

# Robotics Competitions and Professional Societies:

How do we improve the workforce readiness of our students?

Deidre Sullivan

Marine Advanced Technology Education (MATE) Center  
Monterey Peninsula College  
Monterey, CA USA  
dsullivan@mpc.edu

Jill Zande

Marine Advanced Technology Education (MATE) Center  
Monterey Peninsula College  
Monterey, CA USA  
jzande@marinetech.org

**Abstract**—Effectively preparing students for the science, technology, engineering, and mathematics (STEM) workforce is a challenge. One way that the MATE Center has found to be successful is through its ROV (remotely operated vehicle) competitions. Developed in partnership with the Marine Technology Society (MTS), these competitions provide students with a learning experience that simulates the STEM workplace. The competitions challenge students to work through the engineering design process, developing technical, teamwork, creative thinking, and problem solving skills along the way. The competitions allow students of all ages to interact and learn from each other as well as from the industry professionals who serve as judges and technical support. It is the involvement of these technical professionals, many through professional societies like MTS, that have allowed the MATE Center to expand the reach and impact of the competition program.

**Keywords**—robotics; competitions; workforce preparation; professional societies; MATE; MTS

## I.

## INTRODUCTION

Preparing students for the 21<sup>st</sup> century workforce is a challenge, especially when many classrooms have not changed significantly in decades. So *what does it take to effectively interest and prepare students to participate in the science, technology, engineering, and mathematics (STEM) workforce?* It requires learning experiences that closely simulate the workplace where students can envision themselves in these careers. It requires collaborative environments that provide access to resources, foster social connections, and nurture a sense of belonging, personal expression, freedom, and accomplishment. It requires meaningful interactions where students work side-by-side with STEM professionals so that the students' skill development, creativity, and innovation are not limited by a set curriculum or the knowledge and abilities of their instructors. It requires a network of friends, parents, and educators who understand

and support students' interests and encourage them to develop their skills. For students in socioeconomically disadvantaged environments, it requires access to opportunities that they (and their parents) might not have and a guarantee of gainful employment (i.e., money) at the end of their educational pathway.

## II.

## BACKGROUND

For the past 12 years, the MATE International ROV Competition program and the Marine Technology Society (MTS) have worked together to create and carry out ROV competitions all over the country and world. MATE's ROV competitions use ROVs as a platform to instruct students in STEM (science, technology, engineering and math) subjects and demonstrate how these disciplines are applied in the real world. The competitions challenge students to think of themselves as entrepreneurs and transform their teams into companies that manufacture, market, and sell "products and services." They require students to solve problems in new and innovative ways, work as part of a team, and develop an understanding of the breadth of business operations – all important 21st century workforce skills.

For example, in 2012, teams were presented with a fictional request for proposals (RFP) that called for the development of an ROV to assess the condition of a simulated World War II shipwreck and determine a course of action if the vessel still contained fuel oil, posing both an environmental and a socioeconomic disaster. (This was modeled after a U.S. Coast Guard RFP for the *S.S. Montebello*; please see <http://vimeo.com/53033793> for a short video overview of the competition event). In 2011, the competition focused on the Deepwater Horizon oil spill and tasked teams with engineering both an ROV and a cap to secure the wellhead. In 2010, teams embarked on scientific mission to study Loihi, an undersea volcano near Hawaii's Big Island, which included

deploying instruments, measuring temperature, and collecting organisms.

In addition to constructing an ROV, each year the students are required to submit technical documentation and deliver engineering presentations to STEM professionals who serve as judges, solidifying the connection to real-world industry practices as well as showcasing examples of potential careers. Students are also required to create a poster display that communicates to the layperson information about their vehicle design, their company (team), the problem they were tasked to solve, and how this problem relates to real-world events. The MATE Center created the ROV competition in 2001 in partnership with the MTS ROV Committee. The program currently consists of one international and 22 regional competitions held annually (16 within the U.S., two in Canada, and one in each of the following: Hong Kong, Scotland, Japan, and Egypt). Since 2001, the MATE Center and its regional partners have carried out 11 international and 104 regional events. To date, the competitions and their supporting professional development workshops have impacted more than 12,000 students and 2,000 teachers at more than 2,000 formal and informal educational institutions (middle schools, high schools, home schools, community colleges, universities, 4-H clubs, and public aquaria, among others).

### III. COMPETITION SUCCESS

The success of the competition can be attributed to a number of factors, including its structure; cost and accessibility; the regional network that continues to expand; and widespread industry participation and support. The competition structure consists of three levels, or “classes,” of vehicle and mission complexity: SCOUT (entry-level), RANGER (intermediate), and EXPLORER (advanced). This progressive class structure complements the educational pipeline by providing students with the opportunity to build upon their skills – and the application of those skills – as they engineer increasingly more complex ROVs for increasingly more complex mission tasks. It also provides the opportunity for interactions among all grade and experience levels, which results organically in

near-to-peer mentoring, sharing ideas and experiences, and motivating students to continue “next year.”

The ROV competitions are designed with workforce skills and employability in mind and it is the educational-professional society-industry partnership that makes this possible.

Together we are able to create learning environments that give students a big picture perspective on how industry works, how business organizations work, how project teams work, and how science and technology work together to solve real-world problems. One of the best ways to understand how this is accomplished is to read the MATE competition manuals (see [www.marinetech.org/ranger/](http://www.marinetech.org/ranger/) for an example) and through the student success stories. We are extremely pleased when students use their MATE ROV competition experience as the focus of their college entrance essay and are accepted into the college of their choice, or students describe the MATE ROV competition as their work experience on a resume and it helps them land a job in their field of study.

### IV. SUMMARY

The MATE Center is always looking to partner with marine industries and marine professionals to expand the reach and impact of the program. It is the collective network of passionate professionals that make the competitions possible. For more information or to get involved, please contact the MATE Center at [www.marinetech.org/contact](http://www.marinetech.org/contact).

### ACKNOWLEDGMENT

MATE was established as an Advanced Technological Education (ATE) Center of Excellence in 1997 with funding from the National Science Foundation and currently continues as an NSF ATE Resource Center (NSF/DUE 1104310) and receives additional funding from the NSF ITEST program (#0929875). Headquartered at Monterey Peninsula College (MPC) in Monterey, California, the Center has built a national reputation as a leader in advancing marine technical education, particularly with respect to workforce assessment and development.