

IAF SPACE EDUCATION AND OUTREACH SYMPOSIUM (E1)  
Lift Off - Secondary Space Education (2)

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THE ZERO ROBOTICS PROGRAM INVITES YOUTH TO PROGRAM ROBOTS ON THE  
INTERNATIONAL SPACE STATION

**Abstract**

Zero Robotics is a programming competition in which youth write code for an autonomous robot aboard the International Space Station. Zero Robotics starts virtually with students using an online simulation to learn coding and test their strategy; finalists earn the unique opportunity to send their code to the International Space Station (ISS). During the live final event Astronauts host as student code is run on the Astrobeer Robotic Platform. Students watch live and observe the performance of the robot. Zero Robotics has an impactful history of training secondary school students for over a decade. To date approximately 20,000 students have participated, including middle school students and their informal out of school time educators from 20 US states and from 30 US states and multiple countries. The original Zero Robotics competition used the SPHERES system as the robotic platform on the ISS. Recently the SPHERES system retired from the ISS and new researchers are invited to apply for robotic experiments on the Astrobeer. The Astrobeer system includes three robots that can regularly receive fresh code, navigate autonomously in the ISS and perform tasks such as searching for items and assisting astronauts with procedures. The Astrobeer robots use fans for propulsion and visual navigation to locate themselves within the ISS. Through this funding, the Zero Robotics Program has achieved the first Middle School program to use Astrobeer during June to September 2022. During the 2022 Zero Robotics session student were taught to write code that allowed Astrobeer to trace the shape of letters. Student earned points for meeting all the geometric and timing constraints. The Zero Robotics team is co-led by the Massachusetts Institute of Technology and the Innovation Learning Center with support from many collaborators. The recent efforts have been funded in part by the NASA Minority University Research and Education Program and the Aerospace Corporation. With funds from the NASA MUREP program the Zero Robotics project seeks to improve opportunities for underrepresented students to participate in computer science and space robotics. Specifically, the Zero Robotics team is collaborating with the Navajo Technical University and California State University, Long Beach to improve the quality of service for indigenous and Hispanic students in the regions near the universities. The Zero Robotics team applies a Design Framework called Systems Architecture to analyze and design the program while considering the context and needs of stakeholders in indigenous and Hispanic communities.