Maryland Engineering Challenges
2017 Robot Challenge
High School Level – Grades 9 to 12

Sponsored by the:
Institute of Electronic and Electrical Engineers (IEEE)

Engineer Contact:
Neville Jacobs — nevilleed@aol.com or 410.653.4176

Important Dates

Project Information Session

⇒ **Thursday, May 26, 2016** **4:00 p.m. to 7:00 p.m.**

This "drop-in" event is designed for teachers (and home schoolers) interested in coaching a team, to stop by and chat with engineers. Find out if this multi-part Challenge is a good fit for your students. There is no cost. Registration is not required (though an e-mail notification would be helpful). Contact James at jkeffer@thebmi.org or Nevilleed@aol.com for more information.

Coaches' Information and Hands-On Workshop

⇒ **Thursday, November 17, 2016** **4:00 p.m. to 7:00 p.m.**

This event is designed for Teachers and Mentors interested in coaching a team to learn about the project. Find out if this Challenge is a good fit for your students. The Training is not a requirement for this project but is strongly recommended, particularly for first-time participants. There is no cost. Registration is strongly encouraged. Contact James at jkeffer@thebmi.org, or Nevilleed@aol.com.

Coaches' Hands-On Workshop

⇒ **Saturday, January 28, 2017** **Beginning at 10:00 a.m.**

Learn the practical aspects of this Challenge. Work with engineers to explore design and constructions aspects of the project. Especially helpful for first-time Coaches and/or those with little previous engineering experience. Registration required prior to 1/25/17. Lunch is included. There is no cost. Contact James at jkeffer@thebmi.org, or Nevilleed@aol.com.

Written Report Due

⇒ **Friday, April 7, 2017** **Prior to 4:00 p.m.**

The team's Written Report should be submitted as a HARD COPY to the Baltimore Museum of Industry, and represent 25% of the total points awarded.

Registration - two are required:

- **One, for participation and to obtain the Robot Kits and Manuals**
- **A second, to register for the date and arrival time at the Robot Challenge Event**

To register for participation through the BMI, coaches should go to https://48278.blackbaudhosting.com/48278/MEC-Coach-Fee, and submit a $5 Coach's Fee. Coaches can also register by contacting the IEEE directly at Jay.Gamerman@ieee.org (no fee). Registration should be timed so that the robots are completed approximately 2 weeks before the Robot Challenge Event (for information on how to do this, see later).

To register a team for the Robot Challenge Event, one member of each team should register on-line at: http://goo.gl/forms/0vLo1NDEvn no later than 2 weeks before the Event. There is no charge for this.

- **Note that by signing up for participation in the project, each team is committing to participate in the Robot Challenge Event, as this portion of the project represents a major part of the educational adventure.**

The Robot Challenge Event

⇒ **Saturday & Sunday, April 22 & 23, 2017 Doors open at 9:00 a.m. and it continues through the afternoon.**

⇒ **Whereas most teams seem to prefer Sunday (fewer sports conflicts), the Saturday Event will be for those teams that cannot attend Sunday.**

⇒ **Teams will be notified of arrival time options in early April, 2017.**

The Event consists of a friendly competition with robots from teams from other schools (40% of the total points), followed by an Oral Presentation to a panel of Judges, who review verbal communication skills, workmanship, teamwork, and artistic creativity (35% of total points). More details about the Challenge will be e-mailed to Coaches after registration.

Questions about Challenge specifications or judging should be sent to the Engineer Contact:
Neville Jacobs — nevilleed@aol.com or 410.653.4176

Other questions?
James Keffer jkeffer@thebmi.org

THE CHALLENGE

Project simulates what a practicing engineer would experience while working on an engineering project. In addition to building a walking robot, there is the required artistic creation of the outer body of the robot, as well as the need to demonstrate both written and verbal communication skills. 8 degrees of challenge are available, and all must participate in the Challenge Event to be held on April 22 and 23, 2017.

Design and build a motor-powered robot that walks under direction. The robot body can have any form, 2 or 4 legs, and have the ability to go over uneven terrain. Each leg shall be controlled by one student using two independent motors; the control and co-ordination of the motors, and

the smoothness and speed of the robot, will be factors considered by the judges. Any wheels used should not touch the table surface or be visible. Manual control of the robot is a basic requirement, but extra credit (up to 15 points) will be given for any form of add-on automation that furthers the above goals. Kits can be obtained from IEEE, and range from $49 for a 2-leg robot with manual control (for 2 to 4 students), to $165 for a 2-leg automation controller (other prices available upon request).

