team's lunar lander platform.	3	3 - 12*	9 - 36*
Moon Rock Processed	<a href="#">Inside</a> the team's mineral processing tray.	10	3 - 12*	30 - 120*
Core Sample Processed	<a href="#">Inside</a> the team's mineral processing tray.	13	3 - 12*	39 - 156*
Radio Antenna Repaired	Antenna arm is touching the vertical stop.	15	1	15
Solar Panel Repositioned	Solar panel is touching the hard stop.	25	1	25
Solar Array Cleaned	Solar array wiper is inside the banded region.	15	1	15
Robot Battery Replenished	Robot battery is resting on the robot.	8	1 - 4**	8 - 32**
Robot Recharged	Robot recharge cable connector is fully supported by the robot.	30	1	30
Robot Self-Preservation	Robot is inside the self-preservation area.	30	1	30

Task Completed	End of Match Location/Condition	Points Each	Max # Possible Per Team	Max Pts Per Team
<b>Central Basin Crater Tasks</b>				
Habitat Module Attached Level 1	Habitat module is fully supported by the base of the habitat construction location and <u>inside</u> the habitat location boundary	30	3	150
Habitat Module Attached Level 2	Habitat module is fully supported by any level 1 scoring habitat module.	40	3	
Habitat Module Attached Level 3	Habitat module is fully supported by any level 2 scoring habitat module.	50	3	
Habitat Power Cable Driver-Controlled Retrieval	Habitat power cable is outside the PSR boundary.	40	1	100
Habitat Power Cable Autonomous Retrieval	Habitat Power Cable Retrieval was accomplished under Autonomous Robot Control.	100		
Habitat Power Connected	Power connector is inside the Hoberman Habitat Site power cable receptacle.	60	1	60
<b>Bonuses</b>				
Hoberman Sphere Construction Bonus	Hoberman sphere expansion is (activated).	35	1	35
Astronaut Ride-a-long Bonus	The astronaut is upright and fully supported by the robot.	50	1	50
Multi-Team Construction Bonus	When a habitat module stack consists of habitat modules of differing colors. The bonus is applied to each team participating in the stack.	50	3	150

\*Up to 12 could become available if dropped in the Central Basin Crater.

\*\*Up to 4 could become available if dropped in the Central Basin Crater.



# Bonuses

## 3.7.15 Bonuses

### 3.7.15.1 Lunar Surface Terrain Multiplier

- a. Points for the lunar surface tasks shown in Table 3.5 will vary depending on the team's selected lunar surface terrain (see section 3.3.3 ).
- b. The team must select a lunar surface terrain setting prior to the match starting.
- c. The point values of lunar surface tasks at the easy terrain setting are shown in Table 3.5.
- d. The point values of lunar surface tasks at the moderate terrain setting will be twice (2X) the value of the easy setting point values.
- e. The point values of lunar surface tasks at the hard terrain setting will be triple (3X) the value of the easy setting point values.

### 3.7.15.2 Hoberman Sphere Construction Bonus

- a. Bonus points will be awarded to the team who causes the Hoberman sphere release mechanism to drop exposing the color-coded hinge flap on the release mechanism.

### 3.7.15.3 Astronaut Ride-a-long Bonus

- a. Bonus points will be awarded if the astronaut is upright (head above lap) and fully supported by the robot at the end of the match.

### 3.7.15.4 Multi-Team Construction Bonus

- a. Bonus points will be awarded to each team participating in a stack of habitat modules with other teams.
- b. Bonus points may be awarded to a team for up to three habitat stacks.

## 3.7.16 Scoring Definitions

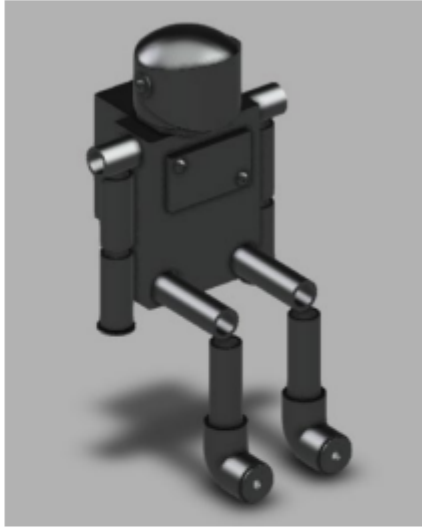


**Resting on** – touching such that the entire weight of the object is supported by what it rests on.


**Inside** – within the imaginary infinite vertical planes defined by the innermost sides of a container/area or the inner edge of a tape line defining the boundaries of an area.

**Connected/Attached** – When Velcro attachment is involved, a successful connection simply means that at least one Velcro fiber is connected, and the game piece remains in place.

