

## What Is Beaver Works Summer Institute?

The MIT Beaver Works Summer Institute (BWSI) is a rigorous, world-class STEM program for talented students who will be entering their senior year in high school. The four-week program teaches STEM skills through project-based, workshop-style courses. BWSI began in 2016 with a single course offered to 46 students, a mix of local daytime students and out-of-state residential students. In this course, RACECAR (Rapid Autonomous Complex Environment Competing Ackermann steering), students programmed small robotic cars to autonomously navigate a racetrack.

The positive student reaction to our hands-on learning style led to the expansion of the program to include two new courses in 2017. To make sure students had the STEM background to participate fully in the three courses, the BWSI instructors developed online tutorials that students had to complete as a prerequisite for applying for the summer program. The new courses were Autonomous Air Vehicle Racing and Autonomous Cognitive Assistant. In 2017, 98 students from 49 high schools nationwide enjoyed BWSI.

In 2018, we grew again. This year, we had eight courses, adding five ones; each new course is developed with a requisite online tutorial. The 2018 class of BWSI boasted 198 young people from 106 high schools from across the country and Puerto Rico.

In 2019, we grew yet again and added two new courses to our eight. The 2019 class of BWSI grew to 239 students from 158 high schools across the country and Puerto Rico. As in the previous two years, we have had teams from Massachusetts and outside the United States participate in our RACECAR Grand Prix after they completed the course curriculum on their own.

In 2020, we offered 7 courses and 1 independent project virtually thanks to substantial efforts to shift the onsite program. BWSI partnered with many high schools to recruit future engineers to participate in our program, and had the pleasure of working with 178 students from 101 high schools across the country for the seven courses offered this year.

We stayed virtual in 2021, but expanded to 13 courses building adding autonomous systems, cybersecurity, software and engineering courses. We have over 330 students participating in our program from over 200 high schools and 30 states. We also supported 2 in-person programs at sites in Huntsville AL, and on the Kwajalein Atoll in the South Pacific for 25 students. We also had international teams from Mexico, Japan and Greece work through the curriculum independently and submit videos for our final event.

Expansion in the coming years will focus on developing new courses and working with collaborators to scale up the program nationally and internationally. We will continue to advise high school STEM teachers who want to incorporate the BWSI concepts and materials into their classrooms. Our vision is a broad network of BWSI-like programs that will help improve engineering education, and toward that goal, we will share our work and ideas with universities and schools worldwide.

Contact us at [bwsi-admin@mit.edu](mailto:bwsi-admin@mit.edu) for information on how to adopt this program into your school curriculum.