Website: www.RobotChallenge.com Lots of information about the project, FAQ and helpful hints. Photos and results of previous Challenges.

ENGINEERING TEAM REQUIREMENT

Each team should have 2-8 students (2 to 4 for 2-leg robots, 4 to 8 for 4-leg robots). There is no limit to the number of teams a school may have. High School age students at Public, Private and Home schools, and Science Clubs are eligible to participate.

SPECIFICATIONS AND SUPPLIES

The competition involves four main components, a written report, the construction of the entry, the robot's performance on a course with hurdles each robot must climb over as it meets in competition with other entries, and an oral presentation before a panel of judges, which may include a review of an optional video presentation, verbal communication skills, workmanship, teamwork, and artistic creativity. The Institute of Electrical and Electronic Engineers (IEEE) will supply the parts for the power unit and the control unit, and provide instructions, drawings, training materials, and mentors for the basic electrical equipment. Each team will be responsible for creating the robot body and building the power units and control units, and should contact their mentors by e-mail at defined intervals. They will need to provide the D-cell batteries and learn to coordinate the operation of the motors (learn to walk) as a team.

If the registration form is received prior to October 15, the design data package and the parts will be sent out in November (earlier by special request). After that date they will be sent in January. No entries accepted after the end of February. For the 2016-2017 school year, a kit for a 2-leg robot will be provided at NO CHARGE for each school. A team that has successfully competed one year is eligible to receive a $89 credit on an automation kit the following year—limit one per school.

Additional kits available as below.

- NOTE: The cost for additional 2-leg kits is $49. A 4-leg robot is twice as much work, and is more challenging to operate. Extra charge for a 4-leg kit (instead of the FREE 2-leg kit) is $39. Additional 4-leg kits are $88. Classic Automation kits: $89 for 2-leg, $118 for 4-leg robots. NEW pre-assembled (re-usable) Automation Controller boards: $165 for 2-leg, $240 for 4-leg robots – one year lease prices available by request.
- Though Robot kits will be available in November 2016 or earlier by special request, teams are requested to try to complete their projects shortly before the competition dates in April. To meet the early April completion objective, coaches will need to determine how many hours a week the students will work on the project, then use the figures below to estimate when the students should begin, based on the following:
  2-leg Robot (21 hours required*), 3 hours a week (7 weeks), start mid-February.

2 hours a week (14 weeks), start early January
1 hour a week (21 weeks), start early November

* These numbers can vary based on student skills, the number of students in a team and their absences (we have tried to allow for winter and spring breaks and snow days). Building the robot body with a 3-D printer may reduce this figure by 4 hours.

- Allow up to 28 hours for a 4-leg manually controlled robot, 30 hours for a 2-leg robot with basic automation, and up to 36 hours for full automation. Teams planning to automate their robot would need to start significantly earlier, but coaches doing this project for the first time are strongly advised to build just the 2-leg robots with manual control.
- As mentioned earlier, teams ordering kits are required to participate in the Robot Challenge on one of the two competition dates.
- Teachers and Coaches are urged to attend the no-charge training sessions on November 17, 2016, 4 to 7 PM; and/or January 28, 2017, 10 AM to 2 PM (lunch included).
- For more information, please call the organizers on 410-653-4176.

JUDGING GUIDELINES

I. Design Development and Fabrication — Competition value: 20 points*

The team must use the parts provided in the kit, substitutions are not allowed, but additions are permitted. Wheels (if used) may not touch the table or be visible. The robot body must be designed such that the team can fully expose all mechanism for inspection by the judges.

* Awarded during the Oral Presentation, based on the judges' findings.

II. Written Report — Competition value: 25 points

Points will be awarded for creativity, originality, sketches, photos, and the Robot's artistic body covering.

III. Performance Demonstration — Competition value: 40 points

The course will have 2 tracks on an 8 foot table, with the start and finish lines 6 feet apart. Two half-inch high hurdles will have to be climbed over. The robots will first race two at a time in manual mode, and team members (one per leg) must stay at their side of the table. Points will be awarded for the time taken, the smoothness of the robot's movements, and the coordination and cooperation of the operating team. In the event that some degree of automation has been added, the robot shall run a second or third time in that mode for bonus points.

IV. Oral Presentation To Judges — Competition value: 15 points

GOOD LUCK TO YOUR TEAM!