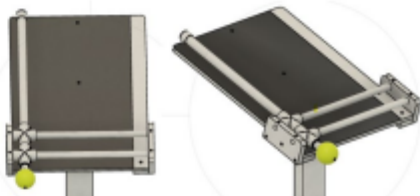
# Game Pieces

Table 3.1 Scored Game Pieces (Team Owned)


Game Piece	Description	Image
Astronaut	<p>10" H x 6" W x 3" D</p> <p>humanoid figure, in a seated position. Arms and lower legs hang freely.</p> <p>Made from 1/2" PVC pipe and wood blocks.</p>	
Habitat Module	<p>6" x 4" x 4" cardboard box, color-coded by team</p>	
Solar Array Power Cable (Robot Charging Cable)	<p>1/2" braided rope, 144" length</p> <p>One end fixed to the solar power station.</p> <p>One end is loose with a tennis ball attached.</p>	


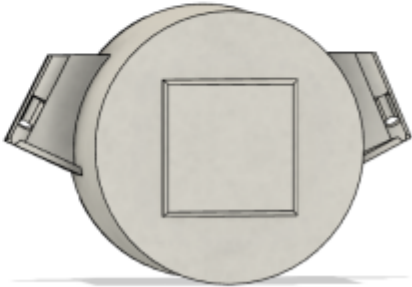
Game Piece	Description	Image
Habitat Power Cable	<p>1/2" braided rope, 72" length</p> <p>One end is routed through the PSR wall.</p> <p>One end is loose with a tennis ball attached.</p>	

*Table 3.2 Scored Assemblies (Team Owned)*

Game Piece	Description	Image
Solar Array Panel	<p>24" x 18" flat panel affixed to the top of the Solar Power Station. The panel can be tilted from ~15° (near horizontal) to ~75° (near vertical).</p>	

*Table 3.3 Scored Game Pieces (Not Owned by Team)*

Game Piece	Description	Image
Moon Rocks	<p>~ 5.5" round Squishy ball, color is irrelevant, 20 spikes removed</p>	

Game Piece	Description	Image
Core Samples	<p>1/2" Foam pipe insulation In three lengths (18", 14", 10"). Dark Gray.</p> <p>1/2" PEX inside (through entire length)</p>	
Batteries	<p>4" diameter plastic electrical junction box with a metal cover.</p> <p>2" x 2" Velcro (loop-side) on the plastic face.</p>	

**Thank you to all of the generous sponsors of  
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**BEST Robotics**

**Platinum [\$5,000.00 - \$9,999.00]**

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CONGRATULATIONS ON YOUR SUCCESS

ROBOTICS

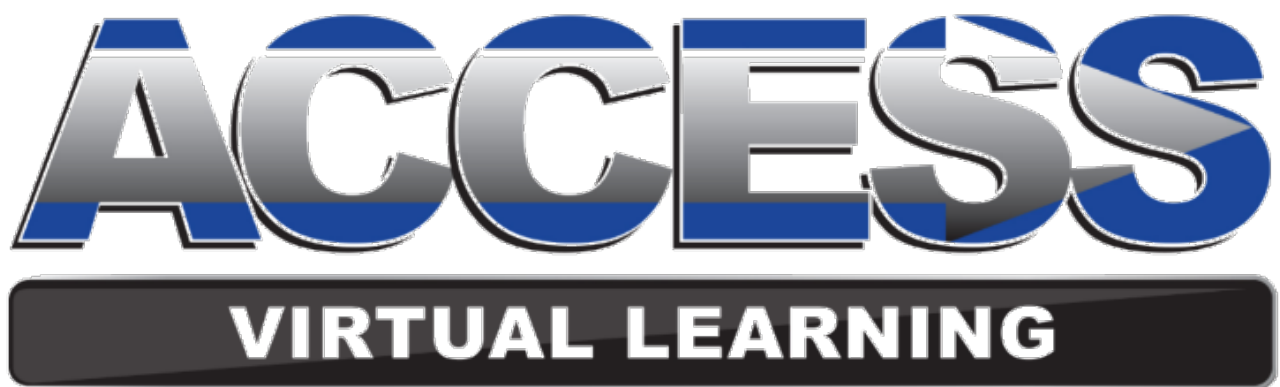
**BEST**



**Southeast Gas**

May the **EXCITEMENT** of the day **THRILL** you.  
May the **CHALLENGE** of the project **GROW** you.  
May the **SUPPORT** of your community **INSPIRE** you.

**Best wishes as you continue your  
successful path!**





# Thank you to all of our sponsors and supporters of TROY University BEST Robotics!



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BEST Robotics

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Dr. Robin Bynum	Executive Director of Educational Outreach Professor College of Education	Hub Logistics/ Awards Volunteers/ Judging
Dr. Hyung Jae (Chris) Chang	Associate Professor Computer Science College of Arts and Sciences	Volunteers/ Judging Software Support
Mr. Tom Dreilinger	Director, eLearning Alabama College of Education	Volunteers/ Judging Software Support
Dr. Shirley Farrell	Associate Professor College of Education	Volunteers/ Judging
Mrs. Margaret Folmar	Program Development Consultant Southeast Alabama Regional Inservice Center College of Education	Hub Logistics/ Awards Recruitment of Teams
Dr Byungkwan Jung	Assistant Professor Department of Computer Science College of Arts and Sciences	Software Support
Dr. Long Ma	Assistant Professor Department of Computer Science College of Arts and Sciences	Kit Assembly/ Software Support
Mrs. Jessica Moran	Instructor, Troy City Schools Troy, AL	Game Field Assembly
Dr. Charisse Snell	Alabama Technology in Motion Specialist Troy University, College of Education	Volunteers/ Judging Software Support

**Good luck to all teams!**

**Thank you to all of the generous  
sponsors of  
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**Thank you to all of the generous  
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