



Baltimore Section



THE ROBOT CHALLENGE **- AN AFFORDABLE HANDS-ON ENGINEERING EXPERIENCE** for High School Students

THE SPEAKER

Neville Jacobs is a teacher at Beth Tfiloh Dahan High School in Baltimore County, Maryland, USA. The Robot Challenge has been part of his “Introduction to Engineering“ course for the past 6 years. He is currently Director for Student Activities at the Institute of Electrical and Electronic Engineers (IEEE), Baltimore Section. Previously he was a Fellow Engineer at Westinghouse Electric Corporation.

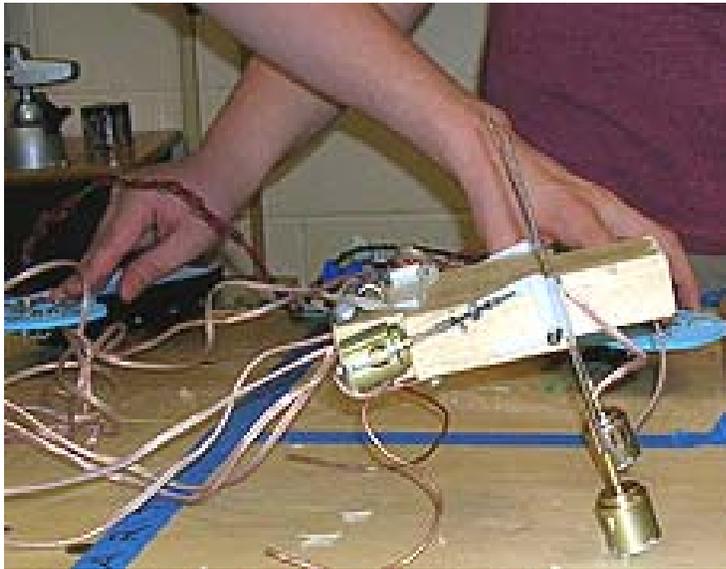
INTRODUCTION AND SUMMARY

As a high school teacher and a working engineer before that, it has been my school’s objective to bring to life the excitement and fulfillment of being an engineer, and encourage students to consider this challenging profession. The Institute of Electrical and Electronic Engineers (IEEE) Baltimore Section has worked on this idea for 10 years, and this paper presents an outline of the program that they offer. The program is currently being used at 33 high schools in the Baltimore-Washington area of the USA. Over 2000 students have participated in the building of the walking robots since the start of the program, and they have met together at events that are held annually at the Baltimore Museum of Industry. This is an excellent example where Industry and Academia are working together to benefit both students and teachers. Most important, the Robot Challenge is economically priced so that it is accessible to any high schools seeking such a program.

THE ROBOT



The picture (on the left) shows a finished 2-leg walking robot, which is operating in Automated mode. The Robot is about the size of a shoe box, and under the body covering is a block of wood with legs powered by 4 or more motors (see photo on next page).



This is an uncovered 2-leg robot. It has two skids for support, and is being operated manually. The motors operating each leg are energized by one Control Unit, and each Control Unit is operated by a different student. Since the students' coordination is essential for the successful operation of the robot, teamwork is vital.

THE CHALLENGE

The Challenge is to build the Robot and Control Units, design the body, learn to walk the robot, prepare a Written report on the process, compete with other teams to determine how well the robot performs, and present and defend their achievement to a panel of judges at the Oral Presentation. They will encounter many problems along the way, which they will have to resolve. Detailed manuals are provided, the entire process takes 2 to 4 months, and in order to customize the Challenge to the ability of the students, students and teacher may select among 4 levels of difficulty, though all robots perform together at the Robot Challenge event. Typically over 30% of the participants are girls. Though a final scoring is published, teams are really discovering how well they are able to perform as a team, rather than competing against others.

THE COST

The kits are simple and consist of a block of wood, a piece of plywood, paper clips, brass fasteners, small motors, a few custom pieces, threaded rods and tubing. The students, using simple tools, do most of the work and get the hands-on experience. The cost works out at about \$12 per student for the 2-leg robot, and the D-cell batteries are generally provided by the students. The Challenges involving greater difficulty require additional kits, so the cost is approximately x2 for a 4-leg robot, x3 for the 2-leg robot with Automation, and x4 for the 4-leg robot with Automation. Typically 70% of the teams build and operate the 2-leg robot. Schools outside the US may wish to consider building their own kits locally, with just the critical parts coming from a US distributor.

THE IEEE

The Institute of Electrical and Electronic Engineers is the largest technical organization in the world, with sections and chapters in almost every country. Their mission is not to sell robot kits, but to provide an engineering experience; the kits are offered as a way to obtain the needed parts. Schools should contact their local IEEE section to obtain kits, support and in some cases grants. If the local IEEE section is unfamiliar with the program they should contact us, or you may

contact us directly, at Nevilleed@aol.com or by phone at 410-653-4176. You may also access our web page www.robotchallenge.com for additional information and technical assistance.